

Digital Health and AI: Ushering in a New Era of Employee Productivity and Well-Being



BRIEFING PAPER
NOVEMBER 2024

Throughout history, advances in technology have augmented, enhanced and reshaped human labour to drive improvements in productivity and economic growth. Unfortunately, they have also had unforeseen, negative health impacts, many appearing years later and disproportionately affecting individuals from lower socioeconomic backgrounds. While innovators and entrepreneurs may reap significant economic rewards from technological advancement, it is often the front-line workers who have suffered adverse health effects from exposure to hazardous substances, poor working conditions and increasing work pressure. As society navigates this Fourth Industrial Revolution, the opportunity to use artificial intelligence (AI) to change the world of work and health for good holds immense promise. At the same time, extra vigilance is needed to identify the risks of potential harms at the earliest opportunity and to ensure they are mitigated.

From a worker and workplace perspective and across different groups of employees (in both white collar and blue collar positions), the positive impacts of digital health and AI on workforce health, well-being and productivity can be considered in three areas:

- Improved personal health using data, wearable technologies and AI
- Early detection of exposure to harmful workplace substances and improved safety standards
- Enhanced access to affordable healthcare

Areas for further focus and extra vigilance include:

- Workforce dissatisfaction and anxiety related to job loss/disruption
- Bias in datasets driving AI-based decision-making and inequitable distribution of benefits
- Data privacy, information security and ethical concerns
- Quality of evidence for sustainable behavioural change and health outcomes from using wellness tools

Opportunities to enhance health and productivity

Improved personal health using data, wearable technologies and AI

For more than a decade, digital health technologies such as smartphone apps and wearables have been expanding in scope and scale. AI algorithms are increasingly being developed to improve the self-management of health conditions. Ideally, AI-powered wearable technologies that track vital signs alert the wearer to abnormalities at an early stage, and before they feel unwell. Targeted information then offers opportunities to improve the management of both new and existing conditions. Importantly, by embedding behavioural psychology principles into the design and delivery of AI-driven advice, users can go beyond just following their numbers, towards sustainably changing their habits to achieve better health.

Engagement of individual workers/patients in self-management of chronic disease risks is critical to achieving sustained improvements in health outcomes. This includes involving them in decisions about treatment options and healthy lifestyle choices. Several studies have shown positive impacts on health risks from the use of wearables in the management of cardiovascular disease¹ and diabetes mellitus.² Studies in Japan have demonstrated the utility of AI-based screening tools to identify workers suffering from psychological distress with similar accuracy to psychiatrists.³ With reports of increased burn-out among managers and workers at 35% and 43% respectively in a recent global corporate survey,⁴ identifying those at risk early and fast-tracking to appropriate interventions can have significant benefits for both individuals and organizations. Despite these encouraging signs from evaluation of wearables and AI-driven advice, more research is needed to demonstrate whether the results are generalizable to wider populations, and whether they lead to sustained health outcomes.

At an organizational level, a healthy and engaged workforce, whose members feel supported by their employer to achieve shared wellness goals, have repeatedly been shown to be more productive.⁵ Therefore, workforce well-being programmes or packages that cover individual purchases of wearables or well-being software and subscriptions may become beneficial and empowering to employees.

The provision of wearables as a part of corporate wellness programmes can also serve as a means of articulating a company's concern for its employees' health and well-being. Financial and non-financial incentives can be aligned with the degree to which employees participate in physical activity, healthy eating, psychological well-being and other wellness programmes to further encourage commitment. In addition to the benefits to employee health, employers report greater engagement in wellness programmes and increased returns, particularly for mental health investments.⁶ Group programmes also have the potential to improve social connectedness, which is increasingly reported as protective of mental health and well-being.⁷

Early detection of exposure to harmful workplace substances and improved safety standards

The International Labour Organization (ILO) estimates that nearly 3 million people globally lose their lives each year to work-related incidents or illnesses, while 395 million people suffer a work-related accident annually.⁸ AI has the potential to analyse vast quantities of complex safety and health data, highlight the root causes of work-related accidents and illnesses and facilitate the targeting of evidence-based opportunities for prevention and improvement. In cases where adverse health outcomes can be reliably predicted by particular unsafe conditions and worker and/or supervisor behaviour, preventative action can be better targeted. Modifications to workplace design needed to prevent recurrence can then be identified to reduce the risks of worker harm in the future.

“ AI and digital technologies are significantly changing the way we work. From a health and safety perspective, integrating data metrics can support the prediction of potential accidents and support our people to be better equipped for future challenges. One exciting development might be the use of digital twins to simulate factories and workplaces, enabling us to create predictive models. These models could forecast ways of helping to prevent accidents and work-related illnesses.

Ralf Franke, Executive Vice-President, Environmental Protection, Health Management and Safety, Siemens, Germany

AI can also improve occupational-health surveillance, enhancing the effectiveness of early detection and the targeting of health interventions. For example, a key application of AI in occupational health surveillance is in the control of noise-induced hearing loss at work. With exposure to workplace noise estimated to be one of the most common occupational hazards in the USA and Europe,⁹ the opportunity is compelling, particularly for those working in construction, manufacturing and mining.

In addition to the workplace factors (including noise exposure and the design of engineering protections), the risks of hearing loss in workers are affected by a complex mix of personal factors (hypertension, hyperlipidaemia, etc.) and individual health-related behaviour (selection and appropriate use of personal protective measures, smoking, drinking, etc.), all of which can be prevented and mitigated using AI's predictive power. AI and machine learning are well placed to combine the focus on organizational prevention strategies (implementation of engineering controls) with personal behaviour change (better condition management, use of personal protective equipment and lifestyle changes), pinpoint areas for interventions and highlight accountabilities for better health outcomes.

AI-enabled imaging holds great potential for early detection of many diseases affecting workers, such as cardiovascular diseases, cancers and respiratory diseases.¹⁰ For instance, AI-interpreted radiographic imaging is already showing promise in improving the early diagnosis and management of work-related lung diseases. With early detection of the preclinical health effects of dust exposure in populations with limited access to professional advice in low- and middle-income countries (LMICs), the risks of silicosis and other lung diseases can be reduced. Similarly, AI can be used to detect the early onset of cancers.

The use of AI to reduce ergonomic risks is another area of promise. Using AI software to analyse workspace ergonomics and identify poor postures and repetitive tasks has the potential to reduce the risk of musculoskeletal injury. Musculoskeletal conditions are the leading contributor to disability and human suffering worldwide¹¹ and are estimated to affect approximately 1.71 billion people globally.

With the impacts of climate change increasingly apparent, the number of people exposed to extreme heat is growing exponentially in many parts of the world.¹² One consequence of this is that more workers are at risk of exposure to prolonged and excessive heat. With its capacity for big data analysis and predictive modelling, AI can play an important role in preventing work-related heat illness. Algorithms can trigger interventions when the environmental risks may be highest, based on the analysis of past weather conditions. Current data can be used to optimize ventilation and cooling systems in built and working environments. By combining environmental data with individual worker data, workers and their supervisors can be alerted when physiological signs (e.g. body temperature, hydration, heart rate) suggest a change is needed in activity or worker behaviour to reduce the likelihood of heat-related illness – for example, communicating a reminder to take a break, seek shade or rehydrate.

Enhanced access to affordable healthcare

With many populations geographically distant from health experts, advances in technology are enabling individual health-risk data to drive personalized advice or interventions remotely. Generative AI (GenAI) has joined the list of guided (coached) and unguided (self-help) digital tools that aim to deliver health advice, especially early mental health interventions.

Telehealth or real-time remote communication between patients and clinicians is not new and has been providing healthcare support to populations with limited access in many countries.¹³ It is already replacing many face-to-face clinical consultation and monitoring visits to free up pressurized clinician time and refocus it where and when it makes most sense. Additional benefits include a reduced risk to healthcare professionals during infectious disease outbreaks, as was seen during the COVID-19 pandemic.

AI-assisted telehealth has the potential to support and direct health advice based on risk information. Algorithms can generate a “stepped care” approach to organizing the delivery of care and treatment. Here the most effective, least intrusive and least resource-intensive treatments are delivered to patients first, with “self-correcting” mechanisms in place so that those people who do not benefit from initial treatments can be “stepped up” to access more intensive treatments as they need them.¹⁴ These developments are particularly helpful in workplace settings where early interventions can be promoted to provide some immediate medical support and prevent issues from getting worse before a face-to-face appointment is made.

AI-enabled clinical equipment is being developed to allow low-cost, novice-performed “point of care” data assessments that drive critical decisions with similar accuracy to that of hospital expert assessments; recent studies have found that ultrasound assessments of gestational age using AI-enhanced ultrasonography offer great promise for establishing gestational age for improved decision-making and overall pregnancy care, especially in LMICs.^{15,16}

Use of AI and machine learning has also been proposed as a means of expanding access to vision screening for diabetic retinopathy (DR), particularly in remote areas where healthcare access is limited. Automated detection and grading of DR and predictions of progression from retinal photographs all have the potential to increase case detection and triage referrals at a time when sight can be preserved. Such applications have potential benefits for workers, organizations and the public, especially those in jobs with specific visual acuity requirements, such as vocational drivers. Similar approaches to the delivery of a wide range of health interventions can be considered as part of an overall employee health benefits strategy. At the same time, the challenges of implementing such systems without access to reliable and fast internet connections and meeting demands for those requiring a clinical intervention should not be underestimated, especially in low-income countries.

A significant proportion of the costs associated with health and healthcare relates to labour-intensive administrative activity. Automating hospital logistics is necessary to improve resource allocation and meet ever-increasing healthcare demands and operations. Significant savings can also be made when activities such as appointment scheduling and billing can be automated.¹⁷ The same is true in occupational settings, where AI can be used to optimize the identification of exposed populations for health surveillance, to schedule appointments in electronic health record systems and to remind employers of their accountabilities, when they need to control exposure and before any irreversible harm is caused to workers.

Of course, people of working age are also the beneficiaries of wider AI-driven improvements in population health,¹⁸ including personalized healthcare, accelerated drug discoveries and precision medicine, all of which can reduce the time they may need to be away from their jobs. At most, a very

small proportion of AI-developed health tools have been fully evaluated to assess their impacts on health outcomes and workforce productivity. Integrating healthcare access opportunities as employee benefits in workplace settings is an area in which a close working relationship between chief health officers, academics and reward managers can be beneficial.

Areas for further focus and extra vigilance

Just as AI has the potential to improve worker health and organizational productivity, areas of concern are being identified every day in which caution is needed to ensure that the benefits are not outweighed by the harms to health and reputation.

Workforce dissatisfaction and anxiety related to job loss/disruption

Workplace relationships are fundamental to the long-term success of all safe, effective and productive organizations. The World Economic Forum’s *Future of Jobs* report estimates that new technologies will be at the heart of almost 69 million new jobs in the next five years.¹⁹ However, with up to 83 million new jobs being put at risk at the same time (corresponding to 2% of employment of the time of the report), current jobholders will face significant change and uncertainty, which is known to be associated with anxiety.

Use of AI technologies and “people analytics” are becoming integral components of business decision-making. If widely used in operational settings to increase the efficiency of work processes, they can, however, lead to greater intensification of work. AI-driven task assignment, monitoring and scheduling of activities and breaks can reduce worker involvement in decisions that affect them. Such increases in workload and reductions in worker autonomy are well known to increase work stress and risk of burn-out.^{20,21} At the same time, there is no doubt that computers are better at rapidly processing multiple, complex datasets than humans and have the potential to reduce digital overload when sympathetically deployed.

There is an important role for health and well-being advisers to inform organizations of the potentially unexpected consequences of AI-driven technical advice. They can also be instrumental in shaping more successful implementation strategies that include support for the mental health and well-being of employees as they navigate these changes.²²

Bias in datasets driving AI-based decision-making and distribution of benefits

AI has the potential either to improve or to exacerbate existing workplace safety and health inequities. AI algorithms are dependent on large datasets, and yet, in many of the existing health databases driving these algorithms, women, ethnic minorities and other underserved populations are underrepresented in the core data. In employment settings, the datasets may also be relatively small, magnifying such inequalities. This makes the conclusions drawn and advice given less relevant to those populations and in some cases harmful.

It is essential to ensure that investments in AI technologies enable accurate identification of the health risks to inform and direct planners towards appropriate sources of support. Importantly, more diverse data must be collected to address the current biases. At the same time, more investment is needed to achieve the desired long-term outcomes – sustained lifestyle behavioural changes. Uptake of digital health opportunities is often most challenging in communities with some of the most significant health challenges and existing health disparities. For employers, integrating pricing strategies into procurement processes that correlate with levels of employee engagement achieved and health outcomes delivered has significant benefits for employer and employee alike over fixed pricing approaches to access the technology.

Data privacy, information security and ethical concerns

AI systems rely on access to personal data in order to function. Such data is already subject to international and national regulations to protect the privacy of the individual. In harnessing the benefits of AI in occupational-health settings, the same requirements apply to ensure that data cannot be accessed by unauthorized users nor used for purposes other than those agreed with users. Failure to address these concerns in workplace settings can lead to privacy violations, including identity theft.

There is a deeper philosophical question as to whether companies should track all of the personal health data they are interested in. This is not just a data privacy issue, it is also about workers' agency in looking after their own health. While controlling exposure to workplace hazards is clearly an issue of management accountability, it is the workers themselves who are surely responsible for many of the lifestyle changes and better health habits needed to address their own health risks. However, employer support – for example, by providing healthy choices where food is available – can help bring about positive lifestyle choices. Therefore, finding a balance between employer support and workers' agency is crucial here.

In addition, if AI models predict the early onset of cancers/illnesses through early scanning programmes at work, what are the implications in terms of current and future employment decisions and access to health insurance, notwithstanding the equality regulations currently in place to protect employees from discrimination?

Quality of evidence for sustainable behavioural change and health outcomes from using wellness tools

While the issue of data quality is well known, the risks and costs of using poor data to shape AI development cannot be overestimated. Not only might some people receive inappropriate or potentially harmful advice through poor-quality data, but others might be excluded altogether from access to care. In the end, such exclusion leads to significant harm and a costly erosion of trust in the tools and the employers who designed and implemented them.²³

Developers of AI tools and those who choose to promote them, including employers, must ensure that the claims made for their benefit, such as changing health outcomes, are trustworthy. The European Union AI Act specifically requires this in order to protect the health, safety and human rights of those who rely on them.²⁴

With the race to deploy AI interventions in health and healthcare, the importance of clinical evidence for positive health outcomes is critical. Chief health officers are well placed to contribute to governance in workplace settings, and to advocate for a more equitable, participatory approach to the development of AI algorithms.

“ I’m excited about AI’s potential across drug discovery, diagnostics, personalized health and safety, all aimed at delivering more effective health and well-being. We are actively integrating AI into drug discovery and development to accelerate the creation of new molecules and medicines. We’re also leveraging AI to enhance employee health and safety: wearable devices provide real-time feedback on movement speed in sterile gowning areas, with haptic alerts guiding optimal speed to reduce contamination and injury risks. This is just the beginning – AI has the power to transform diagnostics and therapeutic care as well, not by replacing clinicians but by supporting them in delivering precision care. We’re only beginning to see how AI will shape the future of patient care and the making of medicines.

Michael A. Kaufmann, Associate Vice-President, Global Employee Health Services, Eli Lilly and Company, USA

Calls for action

Leaders should consider the following actions when seeking to maximize the positive impacts and minimize the risks from AI and digital health initiatives in their business.

CEO and executive leadership

- Champion health equity and the elimination of health disparities throughout the workforce (e.g. employee workplace health risk exposures) and in offerings and services (e.g. quality and accessibility for underserved populations), communities (e.g. investments in community health) and wider business environments (e.g. health equity promotion through advocacy and public statements)²⁵
- Promote equity and inclusion as measures of the successful development/deployment of AI
- Ensure that there are robust systems in place for data protection, for addressing bias sets and for the ethical use of health data
- Adapt AI-driven health-tool procurement processes to create incentives for the delivery of employee engagement and health outcome targets instead of taking a fixed-price approach to accessing the technology

People and culture leaders (chief people officers and their teams)

- Review people analytics governance to ensure that processes do not contribute to risks to mental ill health and burn-out but enhance employee well-being and engagement
- Ensure that diversity, equity and inclusion (D, E & I) policies include health equity requirements in the digital health and AI environment

Chief health officers and their teams

- Promote and develop support processes to manage stress and minimize the mental health impacts of the uncertainties associated with digital technology
- Ensure that the health and wellness AI technologies deployed are rigorously evaluated prior to deployment through well-designed studies to demonstrate their sustainable and positive impact on health outcomes

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