



AI2MED

Artificial Intelligence in Medical Care: Reducing Errors and Saving Lives



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AI2MED

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D4.3: 5 MOOCs for developing AI-in-MED skills

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Executive Summary

AI2MED (Artificial Intelligence in Medical Care: Reducing Errors and Saving Lives) is an Erasmus+ funded project addressing the growing need for **AI competences in the healthcare sector**. This deliverable presents five Massive Open Online Courses (MOOCs) developed to provide accessible, high-quality education on AI applications in medicine for Higher Education Institution (HEI) and Vocational Education and Training (VET) learners, as well as professionals seeking upskilling or reskilling opportunities. **The MOOCs cover essential topics** including data management and cybersecurity, advanced digital competencies such as machine learning and predictive analytics, interpersonal and cross-disciplinary communication, AI ethics and oversight, and foundational AI literacy for VET learners. Together, these courses comprise 22 modules and 80 learning units, all **freely accessible** through the AI2MED Moodle platform, designed to bridge the current AI-in-MED skills gap and support the **responsible integration of artificial intelligence in healthcare practice across Europe**.

1 Introduction

Artificial intelligence (AI) is rapidly transforming healthcare across the globe, offering **unprecedented opportunities to improve patient outcomes, reduce medical errors, and enhance the efficiency of healthcare delivery**. From diagnostic imaging and predictive analytics to personalised treatment recommendations and administrative automation, AI applications are becoming integral to modern medical practice. **The European Commission has identified AI as a key enabling technology for the future of healthcare**, emphasising the need for a **skilled workforce capable of leveraging these tools responsibly and effectively**.

Despite the rapid advancement of AI technologies in healthcare, **a significant skills gap persists** between the current capabilities of healthcare professionals and the competences required to effectively utilise AI tools in clinical settings. Many healthcare workers lack foundational knowledge in data science, machine learning principles, and the ethical considerations surrounding AI deployment in sensitive medical contexts. This gap is particularly pronounced in **vocational education settings**, where practical training often does not yet incorporate AI-related competences. Addressing this gap is essential to ensure that healthcare systems across Europe can fully benefit from AI innovations while maintaining patient safety and trust.

Work Package 4 (WP4) focuses on building HEI and VET curricula for AI2MED, with Task 4.4 specifically dedicated to **developing MOOCs for project-based learning**. The five MOOCs presented in this deliverable cover a broad spectrum of AI-in-MED competences, from **foundational data management and digital literacy to advanced machine learning techniques, ethical frameworks, and professional communication skills**. The AI2MED MOOCs were developed based on the syllabi created within Deliverable D4.1 Cross-sectoral multidisciplinary curricula for HEI/VET learners on AI-in-MED skills, where additional detailed information for each MOOC can also be found. In addition, complementary teacher training materials were developed within Deliverable D4.2 Teacher training materials on AI-in-MED to further support educators in implementing these learning resources. **All materials are openly available on the project website at www.ai2med.eu**.

This deliverable aims to present the five AI2MED MOOCs as **complete, accessible learning offers that can be used independently or integrated into existing educational programmes**. Specifically, this document describes the target audiences for the MOOCs, explains how to access and use the courses, provides detailed overviews of each MOOC including its modules and units, highlights the key competences addressed by each course, and demonstrates how these MOOCs contribute to building AI-in-MED competences across Europe.

2 AI2MED MOOCs

2.1 Who Should Use Our MOOCs

The **AI2MED MOOCs are designed to serve diverse learner groups** who seek to develop competences at **the intersection of artificial intelligence and medicine**. The courses accommodate different starting knowledge levels and professional backgrounds, ensuring accessibility for a wide range of users.

Primary Target Audiences:

- **HEI learners** in medical, health-related, and data science fields who need to understand AI applications in clinical contexts and research settings
- **VET learners** pursuing careers in healthcare support roles, nursing assistance, medical technology, and administrative positions that will increasingly encounter AI-enabled tools
- **Healthcare professionals** (physicians, nurses, administrators, technicians) seeking to **upskill or reskill** to remain current with technological advances in their field
- **Data scientists and IT professionals** working in or transitioning to healthcare sectors who require domain-specific knowledge
- **Policy makers and healthcare managers** who need to understand AI implications for governance, ethics, and strategic planning

The courses are structured to accommodate different entry levels. MOOC 5 is specifically designed for VET learners and those seeking foundational digital literacy, providing an accessible entry point for learners with limited technical backgrounds. MOOCs 1-4 address more advanced topics suitable for HEI learners and professionals with existing technical or clinical backgrounds, though they remain accessible to motivated learners from other fields.

2.2 How to Use Our MOOCs

Access and Delivery:

All AI2MED MOOCs are self-paced and delivered entirely online, allowing learners to progress through materials according to their own schedules and learning speeds. The courses are hosted on the Algebra Bernays University Moodle platform and can be accessed via the **AI2MED project website at www.ai2med.eu**. Registration is **free and open to all interested learners**.

Technical Requirements:

Technical requirements are minimal, ensuring broad accessibility. Learners need only a standard computer, laptop, or tablet with a reliable internet connection and a modern web browser. **No specialised software installation is required**, as all interactive elements and assessments are delivered through the Moodle platform.

Flexible Usage Modes:

The MOOCs can be used **flexibly to suit different learning contexts**:

- As standalone self-study courses for individual learners pursuing independent professional development
- As complementary resources integrated into formal classroom teaching at universities and VET institutions

- As structured materials for blended learning programmes combining online and face-to-face instruction
- As reference materials for continuing professional development and workplace training
- As group learning activities for team-based exploration of AI in healthcare

Course Components:

Each MOOC includes **theoretical content presented through multimedia materials** (videos, readings, interactive presentations), **knowledge-check quizzes** to reinforce learning and provide immediate feedback, **practical exercises and case studies** that connect theory to real-world applications, and **assessment activities** that evaluate learner progress against defined learning outcomes. Upon successful completion of all required activities, learners receive **digital certificates** documenting their achievement, which can be shared with employers and included in professional portfolios.

3 List of Available MOOCs

This section provides **detailed descriptions of each of the five AI2MED MOOCs**, including their learning goals, target audiences, module structures, and the specific units within each module. The courses are numbered 1-5, with MOOCs 1-4 targeting primarily HEI learners and MOOC 5 designed specifically for VET learners.

3.1 MOOC 1: Data Management and Cybersecurity

Target Level: HEI learners in health informatics, data science, medical fields, and healthcare administration

Main Learning Goal: Learners will acquire comprehensive knowledge of healthcare data management principles, governance frameworks, information systems security, and cybersecurity practices essential for protecting sensitive medical information in AI-enabled healthcare environments.

Course Structure (4 Modules, 16 Units):

Module 1: Introduction to Data Management

- Data economy and data management: implication for healthcare
- The importance to ethically manage data in healthcare
- Data Quality and Security
- Data Storage and Organization

Module 2: Healthcare Data Governance

- Foundations of Healthcare Data Governance
- Data Governance Strategies
- Healthcare data life cycle
- Data compliance in healthcare

Module 3: Secure Health Information Systems and Interoperability

- Fundamentals of Health Information Systems Security
- Interoperability Standards and Protocols in Healthcare
- Secure Data Exchange and Integration
- Risk Management and Compliance in Health

Module 4: Developing a Healthcare Data Management Strategy

- Fundamentals of a data management strategy
- Assessing Healthcare Data Needs and Challenges
- Designing and implementing a Comprehensive Data Management Framework
- Evaluating and Optimizing Data Management Strategies

Key Competences Addressed: Technical competences in data management, storage, and security protocols; digital competences in health information systems and interoperability standards; ethical competences in data privacy, compliance, and governance.

3.2 MOOC 2: Advanced Digital Competencies

Target Level: HEI learners in data science, computer science, biomedical engineering, and clinical informatics

Main Learning Goal: Learners will develop advanced technical skills in data visualization, predictive analytics, machine learning algorithms, and their applications in clinical data analysis, healthcare decision-making, and patient outcomes improvement.

Course Structure (4 Modules, 20 Units):

Module 1: Data Visualization

- Introduction to Visualization Tools & Techniques
- Types of Medical Data & Formats
- Design Principles in Medical Visualization
- Interactive Visualizations & Dashboards

Module 2: Predictive Analytics

- Fundamentals of Predictive Modelling
- Statistical Techniques & Risk Scores
- Data Mining & Pattern Recognition
- Validation Methods
- Clinical Applications & Case Studies

Module 3: Machine Learning

- Overview of Machine Learning Algorithms
- Neural Networks & Deep Learning Basics
- Algorithmic Complexity & Model Optimization
- Workflow & Pipelines for Healthcare ML Projects
- Real-World ML Applications in Medicine

Module 4: Foundations on AI Impacts on Data Management & Clinical Outcomes

- AI Governance and Regulatory Frameworks
- Ethical Principles & Bias in AI
- Data Security & Privacy Issues
- Clinical Workflow Integration
- Impact on Healthcare Delivery & Patient Outcomes

Key Competences Addressed: Technical competences in machine learning algorithms, neural networks, model optimization, and data visualization; clinical competences in healthcare ML applications and outcome prediction; ethical competences in AI governance, bias awareness, and responsible AI deployment.

3.3 MOOC 3: Interpersonal and Cross-Disciplinary Communication

Target Level: HEI learners in healthcare management, medical informatics, clinical practice, and health communication

Main Learning Goal: Learners will master effective communication strategies for explaining AI solutions to diverse healthcare stakeholders and develop skills for fostering collaboration between technical and clinical teams in AI-enabled healthcare environments.

Course Structure (5 Modules, 11 Units):

Module 1: Foundations of Interpersonal and Cross-Disciplinary Communication

- Fundamentals of Communication in Healthcare and AI
- Common Barriers and Challenges in Interdisciplinary Communication
- Communication Models in AI and Healthcare

Module 2: Ethical, Legal, and Patient-Centered Considerations in AI Communication

- Ethical and Legal Frameworks in AI-Driven Communication
- Patient-Centered AI Communication Strategies

Module 3: Effective Strategies for Communicating AI Solutions in Healthcare

- Communicating AI Concepts to Medical Professionals
- AI Tools for Enhancing Healthcare Communication

Module 4: AI's Role in Reducing Errors and Improving Decision-Making in Healthcare

- Case Studies on AI's Impact on Medical Errors
- Designing AI Solutions for Safe and Effective Healthcare Communication

Module 5: Continuous Learning and Professional Development in AI-Healthcare Communication

- Lifelong Learning in AI and Healthcare Communication
- Creating AI Education Materials for Healthcare Professionals

Key Competences Addressed: Clinical competences in patient communication and interdisciplinary collaboration; digital competences in using AI tools for healthcare communication; ethical competences in transparency, patient safety, and responsible messaging about AI capabilities and limitations.

3.4 MOOC 4: AI Ethics and Oversight

Target Level: HEI learners in medical ethics, health law, healthcare administration, clinical practice, and health policy

Main Learning Goal: Learners will develop comprehensive understanding of ethical frameworks, legal requirements, risk assessment, and governance structures necessary for responsible AI deployment in healthcare settings, with particular emphasis on EU regulatory contexts.

Course Structure (5 Modules, 17 Units):

Module 1: Foundations of AI in Healthcare

- Introduction to AI and Machine Learning
- Current AI applications in diagnostics, treatment, and administration
- Overview of Healthcare Data and AI Integration
- Principles of medical ethics
- Potential impact of AI on patient care, provider roles, and healthcare systems

Module 2: AI Risks

- Inherent AI risks
- Societal and professional risks of AI

Module 3: AI Healthcare Ethics and Law

- Ethical Frameworks for AI in Healthcare
- EU Legal Frameworks for AI in Healthcare
- Issues of bias and fairness in AI

Module 4: Application of EU Ethical AI Guidelines to Healthcare Context

- The social and environmental impact of AI in healthcare
- AI and transparency
- Data privacy in AI systems
- Patient consent and autonomy

Module 5: AI Accountability, Safety and Governance

- Ensuring data security
- Human oversight of AI decision making
- Governance of AI systems in healthcare

Key Competences Addressed: Ethical competences in addressing bias, fairness, transparency, and patient consent; clinical competences in patient autonomy and safety assessment; technical competences in data privacy, security governance, and risk management; legal competences in EU AI regulations and compliance.

3.5 MOOC 5: AI in Healthcare for VET

Target Level: VET learners in healthcare support, nursing assistance, medical technology, and healthcare administration roles

Main Learning Goal: Learners will acquire foundational digital literacy and practical skills for working with AI-assisted healthcare systems in support roles, with emphasis on ethical awareness, adaptive competences, and effective human-AI collaboration in clinical environments.

Course Structure (4 Modules, 16 Units):

Module 1: Basic Digital and AI Literacy

- Introduction to Digital Tools in Healthcare
- AI-Assisted Healthcare Systems
- Managing Patient Data and Privacy
- Digital Literacy and AI Readiness
- AI in medical diagnostics

Module 2: Collaboration with AI Systems

- Communicating with medical AI tools
- AI-powered clinical workflows
- Validation and application of AI recommendations

Module 3: Practical Technical Skills in AI Contexts

- Medical data and AI training
- Creating a medical AI prototype
- Testing AI accuracy in medicine
- Optimising AI for clinical use

Module 4: Integrated Ethical and Adaptive Competences

- Ethical Considerations in AI Healthcare
- Human-AI Collaboration and Decision-Making
- Adaptive Competencies for AI in Healthcare
- Regulatory and Policy Frameworks

Key Competences Addressed: Digital competences in basic AI tools and patient data management; technical competences in AI system operation, validation, and testing; ethical competences in privacy, human-AI collaboration, and regulatory

3.6 Summary of AI2MED MOOCs

The following table provides an overview of all five AI2MED MOOCs, summarising their key characteristics for quick reference.

Table 1: Key characteristics of the 5 AI2MED MOOCs

MOOC	Title	Main Focus	Level	Modules
1	Data Management and Cybersecurity	Healthcare data governance, security, interoperability	HEI	4 modules, 16 units
2	Advanced Digital Competencies	Data visualization, ML, predictive analytics, clinical AI	HEI	4 modules, 20 units
3	Interpersonal and Cross-Disciplinary Communication	AI communication, interdisciplinary collaboration	HEI	5 modules, 11 units
4	AI Ethics and Oversight	Ethics, EU law, risk, governance	HEI	5 modules, 17 units
5	AI in Healthcare for VET	Digital literacy, practical AI skills, ethical awareness	VET	4 modules, 16 units

4 Conclusion

The five AI2MED MOOCs presented in this deliverable **represent a comprehensive and carefully structured educational response to the growing need for AI competences in the healthcare sector**. Developed collaboratively by expert partners from across Europe, these courses address the full spectrum of knowledge and skills required for the responsible and effective integration of artificial intelligence in medical practice.

Together, the five MOOCs comprise 22 modules and 80 individual learning units, **covering topics ranging from foundational data management and digital literacy to advanced machine learning techniques, ethical frameworks, communication strategies, and governance structures**. This breadth ensures that learners at all levels can find appropriate content for their needs, whether they are beginning their journey into AI-in-MED or seeking to deepen existing expertise.

The MOOCs offer **significant advantages for learners and institutions alike**. Their self-paced, online delivery ensures accessibility regardless of geographic location, time zone, or scheduling constraints. The minimal technical requirements lower barriers to entry, while the flexible usage modes allow integration into diverse educational and professional contexts. Learners can engage with the courses as standalone self-study resources, as components of formal degree programmes, or as materials for workplace professional development.

The explicit distinction between HEI-targeted courses (MOOCs 1-4) and the VET-focused course (MOOC 5) ensures that educational content is appropriately calibrated for **different learner backgrounds and career trajectories**. This differentiation addresses the often-overlooked need for AI competence development among vocational learners, who form a crucial part of the healthcare workforce and will increasingly interact with AI-enabled tools in their daily work.

The long-term value of these MOOCs extends beyond immediate learning outcomes. As AI continues to evolve and expand its presence in healthcare, the competences developed through these courses will **remain relevant and adaptable**. The courses establish a foundation for lifelong learning in AI-in-MED, preparing learners to continuously update their skills as the field advances. The open accessibility of the courses via the AI2MED website and Moodle platform ensures that these resources will continue to benefit learners well beyond the project duration.

By providing accessible, high-quality education on AI in medicine, the AI2MED MOOCs contribute directly to the project's overarching goal of reducing errors and saving lives through improved AI literacy across the healthcare workforce. These educational resources support the **sustainable development of AI-in-MED competences throughout Europe**, helping to close the skills gap that currently limits the potential of AI to transform healthcare for the better.