FIP STATEMENT OF POLICY
Artificial intelligence in pharmacy practice

INTRODUCTION

Background

The 2030 Agenda for Sustainable Development highlights the great potential that the spread of information and communications technology and global interconnectedness has to accelerate human progress, bridge the digital divide and develop knowledge societies.[1, 2] According to the World Health Organization (WHO), digital health should be integral to health priorities and benefit people in a way that is ethical, safe, secure, reliable, equitable and sustainable. It should be developed with principles of transparency, accessibility, scalability, replicability, interoperability, privacy, security and confidentiality.[3] The International Pharmaceutical Federation (FIP) Development Goal 20 (Digital Health) recognises the place of digital health and new technologies such as artificial intelligence (AI) as mechanisms for widening access and equity, including access to digital pharmaceutical care.[4] WHO defines AI as the "capability of algorithms integrated into systems and tools to learn from data so that they can perform automated tasks without explicit programming of every step by a human".[5] Moreover, WHO advocates for the integration of ethics and human rights at the core of AI design and implementation to ensure that these technologies serve the public good.[5]

Indeed, the rapid advancement of AI presents opportunities for enhancing the pharmacy profession and healthcare systems worldwide.[6, 7] AI technologies, such as machine learning, generative AI, natural language processing, large language models (LLMs), AI agents, deep learning and robotic automation, have the potential to complement, improve and modernize pharmaceutical care provided by healthcare professionals by significantly improving efficiency, accuracy, and personalisation.[8] From streamlining the dispensing of medication to enhancing clinical decision support, AI can optimise processes and deliver better patient outcomes.[9] However, to ensure the safe, effective, and equitable implementation of AI in pharmacy practice, robust regulations and governance policies are essential. AI will revolutionise pharmaceutical sciences by accelerating drug discovery and optimising clinical trials. In education, it enables personalised learning and real-time performance feedback. In pharmacy practice, AI enhances patient care through predictive analytics, medication management, and automation. This integration will boost efficiency, improve outcomes, and transform the roles of pharmacists into more clinical and consultative positions. These transitions not only reduce administrative burdens but allows pharmacists and pharmaceutical scientists to contribute more meaningfully to improving patient outcomes. Workforce redesign requires careful planning to ensure that job satisfaction, workload balance, and pharmacists' autonomy and responsibility to patient confidence, patient safety and ethical standards are preserved during the transition. AI has the potential to displace operational and repetitive tasks in pharmacy and eventually make certain tasks currently performed by pharmacists redundant such as manual data entry, administrative tasks, billing processes, scheduling, and documentation, potentially reducing errors.[10]

However, this will also create opportunities for pharmacists to assume more specialised and patient-focused roles. By taking the lead in driving these changes and developing new skills, the pharmacy

workforce can leverage AI rather than compete with it.

In clinical practice, AI is already demonstrating its potential to support pharmacists to benefit care across a range of applications. Predictive analytics can identify patients at high risk of medication non-adherence, adverse drug reactions, and/or hospital readmissions, allowing pharmacists to intervene proactively. AI-driven clinical decision support systems provide evidence-based recommendations, flag drug-drug interactions, improve prescription interpretability, reduce errors, and enhance prescribing accuracy. AI and advanced information technologies go beyond the traditional role of IT systems, databases, and software tools used in professional practice over the past decades. They now enable predictive insights and early detection, enhancing decision-making and service quality.[8]

The field is evolving from using AI mainly for analysis and prediction (Machine learning/Deep Learning) to embracing generative AI for innovation and creation, signalling a major transformation in how drugs are discovered and developed.[11-13] Generative AI is revolutionising drug development and accelerating innovation in drug design and repurposing by designing novel candidates, repurpose old drug for new indications, optimising molecular structures, and improving their interactions with specific targets.[11-13] Additionally, AI supports personalised medicine approaches by tailoring treatments based on patient-specific data, including genetic, behavioural, and clinical factors.

Robotics further improves safety and efficiency in compounding, dispensing, and inventory management, while AI tools help monitor chronic diseases by integrating real-time patient data points to deliver actionable insights.[14]

AI continues to transform education by introducing innovative approaches that enhance learning, development, assessment, and evaluation. Adaptive learning systems provide personalised experiences tailored to individual student needs and performance. AI-driven virtual simulations offer realistic scenarios to help students build clinical decision-making skills.[15] Data analytics enable educators to identify knowledge gaps and refine teaching strategies, ensuring more effective learning. Scalable AI solutions also support CPD and lifelong learning by offering accessible resources for continuing professional development.[16] Additionally, AI tools facilitate research in areas such as medication safety, health outcomes and pharmacogenomics.[8] These advancements make pharmacy education more dynamic, adaptive, and aligned with the evolving needs of health care.

In addition, generative AI, a subset of AI that focuses on data generation, such as the creation of text, images, and datasets has the potential to significantly impact the way we work. Applications include drug discovery and repurposing, disease progression modelling, enhancing patient communication and education, streamlining clinical documentation, optimising workflow efficiencies, reducing administrative tasks, and enhancing clinical decision support tooling.[16]

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However, these AI systems have limitations that must be taken into consideration, including a tendency to hallucinate or generate false information, potential biases, lack of contextual understanding, and inability to verify the accuracy of their outputs.[14, 17] Therefore, pharmacists must always supervise and validate any AI process that is related to the provision of health care.

To effectively prepare current and future pharmacy professionals and their teams for the integration of AI, appropriate education and training strategies must be prioritised. Pharmacy curricula should incorporate foundational AI knowledge, including machine learning, data analytics, digital health, and ethical implications of AI in health care.[10, 18] Practical experience with AI systems in simulated and real-world environments is equally essential to build competency and confidence. For practising pharmacists, accessible continuing professional development programmes are vital to enable upskilling and reskilling to meet evolving demands.[16] The programmes should focus on practical applications of AI such as medication management, clinical decision support and patient engagement. By fostering AI education

and training, the pharmacy professionals can be well-equipped to leverage AI technologies responsibly, effectively and innovatively.[19]

The expanding role of AI and advancements in clinical informatics may also lead to the development of a new area of interest to pharmacists and potential pharmacy specialisation.[1a] This area of interest will be driven by the integration of AI knowledge and best AI practice systems and informatics tools with the potential to enhance clinical decision making and operational efficiency without compromising patient safety. By collaborating with developers, clinicians, and healthcare teams, pharmacists can help align AI tools with pharmacy-specific needs while safeguarding patient safety and data integrity.

Furthermore, AI is increasingly being integrated into direct clinical care through digital therapeutics, including regulated AI-enabled devices and services, as well as patient-facing applications such as generative AI-based medicine information platforms and health and wellness tools.[20, 21] As this technology evolves, the role of AI as a therapeutic is expected to expand significantly in scale and scope. Consequently, it is crucial to thoughtfully consider how pharmacists can be effectively integrated into the prescribing and monitoring of AI-powered digital therapeutics and AI-powered diagnostic tools. Pharmacists' oversight of these tools is key to prevent and/or manage any potential negative outcomes or errors they may produce, especially when they are directed at patients.[22] Additionally, pharmacist involvement in the development, deployment, use and supervision of direct-to-consumer AI-enabled health devices and applications are equally important to ensure medication safety and to promote improved health outcomes.

To effectively implement and regulate AI in pharmacy, a collaborative approach that involves diverse stakeholders is essential. While patients are a core focus, partnerships with healthcare providers, regulators, technology developers, insurers, educators and advocacy organisations are also critical to ensure that AI adoption is transparent, equitable, and beneficial for all. The partnerships should address the various impacts of AI including ethical considerations, digital literacy, accessibility, misinformation, and the integration of AI into the healthcare ecosystem. In addition, a mechanism should be established to assess the need for implementation on a local level.

As AI continues to advance, it offers an unprecedented opportunity to transform pharmacy practice. By addressing regulatory, ethical, and workforce challenges and investing in education and specialisation, the profession can harness AI's potential to improve medication safety, optimise therapies, and enhance patient outcomes—all while maintaining the highest standards of care and professionalism.

This Statement of Policy aims to provide recommendations on the role of AI in pharmacy, ensuring that AI tools are used to boost productivity and enhance care, in alignment with the values of the pharmacy profession and to the benefit of patients and healthcare systems.

AGAINST THIS BACKGROUND, FIP RECOMMENDS THAT:

A. Governments and policymakers, in collaboration with FIP member organisations, should undertake actions to deliver the following objectives:

A.1 Access to AI technologies

1. Ensure that relevant, accurate, and secure patient data are made accessible to pharmacists and pharmaceutical scientists through interoperable national digital health platforms. Access should be granted exclusively to authenticated and authorised healthcare professionals, strictly governed by patient consent and aligned with data privacy regulations;

[1] *In January 2024, The APhA Board of Pharmacy Specialties (BPS) in the US issued a call for petition for pharmacy informatics, which supports further consideration of this new specialty certification*

2. Work towards obtaining validated data in order to develop better AI models;
3. Develop national AI strategies that include specific provisions for health care and pharmacy;
4. Ensure equitable access to AI technologies as a complement to professional care and patient access across healthcare systems;
5. Provide funding and resources for research, purchase and maintenance into AI applications that enhance medication safety and healthcare outcomes;
6. Collaborate with international organisations to standardise AI regulations and best practices;
7. Encourage public-private partnerships to foster innovation and collaboration in developing, adopting and implementing AI technologies; and
8. Promote algorithm transparency and interoperability standards.

A.2 AI regulation

1. Develop and regularly update standards for AI system design, validation, and deployment in collaboration with health professionals for which the AI system is intended;
2. Wherever possible, encourage international collaboration towards harmonisation of AI regulations to facilitate the safe and consistent review and deployment of AI products and technologies;
3. Share best practices to encourage consistent clinical, ethical and performance standards of AI tools;
4. Implement rigorous pre-market evaluation to ensure AI tools meet accuracy, safety, and clinical relevance standards;
5. Conduct ongoing audits to monitor performance and address AI errors or biases post-implementation;
6. Enforce compliance with data privacy laws (e.g., the General Data Protection Regulation in the EU, The Health Insurance Portability and Accountability Act in the USA) to safeguard patient confidentiality, including data that have not traditionally been considered health data. Examples of this type of data include wearable fitness data (such as activity tracking and step counts), location data, mood tracking, and answers to questionnaires in health and wellness apps. Special consideration should be paid to legislation preventing cross-border data transfer;
7. Establish clear liability frameworks to define accountability for AI-related errors or adverse outcomes including healthcare continuity planning and disaster recovery plans to support reliable service delivery;
8. Recognise and integrate pharmacists into the prescribing and monitoring processes for relevant AI-enabled consumer diagnostics and therapeutics;
9. Urge that any regulations on AI need to be adapted or adjusted and maintained alongside innovation to allow pharmacists and caregivers to apply it for patient benefit; and
10. Promote collaborative frameworks among political leaders, international bodies, and key stakeholders to develop strategies that ensure the economic sustainability of AI in health care.

A.3 Ethical considerations

1. Mitigate bias and inequity across the total product life cycle by carefully designing, validating, implementing and monitoring AI algorithms to prevent disparities in care caused by biased training data or model design;
2. Ensure transparency and explainability so pharmacists can interpret AI-driven decisions, fostering trust and accountability;
3. Avoid over-reliance on technology by prioritising pharmacist and pharmaceutical scientists autonomy, professional judgement and clinical oversight alongside AI support;
4. Protect patient privacy with strict measures to prevent misuse or breaches of sensitive patient data;

5. Conduct regular monitoring and auditing of AI systems to identify vulnerabilities early, ensure consistent performance, and safeguard patient safety and trust;
6. Establish robust mechanisms to promptly address cybersecurity breaches, algorithmic failures, and other unintended consequences;
7. Manage unintended consequences such as workforce displacement, reduced human interaction, and algorithm failures to safeguard patient care;
8. Establish clear guidelines for the effective integration and optimisation of AI in pharmacy education;
9. Address the unapproved use of AI in pharmacy care and related responsibilities in line with local governance policies; and
10. Ensure consistency with environmental and workplace sustainability efforts in terms of WHO's ethical AI use considerations.[23]

B. Patient organisations and advocacy groups, technology developers, health insurers, and other stakeholders, in collaboration with FIP member organisations should:

1. Educate patients on the role of AI in pharmacy and its potential benefits as a tool to improve care. Develop and disseminate accessible educational materials that explain AI's role, benefits, and risks in pharmacy practice, using clear, non-technical language;
2. Advocate for transparent communication about AI's influence on healthcare decisions, ensuring patients are informed and empowered;
3. Encourage patient participation in discussions about AI-driven healthcare innovations. Establish feedback mechanisms to incorporate patient perspectives into AI tool development and policy discussions;
4. Promote equitable and affordable access by addressing digital literacy and cultural diversity, ensuring AI tools benefit all populations so that no patient is disadvantaged or excluded from care due to an inability or unwillingness to engage with digital tools;
5. Counteract misinformation about AI in pharmacy through targeted campaigns and partnerships with trusted stakeholders; and
6. Support patient organisations in developing national networks that promote access to self-care pharmaceutical services. Encourage cross-regional collaboration to reduce disparities in the implementation of AI-enhanced healthcare services.

C. Pharmaceutical scientists and the pharmaceutical industry and regulators, in collaboration with FIP member organisations, should:

1. Adopt a collaborative approach to lead and ensure the implementation of responsible and ethical AI, guided by regulations, professional standards and a shared goal of improving patient care;
2. Validate AI tools before deployment, ensuring compliance with regulations and professional standards. Maintain human oversight in pharmacy practice, research, and education to safeguard patient safety and clinical accountability; Leverage AI for drug development, disease progression modelling, and clinical trials. Optimise treatment discovery, patient recruitment, and trial design while ensuring AI models are validated for accuracy and reliability;
3. Establish clear guidelines for AI accountability in research and manuscript writing. Ensure transparency, bias mitigation, and validation of AI-generated data to maintain scientific integrity and patient trust;
4. Develop standardised, secure data-sharing frameworks with anonymisation and governance agreements by leveraging privacy-preserving technologies. Promote best practices in AI-driven pharmaco-epidemiological research and real-world data analysis;

5. Collaborate on AI training, workshops, and professional development to equip pharmacists and pharmaceutical scientists with AI skills for informatics, governance, and interdisciplinary research;
6. Establish best practices for AI-driven pharmacy workflows, medication management, and patient engagement.
7. Promote research collaborations to assess AI's impact on clinical outcomes and workforce sustainability, and
8. *Specifically in pharmaceutical and pharmaco-epidemiological research:*
    a. Validate AI tools before usage and provide suitable human oversight in decision-making procedures for pharmacy practice, research, and education;
    b. In drug development and discovery, expand the range of possible treatments, create new molecules with particular properties, predict the toxicity and efficacy of drug candidates more accurately and efficiently, identify new drug targets and potential compounds more quickly and optimise drug discovery using chemical libraries and deep learning.
    c. In clinical trials, improve patient acquisition and retention, streamline trial design for increased effectiveness, and examine big data to spot trends and derive insightful conclusions.
    d. Optimise data generation, validation and analysis. Use algorithms to augment pharmaceutical datasets, validate the use of AI to generate de novo datasets, conduct molecular simulations to test compound effects before clinical trials, identify potential biomarkers, analyse big data sets (real-world data in particular), develop feedback loops to improve predictive abilities and stability of AI algorithms, and enhance data quality and completeness for more reliable AI-driven insights.
    e. Establish clear guidance on accountability and responsible use of AI in the manuscript writing process, to prevent over-reliance that could lead to inaccuracies or errors.
    f. When using AI for pharmaceutical and pharmaco-epidemiological research, respect ethical considerations:
        i. Declare the use of AI at every step of the research (transparency).
        ii. Create adaptable and sustainable guidelines that consider context and intended applications.
        iii. Make sure AI systems are ethical, safeguarding patient data (security, privacy) and avoiding bias in results.
        iv. Develop frameworks that stay up to date with innovation while guaranteeing quality (validity and reliability), non-discrimination (inclusivity and accessibility), and safety.

D. FIP member organisations, should undertake to deliver the following objectives:

D.1 Advocacy

1. Advocate for pharmacist representation in AI-related policymaking and technology development;
2. Provide resources and training to equip members with AI-related skills and knowledge;
3. Collaborate with academic institutions to promote the inclusion of AI education in pharmacy curricula;
4. Establish frameworks and evaluation tools to assess the impact of AI on pharmacy practice and workforce dynamics; and
5. Ensure the autonomy as well as the professional and clinical judgment of the pharmacist is maintained in AI policies.

D.2 Education and training

1. Integrate AI into curricula by including foundational knowledge in machine learning, big

data, digital health, and ethical considerations;
2. Deliver practical training experiences, including simulations of real-world AI applications, to build competence and confidence;
3. Integrate training on essential knowledge and skills, including ethical reasoning and interprofessional collaboration, into pharmacy curricula and professional development programmes to support the effective and responsible integration of AI;
4. Offer professional development via accessible continuing education programmes to upskill practising pharmacists in AI tools, applications, and data interpretation;
5. Promote research and innovation by encouraging academic institutions to explore AI-driven solutions such as predictive modelling, clinical decision support, and patient engagement;
6. Facilitate interdisciplinary programmes to enable pharmacists to collaborate and understand broader AI applications in health care; and
7. Promote undergraduate and postgraduate training or specialisation of pharmacists in AI as part of the responsibility of universities.

D.3 Educational applications of AI

1. Implement adaptive learning systems to deliver personalised learning experiences tailored to individual student needs and performance;
2. Incorporate AI-powered virtual patient simulations to provide realistic scenarios for developing clinical decision-making skills;
3. Apply data analytics in education to analyse performance trends, identify knowledge gaps, and adjust teaching strategies effectively;
4. Utilise AI-driven tools to enhance student assessment and evaluation by providing personalised feedback, identifying learning gaps, and adapting assessments to individual student needs;
5. Support lifelong learning through scalable AI solutions that offer accessible resources for continuing professional development; and
6. Enhance research applications by leveraging AI tools to facilitate studies in areas such as medication safety, health outcomes, and pharmacogenomics.

D.4 Pharmacy workforce

1. Redesign workforce roles by shifting pharmacists from repetitive and administrative tasks to patient-centred services, clinical consultation, and AI-augmented decision-making;
2. Implement upskilling and reskilling programmes to equip pharmacy professionals with AI literacy, data analytics, and technology management skills. Include content on AI and the evolving role of the pharmacist (extended to pharmacogenomics, personalised medicines, pharmaco-informatics, etc. and exposing pharmacists to new AI tools;
3. Foster interdisciplinary collaboration by encouraging pharmacists to work with AI developers, data scientists, and healthcare providers to ensure AI tools are clinically relevant and effectively deployed; and
4. Conduct impact assessments on the workforce to evaluate the effect of AI on job roles, satisfaction, and workload distribution, and ensure smooth transitions without compromising critical human oversight.

D.5 Leverage the clinical applications of AI

1. Leverage predictive analytics to identify patients at high risk for adverse drug reactions, poor treatment outcomes, medication non-adherence, or hospital readmissions, enabling proactive interventions;
2. Utilise clinical decision support tools to analyse vast datasets, recommend optimal medication therapies, flag drug-drug interactions, and improve prescribing accuracy;
3. Ensure pharmacists and pharmaceutical scientists remain accountable for decisions and

outcomes when using AI tools, ensuring that AI serves as a support mechanism rather than replacing professional judgment. AI technologies are intended to support and enhance pharmacy practice, not to substitute the critical decision-making and personalized care provided by trained professionals. Maintaining human oversight is essential to ensure safe, ethical, and patient-centred care. Patients must always have access to pharmacists for consultation, advice, and tailored health interventions, preserving the trusted relationship fundamental to effective healthcare;

4. Ensure organisations deploying AI systems designate a responsible individual or team to oversee the ethical and responsible use of AI. This role should ensure compliance with regulations, monitor AI performance, address biases, and maintain transparency in AI-driven decisions;
5. Optimise medication use by employing AI-powered therapeutic drug monitoring with pharmacist oversight and enhance processes through patient-specific data analysis;
6. Implement robotics and intelligent systems to improve administrative tasks such as inventory management;
7. Enable personalised medicine using machine learning algorithms to support pharmacogenomics and precision medicine, tailoring treatments to individual genetic, behavioural, environmental, and clinical factors;
8. Enhance chronic disease management by integrating real-time patient data with AI tools to support pharmacists in monitoring conditions and providing actionable recommendations;
9. Develop recommendations and best practices for the adoption of AI-enabled therapeutics into clinical practice models for improved health outcomes;
10. Create frameworks and processes to validate and continuously monitor the use of generative AI in patient education tools;
11. Leverage AI within patient communication platforms to improve patient engagement, reduce administrative burden, and improve efficiency of those communication channels;
12. Encourage pharmacists to advocate for and lead the integration of AI tools within their practice settings to enhance clinical and patient care, medication safety and operational efficiency; and
13. Optimise time for valuable clinical interventions through AI-driven automation in medication management, ensuring professional oversight to uphold pharmacists' responsibility and autonomy and reinforce their critical role in patient care.

E. Pharmacists should:

E.1 Actively participate in AI supported practice transformation

1. Engage in continuous professional development to stay updated on AI technologies and their applications;
2. Collaborate with AI developers and healthcare teams to ensure tools meet clinical needs;
3. Actively participate in the evaluation and implementation of AI systems within their practice; and
4. Maintain accountability, confidentiality and autonomy for decisions supported by AI, ensuring patient safety and quality of care.

E.2 Develop AI-competent pharmacy professionals

1. Act as promoters and experts in pharmaceutical information technology by developing specialized knowledge in pharmacy-related AI technologies. This specialization will enable pharmacists to play a pivotal role in bridging the gap between AI innovations and clinical pharmacy practice;
2. Ensure system integration by seamlessly incorporating AI tools into pharmacy workflows and broader healthcare systems to maximize their impact on patient care;

3. Monitor performance to evaluate the accuracy, effectiveness, and clinical utility of AI systems, ensuring optimal patient outcomes;
4. Provide training and education to equip pharmacy teams with the skills to implement, interpret, and understand the limitations of AI-driven tools;
5. Manage data effectively by maintaining data quality, integrity, and security to facilitate reliable AI outputs;
6. Foster collaboration with IT teams, engineers, data scientists, clinicians, and developers to align AI solutions with pharmacy-specific clinical and operational needs; and
7. Advocate for innovation by supporting new AI developments that address unmet needs in pharmacy practice, such as improving patient safety and medication optimisation.

F. AGAINST THIS BACKGROUND, FIP COMMITS TO:

1. Recognise the transformative potential of AI in all areas of pharmacy and provide leadership on ethical, professional, and technical questions on AI integration to ensure its responsible and effective use;
2. Advocate that AI technologies are used to help pharmacists to enhance patient care, improve medication safety, and support evidence-based practice;
3. Promote professional competency and ethical considerations among pharmacy professionals in the context of AI;
4. Encourage collaboration between pharmacists, technology developers, policymakers, educators and other healthcare professionals in advancing AI applications in pharmacy; and
5. Advocate that pharmacists educate and reassure patients about the possibilities and benefits of AI, while emphasizing that human oversight remains essential. AI should serve to enhance—not replace—the clinical judgment and personal interactions of pharmacists.

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