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Prof. Dr. Melike ÖZER KESKİN

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SAĞLIKTA BÜYÜK VERİ VE YAPAY ZEKÂ: MAHREMİYET VE ETİK SORUNLARA GENEL BİR BAKIŞ

BIG DATA AND ARTIFICIAL INTELLIGENCE IN HEALTH CARE: AN OVERVIEW OF PRIVACY AND ETHICAL ISSUES

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ÖZET
Sağlık alanında büyük veri ve yapay zekâ (YZ) teknolojilerinin kapsamlı entegrasyonu, tanı ve tedavi süreçlerinde yaşanan köklü değişimlerin başlıca nedenini oluşturmaktadır. Bu mekanizmalar bir yandan klinik karar alma süreçlerinde önemli bir destek sunarken, diğer yandan mahremiyet, veri koruma ve etik sorumluluk konularını ön plana çıkarmaktadır.Sağlık verilerinin kitlesel düzeyde işlenmesi; yeniden tanımlanma riski, veri akışlarının izlenebilirliği, algoritmik süreçlerin şeffaflığı ve verilerin nasıl ve neden kullanıldığına dair açıklık gibi çok sayıda önemli soruyu gündeme getirmektedir. Yapay zekâ teknolojilerinin hastanelere entegre edilmesi, yalnızca teknik işleyişin geliştirilmesiyle sınırlı kalmamakta; hasta hakları, adalet ilkeleri ve kurumsal sorumluluk gibi alanları da doğrudan etkileyerek karmaşık ve çok boyutlu bir yapı ortaya çıkarmaktadır. Bu araştırma, büyük veri ve yapay zekâ temelli sağlık uygulamalarının doğurduğu mahremiyet ve etik sorunlara geniş bir perspektiften yaklaşmaktadır. Değerlendirmelerde; teknik koruma önlemleri, algoritmaların açıklanabilirliği, veri minimizasyonu, sorumluluğun adil şekilde paylaştırılması ve hasta güveninin tesis edilmesi gibi temel ilkelerin önemi vurgulanmaktadır. Sağlık verilerinin doğası gereği taşıdığı yüksek hassasiyet, ortaya çıkan problemlerin yalnızca teknolojik çözümlerle giderilemeyeceğini göstermektedir. Bu tür sorunların çözümünde ahlaki ilkelerle kurumsal politikaların birlikte değerlendirilmesi gerekmektedir. Genel olarak, büyük veri ve yapay zekâ teknolojileri sağlık sektörü için büyük bir potansiyel taşısa da, etik ve mahremiyet boyutları göz ardı edildiğinde bu teknolojilerin güvenilirliği ve toplumsal kabulü tehlikeye girebilir. Bu bağlamda, çalışma, modern sağlık hizmetlerinin sunumunda giderek belirginleşen temel etik sorunlara dikkat çekmeyi amaçlamaktadır.
Anahtar Kelimeler: Büyük Veri, Yapay Zekâ, Mahremiyet, Veri Güvenliği, Etik Sorunlar

ABSTRACT
The substantial integration of big data and artificial intelligence (AI) technologies in healthcare is the main factor behind profound changes in the diagnostic and treatment processes. These mechanisms, on one hand, are a great clinical decision-making support tool, but, on the other hand, the issues of privacy, data protection, and ethical accountability come to the front. Mass health data processing provokes a lot of profound questions, among them are the risk of re-identification, the traceability of data flows, the transparency of algorithmic processes, and clearness of how and why the data are used. AI technology installation hospitals is not just about upgrading the technical operations but patient rights, principles of justice, and institutional accountability, which form a complex multidimensional structure, are directly affected there. This research gives a broad picture of the privacy and ethical problems that come from healthcare applications driven by AI and big data. The conversation features the significance of several core principles such as technical safeguards, algorithmic explainability, data minimization, the just allocation of responsibility, and the establishment of patient trust. Health data are of such a nature that the problems raised cannot be solved by mere technological means. A blend of moral principles and institutional policies is required in the handling of such issues.

In general, big data and AI technologies are a great asset to the healthcare sector but if their ethical and privacy aspects are left unattended, their trustworthiness and public acceptance may be at risk. Against this background, the paper is intended to highlight the major ethical issues that are becoming increasingly dominant in the provision of modern healthcare services.
Keywords: Big Data, Artificial Intelligence (AI), Privacy, Data Security, Ethical Issues

INTRODUCTION

More recently, the integration of big data analysis and artificial intelligence (AI) is poised to disrupt several facets of health care delivery. Machine learning and deep learning algorithms now possess the ability to identify informative trends from electronic health records, genomic information, images from medical equipment, and ongoing measurements from wearable health devices (Price and Cohen, 2019; Reddy et al., 2020).

The traditional three dimensions that characterize big data volume, variety, and velocity take on a very specific form in health care. Large-scale population health records, highresolution images, and genomic and sensor-based physiological data all come under one umbrella for analysis. While this offers substantial potential for improving the quality of health care, doing so raises complex ethical considerations especially with regard to privacy (SHAPES Ethics Framework, 2019).

However, the advancement in artificial intelligence technologies has enabled the development of decision-support systems that can match and even outperform the capabilities of human professionals on particular tasks such as automatic classification for skin lesions and predictive models for detecting potential clinical downturns among critically ill patients (Price and Cohen, 2019). Nonetheless, such innovations work on the premise that they can access and process large amounts of information that can enable them to generate highly detailed personal health information that can raise potential questions on personal privacy considerations.

With the integration of AI solutions within the health industry escalating, the principles for such solutions being developed and implemented have come under greater emphasis. On one side, current governance frameworks tend to be grounded within specific sectors such as medical device regulation and research ethics. However, such governance might overlook specific considerations arising from big data and AI interactions (Morley et al., 2022; Reddy et al., 2020). In this context, governance is perceived within a more holistic scope involving transparency and public trust (Reddy et al., 2020).

There exist several recent proposals seeking to sketch out the contours under which such governance may be realized. The SHAPES framework articulates substantive and procedural values to inform ethical reasoning around health data practice. Reddy and colleagues highlight fairness, transparency, trustworthiness, and accountability as core considerations for embedding AI within clinical practice (Reddy et al., 2020). The intervention from Maryala brings forward a Sensitivity Risk Index to measure several dimensions of data sensitivity andfacilitate risk management contingent on context (Maryala, 2025). Morley and colleagues further demonstrate considerable international variation with regard to governance on both AI and health data (Morley et al., 2022).

This research arises from the premise that the ethical and privacy dimensions engendered by big medical data and AI applications within health care have now transformed and intensified to a highly complex issue domain. While safe-guarding technologies can and should continue to be important for this domain, more normative and shared principles and responsibilities across all stakeholders and community members must be promoted and pursued. This research aims to identify and scrutinize important ethical and privacy considerations for big medical and health care AI applications and investigate central governance structures which have been argued within current literature.

EMERGENCE OF BIG DATA AND ARTIFICIAL INTELLIGENCE WITHIN THE HEALTH CARE INDUSTRY

The increase in the adoption and development of health informatics platforms has created unprecedented volumes and variability within health care data. Electronic health records, laboratory reports, images from diagnostic imaging studies, genomic sequencing data, pharmacovigilance reports, and real-time biometric monitoring from wearables all meet within the current health informatics landscape. Increasing variability within health informatics platforms means that traditional solutions for signal recognition and analysis within health care data have diminished efficiency and thus justify the prominence and adoption of AI within health care (Price and Cohen, 2019).

Machine learning methods can be aided and improved by the uniqueness and amount of healthrelated data now being produced. For example, improvements in image recognition tasks demonstrate the capacity for algorithmic approaches to distinguish between dermatologic and radiologic observations with a degree of proficiency close to that of human professionals (Price and Cohen, 2019). Applications for similar methods exist within prediction for clinical decline and response to treatment within intensive care settings.

However, the diversity of types of data being collected is equally important. Genomic data, lifestyle factors, exposure data, and social determinants of health can now be incorporated within a single framework for analysis and this is important for risk analysis and providing personalized health services (SHAPES Ethics Framework, 2019).

However, quality, representation, and representativeness still form the core difficulties. If some communities tend to be underrepresented and misrepresented in current data representations, this may lead to reproducing similar representations within AI models and may impact health equity with regards to care delivery (Price and Cohen, 2019). This has greater implications for communities that tend to interact with the health care system occasionally and under constrained circumstances.

With the integration of AI within health care gaining momentum, concerns and queries on the governance and regulation around these emerging technologies intensify. The policies and frameworks around the useage and validation of health care data and the integration of AI solutions within health care tend to differ widely across the globe (Morley et al., 2022).

In this context, the role and impact of AI on health care can be best understood and appreciated if the phenomenon is regarded not as a technological innovation alone, but as a shift and transformation that is taking place.

ETHICAL ASPECTS OF HEALTH DATA AND THE ISSUE OF PRIVACY

The intensity of the sensitivity for health data is greater than for any other type of personal information. Health data can describe not just biological facts, but also the potential for health conditions and lifestyle factors. For these reasons, handling health information raises important ethical considerations outside the normal parameters normally protected within the framework of health information (Price and Cohen, 2019). With the continued expansion of health information available and advanced predictive models being developed at a rapid rate, definitional inquiries on privacy and personal health information management continue to evolve.

Also, the ethical discourse on privacy is founded on two approaches that complement each other. For one, consequences relating to the violation of privacy could be related to insurance, employment, and social respect, and may even lead to psychological trauma (Price and Cohen, 2019). On the other hand, the wrongness associated with a lack of control over one's personal information does not hinge on consequences.

Re-identification risk where anonymized data may be traced back to specific persons by linking the information with other datasets is one such issue that raises the weakness found within traditional approaches to privacy. It is now very challenging to de-identify health information once shared (Price and Cohen, 2019).

Another issue at stake is representation and fairness. If some communities are underrepresented within the data sets used for creating AI models, this can lead to disparities within the prediction models and increase gaps between various communities (Price and Cohen, 2019). Communities with limited health care and limited interaction with online health platforms can be at risk (Priceand Cohen, 2019). This is a clear indication that fairness and privacy cannot be separated when applying AI within health care.

In response to such developing conditions and constraints, various governance frameworks start productively on tasks such as the evaluation of health information with regard to its sensitivity (Maryala, 2025). This is done with the help of a tool such as the Sensitivity Risk Index. It considers health information on aspects such as identifiability, intrinsic sensitivity, potential for harm, and consent considerations.

In addition to this, privacy is closely associated with trust and trustworthiness. People find the use of their data more acceptable if they know for whom the information is being used and for which particular end. The SHAPES framework on health care ethics is therefore focused on respect for persons and trust and the vulnerable (SHAPES Ethics Framework, 2019). The above principles make it clear that health data protective aspects cannot be confined to health information security alone; they should instead concentrate on being consistent with health system and person integrity.

PRIVACY, TRUST, AND ACCOUNTABILITY: CORE ETHICAL ISSUES

With the growing integration of big data and AI in the health care sector, several ethical concerns emerge as a result of the interaction between personal and institutional values and community and cultural norms. The pivot around which all these ethical concerns revolve is the nexus between three important concepts: privacy, trust, and accountability.

Privacy

A health care context defines privacy as a basic tenet including both personal autonomy and the respect for the health system and client relationship. However, for large and complex datasets interlinked, privacy threats may be broader than simple entry by unauthorized individuals. Data taken to be anonymized at one stage being made possibly identifiable from other available datasets can uncover personal information relating to one's health state and social conditions (Price and Cohen, 2019).

Together with other relevant tools, data sensitivity analysis help identify the risks. The Sensitivity Risk Index is a method that is used to determine the sensitivity of the data based on criteria such as identifiability, intrinsic sensitivity, potential harm, and alignment with consent (Maryala, 2025).

Trust

It is vital for the adoption and proper utilisation of AI within health care that trust is at the forefront. Patients must be aware of the way their information is being utilised and handled. Governance structures therefore position trust more as a corporate attribute than a personal one and position transparency and explainability within this context. The transparency with which organisations communicate the risk and function of AI within health care is critical for building trust with the general public (Reddy et al., 2020; SHAPES Ethics Framework, 2019).

Accountability

Accountability is highly important for ensuring that AI systems play a safe and ethical role when used for clinical practice. It is important to determine whether developers, organizations, and professionals must be held responsible for the impact of AI on clinical practice (Reddy et al., 2020).

For adaptive algorithms, additional difficulties arise. As models undergo processes of evolution, the processes that model behavior is tracked and risk is managed take on even more significance. A lack here can undermine safety for patients and trustworthiness for the institution (Morley et al., 2022).

A complex interrelationship exists between privacy, trust, and accountability. A weakness within one may undermine the other two: A loss of privacy may lead to a loss of trust, and a loss of trust may undermine accountability. As such, all three must be assessed cumulatively within considerations for the ethical integration of AI within health care.

ETHICAL GOVERNANCE PRINCIPLES FOR BIG DATA AND AI APPLICATIONS WITHIN THE HEALTH SECTOR

A growing discourse on big data and artificial intelligence within the context of health care is increasingly focused on the ethical imperatives that can be employed for the safe and fair application of such technologies. Governance is more than adherence to legal parameters, including transparency and establishment of well-articulated lines for decision-making and the means for building public trust. A number of contemporary approaches offer specific ways on this end.

Value-Based Institutional Frameworks

A significant approach emphasizes the use of value-based frameworks for decision-making with regard to the application and sharing of health data. Under this approach, ethical assessment is grounded on principles including respect, privacy, justice, public benefit, transparency, and accountability. The SHAPES framework has outlined nine substantive and seven procedural values for decision-makers to navigate ethical issues underpinning health data (SHAPES Ethics Framework, 2019). The outlined values underpin the position that health data decision-making cannot be strictly grounded on the principles and processes underpinning technology.

Normative Governance Models for Artificial Intelligence

Ethical considerations arise at all stages of the life cycle of AI-driven solutions, from choosing and developing models to implementing them at the clinical stage. Apart from governance structures for health care and AI, fairness, transparency, trustworthiness, and accountability must be prime considerations for responsible integration (Reddy et al., 2020). Governance structures for health care and AI identify the necessity for assurance on provenance and quality from the training environment for AI models and the methods for risk evaluation and management (Reddy et al., 2020).

International Coordination and the Challenge of Divergent Standards

A highly complex issue with regard to governance within this field is the diversity and disparity among various nations and their approaches to data protection and validation with regard to AI and clinical application. It is observed among various nations that they vary widely with respect to governance bodies for validation and regulation on the application of health-related information and safety norms for AI development and application (Morley et al., 2022). It is now being realized that there is a critical need for global collaboration to address this issue.

Systematic Assessment of Data Sensitivity and Risk

Ethical governance practice must, therefore, take into consideration the varying risk levels posed by different types of health data. A methodical framework for risk evaluation for such health data is made possible by the use of the Sensitivity Risk Index. Specifically, the dimensions involving identifiability and inherent sensitivity and harm potential relative to preferences for consents (Maryala, 2025) must be evaluated. Together, these models of governance show that big data/ AI must be more than reliable for health care if it is to be used properly: big data/ AI must be guided by a consistent set of ethical principles. The models described above make one thing clear: transparency, fairness, and trustworthiness must be at the heart of any health system that uses AI successfully.

CONCLUSION

This work asserts that with the integration between big data and AI being more deeply incorporated within health care processes, the core areas within the ethical framework relate to privacy, trust, and accountability. With highly sensitive health care information, the potential for re-identification informing and intersecting within complex datasets outside predictable parameters serves to inform the premise that health care privacy requires ethical parameters outside those informing strictly computational approaches (Price and Cohen, 2019).

On this basis, any discourse on health care data relates to more than security approaches and inform principles including personal and social accountability. The implication of AI application within medical decision-making further strengthens the emphasis on normative analysis. As AI is increasingly being used for various medical aspects such as diagnosis and treatment, data reliability and representitivity play critical roles within clinical practice (Reddy et al., 2020).

In this regard, transparency is therefore communicating model ability and risk, as opposed to merely explaining model behavior (Colloby et al., 2020). Fairness is a substantive issue when the datasets on which the model is built do not adequately reflect diversity within the population. In such a case, one can be expected to encounter biased forecasts and treatment disparities with regard to providing medical care for all patients equally (Price and Cohen, 2019).

Adequate representation is thus among the prime responsibilities within AI model building and application. Governance frameworks provide a system for addressing all these considerations. Value-based methods for decision-making are focused on respect for others, justice, transparency, and the greater good; normative governance frameworks mean that certain standards must be met for responsible AI development and application; and global partnerships reaffirm the critical application for harmonizing approaches across multiple governing bodies (SHAPES Ethics Framework, 2019; Reddy et al., 2020; Morley et al., 2022).

More specific methods for responsible decision-making can be found through the use of methods such as the Sensitivity Risk Index (Maryala, 2025). Taken together, these observations point to the reality that the judicious application of big health care data and AI must be multifaceted. Issues such as regard for personal privacy and transparency should play important roles for practitioners. Once this is accomplished, the potential for big health care data and AI to renew the ethical and human aspects within health care can be fully realized.

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