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Bioethics in contemporary digital medicine

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Abstract

This is a systematic literature review based on publications available on databases such as PubMed and SciELO. The review aims to analyze some technological advances in Medicine, especially those holding a significant impact on bioethical, regulatory, and legal aspects. Among these new technologies, wearable devices used for continuous patient monitoring, telemedicine and telehealth—which expand access to healthcare for different populations—bioprinting of organs and tissues, and the growing use of artificial intelligence are highlighted. Each of these innovations must be deeply reflected on the regulatory, bioethical, and legal implications involved. Furthermore, it is crucial to analyze their effects on Public Health, the doctor–patient relationship, and the judicialization of healthcare, especially given the high costs associated with them, in a scenario in which financial resources are finite, while social demands are potentially unlimited.

Keywords: Technological advances in health. Public health. Doctor-patient relationship. Judicialization of health.

Resumo

Bioética na medicina digital contemporânea

Este artigo é uma revisão sistemática de publicações disponíveis em bases de dados como PubMed e SciELO com o objetivo de analisar alguns dos inúmeros avanços tecnológicos na área da medicina que geraram grande impacto em aspectos bioéticos, regulatórios e legais. Entre as novas tecnologias, destacam-se os dispositivos vestíveis utilizados para monitoração contínua de pacientes, telemedicina e telessaúde, que ampliam o acesso a cuidados de saúde para diferentes populações, a bioimpressão de órgãos e tecidos, além do uso crescente de inteligência artificial. Cada inovação exige profundas reflexões sobre as repercussões regulatórias, bioéticas e legais envolvidas. Além disso, é fundamental analisar seus efeitos na saúde pública, na relação médico-paciente e na judicialização da saúde, especialmente em razão dos altos custos associados a essas tecnologias para a sociedade, num cenário em que os recursos financeiros são finitos, enquanto as demandas sociais se mostram potencialmente ilimitadas.

Palavras-chave: Avanços tecnológicos em saúde. Saúde pública. Relação médico-paciente. Judicialização da saúde.

Resumen

Bioética en la medicina digital contemporánea

Este artículo realiza una revisión sistemática de la literatura basada en evidencia disponible en las bases de datos PubMed y SciELO, para analizar algunos de los avances tecnológicos en medicina que han generado impactos en aspectos bioéticos, regulatorios y legales. Estas nuevas tecnologías incluyen dispositivos portátiles utilizados para el monitoreo continuo de pacientes, telemedicina y telesalud, que amplían el acceso a la atención médica para diferentes poblaciones, la bioimpresión de órganos y tejidos, y el creciente uso de inteligencia artificial. Cada una de estas innovaciones requiere reflexiones profundas sobre las repercusiones regulatorias, bioéticas y legales involucradas. Además, es fundamental analizar sus efectos en la salud pública, en la relación médico-paciente y en la judicialización de la salud, especialmente por los altos costos asociados a estas tecnologías para la sociedad, en un contexto en que los recursos financieros son finitos, mientras que las demandas sociales son potencialmente ilimitadas.

Palabras clave: Avances tecnológicos en salud. Salud pública. Relación médico-paciente. Judicialización de la salud.

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Dossier

Medical practice and science have been transformed over time, generating innovations through new technologies and sparking debates in medicine, philosophy, and law. Bioethics, grounded in the fundamental principles of autonomy, beneficence, non-maleficence, and justice, goes beyond mere theoretical reflection, increasingly establishing itself as an indispensable practice in life, serving as a moral compass. Balancing scientific progress with social justice and equity in access to innovations is essential, while always preserving respect for individual and cultural differences [1].

New technologies decisively affect diagnosis, treatments (whether surgical or not), prognosis, and the physician–patient relationship. For this reason, regulation and reflection are imperative. In this article, some technological innovations with a major impact on medical practice are analyzed, considering the dynamic nature of the topic and assessing their legal and bioethical aspects, while also contributing to the resolution of the dilemmas they create.

It is important to understand that technologies must ensure, for both patients and physicians, that their use will occur ethically, in accordance with the prerogatives of medical practice, respecting patient rights, and safeguarding their privacy.

Impact of wearable monitoring devices

In terms of technological innovations, wearable devices have gained prominence as they provide real-time data, enabling physicians to manage patients' health more effectively and to track their vital signs, while also supporting other healthcare professionals. Smartwatches and other wearable devices allow for continuous monitoring of patients' vital signs, making it possible for physicians to make precise therapeutic adjustments and prevent potential complications. As a result, these tools render healthcare far more effective and preventive.

Findings indicate that wearable devices and digital health applications enable continuous monitoring, real-time feedback, and personalized care, which can positively influence health outcomes. However, despite their many benefits, they also pose significant challenges. One of the most relevant concerns is data privacy [2]. It is essential to note that discrepancies in monitoring data may lead to erroneous diagnoses in patients with severely compromised health conditions. For these reasons, it is necessary to develop strategies that ensure proper interpretation of such data, preventing misanalyses and potential risks resulting from inadequate interpretations [3].

Telemedicine and telehealth

Telemedicine became definitively incorporated into the daily lives of physicians and patients during the COVID-19 pandemic, due to necessities imposed by that context, highlighting both the benefits and the critical issues of this new model of care. It is undeniable that it has brought numerous conveniences, particularly for remote areas; however, gaps remain concerning the confidentiality of medical information and the quality of the physician–patient relationship within this model.

According to Schramm and Escosteguy [4], a hasty incorporation of new technologies without bioethical analysis may result in unequal implementation, excluding vulnerable populations due to lack of access. Technologies employing artificial intelligence for diagnostic purposes may generate certain biases, deepening inequalities within specific populations. Furthermore, technologies such as genetic editing and tissue bioprinting may lead to uncoordinated actions between governments and health institutions, even increasing judicialization [5].

The judicialization of healthcare in Brazil generates significant tension between citizens' rights and the economic sustainability of the Unified Health System (SUS) [6]. For this reason, integration between the judiciary and the executive powers is crucial to assess the impact of decisions on the health system as a whole. Coordination between the healthcare sector and the judiciary is essential to maximize the benefits and minimize the risks of new technologies.

The absence of physical contact between physicians and patients undoubtedly affects the relationship established, which is fundamental for developing trust and empathy—essential elements for the success of treatments. Moreover, remote consultations may not provide as accurate an

assessment as an in-person physical examination, which could also affect treatment outcomes. In this regard, the Federal Council of Medicine (CFM) Resolution no. 2,314/2022 [7] acknowledges that the gold standard for medical evaluation remains in-person consultation, leaving it to the physician's discretion to determine whether the consultation should be concluded with an in-person examination.

Since telemedicine involves digital platforms, rigorous monitoring of potential privacy violations and control over the misuse of patients' sensitive data are indispensable. The General Data Protection Law (LGPD) [8] establishes specific guidelines for handling such data, imposing duties of security, consent, and transparency. CFM Resolution No. 2,314/2022 [7] details the proper approach, as do the Brazilian Internet Civil Rights Framework (Law no. 12,965/2014) [9], the LGPD [8], and the Telehealth Law (Law no. 14,510/2022) [10].

Bioprinting of organs and tissues

Bioprinting of organs and tissues holds great potential for tissue regeneration and may revolutionize organ transplantation, as the creation of patient-specific organs could drastically reduce dependence on donors and, consequently, shorten waiting lists for such treatments.

From a regulatory and ethical standpoint, it is crucial to assess the safety and effectiveness of this treatment, since, as a recent technology, its long-term effectiveness remains uncertain. According to Oliveira and collaborators [11], guidelines for bioprinting practices are essential to prevent patients from being exposed to the risks of still-experimental procedures, as well as to help limit access due to the high costs associated with this technology. International discussions have also emphasized the need for clear regulatory frameworks and ethical principles for bioprinting, particularly in light of legal uncertainties regarding intellectual property and the safety of these procedures [12].

Informed consent is essential in this practice, as patients must be fully aware of the limitations and risks of such treatments, thereby upholding one of the fundamental principles of bioethics: autonomy. Decisions must be made consciously, with complete access to available information, in order to avoid unrealistic expectations [1].

Artificial intelligence and the autonomy of patients and physicians

Artificial intelligence (AI) has gained increasing visibility and application in healthcare, particularly in personalized diagnoses and treatments, thanks to the vast volume of information it can rapidly process, especially in radiology, oncology, and cardiology. Algorithms analyze and evaluate medical images, detecting abnormalities that might often go unnoticed by a human observer, thus making early diagnosis a reality. In the case of cancer, early detection may mean extended survival or even the cure of the disease.

The most critical issues in this context concern patient privacy and confidentiality, since sensitive information may be exposed, as noted by Elias and collaborators [13]. Moreover, it is essential to ensure that access to these services does not exacerbate inequalities among patients.

Among the most pressing concerns are the autonomy of both physicians and patients, the secondary role of physicians in establishing diagnoses—which may compromise the physicians' guidance in patients' decision-making, and the lack of clarity regarding liability in cases of medical malpractice. The physician–patient relationship is affected when decisions rely on automated systems [14].

Assigning responsibility is a highly complex issue in procedures such as robotic surgery, since failures may result either from the surgeon's actions or from the functioning of the software. However, such events are extremely rare when compared to what occurs in traditional surgeries [15].

In Brazil, there is still no specific legal framework regulating civil liability in cases involving artificial intelligence applied to healthcare. This heightens legal uncertainty in the event of technical failures or harm to patients. A legislative proposal currently under discussion in the National Congress (no. 2,338/2023) [16] aims to establish a legal framework to regulate the use of AI in the country, which could provide greater predictability and legal protection for professionals and users of these systems.

Final considerations

New health technologies are already transforming medical practice through personalized diagnoses and treatments. *Not everything that is scientifically possible is ethically acceptable*—the well-known phrase attributed to Van Rensselaer Potter [17], one of the pioneers of bioethics, encapsulates the concern with scientific and technological advances, particularly in the fields of biology and medicine, and the need to establish ethical limits on their use.

Institutions such as the CFM, which oversees regulation, ethical adjudication, and the development of guidelines, and the regional councils, which are responsible for oversight and ethical review, must increasingly guide medical practice. Their role is to provide the ethical and bioethical framework that supports a form of medicine capable of embracing technological advances without sacrificing the humanistic dimensions of the physician–patient relationship.

The judicialization of healthcare should be mitigated, given that technological advances may impose significant costs to the system. These impacts must be mitigated through dialogue and coordination between the judiciary and public health authorities, ensuring respect for patients' rights while preserving the sustainability of the public healthcare system.

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Dossier

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