

Healthcare technologies: innovations, practices, and contemporary challenges

Tecnologías sanitarias: innovaciones, prácticas y retos actuales

Tecnologias do cuidado em saúde: inovações, práticas e desafios contemporâneos

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The fourth technological revolution has imposed new frameworks on the field of health, but in nursing, the debate about care technologies is not new. Inspired by the reflections of Emerson Merhy¹, this editorial assumes that care is produced in the encounter between workers and users, the so-called living work in action, and that technologies are divided into three inseparable dimensions: soft (bonding, listening, welcoming), soft-hard (structured knowledge, protocols), and hard (equipment, software, artificial intelligence). The thematic issue we are presenting brings together articles that explore these three facets of innovation, seeking to highlight how the encounter between 'living work in action' (Merhy) and technological artifacts can strengthen or weaken the production of humanized, safe, and equitable care.

From a management and training perspective, the articles in this edition engage with the proposal to curricularize research and outreach. Just as Kataoka² advocated for mandatory scientific initiation in undergraduate studies, we argue that digital skills and critical thinking about technologies cannot be elective; they need to be integrated across nursing curricula. The pandemic highlighted that telehealth and predictive systems are here to stay, but it also laid bare the digital exclusion of vulnerable populations. Genuinely innovative technology, therefore, expands patient agency and the power of the clinical encounter, reducing inequalities.

The theorists who underpin this view are numerous. In addition to Merhy¹, who bequeathed to us the micropolitics of living labor, Barbara Starfield³ taught us that balanced primary health care, encompassing needs, services, and technology, is the foundation of just health systems. Gastão Campos⁴ introduced intersectorality as an indispensable component of comprehensiveness. And authors such as Turato⁵ and Nogueira-Martins & Bógus⁶ reinforced the importance of a qualitative approach to capture the complexity of care. Their work is an essential reference for anyone researching care technologies.

Ethical challenges have not been forgotten either. Predictive artificial intelligence systems can reproduce racial and socioeconomic biases if trained on unrepresentative databases. Nursing, as a frontline profession committed to equity, must play a leading role in the governance of these tools, not only implementing them, but questioning them, adapting them, and, when necessary, rejecting them. This edition welcomes research that examines these dilemmas in diverse contexts, from primary care to intensive care.

In this sense, the articles in this edition offer a true picture of the potential and critical issues. They demonstrate that, although soft technologies (listening, bonding, welcoming) are widely recognized as central to "living work in action," their implementation encounters organizational barriers: communication failures, low problem-solving capacity, and a lack of continuing education policies. Furthermore, they show that soft-hard technologies, such as prenatal groups and occupational therapy interventions, remain underutilized, indicating that the mere existence of protocols does not guarantee comprehensive care. This diagnosis echoes the challenges found at other levels of care, as shown in the articles on patient safety and network coordination in this same collection.



Another noteworthy finding is the necessary articulation between technological dimensions: hard technology (equipment, electronic medical records, decision support systems) only acquires health value when accompanied by investment in relationships. As the study by Pressato & Duarte⁷ aptly summarizes, the transformative power of primary health care lies in the intentional integration of the three technologies in a logic centered on the individual and the territory. From a practical point of view, this means that the implementation of a new telemonitoring system should be preceded or simultaneously with discussion sessions with the team and users, so that everyone understands not only "how" to operate, but also "why" and "for whom". Nursing, due to its capillarity and longitudinal link, is the profession best positioned to lead this integration.

In terms of management, however, a mismatch persists: hard technologies often receive substantial budgets, while actions to strengthen soft technologies (clinical supervision, continuing education, matrix support) are treated as a secondary cost. The articles by Marchon & Mendes⁸ and Sarti⁹, included in this edition, demonstrate that the lack of communication, a typical problem in the domain of soft technologies, is responsible for a significant portion of patient safety incidents and the fragmentation of care networks. Reversing priorities requires not only political will, but also evaluation indicators that incorporate relational variables, such as user satisfaction, trust in the professional, and perception of being welcomed.

The training of future nurses is, therefore, strategic ground. The curricularization of research and outreach, inspired by Kataoka's argument², needs to be accompanied by the curricularization of critical digital competence. This means that students must learn to program an electronic reminder, but also to question: who will not have access to

this reminder? Could the algorithm generate unnecessary alarms? How can technology be adapted for people with low digital literacy? Nursing schools that already adopt active methodologies, such as realistic simulation and problem-based learning, can easily include scenarios that articulate the use of health applications with the practice of active listening.

We must also not forget the ethical imperative of algorithmic equity. Predictive artificial intelligence systems used for risk stratification or resource allocation in healthcare are trained on historical data that carries structural inequalities. An algorithm that underestimates the pain of Black women or that directs fewer home visits to marginalized communities is not neutral; it is a technology that deepens injustices. Nursing, as a profession that works on the front lines and witnesses these disparities, needs to be trained to audit biases, participate in data ethics committees, and, when necessary, refuse the use of tools that do not demonstrate their equity. This thematic issue welcomes research that already points in this direction, with experiences in inclusive telehealth and co-design of applications with traditional communities.

Thus, we reiterate that no technology, however sophisticated, replaces the encounter between professionals and users. The digital revolution cannot become a revolution of coldness. It is up to nursing, the science of care that historically combines technique and sensitivity, to ensure that innovations serve to extend the time for dialogue, not to shorten it; to give voice to the most silenced, not to silence them even more. We invite readers to delve into the articles in this edition with an active eye and a critical heart. May the following pages inspire new practices, new research, and, above all, an increasingly technologically intelligent and radically human care.

Enjoy your reading!

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