PERSPECTIVE AND INSIGHT

Artificial intelligence in the promotion of human well-being: Current trends and future directions

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ABSTRACT

In this article, we examined the evolving interaction between artificial intelligence (AI) and human well-being across multiple domains. Specifically, we explored how AI technologies are increasingly functioning as extensions of human capabilities rather than replacements, creating new opportunities for promoting a better life. Our analysis focuses on five key areas: AI-enhanced social connection and companionship, particularly for vulnerable populations; AI applications in cognitive and sensory enhancement that expand human perceptual and intellectual capacities; AI implementations in mental health and social well-being; AI extended humanity and AI enhanced medical practice and physician well-being. We conclude by emphasizing the importance of human-centered design approaches, interdisciplinary collaboration, and ethical considerations to ensure AI technologies genuinely contribute to human flourishing while addressing concerns around privacy, equity, and technological dependence.

Key words: artificial intelligence, well-being, cognitive enhancement, mental health technology, social connection, humanity, medical practice

ARTIFICIAL INTELLIGENCE HEALTHCARE REVOLUTION

The convergence of artificial intelligence (AI) and human well-being represents a paradigm shift in our approach to improving quality of life. Recent market analysis indicates that the global AI in healthcare market size was estimated at USD 19.27 billion in 2023 and is expected to grow at a compound annual growth rate of 38.5% from 2024 to 2030 (Grand View Research, 2023). AI-driven interventions have demonstrated remarkable success, with studies showing the diagnostic performance of AI models to be equivalent to that of health-care professionals (Liu et al., 2019) and a significant reduction in diagnostic errors when used as a support tool in clinical settings (Rajpurkar et al., 2022).

The foundation of AI was established through expert systems and rule-based approaches in the 1960s and 1970s. These early systems demonstrated promising results in infectious disease diagnosis, with performance comparable to specialists at the time (Shortliffe & Buchanan, 1975). Contemporary AI systems have far surpassed these early capabilities, with modern diagnostic systems achieving high accuracy rates in specific medical conditions. For example, an AI system was capable of surpassing human experts in breast cancer prediction. It maintained non-inferior performance and reduced the workload of the second reader by 88% (Mc McKinney *et al.*, 2020), reflecting the tremendous progress in this field over the past several decades.

HISTORICAL DEVELOPMENT OF WELL-BEING SCIENCES

The scientific study of well-being has undergone

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significant evolution over the past century. Early research in the 1950s focused primarily on objective measures of life satisfaction, with Bradburn's pioneering work establishing one of the first systematic measurements of psychological well-being through the Affect Balance Scale (Mechanic & Bradburn, 1970). The field experienced a paradigm shift in the 1980s with the introduction of Ryff's six-factor model of psychological well-being (Ryff & Keyes, 1995).

Longitudinal studies have provided crucial insights into well-being development. The Harvard Study of Adult Development, spanning over 80 years, revealed that social relationships were the strongest predictor of sustained well-being, with individuals maintaining close relationships showing significantly higher life satisfaction scores compared to those with weaker social connections (Waldinger & Schulz, 2010). Similarly, longitudinal research based on the British Cohort Study has demonstrated that psychological well-being in adulthood can be predicted by childhood social connections and environmental factors (Richards & Huppert, 2011).

Recent developments in well-being science have expanded to include neurobiological markers. A comprehensive meta-analysis of neuroimaging studies identified specific neural signatures associated with different aspects of well-being, with positive emotional states showing increased activation in reward-related brain regions (Kringelbach & Berridge, 2017). Additional research has demonstrated that interventions targeting psychological well-being can produce measurable changes in neural and physiological indicators associated with improved health outcomes (Galante *et al.*, 2021).

CURRENT STATE OF AI IN WELL-BEING SCIENCES

The integration of AI into well-being sciences represents a transformative frontier in human flourishing research and applications. Recent reviews indicate that social media and AI-driven well-being interventions have demonstrated efficacy across multiple domains (Torous *et al.*, 2021). The multidisciplinary convergence of AI capabilities with psychological, social, and neurobiological insights has catalyzed innovations across five key dimensions: enhancing social connections through companionship technologies, augmenting cognitive and sensory capacities, revolutionizing approaches to social well-being and mental health, AI extended humanity and AI enhanced medical practice and physician well-being. These developments reflect an evolving ecosystem where algorithmic intelligence increasingly complements and extends human capabilities, presenting both unprecedented opportunities and complex ethical considerations in the pursuit of enhanced well-being (Calvo & Peters, 2016). Figure 1 summarizes these key areas for AI adoption.

AI-enhanced social connection and companionship

AI technologies are increasingly being deployed to address social isolation and enhance human connection through various companionship applications. Socially assistive robots (SARs) have shown promising results in improving quality of life among older adults, with a randomized controlled trial of 68 participants demonstrating significant reductions in loneliness scores and increases in social engagement metrics after a 12-week intervention program (Robinson et al., 2013). These technologies leverage natural language processing and affective computing to create more authentic interaction experiences.

Moreover, AI characters, including chatbots and virtual avatars, are revolutionizing mental health care for adolescents by providing accessible and stigma-free support (Chaturvedi *et al.*, 2023). Given the different functional roles an AI Companions (AICs) can play in a person's life, these objects hold great significance for humans. For example, someone shares physical intimacy with love dolls (such as Harmony), someone buries their AI pets, such as Paro or their love dolls in a proper farewell ceremony (Jacobs, 2024). The Corona Virus Disease 2019 (COVID-19) pandemic accelerated the adoption of AI companionship technologies. These developments suggest that AI-enhanced social companionship, while not replacing human connection, may serve as a valuable complement to traditional social support systems in promoting well-being across diverse populations.

AI applications in cognitive and sensory enhancement

The application of AI in cognitive and sensory enhancement represents a rapidly evolving domain with significant implications for human well-being. Research in AI-enhanced cognitive training programs has demonstrated measurable improvements in executive function, with controlled studies showing benefits across working memory and attention tasks. A meta-analysis by Lampit *et al.* (2014) found that computerized cognitive training produced significant moderate effect sizes in cognitive performance among healthy older adults, suggesting potential for AI-augmented approaches to cognitive enhancement.

In the sensory domain, AI-powered assistive technologies are expanding perceptual capabilities for individuals with disabilities. For people with visual impairments, AI-based computer vision systems have

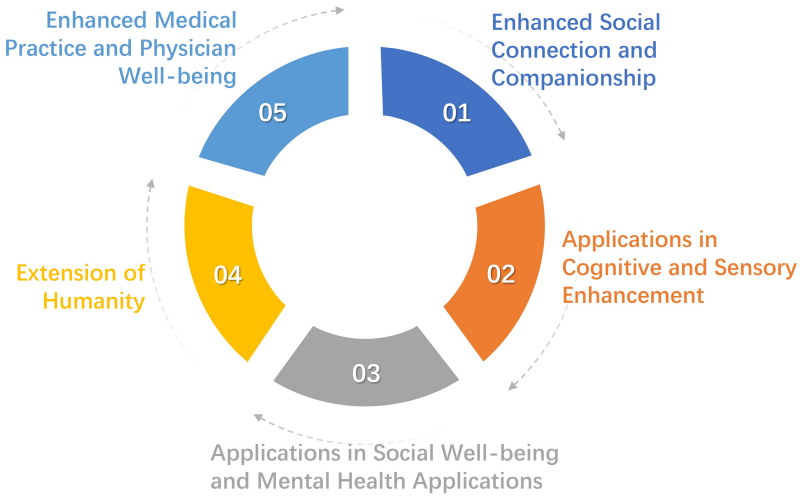

Figure 1. Artificial Intelligence in five key areas.

demonstrated significant utility in environmental navigation and object recognition. Zhao *et al.* (2019) documented substantial improvements in navigation performance and user confidence through AI-assisted guidance systems. For individuals with hearing impairments, deep learning algorithms have improved speech recognition in noise by approximately 25% compared to traditional hearing aids (Healy *et al.*, 2013).

AI applications in social well-being and mental health applications

Access to large quantities of data through new digital sources including online platforms, social media, online search behavior, and mobile devices, combined with advanced data analysis techniques and large computing power, is making it possible to uncover patterns or trends in human behavior and illness trajectories that were previously not visible. An increasing number of studies demonstrated the feasibility and promise of using online sources of big data to study behavioral patterns, monitor disease risk, and inform development of targeted interventions (Ilieva & McPhearson, 2018; Insel, 2018), with new emphasis on these digital methods for studying mental health (Bidargaddi *et al.*, 2017).

Efforts in the field of human-computer interaction (HCI) have attempted to understand both how mental health is experienced and the interactions that experience can have on technology use (Pendse *et al.*, 2019). Works in HCI have involved use of online data to explore mental health states, and analysis of social media data to predict the onset of symptoms of mental illness. For example, analysis of data from Twitter showed over 70% accuracy in predicting onset of postpartum depression (De Choudhury *et al.*, 2013). Other studies have explored interactions between technology and mental health, including predicting when an individual would come to feel better, predicting shifts to suicidal ideation using data collected from Reddit (De Choudhury et al., 2016).

The integration of AI into mental health and social well-being applications represents one of the most promising developments in digital therapeutics. These digital interventions offer values for addressing treatment barriers (Naslund *et al.*, 2019).

Extension of humanity through AI

The conceptualization of AI as an extension of human capabilities rather than a replacement represents a paradigm shift in our understanding of human-AI symbiosis. This perspective views AI technologies not as autonomous entities that operate independently of human values and goals, but as sophisticated tools that amplify human cognition, creativity, and problem-solving abilities. As Clark (2003) argued in his seminal work on extended cognition, technology has long served as a cognitive extension of the human mind, with AI representing the latest frontier in this evolutionary partnership. Recent empirical research supports this framework, with studies demonstrating that human-AI collaborative systems consistently outperform either humans or AI working independently across diverse domains including medical diagnosis (Topol, 2019) and scientific discovery (Jumper *et al.*, 2021).

The extension paradigm further emphasizes the importance of designing AI systems that complement human strengths while compensating for human limitations. Meta-analyses of human-AI interaction studies reveal that the most effective collaborative systems maintain human agency while leveraging

computational strengths, creating what Rahwan *et al.* (2019) term "augmented collective intelligence". This approach moves beyond the dichotomy of human versus machine to explore the emergent capabilities of integrated human-AI systems, suggesting a future where artificial intelligence functions not as a separate technological domain but as an organic extension of human cognition, creativity, and social connection.

AI enhanced medical practice and physician well-beings

AI is increasingly recognized as a transformative force in healthcare that not only improves patient outcomes but also significantly enhances physician well-being and work satisfaction. Studies indicate that AI-augmented clinical decision support systems can reduce physician cognitive load by automating routine tasks and providing evidence-based recommendations, addressing a critical factor in burnout prevention. Research by Khairat *et al.* (2018) demonstrated that implementing AI-assisted clinical decision support systems increased efficiency, reduced medical errors, and improved outcomes.

The integration of AI into diagnostic processes has shown promise in reducing professional anxiety associated with diagnostic uncertainty as well. A multicenter study by Rajpurkar *et al.* (2022) found that AI-assisted image interpretation not only improved diagnostic accuracy but also increased physician confidence and reduced self-reported decision fatigue.

As healthcare systems increasingly adopt AI technologies, preliminary longitudinal data suggest potential long-term benefits for physician resilience and career longevity. Roth *et al.*, (2021) documented improved retention rates and career satisfaction scores among physicians working with AI-augmented systems compared to traditional practice environments, suggesting that thoughtfully implemented AI may contribute to sustainable medical careers and ultimately to improved patient care through enhanced physician well-being.

CHALLENGES AND FUTURE DIRECTIONS IN AI AND WELL-BEING

Despite the promising advancements in AI applications for well-being, significant challenges remain that require careful considerations. The implementation of AI systems in sensitive domains related to human well-being raises important ethical concerns regarding privacy, autonomy, and equity. There was research that highlight how algorithmic decision-making in well-being contexts can perpetuate existing social biases and inequalities if training data reflects historical disparities (Mittelstadt et al., 2016). This concern is particularly acute in mental health applications, where demographic representation in datasets remains problematic.

Technological dependence constitutes another critical challenge, as noted by Turkle (2017), who cautions against potential psychological consequences when human connections are increasingly mediated or replaced by AI systems. The risk of over-reliance on AI for emotional support or social connection may lead to diminished human-to-human relationship skills and lower resilience in facing interpersonal challenges. Additionally, there remains a significant gap between laboratory efficacy and real-world effectiveness of AI well-being interventions, as there was high abandonment rates for mental health applications despite promising clinical trial results.

Future studies should prioritize participatory design approaches that include diverse stakeholders in AI development processes. As Burr and Cristianini (2019) argue, the integration of multiple perspectives—including those of end users, clinicians, ethicists, and technology developers—can help ensure that AI well-being technologies align with human values and needs. Furthermore, longitudinal research examining the sustained impacts of AI interventions on well-being indicators will be essential for understanding their true efficacy beyond short-term outcomes.

Interdisciplinary collaboration represents another crucial frontier. We should advocate for greater integration between computer science, psychology, neuroscience, philosophy and other related disciplines to develop more holistic approaches to AI-enhanced well-being. Such collaborations could yield more sophisticated frameworks for evaluating AI's impact on complex, multidimensional aspects of human flourishing beyond simplistic metrics.

As AI systems become more embedded in well-being contexts, developing appropriate regulatory frameworks that balance innovation with protection of vulnerable populations will be essential for ensuring that technological advancement truly serves human flourishing.

CONCLUSION

The convergence of AI and well-being sciences represents a pivotal development in our ongoing quest to enhance human flourishing. As we have explored, AI technologies are increasingly extending human capabilities across multiple dimensions of well-being—from enriching social connections and companionship to augmenting cognitive and sensory experiences, and revolutionizing approaches to mental health care, and extending humanity and enhancing medical practice and

physician well-beings. These advancements offer unprecedented opportunities to address longstanding challenges in human well-being, particularly for vulnerable or underserved populations. However, the path forward requires thoughtful navigation of significant ethical, social, and technical challenges to ensure that AI truly serves as an extension of humanity rather than a replacement for essential human connections. The most promising trajectory lies not in viewing AI as an autonomous force, but as a collaborative partner in human flourishing—one that amplifies our innate capacities while respecting the fundamentally social and embodied nature of human well-being. By maintaining this balanced perspective and embracing interdisciplinary approaches to both research and implementation, we can harness the transformative potential of AI to create more inclusive, accessible, and effective pathways to well-being for people across diverse circumstances and needs.

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Zhao Y: Writing—Original draft preparation. Sun P: Conceptualization, Writing—Reviewing and Editing.

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Sun P is the Associate Editors-in-Chief of the journal. The article was subject to the journal's standard procedures, with peer review handled independently of the editor and the affiliated research groups.

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None declared.

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