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Global Health, the Nursing Profession, Artificial Intelligence, and Work-Related Musculoskeletal Disorders: Protecting Healthcare Workers to Bring About Sustainable Transformation of Health Care Systems

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Abbreviations: MSDs -Musculo Skeletal Disorders, WHO-World Health Organization, AI- Artificial Intelligence.

Editorial

Global health faces challenges of unprecedented magnitude. An aging population, the rise of chronic diseases, pandemics, climate crises, armed conflicts, and deep-seated social inequalities are placing increasing pressure on health care systems [1]. In this complex context, the availability of qualified professionals, their health, and their ability to provide quality care are essential to maintaining resilient health systems. Nurses, who constitute the largest professional group in the health sector [2], are at the heart of this evolution. However, their contribution remains undermined by demanding working conditions, a persistent staff shortage [3], and significant exposure to occupational risks, particularly work-related Musculo Skeletal Disorders (MSDs) [4]. The concept of Global Health, introduced by Koplan in 2019, now extends beyond the prevention of communicable diseases alone [5]. It encompasses the economic, environmental, social, technological, and professional factors that influence the health of populations. From this perspective, the health of health care professionals and nurses in particular is no longer an individual or institutional issue, but a major global public health challenge. Investments in their protection are now essential to improving the quality of care, enhancing patient safety, and ensuring the sustainability of health care systems. According to the most recent estimates from the World Health Organization (WHO), there will still be a global shortage of 5.8 million nurses over the next decade, with particularly marked disparities between low-, middle-, and high-income countries [6,7].

This shortage leads to an intensification of work, an increase in physical and psychological strain, and a gradual deterioration in working conditions [8]. The consequences extend far beyond the professional sphere: they directly affect the continuity of care, the quality of patient care, patient safety, and the ability of health systems to respond to health crises.

Among the occupational risks faced by nurses, musculoskeletal disorders remain the most common [9]. Lower back pain, neck pain, and pain in the shoulders, wrists, and upper limbs are primarily linked to the repeated handling of patients, prolonged static postures, repetitive movements, and organizational constraints. These conditions are the leading cause of sick leave in many healthcare facilities and contribute to increased absenteeism [10], lost productivity, burnout, and the early departure of many healthcare workers. The economic consequences of MSDs are considerable [11,12].

They include not only the direct costs associated with care, compensation, and staff replacements, but also the indirect costs linked to reduced team performance, decreased quality of care, and loss of clinical expertise [13]. In the face of these challenges, technological innovations offer unprecedented opportunities. In recent years, Artificial Intelligence (AI) has gradually emerged as a tool with the potential to transform nursing practice [14]. Advances in machine learning, generative artificial intelligence, computer vision, and robotics now make it possible to develop solutions capable of assisting professionals in their daily activities. The potential applications are numerous: clinical decision support [15], automation of documentation [16], prediction of complications, care planning, continuous patient monitoring [17], optimization of hospital workflows, and prevention of occupational hazards. In the specific field of occupational health, artificial intelligence offers particularly promising prospects. Automated motion analysis using computer vision, the use of connected biomechanical sensors, smart exoskeletons, and collaborative robots hold the potential to significantly reduce the physical strain experienced by nurses [18].

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Predictive models powered by ergonomic data could identify high-risk situations early on, suggest targeted interventions, and help prevent the onset of musculoskeletal disorders before they become disabling [19]. However, this digital transformation also raises major ethical questions. It requires in-depth consideration of data management, algorithm transparency, cybersecurity, and the preservation of the therapeutic relationship.

Artificial intelligence for nurses' health

One of the most promising areas of artificial intelligence is the prevention of occupational hazards. While traditional approaches rely primarily on one-time ergonomic assessments and training programs, digital technologies now enable continuous monitoring of biomechanical stresses [20]. Thanks to inertial sensors, wearable devices, computer vision, and deep learning algorithms, it is now possible to identify in real time risky postures, repetitive movements, or situations likely to cause musculoskeletal disorders [19]. These tools pave the way for the development of predictive models that leverage individual, organizational, and environmental data to propose tailored interventions, such as ergonomic adjustments, changes to work schedules, preventive exercises, or the targeted use of assistive devices. Ultimately, this AI-assisted preventive medicine could help reduce the incidence of MSDs, lower absenteeism, and improve quality of life at work. Machine learning models are also capable of optimizing workforce allocation and anticipating periods of high workload to limit burnout and the onset of MSDs.

Furthermore, the rise of Large Language Models (LLMs) is opening new opportunities for nursing practice [21]. These tools provide support to healthcare professionals in drafting nursing documentation, summarizing medical records, conducting literature searches, and performing other related tasks. By reducing the time spent on administrative duties, they enable nurses to devote more time to clinical activities and to building therapeutic relationships with patients. However, their use must remain appropriately regulated to ensure data confidentiality and maintain human oversight over all clinical decision-making.

The need for ethical governance

The integration of artificial intelligence into nursing care requires careful ethical consideration to prevent algorithmic bias, ensure data confidentiality, and maintain human oversight of clinical decision-making [22]. Because AI systems are trained on historical and organizational data, they may inadvertently perpetuate existing biases and contribute to inequities in healthcare if not appropriately monitored [23]. Nurses should therefore be actively involved in the design, development, and evaluation of these technologies to ensure that they address real clinical needs and are aligned with nursing practice [24]. Although AI can improve healthcare efficiency by reducing administrative tasks and supporting clinical workflows, it cannot replace essential human competencies such as clinical judgment, empathy, ethical reasoning, and therapeutic relationships [25]. Its role should therefore be to augment nursing expertise, improve working conditions, and ultimately enhance the quality and safety of patient care.

Training nurses in digital competencies

This transformation requires a profound evolution of both undergraduate and continuing nursing education. Academic curricula should progressively incorporate training in digital literacy, data science, the principles of artificial intelligence, and the ethics of digital health technologies to prepare nurses for an increasingly technology-enabled healthcare environment [22,24]. Future nurses will need not only to use these tools effectively but also to understand their limitations, potential risks, and implications for clinical practice, including issues related to algorithmic bias, transparency, and patient

safety [22]. The development of advanced digital competencies will also foster a new generation of nursing researchers capable of collaborating with experts in artificial intelligence, ergonomics, public health, and data science. Such interdisciplinary collaboration is increasingly recognized as essential for designing innovations that are clinically relevant, ethically sound, and responsive to the needs of healthcare professionals and patients [24,25]. At the same time, healthcare organizations must invest in secure digital environments, robust data infrastructures, and continuing professional development programs to support this transformation and facilitate the responsible adoption of AI technologies [22]. Artificial intelligence will deliver sustainable benefits only if it is embedded within a comprehensive institutional strategy that integrates technological innovation, improved working conditions, workforce development, and lifelong professional learning [26].

Research perspectives: Toward a new scientific agenda for nursing science

The emergence of artificial intelligence represents a major advancement for nursing science. Beyond improving patient care, research is increasingly focusing on protecting the health of healthcare professionals, particularly through the development of tools capable of identifying the early risk of musculoskeletal disorders and supporting preventive interventions. Future research should also evaluate the effectiveness of emerging technologies, such as exoskeletons, collaborative robotics, and automated posture analysis systems, to assess their impact on working conditions, staff retention, and the quality of care. In addition, integrating artificial intelligence into healthcare organizations may help optimize workforce planning and achieve a more balanced distribution of workloads. However, this transformation must be supported by ethical governance that ensures algorithmic transparency, data protection, and the mitigation of bias. Finally, nurses should play a central role in the development and evaluation of these innovations to ensure their clinical relevance and successful implementation in practice.

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