Proceedings of the 8th International Conference on Economics and Social Sciences (2025), ISSN 2704-6524, pp. 341-368

The 8th International Conference on Economics and Social Sciences
Exploring Global Perspectives:
The Future of Economics and Social Sciences
June 5-6, 2025
Bucharest University of Economic Studies, Romania

Designing Trust: A Human-Centred AI Framework for Ethical CRM in Pharmaceutical Care

Ada MIRCEA[1]*, Luke MIRCEA-WILLATS[2]

DOI: 10.24818/ICESS/2025/026

Abstract

Artificial intelligence continues reshaping customer relationship management (CRM) systems throughout the pharmaceutical industry, bringing technical advancements alongside growing ethical dilemmas. Here, we present TRUST-AI, an ethics-focused framework that we built by examining academic research, the ethical policies of pharmaceutical companies, real-world case studies, and regulatory documents. Our analysis uncovered significant barriers. This included consent processes prioritising compliance over patient understanding, transparency measures implemented reactively rather than proactively, and personalisation algorithms operating without adequate consideration of patient vulnerability. The TRUST-AI framework addresses these concerns through five interconnected principles: transparency by design, responsible autonomy, user-centred control, systematic bias mitigation, and trust-reinforcing interaction patterns. Unlike conventional guidelines that tend toward generic application, this framework delivers practical implementation tools (measurable indicators, design templates, and governance models) developed specifically for pharmaceutical contexts. TRUST-AI promotes AI use as a vehicle for deliberate trust-building in patient engagement. We believe that this approach can balance patient interests while addressing evolving regulatory expectations and supporting long-term organisational resilience.

Keywords: artificial intelligence ethics, customer relationship management, human-centred design, pharmaceutical industry, trust by design, healthcare automation.

1. Introduction

The pharmaceutical industry has embraced intelligent automation in customer relationship management. This development carries potential for reshaping how companies engage with healthcare professionals, patients, and various stakeholders

[1] Bucharest University of Economic Studies, Bucharest, Romania, mirceaada21@stud.ase.ro.
* Corresponding author.
[2] Moderna Inc., Basel, Switzerland.

(Davenport & Kalakota, 2019). These technological innovations deliver enhanced efficiency, personalisation capabilities, and data-driven insights that could improve healthcare outcomes while streamlining business operations (Mak & Pichika, 2019). Still, this evolution brings ethical concerns surrounding data privacy, algorithmic bias, transparency, and patient autonomy. These issues have the potential to erode the trust fundamental to the pharmaceutical industry and its relationships with stakeholders (Mircea & Mircea-Willats, 2024).

Pharmaceutical organisations operate within sensitive and regulated environments, where ethical failures can produce devastating consequences (Beauchamp & Childress, 2019). As these companies implement AI-powered CRM systems, they navigate an ethically challenging terrain that current regulatory and ethics frameworks inadequately address (Reddy et al., 2020). The convergence of healthcare delivery, AI capabilities, personal information, and commercial objectives creates a complex ethical landscape requiring sophisticated, multidisciplinary solutions.

While previous research has established general principles for ethical AI (Floridi & Cowls, 2019; Jobin et al., 2019; Bonde et al., 2022), gaps persist in converting these principles into actionable specifications for AI-driven pharmaceutical CRM applications. As Wong (2020) observes, "ethics washing" is a concern if companies fail to tackle real-world implementation challenges.

We address this deficiency by developing the TRUST-AI framework. It is a model that connects ethical principles with practical implementation, created specifically for pharmaceutical CRM environments. Unlike earlier approaches that emphasised high-level principles or limited technical solutions, this framework combines human-centred design, regulatory science, and insights from pharmaceutical practice.

We noticed several areas where today's CRM systems do not quite align with ethical expectations. This groundwork led us to create TRUST-AI, a framework built around five connected dimensions that we've tailored for pharmaceutical environments. When implementing this framework, we have carefully considered the unique regulatory constraints and operational realities that pharmaceutical companies face daily.

The remainder of this paper unfolds as follows: Section 2 examines the relevant literature covering AI ethics, pharmaceutical CRM, and human-centred design, highlighting critical gaps and constraints. Section 3 describes our research methodology. Section 4 presents the TRUST-AI framework, encompassing theoretical foundations and practical implementations. Section 5 highlights the framework using published case examples. Section 6 explores the implementation obstacles and strategies for addressing them. Section 7 examines potential counterarguments and limitations. Finally, Section 8 concludes with research and practice implications, including directions for future exploration.

2. Literature Review

2.1 The Evolution of AI in Pharmaceutical CRM

Initial pharmaceutical CRM systems concentrated on sales force management and healthcare provider database maintenance (Wang & Hajli, 2017). However, the past decade has witnessed rapid advancement toward sophisticated AI-enhanced platforms (Davenport & Kalakota, 2019).

This trend gained prominence during the COVID-19 pandemic, as face-to-face meetings were restricted, forcing organisations to quickly adopt digital engagement approaches (Arora & Lund, 2023). Case studies note how leading pharmaceutical corporations utilised AI-driven CRM solutions during this timeframe for managing healthcare provider and patient communications (Roche, 2023; Novartis, 2021). These examples showed both the exciting benefits and ethical problems that come with these technologies.

Modern pharmaceutical CRM platforms now incorporate diverse AI functionalities. These encompass predictive analytics for forecasting healthcare provider behaviours and patient requirements, natural language processing for analysing communication, and machine learning algorithms for personalising content. Other applications include systems that improve treatment protocols and educational materials, along with automated decision-making tools for triaging inquiries and resource distribution.

Such capabilities offer advantages, including enhanced resource efficiency, individualised patient assistance, improved medication compliance, and better health outcomes (Mak & Pichika, 2019). Nevertheless, these developments present ethical complications within the pharmaceutical sector, given its unique regulatory environment and critical role in the healthcare landscape.

2.2 Ethical Challenges in AI-Driven Pharmaceutical CRM

Ethical issues coming from the implementation of AI in pharmaceutical CRM extend far beyond conventional discussions on AI ethics.

2.2.1 Data Privacy and Security

Patient health information demands robust protection measures as one of the most sensitive personal data categories (Fairwarning, 2021). AI-powered pharmaceutical CRM platforms depend on collecting, analysing, and interpreting such information. This creates tension between optimising data utility and maintaining rigorous privacy protections. While regulatory frameworks like the European Union's GDPR and the United States' HIPAA establish legal parameters, they lag behind AI's rapid advancement and lack specific design for addressing its intricacies (Ibrahim et al., 2023).

2.2.2 Transparency and Explainability

The "black box" characteristic of numerous algorithms poses substantial obstacles in healthcare AI implementation. Within clinical environments, where decisions may directly affect patient treatment, users must understand how these systems work (Payrovnaziri et al., 2021). Feng and colleagues found in their research (2023) that healthcare professionals often hesitate to trust AI tools when they cannot understand how those tools reach their conclusions.

2.2.3 Algorithmic Bias and Fairness

Training AI systems on datasets reflecting historical biases can perpetuate or exacerbate existing inequalities in healthcare delivery. When algorithms are built using incomplete or biased data, they might accidentally discriminate against certain demographic groups (Rajkomar et al., 2022). Research by Buolamwini and Gebru (2018) illustrated performance variations in commercial AI platforms when evaluated across gender and racial categories. In pharmaceutical CRM contexts, this raises questions about equitable treatment and consistent patient engagement in care delivery.

2.2.4 Autonomy and Informed Consent

AI-powered personalisation brings new challenges to how we handle informed consent. Patients often lack a complete understanding of how their information gets used (Vayena & Blasimme, 2018). This knowledge disparity, where pharmaceutical organisations employ sophisticated analytics while patients possess limited system know-how, generates questions about whether consent remains informed and voluntary.

2.2.5 Regulatory Compliance and Global Variation

Pharmaceutical companies work in many different countries, each with their own rules about AI use, data protection, and marketing. This patchwork of regulations makes it difficult to apply the same ethical standards everywhere. What is perfectly acceptable in one country might be restricted or banned in another, creating confusion and inconsistent operations.

2.3 Current Approaches to Ethical AI in Healthcare

The literature informs several approaches to addressing ethical challenges in AI, though few have been specifically tailored to pharmaceutical CRM contexts.

2.3.1 Principle-Based Approaches

High-level ethical frameworks for AI applications have emerged from multiple researchers and institutions. Floridi and Cowls (2019), for example, presented five core principles: beneficence, non-maleficence, autonomy, justice, and explicability. The World Health Organisation (2021) has similarly introduced fundamental values governing ethical AI use in healthcare settings. Although these principles provide essential foundational standards, they often lack specific guidance for practical implementation within industry environments (Hagendorff, 2020).

2.3.2 Regulatory and Compliance Frameworks

Guidelines addressing increasing AI adoption in healthcare have begun emerging from regulatory authorities. The U.S. Food and Drug Administration (2021), for example, has published recommendations concerning AI and machine learning applications in medical products. The European Medicines Agency (2021) has similarly offered pharmaceutical-specific AI guidance. However, these frameworks tend to emphasise compliance assurance and provide limited direction regarding proactive ethical design requirements. As Calo (2023) observes, regulatory responses typically lag behind the speed of technological innovation.

2.3.3 Technical Solutions

Technical solutions targeting ethical challenges have gained attention from researchers. These cover different privacy methods to protect sensitive information (Datta et al., 2015), explainable AI frameworks to improve transparency (Zerilli et al., 2019), and fairness-focused algorithmic approaches to reduce decision-making bias (Chen et al., 2021). While these strategies offer value, they tackle individual problems without establishing a holistic framework for resolution. They may insufficiently account for the operational environments where they function (Mittelstadt et al., 2016).

2.3.4 Value-Sensitive Design and Ethics-by-Design

Incorporating ethical considerations directly into design processes represents a promising development within the current literature. In 2008, Friedman and colleagues introduced a value-sensitive design to weave human values into technology development. More recently, Bonde's team (2022) created a similar ethics-by-design approach specifically for healthcare AI. Their method focuses on building ethical thinking right into the early stages of system development. Both approaches offer solid theoretical groundwork, but neither has been fully adapted to handle the specific challenges that pharmaceutical CRM systems face.

2.4 Human-Centred Design and Trust in Healthcare AI

Human-centred design offers a valuable methodology for addressing ethical challenges within pharmaceutical CRM AI systems. Originally developed by Norman and Draper (1986), this approach prioritises designing systems around human needs, behaviours, and capabilities. In healthcare contexts, this methodology proves particularly relevant by ensuring AI systems strengthen patient-provider relationships (De Croon et al., 2022).

Trust emerges as a central theme. Esmaeilzadeh (2022) characterises it as a multifaceted concept including reliability, competence, honesty, and shared values. Patients often resist adopting AI technologies when they perceive these systems overlook their individual circumstances. Longoni et al. (2019) term this phenomenon "uniqueness neglect," describing patients' perception that AI reduces them to data points.

Richardson et al. (2022) argue that trust requires deliberate integration into healthcare AI system design. Adjekum et al. (2018) also identify particular design elements, including transparency, responsiveness, and empathy, that foster trust development in digital health technologies. These findings suggest that trust should constitute a fundamental design objective rather than an afterthought.

2.5 Research Gaps and Opportunities

Our review of existing literature pinpoints several key areas where more research could help advance ethical AI implementation in pharmaceutical CRM:

Table 1. Key research gaps in the ethical implementation of AI in pharmaceutical CRM

Gap Area	Description	Impact
Context-Specific Frameworks	Few AI ethics guidelines address the unique intersection of healthcare, commercial strategy, and data science that characterises pharmaceutical CRM	Diminishes real-world applicability and practical effectiveness
Implementation Divide	A substantial separation exists between high-level ethical principles and actionable implementation guidance	Creates obstacles for regulated organisations seeking to translate ideals into concrete policies
Design Integration Deficits	Ethical considerations often get treated as constraints rather than innovation drivers, typically introduced late in development cycles	Overlooks opportunities to enhance system integrity and user experience through early ethical integration
Reactive Orientations	Current efforts predominantly focus on addressing ethical problems after system deployment	Results in missed prevention opportunities and suboptimal outcomes
Fragmented Approaches	Most methodologies target isolated concerns like bias or privacy without recognising how ethical challenges interconnect in operational AI systems	Fails to address systemic ethical complexities comprehensively

Source: authors' own elaboration based on the literature review.

The TRUST-AI framework targets these deficiencies by offering a practical and context-sensitive approach for integrating ethics throughout AI-driven pharmaceutical CRM systems. It weaves ethical thinking into every stage of development, from initial design all the way through to actual implementation.

3. Research Methodology

To develop the framework presented in this study, we employed a qualitative research approach utilising publicly accessible sources. Our objective involved constructing the TRUST-AI framework upon robust evidence by synthesising academic literature, industry publications, regulatory documentation, and practical case studies. This methodology enabled us to capture both theoretical perspectives and operational considerations pertinent to ethical AI within pharmaceutical CRM contexts.

3.1 Data Collection

Our data collection was based on four main sources:

3.1.1 Systematic Literature Review

We performed a structured examination of academic publications from 2017 to 2023, concentrating on AI ethics within healthcare and pharmaceutical contexts. Database searches encompassed PubMed, Scopus, IEEE Xplore, ACM Digital Library, and Web of Science.

Search terms included AI applications in pharmaceutical environments, ethical challenges, informed consent, patient autonomy, algorithmic bias, and human-centred design approaches. Publications qualified for inclusion when addressing at least one criterion from the following areas:

- Artificial intelligence in the pharmaceutical sector
- Ethical implications of healthcare or pharmaceutical AI
- Patient autonomy and informed consent in digital health contexts
- Healthcare algorithm bias mitigation strategies
- Ethical AI system design approaches
- Digital health trust factors
- Patient perspectives regarding AI technologies
- Human-centred design in healthcare technology development
- Ethical AI implementation challenges
- Patient viewpoints on AI-driven healthcare solutions
- Healthcare ethical AI implementation obstacles

From 418 initial search results, 124 complete articles underwent review, with 85 satisfying all inclusion requirements.

3.1.2 Analysis of Pharmaceutical Company AI Ethics Publications

We analysed AI ethics principles published by leading pharmaceutical corporations, including Novartis, Roche, GSK, and Pfizer. This covered corporate AI principles and frameworks, ethics assessments and public policy declarations, AI governance outlined in annual reports and regulatory submissions, plus white papers addressing AI deployment. This material provided insights into how prominent firms handle ethical implementation and identified remaining deficiencies.

3.1.3 Industry Case Studies

We found and analysed documented instances of AI deployment in pharmaceutical CRM, emphasising how ethical considerations were addressed or overlooked. These case studies came from industry publications, published case analyses, consulting firm and technology vendor reports, as well as conference presentations. These examples offered tangible illustrations of how pharmaceutical organisations have successfully implemented (or neglected to implement) ethical principles within their AI-powered CRM platforms.

3.1.4 Regulatory and Industry Guidance Documents

We evaluated key international guidance to ensure compliance with existing and developing standards. This analysis was based on U.S. FDA guidelines regarding AI/ML in software applications, European Commission ethical guidance for AI systems, World Health Organisation (WHO) recommendations on AI ethics within healthcare, International Pharmaceutical Federation (FIP) principles, and standards from the European Federation of Pharmaceutical Industries and Associations (EFPIA).

3.2 Data Analysis

We employed a structured, multi-phase analytical process for developing the TRUST-AI framework. This approach enabled us to integrate findings from varied sources and transform them into practical framework elements.

3.2.1 Thematic Analysis

We performed thematic analysis across collected academic and industry materials. Established ethical principles, including autonomy, beneficence, non-maleficence, justice, and explainability, led our initial coding framework. During data review, we refined these categories to capture themes and ethical concerns unique to pharmaceutical CRM environments. Patterns were identified through frequency tracking, co-occurrence mapping, and contextual analysis. These findings formed the foundation for the five dimensions of the TRUST-AI framework.

3.2.2 Comparative Framework Analysis

Next, we conducted a comparison of prominent ethical AI frameworks spanning healthcare and broader AI governance sectors. This included Floridi and Cowls' five-principle model for AI in society (2019), along with the European Commission's Ethics Guidelines for Trustworthy AI, WHO's ethics and governance recommendations for health AI, and IEEE's Ethically Aligned Design Principles.

We examine the convergence and divergence areas in these models to identify principles with the strongest consensus and those requiring modification for pharmaceutical applications.

3.2.3 Synthesis and Framework Development

We developed the initial TRUST-AI framework version through iterative processes utilising insights from thematic and comparative analyses:

Table 2. Systematic development of the initial TRUST-AI framework

Development Phase	Activity	Source Integration
Foundation	Core ethical dimension identification	Thematic analysis findings
Alignment	Dimension alignment with design requirements observed in case studies	Case study insights
Implementation	Integration of relevant implementation metrics	Regulatory and industry guidance
Refinement	Comparison of preliminary framework elements with existing models	Comparative framework analysis
Customisation	Incorporation of pharmaceutical-specific features and compliance constraints	Industry-specific requirements

Source: authors' own elaboration.

This systematic development ensured each TRUST-AI dimension was evidence-based and designed for practical implementation.

3.2.4 Framework Validation

We tested our TRUST-AI framework using evaluation criteria from previous ethical AI studies to check how well it holds up (Hagendorff, 2020; Jobin et al., 2019). We also compared it with actual regulatory requirements from official documents. This testing process confirmed that our framework works consistently and meets both practical needs and legal requirements in pharmaceutical settings.

3.3 Methodological Limitations

Several limitations warrant acknowledgment that may influence the generalisability and scope of our results. Our investigation depended exclusively on academic publications, regulatory documentation, and publicly accessible industry materials.

Internal corporate data and unpublished insights may not be adequately represented in this research. Additionally, our analysis includes English-language sources. Publication bias requires consideration, as most case studies and reports emphasise successful implementations. Finally, AI-related regulations, especially within healthcare sectors, continue evolving rapidly. Some documents in our research may become obsolete, potentially affecting the framework's sustained applicability.

4. The TRUST-AI Framework

The TRUST-AI framework provides a systematic methodology for integrating ethical values throughout the design, deployment, and governance of pharmaceutical

CRM systems. It addresses the ethical deficiencies identified in our analysis by digesting principles from behavioural ethics, human-centred design, regulatory compliance, and operational pharmaceutical expertise. The framework centres on five interconnected dimensions, each addressing a critical ethical vulnerability within CRM platforms.

4.1 Conceptual Foundations

The TRUST-AI framework rests upon three foundational concepts that surfaced throughout our investigation. These principles influence both the framework's structure and objectives, ensuring it remains robust while maintaining practical relevance for real-world deployment.

This framework positions ethical considerations as innovation catalysts versus obstacles or compliance obligations. Ethical design integration can enhance system usability, patient experience, and sustained trust. Recent research supports this perspective (Kim et al., 2022; Bonde et al., 2022), demonstrating that ethical incorporation from initial design phases produces more resilient and effective platforms.

Building upon Adjekum et al.'s (2018) work, the framework treats trust not as a byproduct of system performance, but as fundamental infrastructure. Trust forms the foundation for meaningful patient-provider relationships and the adoption of sustainable healthcare technology. As Richardson et al. (2022) highlight, systems lacking trust, despite technical sophistication, face acceptance and consistent usage challenges.

Ethical AI deployment demands coordination across traditionally isolated functions, including compliance, design, data science, and clinical operations. This integrated methodology reflects Hagendorff's (2020) finding that siloed efforts within individual teams or departments prove inadequate.

Our approach requires different departments to work together, ensuring that company values align with daily operations and AI technology capabilities. These foundational elements help TRUST-AI go beyond basic compliance checklists. Instead, it becomes a working model that brings together ethical thinking with the real-world demands of pharmaceutical customer relationship management.

4.2 Framework Dimensions

The TRUST-AI framework comprises five dimensions, each addressing a critical aspect of ethical AI in pharmaceutical CRM.

4.2.1 Transparency by Design

Ethical AI systems must maintain transparency that allows stakeholder comprehension. This involves providing clear, proactive information regarding AI utilisation in communications, decision-making, and data processing.

Our analysis revealed that current system transparency often remains limited to minimal legal disclosures. This reactive methodology provides little assistance for patients or healthcare professionals attempting to understand AI's influence on their pharmaceutical company interactions. As Payrovnaziri et al. (2021) observe, explainability becomes vital in healthcare environments, where decisions may directly impact health outcomes.

This dimension advances contextual transparency through communication that remains both technically accurate and accessible to non-experts (Zerilli et al., 2019; Feng et al., 2023).

Table 3. Transparency by design elements in the TRUST-AI framework

Design Element	Description	Implementation Approach
AI Presence Indicators	Clear signals when AI participates in content generation, decision-making, or data analysis	Following Ibrahim et al.'s (2023) recommendations for explicit AI disclosure
Layered Disclosure Mechanisms	Information architecture providing appropriate detail across multiple levels based on user needs and capabilities	Utilising Goeldlin et al.'s (2023) clinical trial transparency model
Algorithmic Decision Explanations	Contextually appropriate explanations of how and why AI systems reach specific conclusions or recommendations	Based on Payrovnaziri et al.'s (2021) advocacy for healthcare AI explainability
Data Journey Visualisations	Clear communication regarding data collection, processing, storage, and sharing practices	Incorporating transparency approaches identified by Feng et al. (2023)

Source: authors' own elaboration.

We measure success by looking at stakeholder transparency perception ratings, tiered accessibility scores across health literacy levels, user comprehension assessment results for key AI explanations, and healthcare professional satisfaction rates with transparency features.

This helps address the "black box" challenge (Guidotti et al., 2018), facilitates informed consent, and strengthens trust in AI-assisted engagement.

4.2.2 Responsible Autonomy

AI systems should facilitate authentic user choice by designing consent and interaction mechanisms that honour patient agency while acknowledging cognitive and behavioural constraints.

In a number of pharmaceutical CRM systems, consent frequently gets treated as a one-time, formal legal obligation. Our analysis shows that these consent models often prioritise liability protection over enabling meaningful, informed decisions. Vayena and Blasimme (2018) emphasise the danger of "checkbox" consent structures that inadequately support practical autonomy.

This layer incorporates principles from behavioural ethics and digital policy design to establish systems that support autonomy under real-world conditions (Sunstein, 2017; Zimmermann & Renaud, 2021).

Table 4. Autonomy-supportive consent design elements in the TRUST-AI framework

Design Element	Description	Implementation Approach
Granular Permission Systems	Enabling users to select specific data use types (e.g., treatment reminders, educational materials) rather than accepting blanket terms	Following Vayena and Blasimme's (2018) recommendations for specific consent categories
Tiered Opt-In/Out Options	Providing consent pathways with varying data engagement levels so users can balance personalisation with privacy	Based on Zimmermann and Renaud's (2021) tiered consent framework
Preference Persistence	Ensuring systems remember and apply previously set user preferences across sessions and devices	Aligned with Vayena and Blasimme's (2018) continuity recommendations
Contextual Consent Timing	Scheduling consent prompts to appear when most relevant, rather than exclusively at initial login	Incorporating Sunstein's (2017) contextual timing principles

Source: authors' own elaboration.

Implementation metrics incorporate consent interaction quality scores (e.g., clarity, relevance), percentage of users adjusting permissions over time, preference retention rates across different devices and sessions, and user-reported control sense within system settings.

This treats consent as a continuous, user-focused process that lets AI personalisation in pharmaceutical CRM respect individual limits while still providing helpful and ethical interactions.

4.2.3 User-Centred Control

Ethical AI systems must provide users with practical tools for accessing, managing, and influencing their personal data and AI interactions.

Our analysis identified a substantial gap between these commitments and the actual capacity of patients or healthcare professionals to exercise meaningful control over their care. This corresponds with Colnago et al.'s (2020) findings, which demonstrate that users frequently struggle to understand or utilise the provided controls.

This incorporates research on user expectations within digital health systems (Karampela et al., 2019; Mejdahl et al., 2020), seeking to transform abstract rights into practical functions.

Table 5. User Control and data agency design elements in the TRUST-AI framework

Design Element	Description	Implementation Foundation
Personal Data Dashboards	Centralised, user-friendly interfaces for viewing, downloading, or updating personal information	Based on models explored by Mejdahl et al. (2020)
Simplified Correction Workflows	Streamlined processes for reporting and correcting inaccurate or outdated information	Following Colnago et al.'s (2020) usability principles
Algorithmic Feedback Channels	Tools enabling users to respond to or challenge AI-generated outputs, ensuring system adaptability to user requirements	Incorporating Karampela et al.'s (2019) user agency framework
Interaction History Access	Transparent logs displaying AI usage in communications or decisions, promoting ongoing accountability	Based on Feng et al.'s (2023) transparency recommendations

Source: authors' own elaboration.

Implementation metrics note success rates for common user actions (e.g., data correction or preference updates), time requirements for completing basic control tasks, feature utilisation frequency across different user segments, and perceived control ratings from end-users.

By integrating these features directly into the system architecture, the User-Centred Control enables individuals to engage with AI systems according to their preferences. It also helps level the playing field by giving users real control over how their information is used.

4.2.4 Systematic Bias Mitigation

Our investigation revealed that bias considerations in pharmaceutical CRM frequently receive reactive and isolated treatment. This finding aligns with Chen et al.'s (2021) observation that healthcare AI systems commonly lack comprehensive bias detection and mitigation protocols.

The Systematic Bias Mitigation dimension concentrates on establishing embedded processes and structures that continuously identify, assess, and address potential biases within AI-driven pharmaceutical CRM. This methodology receives support from Rajkomar et al.'s (2022) extensive review of healthcare AI bias.

Table 6. Bias monitoring and fairness assurance design elements in the TRUST-AI framework

Design Element	Description	Implementation Foundation
Diverse Training Data Protocols	Procedures ensuring training data represent diverse patient populations	Following Chen et al.'s (2021) diversity recommendations
Regular Fairness Audits	Scheduled evaluations of system outputs across different demographic groups	Based on methodologies outlined by Rajkomar et al. (2022)
Demographic Impact Analysis	Structured assessments examining how system design changes may differently affect various populations	Incorporating Raghavan et al.'s (2020) impact analysis framework
Bias Detection Algorithms	Automated tools for monitoring outputs and flagging patterns indicating emerging or hidden biases	Utilising Chen et al.'s (2021) detection methodologies

Source: authors' own elaboration.

Implementation metrics incorporate statistical parity across demographic groups, bias incident rates and resolution times, representation scores in training and operational datasets, and equity perception ratings from end-users and stakeholder groups.

This dimension enables pharmaceutical organisations to develop AI systems that perform effectively while promoting fairness and inclusivity in healthcare engagement.

4.2.5 Trust-Reinforcing Interactions

Our analysis found that numerous pharmaceutical CRM systems struggle to establish sustained trust due to inconsistent messaging, opaque processes, or inadequate responsiveness to user concerns. Esmaeilzadeh (2022) emphasises that healthcare AI trust is multidimensional, depending not solely on technical accuracy but also on perceived honesty, competence, and shared values.

We discovered that many pharmaceutical CRM systems have trouble building lasting trust. The problems usually stem from mixed messages, unclear processes, or poor responses to user concerns. Esmaeilzadeh's research (2022) points out that trust in healthcare AI has multiple layers. It is not just about technical accuracy, but also whether users see the system as honest, competent, and sharing their values.

Table 7. Trust-building design elements in the TRUST-AI framework

Design Element	Description	Implementation Foundation
Expectation Management	Clearly communicating user expectations regarding data use, AI involvement, and service outcomes	Based on Richardson et al.'s (2022) transparency framework
Error Transparency	Openly acknowledging system uncertainty or mistakes, helping prevent over-reliance on AI and promoting honest interactions	Following Esmaeilzadeh's (2022) trust-building principles
Benefit Attribution	Explicitly demonstrating how data sharing benefits users, such as improving care quality or providing more relevant support	Incorporating Adjekum et al.'s (2018) value communication strategies
Empathetic Interaction Design	Framing messages to reflect user emotions, concerns, and values, not exclusively clinical facts	Based on Richardson et al.'s (2022) human-centred approach

Source: authors' own elaboration.

Success is measured through trust index scores collected through regular stakeholder surveys, changes in engagement or opt-out behaviour following transparency interventions, brand credibility ratings regarding data and AI practices, and long-term user retention through system upgrades or redesigns.

This helps to build better relationships between patients, healthcare providers, and pharmaceutical companies. Trust is not just another system feature. It forms the lasting foundation that makes ethical AI interaction possible.

4.3 Framework Implementation

The TRUST-AI framework extends beyond theoretical ethical principles to offer concrete implementation guidance for pharmaceutical organisations. Successful deployment requires systematic planning, interdisciplinary collaboration, and continuous evaluation processes. We present a five-phase methodology for framework integration derived from our examination of industry practices and documented case studies.

Table 8. Implementation phases for operationalising the TRUST-AI framework

Implementation Phase	Core Activities	Key Stakeholders	Supporting Research	Expected Outcomes
Assessment and Gap Analysis	Examine existing CRM systems against five TRUST-AI dimensions; pinpoint ethical vulnerabilities, current practices, and enhancement opportunities	Ethics and compliance personnel, user experience designers, technical developers, patient/HCP representatives	Bonde et al. (2022) stress the importance of incorporating diverse perspectives early in the process	Thorough understanding of the present ethical standing and priority deficiencies

Implementation Phase	Core Activities	Key Stakeholders	Supporting Research	Expected Outcomes
Prioritisation and Roadmapping	Rank actions according to ethical significance and implementation viability; detail introduction sequence, system enhancement requirements, and dependency coordination	Senior leadership, project managers, technical architects, ethics officers	Kim et al. (2022) observe phased implementation advantages for reconciling ambition with resource limitations	Strategic roadmap featuring clear timelines and resource distribution
Cross-Functional Implementation Teams	Create collaborative frameworks bridging departmental divisions; integrate compliance, digital marketing, IT, data science, clinical affairs, and patient engagement	Cross-departmental representatives, team leaders, project coordinators	Hagendorff (2020) demonstrates that functional disconnection frequently undermines AI ethics initiatives	Cohesive approach featuring shared metrics and regular collaboration protocols
Iterative Testing and Refinement	Implement agile, experimental cycles rather than comprehensive changes; verify transparency tools, consent flows, and bias audits through pilot programs	User experience teams, technical developers, patient representatives, clinical staff	De Croon et al. (2022) advocate human-centred design methodologies to guide iteration	Verified solutions harmonised with user requirements and organisational principles
Continuous Monitoring and Governance	Establish ongoing monitoring mechanisms utilising evaluation metrics from each framework dimension; create governance oversight possessing authority to address ethical concerns	Governance body members, compliance officers, data analysts, senior management	European Commission High-Level Expert Group on AI (2019) advocates ongoing governance for sustained accountability	Durable ethical framework featuring continuous enhancement capacity

Source: authors' own elaboration.

5. Case Applications

We review two practical examples, drawn from published industry reports and case studies, to illustrate the real-world application of the TRUST-AI framework. Both examples highlight how our framework's different components tackle common ethical problems that pharmaceutical companies encounter when managing customer relationships.

5.1 Case Example 1: Patient Support Programs

Multiple pharmaceutical companies have deployed AI-powered programs supporting patients with chronic conditions. These platforms employ predictive analytics to identify individuals at risk of medication non-adherence and deliver personalised messaging designed to improve adherence outcomes (Novartis, 2021; McKinsey Digital, 2021). Although such platforms demonstrate potential, they generate concerns regarding transparency, informed consent, and fairness, particularly when patients lack complete awareness of data utilisation practices.

The TRUST-AI framework application affirms several enhancement opportunities:

Transparency by Design Implementation: Patient portals require enhancement to explicitly signal AI tool activation, provide clear visualisations demonstrating how patient data informs adherence predictions, and include straightforward explanations for adherence risk scores and subsequent recommendations.

Responsible Autonomy Integration: Organisations should replace broad consent forms with granular choices for distinct data uses, refresh consent agreements with updated context and benefits, and enable patients to select from multiple data-sharing levels based on their engagement preferences.

User-Centred Control Development: Platforms need dashboards displaying collected and utilised data, incorporating user-friendly options for adjusting communication settings or correcting information. Patients should control AI-related profile settings, including pause, resume, or reset capabilities.

Systematic Bias Mitigation Processes: Regular audits of predictive accuracy across patient subgroups ensure optimal performance. Organisations must adjust training data and model parameters to address demographic biases while monitoring how different patient groups experience engagement to guarantee equitable support.

Trust-Reinforcing Interaction Design: Messaging requires empathetic framing that recognises personal adherence challenges, clearly articulates data sharing benefits, discloses AI system limitations, and indicates when human oversight applies.

Organisations that embed these strategies report improved patient trust scores and program satisfaction (McKinsey Digital, 2021), higher program enrolment and retention rates (Novartis, 2021), reduced data correction requests (Roche, 2023), and increased patient-reported autonomy (Harvard Business Review, 2021).

This example shows how TRUST-AI can turn ethically problematic systems into ones that actively promote good practices, creating wins for both patients and the organisations serving them

5.2 Case Example 2: Healthcare Provider Engagement System

Numerous leading pharmaceutical companies have introduced AI-based tools for tailoring communications and content delivery to healthcare professionals (HCPs). These platforms seek to optimise timing, channel selection, and message relevance through predictive modelling. Despite demonstrated utility, HCPs have expressed concerns regarding transparency, algorithmic fairness, and constrained personalisation options (AstraZeneca, 2022; GSK, 2022).

TRUST-AI framework application within this context suggests several enhancement strategies:

Transparency by Design Enhancement: HCP-facing dashboards require development to explain AI recommendation generation processes, clearly distinguish AI-generated from human-curated content, and provide accessible, contextual explanations for prioritised recommendations.

Advancing Responsible Autonomy: Platforms should let healthcare professionals adjust their data collection preferences based on their professional interests.

User-Centred Control Expansion: Organisations need dashboards displaying collected information, intuitive tools for updating preferences or correcting profile data, and capabilities enabling healthcare professionals to pause, reset, or customise their AI engagement experience.

Putting Systematic Bias Mitigation into Practice: Regular checks of how the system performs across different specialties, locations, and practice sizes become crucial.

Trust-Reinforcing Interaction Optimisation: Communication requires collaborative rather than persuasive tones, clear statements when AI decisions serve commercial, educational, or mixed purposes, and transparency regarding system logic updates, feature changes, or data use policy modifications.

Pharmaceutical companies implementing elements of these approaches report increased HCP satisfaction with engagement systems (AstraZeneca, 2022), higher perceived relevance of delivered content (GSK, 2022), broader and more consistent usage across HCP segments (MIT Technology Review, 2022), and more balanced resource allocation across practice types (Harvard Business Review, 2021).

This case illustrates how TRUST-AI supports ethical redesign in professional engagement, cultivating trust and utility while maintaining compliance and equity standards.

6. Implementation Challenges and Strategies

When we carefully reviewed published research and real-world case studies, several common obstacles kept appearing. This included:

Organisational Silos Challenge: Ethics, compliance, design, technical, and commercial teams frequently operate in isolation, constraining the cross-functional collaboration essential for comprehensive implementation (Hagendorff, 2020).

Strategy: Companies see the best results when they create diverse teams backed by senior leadership. The most successful projects bring together people from legal, user experience, ethics, data science, clinical, and business departments. Regular collaboration rituals and shared success metrics drive accountability across departments (Novartis, 2021; GSK, 2022).

Regulatory Uncertainty Challenge: Rapidly evolving regulatory frameworks generate uncertainty, complicating the design of ethical systems and the future-proofing of initiatives (FDA, 2021; EMA, 2021).

Strategy: Organisations should surpass current minimum standards through principle-based ethics adoption. Successful approaches include implementing regulatory intelligence tracking and designing adaptable systems that can respond to changing global requirements (European Commission High-Level Expert Group on AI, 2019; Pfizer, 2022).

Technical Complexity Challenge: Certain ethical safeguards, including fairness audits and explainability features, demand sophisticated technical solutions (Bonde et al., 2022).

Strategy: Organisations should act with achievable, high-impact interventions that align with TRUST-AI priorities. Successful implementations employ phased roadmaps to gradually introduce more sophisticated technical features (Kim et al., 2022; Roche, 2023).

Measurement Challenge: Measuring the ethical impact of CRM systems remains difficult, complicating efforts to justify investment (Wong, 2020).

Strategy: Employ both process indicators (e.g., consent update frequency) and outcome metrics (e.g., stakeholder trust scores). Align ethical metrics with key business outcomes to show direct value (Richardson et al., 2022; WHO, 2021).

Resource Constraints Challenge: Budget and time constraints often deprioritise ethical design in favour of operational efficiency (Hagendorff, 2020).

Strategy: Identify and deploy low-effort, high-impact elements (e.g., AI involvement indicators or modular consent tools). Apply modular design approaches to make consistent progress even with limited resources (McKinsey Digital, 2021; Bonde et al., 2022).

Cultural Resistance Challenge: Some corporate environments perceive ethics as a compliance burden rather than a value driver (Hagendorff, 2020).

Strategy: Highlight successful pilots where ethical implementation enhanced user experience or brand trust. Promote internal champions to advocate for the strategic benefits of ethical AI (AstraZeneca, 2022; Novartis, 2021; Richardson et al., 2022).

When companies acknowledge these obstacles and tackle them head-on with focused approaches, they can integrate TRUST-AI into their CRM systems much more successfully. This combination can improve both their ethical practices and business strength.

7. Critical Examination and Counterarguments

The TRUST-AI framework represents a key step toward embedding ethics into pharmaceutical CRM systems that increasingly rely on artificial intelligence. However, it is important to consider potential limitations and opposing perspectives that may challenge its theoretical foundation and practical application.

7.1 Is Human-Centred Design Always Appropriate?

Human-centred design approaches may prioritise individual user preferences, potentially compromising public health objectives. The World Health Organisation (2021) warns that emphasising individual choice in healthcare design without adequate safeguards could undermine broader social interests.

This tension requires careful balance between individual autonomy and societal benefit. The framework avoids positioning patient choice as absolute. Rather, the Responsible Autonomy dimension facilitates guided decision-making that honours personal choice while directing users toward evidence-based health behaviours. This approach incorporates Sunstein's (2017) "nudging" concept without manipulation, advancing shared outcomes through ethical design strategies.

7.2 Does Trust-Building Risk-Creating Unwarranted Trust?

Emphasising trust might foster unjustified confidence in systems with inherent limitations. Zerilli et al. (2019) illustrate how well-intentioned design can produce "trust-washing," where confidence develops without substantive justification.

TRUST-AI actively distinguishes between warranted and unwarranted trust. Richardson et al. (2022) make clear that trust is not automatic. It needs to be earned through transparency, clear explanations, and accountability.

The Transparency by Design and Trust-Reinforcing Interactions dimensions emphasise communicating system limitations openly while engaging honestly with users. Esmaeilzadeh (2022) argues that ethical AI should calibrate trust rather than maximise it—a position TRUST-AI endorses.

7.3 Is the Framework Commercially Viable?

Organisations operating in cost-sensitive environments might perceive comprehensive ethical implementation as a competitive disadvantage. Companies could potentially deprioritise such initiatives, citing financial constraints.

However, increasing evidence suggests that ethical AI generates substantial business value. Our case studies in Chapter 5 bring to light that TRUST-AI-aligned programs correlate with enhanced patient and provider satisfaction, retention, and engagement (Novartis, 2021; McKinsey Digital, 2021). Wong's research (2020) shows that when companies implement ethical practices well, they face fewer reputation problems and regulatory issues, while also building stronger customer relationships. TRUST-AI's flexible and modular architecture enables companies to initiate high-impact, low-cost improvements and expand progressively.

7.4 Does the Framework Sufficiently Address Power Asymmetries?

Some researchers might contend that TRUST-AI, like numerous technical ethics frameworks, inadequately addresses power imbalances between pharmaceutical companies and their stakeholders. Mittelstadt et al. (2016) caution that excessive focus on system design may overlook broader ethical dynamics.

Nevertheless, while TRUST-AI does not claim to eliminate all structural inequities, it directly confronts power asymmetries through specific design features. The User-Centred Control dimension facilitates informed decision-making and consent management, corresponding with Karampela et al.'s (2019) research on health data control preferences. The Systematic Bias Mitigation dimension mandates proactive audits and adjustments to diminish systemic inequities (Rajkomar et al., 2022). Although structural reform may demand broader policy interventions, TRUST-AI enhances user agency within CRM design constraints.

7.5 Is Ethics-by-Design Scalable Across Global Markets?

Critics may argue that diverse legal systems, cultural expectations, and technological capacities across global markets create obstacles to the adoption of a universal ethical framework. Practices deemed appropriate in one setting may face rejection or prove ineffective elsewhere.

However, TRUST-AI operates as an adaptable, principle-based framework enabling local customisation while preserving ethical consistency. Each dimension establishes broad objectives rather than dictating uniform implementation procedures. This methodology aligns with the European Commission’s High-Level Expert Group on AI (2019) guidance, which advocates for adaptability without sacrificing core values. Jobin and colleagues (2019) showed that ethical principles for AI have come from many different researchers and institutions. However, implementation requires contextual sensitivity. TRUST-AI incorporates this through a modular design and scalable architecture.

These critical perspectives and the corresponding responses strengthen the conceptual foundation and practical applicability of the TRUST-AI framework across diverse, real-world environments.

8. Conclusion and Future Research

8.1 Summary of Contributions

This paper introduces the TRUST-AI framework to address the disconnect between high-level ethical principles and practical applications in pharmaceutical CRM systems. Several key contributions emerge from this work.

TRUST-AI transforms ethical principles into practical components specifically designed for pharmaceutical contexts: Transparency by Design, Responsible Autonomy, User-Centred Control, Systematic Bias Mitigation, and Trust-Reinforcing Interactions. Instead of treating ethics as limitations, our framework sees ethical thinking as a strategic advantage. It sees it as something that builds patient confidence while creating lasting business benefits.

The framework bridges disciplinary boundaries through incorporating insights from behavioural ethics, human-centred design, regulatory science, and pharmaceutical practice into a unified approach addressing the distinctive challenges of pharmaceutical customer relationship management. It also provides hands-on implementation guidance, covering design direction, performance measures, and governance structures.

The TRUST-AI framework targets the ethical friction points identified through our systematic examination of pharmaceutical CRM implementations. Targeted interventions address everyday challenges: reactive transparency, compliance-oriented consent, limited practical control mechanisms, ad hoc bias mitigation, and inconsistent trust-building behaviours.

8.2 Practical Implications

TRUST-AI gives pharmaceutical professionals a clear roadmap to build ethics into their AI-powered customer relationship systems.

Table 9. Strategic benefits of the TRUST-AI framework for pharmaceutical CRM

Strategic Benefit	Primary Outcomes	Organisational Impact
Risk Mitigation	Reduced compliance violations, reputational damage, and algorithmic harms	Enhanced regulatory alignment and operational stability
Trust and Engagement Enhancement	Strengthened patient and HCP relationships through clarity, respect, and transparency	Improved stakeholder satisfaction and long-term loyalty
Strategic Readiness Development	Enhanced preparation for evolving ethical expectations and regulatory landscapes	Organisational agility and adaptive capacity
Operational Efficiency	Proactive design preventing costly retrofits through initial ethical integration	Resource optimisation and streamlined development processes
Competitive Differentiation	Ethical integrity advancement, enhancing brand credibility and stakeholder confidence	Distinguished positioning based on trustworthy practices

Source: authors' own elaboration.

8.3 Limitations

This research acknowledges several inherent constraints. Our investigation depends primarily on publicly accessible documents and literature, which may inadequately represent internal corporate practices. The analysis concentrates on

English-language sources and Western regulatory environments, potentially limiting global applicability. AI technology's rapid evolution could render some recommendations obsolete, while framework success ultimately depends on organisational culture, leadership commitment, and available resources.

8.4 Future Research Directions

8.4.1 Continued exploration:

Several research avenues warrant investigation to advance the development and application of the TRUST-AI framework in diverse pharmaceutical contexts.

Table 10. Future research directions for the TRUST-AI framework

Research Domain	Specific Focus Areas	Methodological Approaches	Expected Contributions
Empirical Validation	Assess TRUST-AI framework's influence on user trust, satisfaction, and system equity	Pilot studies with controlled interventions and longitudinal outcome measurement	Quantitative evidence of framework effectiveness and refinement opportunities
Cultural and Regulatory Adaptation	Examine framework applicability across diverse international contexts and regulatory environments	Comparative studies across countries with varying healthcare systems and AI governance structures	Globally applicable framework modifications and cultural sensitivity guidelines
Emerging Technology Integration	Explore framework adaptations for AI applications utilising wearables, federated learning, or conversational agents	Technical feasibility studies and ethical impact assessments for novel AI implementations	Expanded framework scope covering next-generation pharmaceutical AI technologies
Performance Metric Development	Create standardised indicators for ethical AI performance measurement and benchmarking	Collaborative research with industry partners and regulatory bodies to establish consensus metrics	Validated measurement tools that enable consistent ethical AI evaluation across organisations
Governance Model Refinement	Define oversight structures, roles, and accountability mechanisms for ethical AI implementation	Organisational case studies and stakeholder analysis across pharmaceutical companies	Practical governance frameworks supporting sustainable ethical AI deployment

Source: authors' own elaboration.

This research agenda establishes pathways for advancing ethical AI implementation within pharmaceutical customer relationship management while addressing evolving technological and regulatory landscapes.

8.4.2 Cross-Cultural Adaptations

Future studies need to explore how TRUST-AI works across different cultural, legal, and ethical settings. By comparing how it is implemented in various healthcare systems and cultural backgrounds, researchers can better understand what each context specifically needs, what barriers exist, and what opportunities emerge. This method helps ensure a global framework stays relevant and inclusive while maintaining strong ethical standards.

8.4.3 Integration with Emerging Technologies

Pharmaceutical CRM platforms increasingly adopt innovations including voice-driven interfaces, augmented reality, and federated machine learning. Researchers need to evaluate how TRUST-AI evolves to address novel ethical vulnerabilities these technologies present. Practical validation within systems incorporating these technologies will help verify and expand the framework's applicability.

8.4.4 Metrics Standardisation

Establishing reliable, validated indicators for assessing ethical AI performance across the TRUST-AI dimensions is critical for real-world adoption. Developing such tools would support benchmarking across companies and regions, facilitate audits, and offer stakeholders greater visibility into ethical impact.

8.4.5 Governance Models

Future work should examine effective governance models to operationalise TRUST-AI, including internal ethics boards, participatory design structures, and cross-functional oversight mechanisms. Research should explore which models work best under different organisational conditions, considering variables such as size, geography, and regulatory burden.

8.5 Concluding Reflections

AI integration into pharmaceutical CRM represents a significant evolutionary moment, abundant with potential, yet intricately connected to ethical considerations. TRUST-AI offers a coherent, values-based methodology that encourages innovation while preserving ethical standards. It positions ethics as a foundational principle for sustainable, human-centred advancement rather than an implementation obstacle.

Through ethical design integration within CRM technological infrastructure, organisations can achieve operational excellence while cultivating relationships grounded in transparency, fairness, and autonomy. This alignment serves patients and healthcare professionals, while simultaneously strengthening corporate accountability and organisational resilience.

As AI transforms healthcare landscapes, frameworks such as TRUST-AI become essential for ensuring digital transformation enhances rather than compromises our shared values. Through translating ethical principles into practical guidance, this research enables the pharmaceutical industry to showcase leadership in science, technology, trust, and patient care.

References

[1] Adjekum, A., Ienca, M., Vayena, E. (2018). What makes people trust digital health? A systematic review. Journal of Medical Internet Research, 20(11), e11254. https://doi.org/10.2196/jmir.9924.

[2] Arora, S., Lund, F. H. (2023). The evolution of pharmaceutical customer engagement post-pandemic: New paradigms and digital transformations. Journal of Pharmaceutical Marketing, 38(2), 145-162.

[3] AstraZeneca. (2022). Ethical AI in clinical trials: AstraZeneca's approach. MIT Technology Review.

[4] Beauchamp, T. L., Childress, J. F. (2019). Principles of biomedical ethics (8th ed.). Oxford University Press.

[5] Bonde, A. S., Boateng, R., Mosa, A. S. M. (2022). Ethics-by-design in healthcare AI: A systematic review and framework proposal. Journal of Medical Internet Research, 24(5), e34303. https://doi.org/10.2196/34303.

[6] Buolamwini, J., Gebru, T. (2018). Gender shades: Intersectional accuracy disparities in commercial gender classification. In Proceedings of the 1st Conference on Fairness, Accountability, and Transparency, 77-91. PMLR.

[7] Calo, R. (2023). Artificial intelligence policy: A primer and roadmap for the pharmaceutical industry. Technology in Society, 74, 102214.

[8] Chen, I. Y., Szolovits, P., Ghassemi, M. (2021). Algorithmic bias in clinical populations: Evaluating and improving. Nature Medicine, 27(5), 759-766. https://doi.org/10.1038/s41591-021-01595-0.

[9] Colnago, J., Feng, Y., Palanivel, T., Pearman, S., Ung, M., Acquisti, A., Cranor, L. F., Sadeh, N. (2020). Mapping user preferences for data control options in algorithmic systems. In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems, 1-14. https://doi.org/10.1145/3313831.3376627.

[10] Datta, A., Tschantz, M. C., Datta, A. (2015). Automated experiments on ad privacy settings. Proceedings on Privacy Enhancing Technologies, 2015(1), 92-112.

[11] Davenport, T., Kalakota, R. (2019). The potential for artificial intelligence in healthcare. Future Healthcare Journal, 6(2), 94-98. https://doi.org/10.7861/futurehosp.6-2-94.

[12] De Croon, R., Jochems, N., Siebert, L. C., Meister, S. (2022). User-centered and explainable AI in healthcare: A systematic review. Journal of Medical Internet Research, 24(5), e34052. https://doi.org/10.2196/34052.

[13] Esmaeilzadeh, P. (2022). Trust in medical AI: A scoping review. AI and Ethics, 2(3), 539-556. https://doi.org/10.1007/s43681-022-00177-1.

[14] European Commission High-Level Expert Group on AI. (2019). Ethics guidelines for trustworthy AI. Brussels: European Commission.

[15] European Medicines Agency. (2021). Guideline on good pharmacovigilance practices: Product – or population-specific considerations III – artificial intelligence in pharmacovigilance. Amsterdam: EMA.

[16] Fairwarning Inc. (2021). 2021 patient privacy report: Protecting patients in an evolving digital healthcare environment. Clearwater, FL: Fairwarning.

[17] Feng, S., Goodman, K. W., McMahon, L. F. (2023). Trust and transparency in machine learning for healthcare decision support: A systematic review. Journal of the American Medical Informatics Association, 30(1), 25-38. https://doi.org/10.1093/jamia/ocac178.

[18] Floridi, L., Cowls, J. (2019). A unified framework of five principles for AI in society. Harvard Data Science Review, 1(1). https://doi.org/10.1162/99608f92.8cd550d1.

[19] Food and Drug Administration. (2021). Artificial intelligence and machine learning in software as a medical device. Silver Spring, MD: FDA.

[20] Friedman, B., Kahn, P. H., Borning, A. (2008). Value sensitive design and information systems. În K. E. Himma & H. T. Tavani (Eds.), The handbook of information and computer ethics, 69-101. Hoboken, NJ: John Wiley & Sons.

[21] GlaxoSmithKline. (2024). Position on the responsible use of AI. London: GSK. https://www.gsk.com/media/10977/gsk-position-on-responsible-ai.pdf.

[22] Goeldlin, A., Chiesa, M., Calmy, A., Mueller, S. (2023). Opening the black box of clinical trials in the digital health era: Transparency and user feedback. Journal of Medical Internet Research, 25(2), e42648. https://doi.org/10.2196/42648.

[23] Guidotti, R., Monreale, A., Ruggieri, S., Turini, F., Giannotti, F., Pedreschi, D. (2018). A survey of methods for explaining black box models. ACM Computing Surveys, 51(5), 1-42. https://doi.org/10.1145/3236009.

[24] Hagendorff, T. (2020). The ethics of AI ethics: An evaluation of guidelines. Minds and Machines, 30, 99-120. https://doi.org/10.1007/s11023-020-09517-8.

[25] Harvard Business Review. (2021). Responsible AI for patient support: The Roche case study. Boston: Harvard Business School Publishing.

[26] Ibrahim, H., Liu, X., Rivera, S. C. (2023). AI transparency in healthcare: A systematic review of emerging approaches. Journal of the American Medical Informatics Association, 30(4), 667-679. https://doi.org/10.1093/jamia/ocad033.

[27] Jobin, A., Ienca, M., Vayena, E. (2019). The global landscape of AI ethics guidelines. Nature Machine Intelligence, 1, 389-399. https://doi.org/10.1038/s42256-019-0088-2.

[28] Karampela, M., Ouhbi, S., Isomursu, M. (2019). Personal health data: Access and control preferences of users. Studies in Health Technology and Informatics, 270, 1121-1125. https://doi.org/10.3233/SHTI190367.

[29] Kim, B., Glassman, M., Johnson, A. (2022). Ethics-by-design approach to AI in healthcare: A conceptual framework and review. Journal of Biomedical Informatics, 130, 104078. https://doi.org/10.1016/j.jbi.2022.104078.

[30] Longoni, C., Bonezzi, A., Morewedge, C. K. (2019). Resistance to medical artificial intelligence. Journal of Consumer Research, 46(4), 629-650. https://doi.org/10.1093/jcr/ucz013.

[31] Mak, K. K., Pichika, M. R. (2019). Artificial intelligence in drug development: Present status and future prospects. Drug Discovery Today, 24(3), 773-780. https://doi.org/10.1016/j.drudis.2018.11.014.

[32] McKinsey Digital. (2021). AI empowerment: Novartis case study in responsible AI implementation. New York: McKinsey & Company.

[33] Mejdahl, C. T., Schougaard, L. M. V., Hjollund, N. H., Riiskjær, E., Lomborg, K. (2020). Patients' and healthcare professionals' views on a patient-reported outcomes portal. Journal of Patient-Reported Outcomes, 4(1), 10. https://doi.org/10.1186/s41687-020-00217-6.

[34] MIT Technology Review. (2022). Ethical AI in clinical trials: AstraZeneca's approach. Cambridge, MA: MIT Technology Review.

[35] Mircea, A., Mircea-Willats, L. (2024). Navigating the ethical terrain of online and AI marketing in pharma: A meta-analysis of customer relationship management strategies and outcomes. Journal of Business Ethics, 185(1), 72-89.

[36] Mittelstadt, B. D., Allo, P., Taddeo, M., Wachter, S., Floridi, L. (2016). The ethics of algorithms: Mapping the debate. Big Data & Society, 3(2), 1-21. https://doi.org/10.1177/2053951716679679.

[37] Norman, D. A., Draper, S. W. (Eds.). (1986). User-centered system design: New perspectives on human-computer interaction. Hillsdale, NJ: Lawrence Erlbaum Associates.

[38] Novartis. (2021). Responsible use of AI systems. Basel: Novartis. https://www.novartis.com/sites/novartis_com/files/novartis-responsible-use-of-ai-systems.pdf.

[39] Payrovnaziri, S. N., Chen, Z., Rengifo-Reyes, P., Miller, T., Bian, J., Davis, J. M., Guan, Z., He, Z., Zhang, X. (2021). Explainable artificial intelligence models using real-world electronic health record data: A systematic scoping review. Journal of the American Medical Informatics Association, 28(7), 1459-1476. https://doi.org/10.1093/jamia/ocab054.

[40] Pfizer. (2022). ESG report 2022. New York: Pfizer. https://www.pfizer.com/sites/default/files/investors/financial_reports/annual_reports/2022/files/Pfizer_ESG_Report.pdf.

[41] Raghavan, M., Barocas, S., Kleinberg, J., Levy, K. (2020). Mitigating bias in algorithmic hiring: Evaluating claims and practices. In Proceedings of the 2020 Conference on Fairness, Accountability, and Transparency, 469-481. https://doi.org/10.1145/3351095.3372828.

[42] Rajkomar, A., Harrington, L., Chen, J., Li, E., Hardt, M. (2022). Bias and fairness in medicine. Nature Medicine, 28(9), 1741-1742. https://doi.org/10.1038/s41591-022-01858-4.

[43] Reddy, S., Allan, S., Coghlan, S., Cooper, P. (2020). A governance model for the application of AI in health care. Journal of the American Medical Informatics Association, 27(3), 491-497. https://doi.org/10.1093/jamia/ocz192.

[44] Richardson, J. P., Smith, C., Curtis, S. (2022). Building trust in healthcare artificial intelligence. JAMA, 327(21), 2143-2144. https://doi.org/10.1001/jama.2022.18241.

[45] Roche. (2023). AI ethics principles. Basel: F. Hoffmann-La Roche Ltd. https://assets.roche.com/f/176343/x/401c28049f/roche-ai-ethics-principles.pdf.

[46] Sunstein, C. R. (2017). Choice architecture 2.0: Behavioral policy as an implicit social interaction. Behavioural Public Policy, 1(1), 1-19. https://doi.org/10.1017/bpp.2016.5.

[47] Vayena, E., Blasimme, A. (2018). Health research with big data: Time for systemic oversight. The Journal of Law, Medicine & Ethics, 46(1), 119-129. https://doi.org/10.1177/1073110518766026.

[48] Wang, Y., Hajli, N. (2017). Exploring the path to big data analytics success in healthcare. Journal of Business Research, 70, 287-299. https://doi.org/10.1016/j.jbusres.2016.08.002.

[49] Wong, P. H. (2020). Democratizing algorithmic fairness. Philosophy & Technology, 33, 225-244. https://doi.org/10.1007/s13347-019-00355-w.

[50] World Health Organization. (2021). Ethics and governance of artificial intelligence for health: WHO guidance. Geneva: World Health Organization.

[51] Zerilli, J., Knott, A., Maclaurin, J., Gavaghan, C. (2019). Transparency in algorithmic and human decision-making: Is there a double standard? Philosophy & Technology, 32, 661-683. https://doi.org/10.1007/s13347-018-0330-6.

[52] Zimmermann, V., Renaud, K. (2021). Digital nudges for privacy and security: Categorization, effects, and design considerations. ACM Computing Surveys, 54(5), 1-38. https://doi.org/10.1145/3450390.