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FROM RISKS TO RESILIENCE

Technology transformation in healthcare

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Contents

1 EXECUTIVE SUMMARY

Promise and perils: Technology transformation for healthcare

Healthcare systems are under enormous and increasing strain. Demand will grow as populations get older and sicker, and as medical advances broaden the scope and societal expectations for what can be treated and cured. At the same time, shrinking labor pools will both limit capacity to provide care and raise the cost of delivery.

Under-resourced systems expose themselves to challenges such as declining care quality, escalating liability risks, worsening employee morale, and deteriorating institutional reputations. Systems under chronic stress are more vulnerable to potential future crises driven by contingencies such as pandemics or extreme weather.

Technology advances have a major role in boosting financial, operational, and strategic resilience.

- In the near-term, rapidly evolving technologies such as generative AI can augment humans to improve productivity as well as automate tasks to cut costs. Such efficiencies can ease financial strain, build buffers for future crises, and fund resilience investments at healthcare institutions.
- Digital solutions such as tele-health and automated decision support tools can also deliver operational efficiencies, expand capacity flexibly to meet spikes and swells in demand, improve capacity utilization and care quality, and mitigate disruption risk during crises.
- In the longer run, technologies can help put healthcare demand and costs on a sustainable trajectory by facilitating proactive and personalized care for more effective disease prevention and management, and by improving connectivity and coordination across institutions.

However, technology may augment risks for healthcare systems by amplifying current risk drivers, extending risk interactions, triggering risk cascades, and creating new risks.

- AI and other technologies can worsen existing risk exposures for health institutions, including professional and institutional liability risks related to batch events in which more than one patient is affected by the same cause.
- Technology risks can arise from leaders, managers, and clinicians failing to appreciate the limitations of machines; assigning responsibilities beyond the capabilities of machines; relying on machine outputs uncritically; and failing to anticipate potential failures, their differential impacts, and spillover effects.

Healthcare systems and institutions need to mitigate and manage these and other risks. They need to understand the limitations of technologies; anticipate how, where, and when risks could crystallize; be alert to possible knock-on impacts; and adjust risk transfer and response playbooks. Effective human oversight, accountable governance structures, and other processes can help reduce risk exposures and vulnerabilities.

Even the best new technologies face roadblocks to deployment. To realize their full potential, institutions need to analyze and work to overcome the barriers, which include:

- User hesitancy or resistance, knowledge and skill gaps, and fear of disruption or role changes.
- Old and fragmented technological infrastructure that can delay implementation and limit data sharing, process standardization, and care coordination.
- Technologies that fail to deliver the expected benefits, for example, if institutions deploy unsuitable tools or retain existing process inefficiencies.
- Poor functionality and cumbersome experience due to not involving intended users during design, development, testing, and monitoring phases.
- Sub-optimal deployment due to a failure to invest in continuous learning and upskilling of clinical and non-clinical staff as technology capabilities evolve.

Healthcare systems cannot afford to miss out on the technological opportunities that are becoming available, which will augment healthcare staff, expand healthcare provision, improve patient experience and outcomes, and ensure financial viability. By weighing the risks associated with and without deployment of these technologies, healthcare organizations can optimize their use in cutting costs, improving crisis preparedness and response, and reducing the health vulnerabilities in their communities.

2 INTRODUCTION

Healthcare systems must prioritize resilience

On top of acute financial and capacity pressures, healthcare organizations and systems face a resilience challenge against sudden shocks and accumulating stresses. AI and other transformative technologies can help.

Adding to immediate pressures, megatrends in demographics, climate, and technology will likely create further spikes and swells in healthcare demand as well as service disruptions.

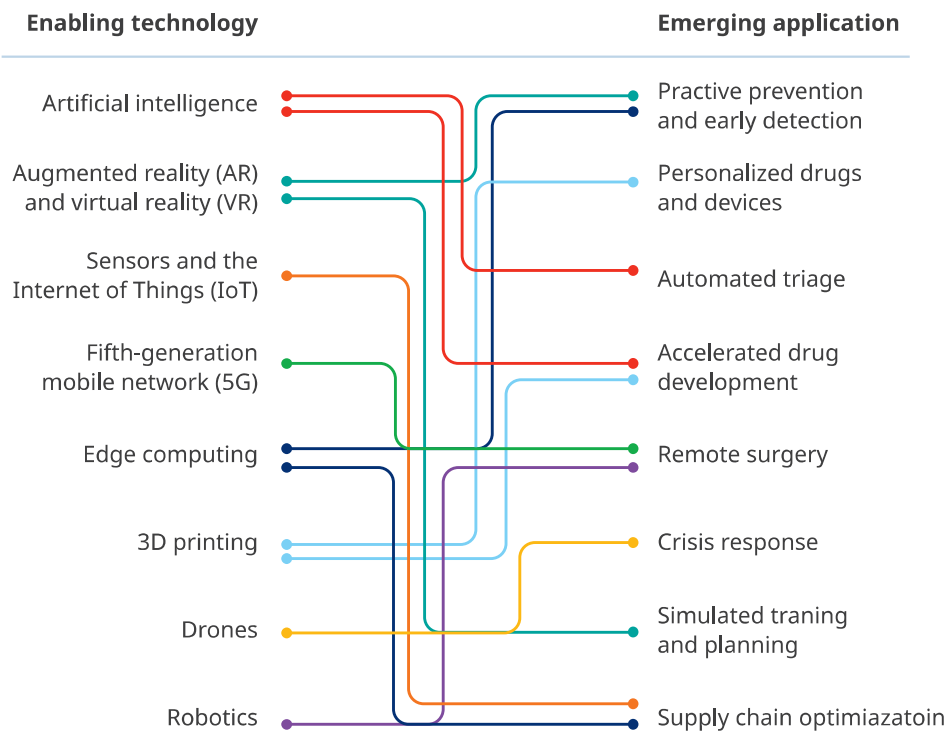
Healthcare systems and institutions[1] must prepare for future shocks and compounding stresses, respond effectively to unpredictable and interacting disruptions, and recover from crises and their cascading impacts. However, systems and institutions under chronic stress are increasingly vulnerable to potential future crises driven by contingencies such as pandemics or extreme weather.

Backlogs in service provision, healthcare workforce shortages, and cost pressures continue to undermine attempts to get back to a better footing after the COVID-19 pandemic. For example, NHS England hit a record backlog of 6.4 million patients (approximately 10% of the population) in October 2023.[2] Meanwhile, dissatisfaction with wages, benefits, and working conditions are driving high levels of burnout and turnover, making healthcare less appealing to workers: 47% of US healthcare workers want to leave the industry by 2025.[3] Chronically under-resourced institutions are more likely to experience declining care quality, revenue loss and financial strain, escalating liability risks, worsening employee morale and retention, and deteriorating reputations. The industry's capacity to provide care and cost pressures look set to worsen as populations age and labor pools shrink.

Adding to these immediate pressures, megatrends in demographics, climate, and technology will likely create further spikes and swells in demand and service disruptions. Populations are getting older and sicker in almost every country, and medical advances are broadening the scope and societal expectations of what can be treated or cured. However, high prices may limit access and drive societal discontent. For example, nearly 100,000 US patients will be eligible for cell and gene therapies at a total cost of US$25 billion by 2025, up from US$5 billion in 2020.[4] At the same time, climate change is increasing the burden of injuries, infections, and chronic disease. Children, older people, and people with low incomes are particularly vulnerable to the health harms of direct and indirect climate hazards[5].

Technology is part of the solution to the resilience[6] challenge. As digital technologies advance and converge, they have the potential to enhance current care delivery and make new applications feasible (see Figure 1). For example, artificial intelligence (AI) tools could support clinicians with triage, documentation, diagnosis, and treatment, enabling them to treat more patients and with reduced risk of errors and omissions. AI and 3D printing could help develop drugs faster and cheaper and facilitate personalized drugs with better outcomes. Technology-driven productivity improvements and innovation can boost healthcare resilience by cutting costs through automation, expanding reach and capacity, and enabling proactive care models for healthier societies and more sustainable healthcare.

FIGURE 1: Transformative technologies shaping the next chapter of healthcare[7]



Source: Marsh McLennan

This report explores how emerging and evolving technologies can support financial, operational, and strategic resilience in healthcare at the institution level, how the adoption of this technology changes risk exposures, what the barriers are to effective deployment, and what it will take for health systems and institutions to realize their potential.

3 How new technologies can help

AI and other evolving technologies can boost healthcare resilience by delivering near-term cost savings, operational efficiencies, and long-term strategic value.

A range of enabling digital technologies — including AI, augmented reality (AR), virtual reality (VR), sensors and the Internet of Things (IoT), edge computing, 3D printing, drones, and robotics — are advancing, converging, and reshaping many industries, including healthcare. A wealth of use cases enabled by these technologies promises to benefit stakeholders, including patients, consumers, and informal caregivers; healthcare providers and institutions; public health bodies; governments; health insurers; employers; and pharmaceutical and medical device companies.

For healthcare institutions, thoughtful adoption and integration of these technologies can boost their resilience across financial, operational, and strategic lenses. Tech-driven cost savings and productivity improvements can help healthcare institutions ease financial strain, build buffers for future crises, and fund resilience investments. Telehealth, automated intelligence, decision support tools, and other digital technologies can expand base and surge capacity to meet swells and spikes in demand, improve capacity utilization and care quality, and mitigate disruption risk during crises. In the long run, tech tools to facilitate proactive and personalized care as well as connectivity and coordination across institutions can put healthcare demand and costs on a sustainable trajectory.

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Financial resilience

Labor costs typically account for about half a healthcare institution's budget and have become an ever-increasing driver of operational costs. For example, US health systems' labor costs grew by 37% during 2019-2022.[7] Slow-burning staff shortages and temporary/agency costs rose sharply during the COVID-19 pandemic and have since plateaued into a lasting crisis in the US, UK, and elsewhere.[8] Care capacity and/or quality is worsening as many institutions struggle to attract and retain clinicians, and a spiral of stress and burnout is driving up risks and costs relating to patient outcomes (such as of medical malpractice) and staff well-being (such as long-term sickness and workers' compensation).

Deployed effectively, digital technologies can increase healthcare workforce productivity and reduce overall staffing needs and costs. The low-hanging fruit may be administrative efficiencies. Automating repetitive, independent tasks can also improve employee satisfaction, reduce burnout, and improve quality as such tasks tend to be tedious, error-prone, and among the least motivating parts of clinical and non-clinical jobs.

Labor cost savings and productivity growth have the potential to ease immediate financial strain on healthcare institutions and support financial stability in the long run (Figure 2). Organizations can further strengthen resilience by funneling savings into strategic investments that strengthen crisis preparedness and response, as well as just-in-case buffers to mitigate the impacts of crises and smooth recovery towards business as usual.

FIGURE 2: How technologies can enhance financial resilience in healthcare[9]

Tech application examples	Financial resilience benefits
Virtual and hybrid care Automated documentation Automated billing and coding Automated workflow management Automated supply chain management	Labor cost savings Increased productivity and revenues Funds for crisis buffers and resilience investments

Source: Marsh McLennan

Telehealth (delivered through digital platforms) and hybrid care (combining in-person and virtual modes) can enable clinicians to see more patients, thereby increasing their productivity and extending their reach beyond nearby areas. By reducing the number of in-person visits required, digital platforms can also reduce access costs, increase convenience for patients and healthcare professionals, and improve patient compliance with care plans for better outcomes and lower overall care costs.

Robotic process automation (also called software robotics) can also increase staff productivity by reducing person-hours needed for back-office tasks.[10] These technologies emulate human interactions with digital systems and free up staff to focus on other — potentially higher-value and more engaging — tasks. Automation has the potential for substantial labor cost savings in admin-heavy healthcare systems: for example, Mercer's experience suggests that US healthcare institutions could redeploy up to 40% of a certified medical assistant's time through tech-enabled job design.

Natural language processing tools can reduce hours and effort spent on documentation, freeing up staff time for higher-value tasks that boost staff and patient satisfaction.[11] These tools can work on spoken and written data, for example, to generate structured data from unstructured notes, extract relevant information, and categorize and summarize data. Healthcare institutions already use such tools to streamline billing by assigning medical codes based on relevant information from unstructured clinician notes. Accurate speech-to-text transcription can simplify clinical documentation, reduce clinicians' administrative burden, and free up additional time for patient interaction.

Cutting-edge generative AI tools can facilitate faster and higher-quality reporting and communication. For example, US doctors are using ChatGPT to draft empathetic and easily understood messages for patients.[12] Stanford Medicine estimates that using a generative AI tool to draft replies to patient emails saves clinicians 3–5 hours of work after clinical days and faster responses can improve patient experience.

Automated workflow management software combined with predictive analysis can improve resource scheduling, utilization, and patient flow at a health system, institution, or department. Besides boosting efficiency indicators such as bed turnover and occupancy rates, automation can also reduce inconsistencies from human error or bias and the consequent costs.

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Automated supply chain management using artificial intelligence/machine learning (AI/ML) algorithms can reduce process costs by 50%.[13] Such tools can yield better insights into inventory, demand, prices, and lead times for medical and surgical supplies, which account for approximately one-third of a typical hospital's operating expenses.

Operational resilience

As populations age and disease burdens swell, healthcare systems and institutions need to keep expanding base capacity to meet ever-increasing demand. To respond effectively to unpredictable shocks, healthcare institutions require flexible capacity that can be scaled up quickly to minimize service disruptions and meet unpredictable spikes in demand. Surges in demand may become more frequent and intense, while crises such as extreme weather and pandemics may exacerbate existing vulnerabilities as populations get older and sicker. Tech tools can help healthcare institutions improve crisis preparedness, response, and recovery by anticipating disruption risks, utilizing existing capacity better, and improving care quality and outcomes (Figure 3).

FIGURE 3: How technologies can enhance operational resilience in healthcare[14]

Tech application examples	Financial resilience benefits
Telemedicine	Expanded base capacity via greater reach and productivity
Digital therapies	Flexible capacity to meet fluctuating demand
Automated language processing	Optimal utilization of existing capacity
Clinical decision support	Risk mitigation for care disruption during crises
Predictive risk management	Better care quality, e.g., specialist-level care in lower acuity settings
	Improved staff productivity, more time for high-value tasks
	Less trial and error in decision-making

Source: Marsh McLennan

Telemedicine, such as virtual consultations via telephone or videoconferencing platforms, can boost flexible capacity by keeping essential care delivery going when crises disrupt in-person care. Virtual consultations surged during the COVID-19 pandemic, driven by patient preferences and supportive regulation. Ongoing utilization of telemedicine has increased the base capacity for some types of care, such as talking therapies for behavioral health, repeat visits for chronic conditions, and timely and convenient care for under-served rural or remote populations.

Fully digital therapies can expand the base capacity and quality of care without necessarily adding staff by bridging or complementing traditional care. For example, computerized or electronic cognitive behavioral therapy (e-CBT) can reduce wait times, increase the frequency of interventions, and improve outcomes: patients who receive e-CBT while waiting for in-person or teletherapy sessions do better than patients who wait without digital support.[15]

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Clinical decision-support tools can provide automated guidance to increase clinician productivity, expand base and surge capacity, and reduce trial and error in clinical decision-making:

- Automated symptom detection and risk triage can improve clinicians' productivity by speeding up diagnosis and treatment decisions in several specialities, including dermatology, gastroenterology, ophthalmology, pathology, radiology, and surgery. For example, machine learning algorithms can already match or exceed the accuracy and reliability of humans in interpreting medical images.[16] Predictive modeling of surgical risk can help clinicians choose the best interventions in high-risk situations, such as emergency surgery[17].
- Clinical decision support tools can also improve care quality and expand complex care capacity in emergency or lower-acuity settings by enabling non-specialist staff to provide higher-level care. This approach can create surge capacity by helping first responders in emergencies and by mitigating localized disruptions of higher-acuity settings during crises. It can also expand the base capacity in poorer or remote locations that lack sufficient specialists or healthcare institutions, resulting in increased access and lower costs of care for under-served patients. For example, novice users could use AI-enabled point-of-care ultrasound in rural areas to provide prenatal care and improve birth outcomes for infants and mothers.

Predictive tools can also improve operational risk management by optimizing capacity utilization, anticipating demand fluctuations and supply constraints, clarifying trade-offs, and monitoring resources:

- Machine learning algorithms can optimize the utilization of available capacity through better evaluation of patient needs and more effective guidance for admission, transfer, and discharge decisions.[18] Healthcare institutions are using such tools to shorten hospital stays and cut readmission risk by directing patients to the right unit such as a ward or intensive care, based on predicted clinical outcomes such as the risk of readmission. Predictive dashboards can anticipate capacity constraints, clarify trade-offs of moving patients from constrained units, and recommend solutions to minimize clinical risk.
- Algorithms can also optimize staffing and enhance flexibility. Predictions regarding patient flow and staff absenteeism can help foresee and pre-empt demand surge and capacity crunch scenarios. Reducing uncertainty in demand and supply can keep teams more consistent and make staff schedules more predictable and less stressful.[19] Such systems lower burnout and turnover levels, and improve team productivity, morale, and care capacity.
- Digitized inventory systems can help track, pool, and coordinate supplies across different parts of a healthcare institution or system during and beyond crises. For example, radio-frequency identification (RFID) trackers combined with analytical capabilities can locate and move supplies across one or more units or facilities to meet demand surges and mitigate disruptions caused by supply constraints or delays.

Strategic resilience

Healthcare faces a perfect storm with a growing disease burden, costs outpacing available funding, and an increasing risk of disruption. To be sustainable in the long run, healthcare systems and institutions will need to transform care models to improve population health and slow the growth in disease burden, healthcare costs, and pre-existing vulnerabilities that amplify demand surges. It will also be critical to boost stakeholder coordination to decrease and dissipate crisis impacts. Emerging and evolving technologies can support these objectives (Figure 4).

FIGURE 4: How technologies can enhance strategic resilience in healthcare[20]

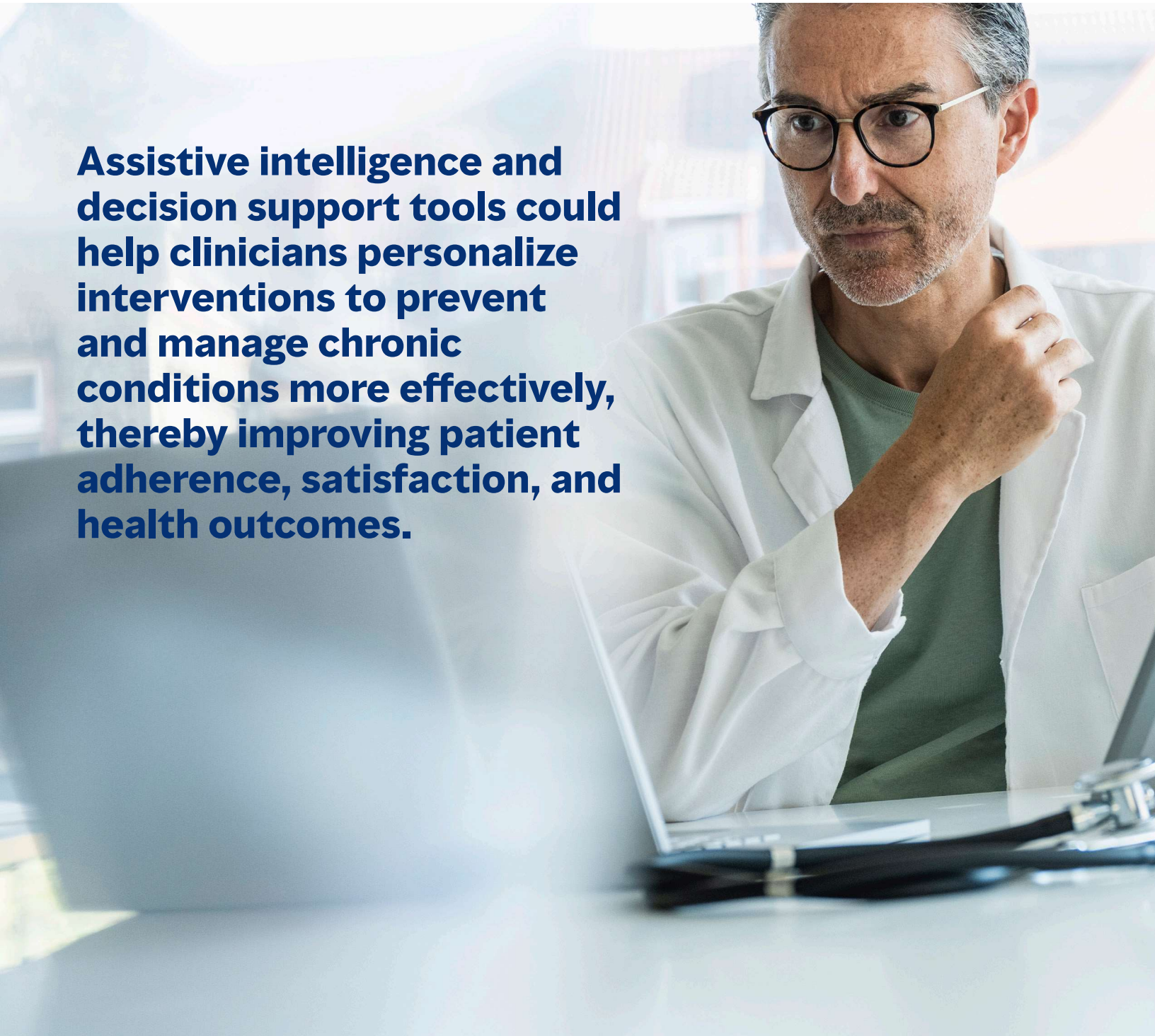
Tech application examples	Financial resilience benefits
Personalized prevention Early disease detection Remote monitoring Care coordination	Healthier populations and less disease burden resulting in more manageable swells over time and spikes during crises. Multi-disciplinary care for complex, high-cost conditions. Essential care continuity in the event of disruptions.

Source: Marsh McLennan

Most healthcare systems and institutions continue to operate on reactive models that treat disease as well as possible but don't prioritize keeping people healthy. This is unsustainable in the context of rapid population aging, a soaring chronic disease burden, and limits to healthcare funding and labor pools. Exponential advances and convergence of technologies present an industry-wide opportunity to shift from reactive sick care to proactive healthcare, by predicting who might need care, when and where, and how to intervene in timely and appropriate ways. For example, the Indian government aims to screen all citizens aged 30 years and above for chronic disease risk factors; the program combines health promotion, early diagnosis, and management and referral for at-risk and unwell patients, with the goal to reduce disease burden and premature deaths.

Personalized approaches to population health and healthcare present another public health opportunity made feasible by evolving technologies. Regulations permitting, increasingly sophisticated machine learning capabilities could help AI tools connect and analyze multi-modal, heterogeneous data relevant to health — such as medical, genomic, and lifestyle data from clinical notes, diagnostic scans, laboratory test results, and wearable device histories. Assistive intelligence and decision support tools could help clinicians personalize interventions to prevent and manage chronic conditions more effectively, thereby improving patient adherence, satisfaction, and health outcomes. By keeping the burden of chronic disease under control and smoothing related demand spikes during crises, healthcare systems and institutions can mitigate a major vulnerability and build their resilience.

To address the growing burden of polychronic disease, healthcare systems are trying to shift from acute care-centric models to complex, multi-disciplinary care that is delivered across hospital, clinical, and community settings. Technologies such as portable health records can share data and coordinate different types of care by various providers across different settings and locations, improving care quality, experience, and outcomes. Effective coordination of teams and institutions can mitigate care delays or disruptions when crises interrupt some care providers. Coordination technologies can also help patients navigate a complicated and dynamic ecosystem during regular times and crises.



Assistive intelligence and decision support tools could help clinicians personalize interventions to prevent and manage chronic conditions more effectively, thereby improving patient adherence, satisfaction, and health outcomes.

4 How risks and roadblocks can be resolved

Tech tools can exacerbate existing risks and potentially create new risks for healthcare institutions. Effective oversight, risk mitigation, and governance are crucial for successful deployment.

Changing risk exposures

Technology risks can arise when humans fail to appreciate the limitations of machines and assign responsibilities beyond the machines' capabilities.

Technology risks can arise when humans fail to appreciate the limitations of machines and assign responsibilities beyond the machines' capabilities. Users may expect machines to work in certain ways and fail to anticipate potential divergence, especially in the early stages of adopting a new or evolving technology. Users and other stakeholders may also fail to foresee how impacts and implications may vary in different circumstances for different groups of people affected by the utilization of the technology. As a result, tech tools can magnify existing risk exposures and potentially create new types of risks, of which five merit particular attention.

- **Cyber risks:** Healthcare institutions are an attractive target for cyberattacks seeking to steal sensitive data and/or disrupt operations. The industry experiences the highest data breach costs, with the average cost growing by 53% over 2020 to 2023.[21] Chronic underinvestment in cybersecurity (about 5% of IT budgets compared to 6% to 7% for retail and banking industries[22]) makes healthcare particularly vulnerable to attacks. As evolving technologies are deployed, the attack surface is likely to expand, including across connected and often outdated devices, and as access to sensitive patient data broadens and the use of telehealth and other virtual or hybrid modes of care increases.
- **Privacy risks:** As healthcare institutions increasingly use generative and other AI for various use cases including potentially care delivery, they will likely need to train various AI models using vast volumes of healthcare data. Some of these datasets may surpass the scale of what has traditionally been stored. Data storage facilities such as private cloud and on-site storage may become more susceptible as 'single points of failure' compared to pre- AI times, and these storage facilities may become more attractive targets for malicious actors. Storage and protection of sensitive healthcare data will become even more important than ever.
- **Clinical risks:** Many healthcare professionals and institutions lack sufficient knowledge, training, and experience to integrate technologies effectively into their workflow. Mistakes in understanding and using new technologies could result in medical errors and patient harm. As health technologies become more complex and critical, the ramifications of unplanned outages, systemic errors, and biases also increase. In the US, outages are estimated to cost between US$5,000 to US$9,000 per minute and 3.5 hours of time lost per employee per week.[23] This creates delays and cancellations and increases the risk of patient injury, while also impacting staff well-being, reputation, and trust.
- **Systemic/batch risks:** Transformative technologies can increase systemic risks such as batch events, which are incidents, errors, or omissions with the same cause that affect more than one patient. Errors caused and biases applied consistently by algorithms — such as those underpinning clinical decision-support applications — could result in harm by omission or error to large numbers of patients long before institutions can detect and address the problem. Figure 5 shows one such AI-related risk scenario and the resulting liability implications for a hypothetical healthcare institution.

FIGURE 5: Illustrative AI risk and liability scenario

A large private clinic provides pathology services using a generative AI tool to automate the generation of pathology reports after human clinicians analyze samples. Over a few years, the AI tool gains trust for its efficiency and precision in producing detailed reports. A malicious actor targets the clinic's AI tool with malware to subtly alter the results, causing patients to receive skewed reports (e.g., benign is labeled as malignant, and vice versa). Over time, multiple patients who thought they had malignant cells discovered after seeking a second opinion that their results were benign. Other patients who believed they had benign cells find that their conditions have worsened and, in some cases, are too late to recover. The clinic discovers the malware infection on investigation. Affected patients file lawsuits against the clinic for emotional distress, negligence, and medical malpractice.

	Applicable stakeholder	Potential triggers	Potential coverage
Healthcare Professional Liability (HPL)	User (doctor/hospital).	Allegations of negligence for things include: • Allegedly providing inaccurate results to patients. • Allegations of bodily injury by patients who underwent unnecessary treatments or missed critical treatments based on erroneous reports.	Defense costs for malpractice claims due to alleged incorrect diagnoses and emotional distress; and if found liable, indemnification for potential settlements/judgments.
General Liability / Product Liability	Developer (generative AI tool creator).	Patient's bodily injury claims may be tendered by the doctors/hospital to the AI tool developer, either on the first receipt of the claim or as a subrogation action by the HPL insurer.	Defense costs and, if found liable, damages, for bodily injury claims (including ensuing emotional distress) arising out of alleged product defects.
Tech Errors & Omissions Liability (E&O)	Developer (generative AI tool creator). Third-party technology services provider (e.g., systems integrator, value added reseller, technology vendor, etc.).	Lawsuits from doctors/hospitals alleging they suffered financial damages from: • The developer's negligence in creating and training of the model, including failing to ensure the AI model was trained on unbiased data • A failure of technology services.	Defense costs for claims alleging negligence or errors in creating and provisioning the tech service/product; and if found liable, indemnity.
Cyber Liability	User (private clinic). Developer (generative AI tool) if hosting the tool in a cloud services model and the entity that experienced the breach.	Discovery of malware in the computer system.	First-party costs incurred to respond to and recover from the cyber malware event including: forensic IT investigation, legal, notification, public relations, and potential regulatory fines and penalties.
Directors & Officers Liability (D&O)	User (private clinic). Developer (generative AI tool creator).	Negligence for failing to implement adequate cybersecurity measures, audits, and contingency plans. Possibly SEC for failure to notify of the breach in a timely manner.	Defense costs, and if found liable, indemnity. Potentially SEC regulatory fines and penalties.

Note: these scenarios are for illustrative purposes only and not intended to be comprehensive.

Effective oversight, risk mitigation, governance, and guardrails require renewing and investing in often-undervalued human skills such as empathy, compassion, common sense, critical thinking, social acuity, and conflict management.

- **Regulatory risks:** Tech advances will continue to outpace regulation, which may vary in different jurisdictions. A key challenge is that existing regulatory approval processes generally were designed for slow, expensive, one-off assessments and often cannot accommodate ongoing changes or self-learning AI tools. In addition, the existing post-market surveillance framework was designed to monitor lagging performance indicators, not real-time signals that are possible and potentially required to mitigate the risk of batch claims against healthcare institutions. Regulatory scope and enforcement will continue to evolve, as will the standard of care and product/tort law and judgments. For example, in the US, there is a shift in risk to technology users. These developments create tensions between product, institutional, and professional liability exposures and could potentially increase medical malpractice and negligence liabilities for healthcare institutions.
- **Unique AI risks:** AI, particularly generative AI, brings a range of unique output risks. These include generating inappropriate outputs and misinformation ("hallucinations"); perpetuating biases encoded in algorithms or training data; and lacking consistency, reliability, explanations regarding how or why a tool reached a given result, and interoperability with existing systems. User perceptions of and interactions with AI can add another layer of risk, for example, through overestimation of capabilities, inappropriate delegation, and automation bias, the overreliance on decision support tools. As a result, AI can aggravate a range of existing risk exposures for healthcare organizations, such as data privacy and security, consumer protection and non-discrimination, and tort liability, including medical malpractice or negligence. AI and other transformative technologies also have the potential to generate new, uninsured risk exposures via emerging theories of liability, such as AI personhood and common enterprise liability.

To monitor, mitigate, and manage these risks, risk leaders should work with others at healthcare institutions to understand technology limitations, anticipate what could go wrong, and have processes to respond early and effectively. The first step is to uncover where technology-related risks exist, as organizations may be absorbing risks without being aware of them or consciously thinking them through. Risk leaders need to understand the organization's risk exposures and vulnerabilities, and to anticipate where risks might crystallize as well as their knock-on impacts. They can then identify and bridge gaps in insurance coverage, and create response playbooks and scenario training exercises that involve the relevant individuals from operations and risk functions as well as executives and directors.

It is vital for risk leaders and clinical and non-clinical users to understand and explain the potential opportunities and limitations of any technology being deployed and to anticipate potential failures in varying ways—for example, is AI perpetuating biases or overruling human decisions. Effective oversight, risk mitigation, governance, and guardrails require renewing and investing in often-undervalued human skills such as empathy, compassion, common sense, critical thinking, social acuity, and conflict management.

The following best practices may help healthcare institutions address major challenges and concerns relating to the development and deployment of transformative tech tools, including AI:

- **Informed consent:** Hospitals and clinics must fully understand where and how AI is involved in patient care. Some hospitals are adding clauses in general consent forms to spark clinician-patient conversations around how AI is used, how it benefits patients and improves the care they receive, and how clinicians continue to remain involved and oversee the tools. Note that the objective is to build knowledge rather than act as a tick-the-box attempt to avoid potential litigation. Institutions also restrict or prohibit vendor access to patient data for product improvement purposes.

- **Guardrails:** Hospitals are developing anticipatory parameters for technology adoption. For example, Stanford Medicine's assessment process for proposed AI tools first asks for a clear description of the problem being solved and questions whether AI at its current capability levels is the appropriate tool. Early adopters have found that providing examples of where AI would be useful versus where it would not be suitable is a better approach than general principles for development.
- **Safeguards and fail-safes:** As technology deployment proceeds, it will be critical to map which systems speak to each other, anticipate how mistakes or malicious attacks may cascade across an institution, detect point failures and ripple effects, and create mechanisms to respond early and minimize unwanted consequences. Broad and ongoing education of clinical and non-clinical users, patients, and risk professionals around the capabilities and limitations of AI tools are vital to protect against over-reliance, misinformation, and erosion of trust.
- **Ethical considerations:** Technologies such as AI present similar trade-offs and concerns as other innovations. Existing frameworks such as the pillars of bioethics[24] — doing good, avoiding harm, giving patients the autonomy to choose when they can, and ensuring justice and fairness — can serve to interrogate the quality of data and decision making. Healthcare institutions may consider disclosing instances of staff overruling tech tool recommendations, learning from near-misses and mistakes to help users improve their ability to work with the technology (without blame or penalties), and proactively looking for and addressing potential biases in training data or algorithms. Active assessment of results as that data set evolves can help uncover biases, and it may be good to involve diversity, equity, and inclusion (DEI) committees in the effort.

FIGURE 6: Evolving regulatory directions for AI

Predetermined change control plan (PCCP)[25]: The US Food and Drug Administration (FDA), Health Canada, and the UK Medicines and Healthcare products Regulatory Agency (MHRA) jointly identified guiding principles to monitor performance and manage retraining risks. The changes involve anticipatory impact assessments and approval for future changes to health AI and medical devices.

Good machine learning practice (GMLP)[26]: US FDA, Health Canada, and UK MHRA guiding principles for medical device development, which may shape future regulation.

The EU AI Act[27]: Based on the regulatory framework proposed by the European Commission, the legislation will regulate AI based on differential risks posed to users. Medical devices are classified as high-risk AI systems with the potential to affect safety or fundamental rights negatively; the law will require risk assessments before market approval and throughout these systems' lifecycle. Generative AI will need to comply with transparency requirements.

Trustworthy AI (TAI) Playbook[28]: Internal principles for all health AI development and deployment across the US Department of Health and Human Services (HHS).

White House Blueprint for an AI Bill of Rights[29]: Principles and practices for responsible design, deployment, and use of AI.

Selecting the appropriate human oversight is important to reduce the risk of errors and automation bias

- **Audits:** For self-learning AI tools, ongoing auditing is vital to ensure they continue performing to expected standards. Organization-level frameworks and dedicated resources can help coordinate audits of potentially fragmented AI across specialties and settings, if any. Institutions also need effective feedback channels that can capture a range of perspectives, such as from users and patients, to understand and respond to evolving perceptions, concerns, and experiences.
- **Oversight and accountability:** Because individual clinicians' experience and competency levels vary, selecting the appropriate human oversight is important to reduce the risk of errors and automation bias. The risk function also needs dedicated experts to follow technology developments, as a lack of understanding — for example, of a black-box AI system — will generally not limit liability if something goes wrong. Committees, such as a telehealth taskforce set up by governments during the COVID-19 pandemic, can serve as a model for developing awareness, guidance, and adoption support for deploying new technologies, effectively becoming an information resource and an accountable body.
- **Compliance:** Healthcare institutions must monitor regulatory changes and their evolving directions. Best practices include following international guidelines to assess potential harms and mitigating those impacts, making risk assessments available even if there is no active reporting requirement, preferring algorithms that "augment not automate" by informing decisions without biasing user judgment, ensuring "humans in the loop" with practitioner oversight and guardrails against over-reliance, and educating staff so that they can understand and explain the technology or technologies used for due diligence and compliance purposes.

Barriers to effective deployment

Even the best technology requires take-up by users to be effective. Some technologies may be easier to use and quick to demonstrate value; a challenge for hospital institutions is to slow down excited early adopters who underestimate the risks. However, for many potentially beneficial technologies, deployment may face several challenges:

- **Resistance to change:** Adoption hesitancy among staff is a major roadblock, owing to bad experiences with fragmented and inappropriate point solutions that may have been designed to meet other stakeholders' needs. Frustrations can build when users see another gadget that adds to their workload without improving outcomes or workflow — for example, when clinicians spend time on excessive data entry instead of interacting with patients. Overstretched staff may lack time to keep up with rapid technological change, balk at the prospect of extra work, fear disruption, or worry about role changes, such as being replaced as trusted repositories of insight. There may also be unresolved tensions between different views, such as those of patients, physicians, and healthcare administrators regarding handling sensitive patient data, therapeutic reliability, and confidence in technology.
- **Skills gaps:** Healthcare institutions often lack enough digitally savvy staff to understand and leverage new technologies. They also face the challenge of maintaining the skills required to operate, maintain, and troubleshoot legacy processes and equipment, which may become critical in the event of an outage or attack on more recent technologies that automate some tasks. Resource constraints and competing priorities often limit the time and funding available for training staff. Gaps in knowledge or skills can result in mistakes and improper use — 70% of health professionals do not use digital solutions as intended[30]. The rapid pace of technological development can also overwhelm staff, especially when they are already stretched.

- **Implementation and integration complexities:** Many healthcare institutions — particularly those under financial strain — cannot afford to upgrade old or outdated technology infrastructure that struggles to cope with AI and other resource-heavy innovations. Lack of interoperability between fragmented legacy systems can limit data sharing, process standardization, and care coordination within and across institutions. Organizations may also make mistakes when developing or deploying new technologies, which curtail or hinder the expected benefits. For example, they may select processes unsuitable for automation or technologies unsuitable for workflow management, or retain process bottlenecks that merely shift existing inefficiencies into the digital domain.

To create trust and encourage take-up, healthcare institutions and technology developers must engage with the intended users, such as relevant clinical leaders, to align on the priorities to be achieved by new technologies or tools. Focusing on solving problems will help develop effective tools that can facilitate new ways of working and enable institutions to communicate benefits and demonstrate value in line with users' priorities. Involving intended users across the design, development, testing, and monitoring phases of new technologies will deliver a breadth of useful perspectives, validate proofs of concept and build business cases, create interest and trust in the new tool or system, deliver what users want in their workflow, and create a group of early users and champions who are sufficiently well-informed and motivated to encourage and support wider adoption by their peers.

To create trust and encourage take-up, healthcare institutions and technology developers must engage with the intended users

At the level of institutions and health systems, clinicians' education will need to evolve from cramming information to training in how to exercise clinical judgment upon easily accessible reams of data. Teaching hospitals or academic medical centers could start such training with students and residents, then work their way up the experience levels to assuage more experienced clinicians' concerns about changing roles. More broadly, healthcare institutions need to train staff to improve their skills and knowledge as technology capabilities evolve. In addition to supporting technology take-up and productivity gains, investment in staff development will also enhance their engagement levels and retention.

5

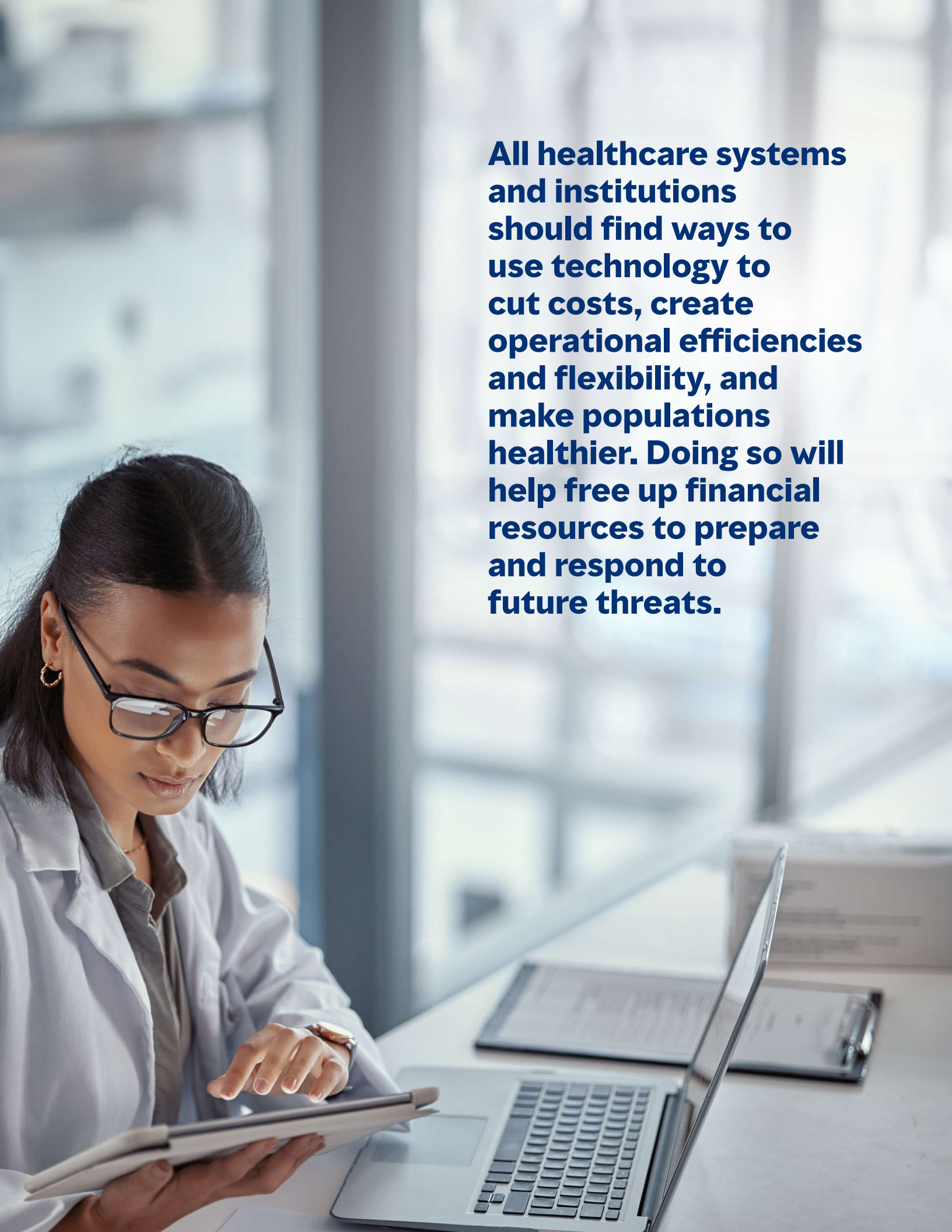
CONCLUSION

Innovation is not optional

Perhaps the greatest risk with transformative technologies in healthcare is being overly concerned with the risks and missing out on the gains. This includes the possibilities for augmenting healthcare staff to generate productivity gains and expanding healthcare capacity to meet ever-increasing demand, while ensuring healthcare systems remain financially viable.

Institutions and healthcare systems need to evaluate the risk environment with and without the use of technologies. For example, how do the risks of medical errors due to clinician overload (without AI) compare to those from using an assistive AI application?

Given that healthcare workforces will be strained for the foreseeable future, disease burden and healthcare costs will continue to accelerate, and polycrises are intensifying, effective, well-managed transformative technologies are necessary. Institutions' risk tolerance will vary, depending on their clinical and non-clinical needs as well as the regulatory environment. But all healthcare systems and institutions should find ways to use technology to cut costs, create operational efficiencies and flexibility, and make populations healthier. Doing so will help free up financial resources to prepare for future threats, ensure an effective response to crises, and decrease overall vulnerability to health hazards.



All healthcare systems and institutions should find ways to use technology to cut costs, create operational efficiencies and flexibility, and make populations healthier. Doing so will help free up financial resources to prepare and respond to future threats.

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