EHMA
European Health Management Association

STRATEGIC INVESTMENTS:

LEVERAGING EU FUNDING FOR THE DIGITAL TRANSFORMATION OF HOSPITAL SETTINGS

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EXECUTIVE SUMMARY

This policy paper explores the urgent need to digitalise medication management pathways in hospital settings and outlines the key European Union (EU) funding programmes available to support this transformation. As healthcare systems face growing pressures, the digitalisation of these pathways is essential to improve patient safety, reduce medication errors, enhance operational efficiency, and support healthcare worker wellbeing.

Despite progress in other areas of digital health, hospital medication management processes remain largely manual, requiring substantial time and resources for ordering, storing, dispensing, and monitoring medicines. This leads to inefficiencies, elevated risk of errors, and increased workload for staff. With approximately 80 million serious medication errors occurring annually across Europe, urgent action is required to address this gap through smart, data-driven solutions.

In March 2024, the European Commission released the Strategic Report underpinning the proposed Critical Medicines Act. The report identified 260 critical medicines, 29 of which are highly vulnerable due to overdependence on limited suppliers and insufficient diversification. To address these risks, the Critical Medicines Act proposes structural, regulatory, and industrial policy actions. These initiatives aim to reinforce health resilience and improve access, availability, and affordability of essential medicines across the EU.

This paper also considers how EU funding instruments - such as the Recovery and Resilience Facility (RRF), EU4Health Programme, Digital Europe Programme, and Cohesion Policy Funds - can be leveraged to modernise medication management pathways. It includes case studies from Italy, Germany, Ireland, and Ukraine, highlighting best practices in strategic investment and implementation.

CALL TO ACTION

EHMA and the Alliance for the Digitalisation of Hospitals Medication Management Pathways (EPACT) call on:

1. Health managers and authorities to make digital medication management central to hospital development and safety plans. This includes adopting interoperable tools like e-prescribing, stock monitoring, and tracking systems, using EU and national funds, and participating in cross-border learning to share best practices.
2. the European Commission, Parliament, and Member States to require national IT systems to collect real-time hospital medicine stock data and connect with EU platforms like the European Shortages Monitoring Platform (ESMP) and forecasting models from the Critical Medicines strategic report. Funding should support this digital infrastructure, which is essential for timely medicine reallocation, accurate safety stock estimates, reduced waste, and solidarity among Member States.
3. the Council of the EU to retain Parliament-approved provisions on hospital stock data, IT system interoperability, stakeholder involvement, and reporting. These are crucial to strengthening hospital resilience, preventing shortages, and building a safe, digitally enabled medicine supply system.
4. National health ministries and managing authorities to design investment strategies for hospital pharmacy automation, digital traceability, and medication governance. These should include stakeholder needs assessments, readiness mapping, and alignment with national digital health plans to ensure strategic use of EU funds and better care outcomes.
5. the EU institutions and Member States to fund and implement interoperable electronic prescribing and administration systems in oncology under the CraNE Joint Action and the Europe's Beating Cancer Plan. These systems must integrate with patient records to meet Comprehensive Cancer Centres (CCC) standards and ensure safety, treatment effectiveness, and cost-efficiency in EU cancer care.
6. the European Commission to create a €3.3 billion EU funding programme (2028–2035) focused on digitalising and automating hospital medication management. Complementing EU4Health and the Critical Medicines Act, it should fund interoperable IT systems, e-prescriptions, stock monitoring, and automation, boosting hospital resilience and patient safety across Europe.
7. Member States to include hospital medication digitalisation and automation in their Recovery and Resilience Plans. These investments are key to improving safety, preventing shortages, and boosting hospital efficiency, aligning national plans with the Critical Medicines Act, the Europe's Beating Cancer Plan, and the EU Pharmaceutical Strategy.
8. the European Commission and Member States to prioritise hospital medication digitalisation and automation in the 2028–2035 Cohesion Policy Funds. These investments will enhance patient safety, reduce errors, and improve crisis readiness, particularly in digitally underdeveloped regions, supporting a resilient and equitable EU health system.

INTRODUCTION

The need to support the full digital transformation of health systems is greater than ever. Digitalising health systems can improve patient safety and quality of care, enhance staff wellbeing, and strengthen the ability of health services to respond to health emergencies and crises. Recognised as essential for sustainable growth and economic resilience, digitalisation is also a priority for the European Commission as part of its goal to digitise public services by the Digital Decade. Given the diverse levels of digital penetration in European health systems and the lessons learnt from the COVID-19 pandemic, the European Commission and Member States understand the necessity to bring significant changes to EU health policymaking to create a strong European Health Union by investing in the digital infrastructure of hospitals' core activities.

At the same time. investing in digital skills for the health workforce and leveraging digital tools and AI applications in care settings are becoming critical enablers of improving operational capacity, safeguarding patient safety and improving the well-being of healthcare workers by saving time and automating processes. One of the responsibilities of hospital management and pharmacists is to monitor adequate stocks of medication and have a detailed. accurate medication demand and inventory overview to make informed procurement and supply chain decisions to avoid medication shortages. However, the visibility of medicine demand and stock in European hospitals is low, as manual activities are a large part of medication management activities, and therefore, this critical information to address patients' needs is not available in real-time.

This briefing paper aims to outline EU funding programmes that can support the digitalisation of hospitals' medication management pathways. It provides health managers, policymakers, and funders with examples of national policies and initiatives that have utilised European funding to digitalise hospitals' medication management activities.

WHY DIGITALISE HOSPITALS' MEDICATION MANAGEMENT PATHWAYS?

The medication management pathway in hospitals is a complex activity. It starts with ordering and receiving medications, which are then stored securely until needed. Next, medical doctors prescribe specific medications, which pharmacists may prepare or compound as necessary, and staff distribute them to the relevant wards or departments. Nurses or other healthcare providers administer these medications to patients, following protocols to ensure safety. Throughout this pathway, the process is closely monitored, requiring collaboration from different healthcare professionals to support the 'Five Rights of Medication Administration', also known as the 5Rs, which include principles that help ensure that the right patient uses the right drug, right dose, right route, at the right time.

Several digital tools and solutions exist, allowing hospitals to tackle weaknesses in medication management pathways (see Annex I). However, studies show that the digitalisation of hospitals' medication management pathways lags, especially compared to other key sectors of economic activity. A study released by the ECAMET Alliance involving 317 hospitals in 13 countries revealed the missed opportunities in the implementation of digital tools and medication management systems with manual shelves, counts and information systems being mostly used to manage pharmacy inventory, and only 25% having central pharmacy robots. The study also pointed out that most hospitals do not have electronic barcodes for checking patients and medication, and IV doses[1]. Finally, a survey by the European Association of Hospital Pharmacists (EAHP) showed that just 4% of hospitals in Europe widely use electronic medical administration records with barcoding[2].

Implications of low digitalisation of medication management

Reducing errors, saving lives and supporting health professionals

The digitalisation of medication management is a key enabler to minimise medication errors in hospitals. Low digital penetration in Europe contributes to high rates of medication errors, with 80 million people reporting serious errors during hospital stays. Daily deaths from medication errors exceed those from breast cancer, HIV, or road traffic accidents, affecting 1 in 5 people in the OECD region and costing the EU €43 billion annually, or up to 3% of health budgets[3].

Patients and their families are not the only ones who suffer when a medication error occurs; health professionals involved in adverse events also experience psychological and emotional harm, becoming 'second victims'. The European Biosafety Network reported that 13% of nurses involved in serious adverse events suffer mental health or psychosocial disorders, with some cases leading to suicide. 31% of nurses involved in

[1] European Collaborative Action on Medication Errors and Traceability (ECAMET). Reduction of medication errors. 2022. Available at: https://ecamet.eu/wp-content/uploads/2022/03/21016698-IN0104-EAASM-Medication-errors_Consolidated.pdf.

[2] European Association of Hospital Pharmacists (EAHP). EAHP's 2023 Medicines Shortages Survey. 2023. Available at: shortages_survey_report_final.pdf.

[3] European Health Management Association (EHMA). Digital medication management in healthcare settings: an opportunity for the European Union. 2022. Available at: https://ehma.org/app/uploads/2023/06/White-Paper-Digital-Medication-Management.pdf.

adverse events reported needing an average of 2-3 months off work due to chronic workplace stress[4] and compassion fatigue, also known as secondary traumatic stress.

Building resilient hospital systems

The medication management pathway in hospitals is a complex process, encompassing ordering, reception, storage, prescription, compounding, distribution to wards, dispensing to patients, and monitoring. Medicine stocks are received and stored in the hospital pharmacy warehouse, then distributed to various departments for administration to patients. In critical areas like oncology and intensive care units, hospital pharmacists compound certain infusion preparations. However, traditional manual inventory systems often face significant inefficiencies that hinder the effective management of medicine stocks. These challenges include inaccurate inventory records, limited real-time monitoring, difficulty in tracking expiry dates, and a lack of integration with other hospital systems.

- **Inaccurate inventory records -** Manual inventory records are prone to human error, such as incorrect data entry or missing information, leading to discrepancies between actual stock levels and recorded data. Additionally, the time-consuming nature of manual updates can delay access to real-time data, which affects decision-making and can result in stockouts of critical medicines.
- **Limited real-time monitoring -** Manual systems lack the ability to provide real-time updates on stock levels, making it difficult for hospitals to continuously monitor availability. Without real-time data, shortages may go unnoticed until it is too late, requiring emergency procurement, which is often costlier and less efficient.
- **Difficulty in tracking expiry dates -** Manually tracking the expiry dates of medicines is challenging, leading to expired medicines remaining on shelves. This not only poses safety risks but also results in financial losses, as expired drugs must be discarded. Additionally, the lack of efficient stock rotation increases waste due to medicines not being used in the correct order.
- **Lack of integration with other systems -** Manual inventory systems often operate independently of other hospital management systems, such as electronic health records or automated dispensing systems. This lack of integration creates data silos, limiting communication and coordination between departments and impeding efficient resource sharing.

To eliminate these inefficiencies, hospitals can adopt automation and digitalisation of their medication management processes. Digital systems can provide real-time updates, reduce human error, enable better tracking of medicines, and integrate seamlessly with other hospital systems, improving overall efficiency, stock visibility, and patient safety.

[4] European Biosafety Network. Mental and Psychosocial Health in Healthcare: Preventing Medication Errors and Adverse Events and Disorders in Healthcare Workers. 2021. Available at: https://www.europeanbiosafetynetwork.eu/mental-and-psychosocial-health-in-healthcare-preventing-medication-errors-and-adverse-events-and-disorders-in-healthcare-workers/.

Call to action 1

EHMA calls on hospital managers and competent authorities to make digital medication management a core component of hospital development and patient safety strategies. This includes implementing interoperable systems such as e-prescribing, stock monitoring, and medication tracking, while also leveraging EU and national funding sources and participating in cross-border learning to share best practices.

More reliable and real-time information about the visibility of medicines

The lagging digitalisation of the medication management pathway impacts the visibility and traceability of hospital medicines. The availability of digital systems that can manage medicine inventories and enhance the visibility of medication stocks in hospitals is low. According to the ECAMET's survey[1], 33% of hospitals do not have pharmacy inventory systems, and 82% do not have robots for inventory management. A follow-up survey by EAHP[2] on this topic demonstrated that 43% of hospitals use manual distribution models; 62% of ICU areas use manual ward stocks as their distribution model. Equally, just 19% of hospitals planned to set a budget aside for multifunctional central pharmacy unit dose robots to support stock management practices. While hospital pharmacies have the best view of medication inventory since the medications are stored there, stock visibility significantly decreases once the medicines are transferred to dispensing locations.

Some of the main potential implications of low visibility of inventory in the hospital supply chain are:

Before shortages

- Inability to predict potential shortages due to manufacturers/wholesaler supply chain issues.
- Low reliability of medication ordering, driving potential medicinal product stock-outs.
- In case of a product recall, time-consuming tasks to investigate and find impacted drugs batches on hospital wards.

During shortages

- Inability to allocate production among hospitals in a region, a country, or within the EU during shortages crises.
- Incremental time and resources for the best management of alternative medicines.

KEY EUROPEAN LEGISLATION AND POLICY INITIATIVES

European Health Data Space (EHDS)

The European Health Data Space is an initiative by the European Union aimed at creating a unified and secure framework for the exchange of health data across Member States. The EHDS Regulation aims to reconcile the primary use of health data by EU citizens and health professionals, and the secondary use by researchers, innovators, and policymakers.

The primary use of data under the EHDS Regulation empowers citizens to control and share their health data, permitting healthcare professionals to access it for treatment and care across Member States. Healthcare professionals will be obliged to encode and update common, interoperable, primary data in the European Health Record System. As levels of digitalisation in hospitals are low across the European Union, with gaps in interoperable infrastructure, the EHDS proposal places challenging obligations on hospitals. Hospital management will be required to install and provide access to digital tools and interoperable systems to facilitate the exchange of electronic health data.

Article 5 of the EHDS Regulation sets a list of priority data to be included in electronic records: data to patient summaries; electronic prescriptions; electronic dispensations; medical images and image reports; laboratory results; and discharge reports.

Category	Main characteristics
Patient summary	Electronic health data that includes important clinical facts related to an identified person and that is essential for the provision of safe and efficient healthcare to that person. The following information is part of a patient summary: 1. Personal details; 2. Contact information; 3. Insurance information; 4. Allergies; 5. Medical alerts; 6. Vaccination information; 7. Current. resolved. closed or inactive problems; 8. Medical history; 9. Medical devices and implants; 10. Medical or care procedures; 11. Functional status; 12. Current and relevant past medicines; 13. Social history observations related to health; 14. Pregnancy history; 15. Patient provided data; 16. Observation results pertaining to the health condition; 17. Plan of care; 18. Information on rare diseases.
Electronic prescriptions	Electronic health data constituting a prescription for a medicinal product as defined in Article 3(k) of Directive 2011/24/EU.
Electronic dispensations	Information on the supply of a medicinal product to a natural person by a pharmacy based on an electronic prescription.
Medical images and image reports	Electronic health data related to the use of or produced by technologies that are used to view the human body to prevent, diagnose, monitor, or treat medical conditions.
Laboratory results	Electronic health data representing results of studies performed through in vitro diagnostics such as clinical biochemistry, haematology, transfusion, microbiology, immunology, and others, and including reports supporting the interpretation of the results.
Discharge reports	Electronic health data related to a healthcare encounter or episode of care, and including essential information about admission, treatment and discharge of a natural person.

In the realm of healthcare, digitalisation is transforming patient care and medical research by providing more efficient ways to share, access and analyse health data.

Central to this transformation is the EHDS; however, its negotiations have faced significant delays, as the complexities of the regulation require thorough analysis to ensure it strikes the right balance between innovation, privacy, and security.

EHDS components impacting the digitalisation of medication management

Data category	Description	Purpose
Patient summaries	Patient summaries are concise records that provide essential information about a patient's health status, including current diagnoses, medications, allergies, and treatment history.	These summaries are crucial for ensuring continuity of care, especially when patients receive treatment in different healthcare settings or across borders.
Electronic prescriptions *(ePrescriptions)*	ePrescriptions are digital versions of traditional prescriptions, allowing healthcare providers to prescribe medications electronically. These prescriptions are integrated into the patient's Electronic Health Record and can be accessed by pharmacies for dispensing.	ePrescriptions streamline the prescribing process, reduce the risk of errors, and facilitate the easy sharing of prescription information across healthcare providers and pharmacies.
Electronic dispensing *(eDispensations)*	Electronic dispensing refers to the digital recording of the dispensing of medications, including details of what was dispensed, the quantity, and the time of dispensing. This information is typically linked to the patient's ePrescription and EHR.	Electronic dispensing ensures accurate tracking of medication usage, helps monitor patient adherence, and reduces the risk of duplicate or conflicting prescriptions.
Discharge reports	Discharge reports summarise the care a patient receives during their hospital stay, including diagnoses, treatments, medications prescribed upon discharge, and follow-up care instructions. These reports are digitally recorded and integrated into the EHR.	Discharge reports ensure that primary care providers and other healthcare professionals have access to complete and accurate information about the patient's hospital care, facilitating continuity of care after discharge.

The role of digitalisation in EHDS data categories

The digitalisation of medication management in hospitals is essential to support the effective use and integration of patient summaries, electronic prescriptions, electronic dispensing, and discharge reports within the EHDS.

Accurate and comprehensive patient summaries		
Role of digitalisation	**Impact**	**Example**
Automated data integration – Digital medication management systems automatically capture and integrate medication data into patient summaries. This ensures that all medications, along with relevant clinical information, are accurately	**Continuity of care -** Real-time, accurate summaries improve continuity of care, especially when patients are treated by multiple healthcare providers or across regions, reducing the risk of medication errors.	A hospital's digital system automatically updates patient summaries with details of all medications, making them accessible to healthcare providers

reflected in the patient's summary. **Real-time updates -** Digital tools enable real-time updates to patient summaries as new medications are prescribed or existing treatments are modified.		within the EHDS framework.
Efficient and safe electronic prescriptions		
ePrescription integration - Digital medication management systems are fully integrated with ePrescription platforms, allowing healthcare providers to generate, modify, and transmit prescriptions electronically. These systems also include decision-support tools to check for potential drug interactions, allergies, and contraindications. **Secure data transmission -** Digital systems ensure that ePrescriptions are securely transmitted to hospital pharmacies.	**Error reduction -** ePrescriptions reduce errors caused by illegibility or transcription mistakes, making the prescribing process faster and more efficient. **Improved access -** ePrescriptions can be easily shared across pharmacies improving accessibility, even internationally, ensuring patients have access to their medications wherever they are.	A physician uses an ePrescription system to prescribe medication, which is immediately transmitted to the hospital pharmacy for timely dispensing or administration.
Comprehensive electronic dispensing records		
Automated dispensing documentation - Digital medication management systems document each instance of medication dispensing/ administration, including details such as dosage, quantity, and time of dispensing. This information is linked to the patient's ePrescription and EHR. **Real-time monitoring -** These systems provide real-time monitoring of medication dispensing activities, allowing healthcare providers to track patient adherence and any discrepancies.	**Enhanced tracking and adherence -** Electronic dispensing records enable accurate tracking of medication usage, helping to ensure that patients adhere to their prescribed treatment regimens. This data is also critical for monitoring potential medication overuse or underuse. **Reduced risk of errors -** By digitising the dispensing process, hospitals can reduce the risk of dispensing errors and ensure that patients receive the correct medication and dosage.	A hospital pharmacy uses an automated dispensing system that records every dispensed medication electronically. These records are immediately updated in the patient's EHR, providing a complete and accurate account of the patient's medication history.

Other implications

Data privacy and security are paramount under the EHDS, with a strong emphasis on compliance with EU standards, like the General Data Protection Regulation (GDPR). Hospitals will need to implement robust security measures, such as encryption, access controls, and regular audits, to ensure their digital medication management systems are compliant.

Support for research and innovation is another important aspect. By facilitating access to large datasets, hospitals and researchers can analyse trends, develop new

treatments, and improve clinical practices. In terms of medication management, this access can lead to innovation in medication protocols, helping to reduce medication errors and optimise treatment outcomes. Hospitals will be able to use the data to research medication usage, effectiveness, and safety, promoting more personalised and efficient care.

Patient empowerment is a key benefit. The EHDS provides patients with access to their health data, including medication records, across the EU. This increased transparency encourages patients to be more engaged in their treatment plans, which can improve adherence to prescribed medications and lead to better health outcomes. Hospitals may need to adapt their digital systems to ensure that patients can easily access and understand their medication information.

Regulatory compliance and reporting will see improvements under the EHDS framework. The EHDS will streamline reporting processes for hospitals, including medication errors, adverse drug reactions, and other important metrics. This will reduce the administrative burden on hospitals while ensuring compliance with EU regulations. Digital medication management systems will need to incorporate features that facilitate easy and accurate reporting to regulatory bodies.

The standardisation of ePrescription and eDispensing systems across Europe is another key implication of the EHDS. Harmonised systems will allow prescriptions to be issued and fulfilled more efficiently in any Member State. This will reduce delays in medication administration and ensure consistent care for patients, regardless of their location.

Finally, the integration of the European Health Data Space with national health systems will ensure alignment with existing national health data infrastructure. Hospitals will need to ensure that their digital medication management systems are compatible with both European and national health systems, facilitating smoother data exchanges. This alignment will enhance the overall integration of healthcare systems across Europe.

New European Medicines Agency mandate and the European Shortages Monitoring Platform (ESMP) database

As part of its reinforced mandate adopted in January 2022, the European Medicines Agency (EMA) was granted a stronger role in crisis preparedness and response, including the monitoring of medicine shortages and supply chain disruptions. One of the key tools to operationalise this mandate is the European Shortages Monitoring Platform, which entered into force in 2025.

The ESMP is a secure, EU-wide digital system that collects information from pharmaceutical companies and national health authorities on the availability of medicines. For hospital and pharmacy managers, this platform will improve access to real-time data on current and anticipated shortages, supporting more informed procurement, stock planning, and patient safety strategies. Specifically, the ESMP enables:

- Flagging potential or ongoing shortages early via structured reporting.
- Coordinating EU-level responses to mitigate risks and avoid duplication.
- Sharing timely information with health professionals and patients.
- Improving stock visibility, especially for critical and high-demand medicines.

The database content and structure were finalised in early 2024, with its phased implementation starting in 2025. All EU Member States and the EMA are expected to contribute and use the ESMP to ensure a harmonised and transparent approach to

managing medicine shortages, aligning with the broader EU objectives for health system resilience and the Critical Medicines Act.

Although the ESMP is primarily managed by regulators, its use will directly impact hospital operations by improving transparency, enabling better coordination across borders, and reducing the administrative burden of *ad hoc* shortage reporting. Hospital managers are encouraged to stay informed via their national competent authority and to align internal stock monitoring systems to take advantage of ESMP data once national integration is fully implemented.

Critical Medicines Alliance (CMA) to tackle medication shortages

The Critical Medicines Alliance (CMA), launched in January 2024 by the European Commission's Health Emergency Preparedness and Response Authority (HERA), serves as a consultative forum to propose structural and policy solutions to secure the availability of medicines across Europe. It brings together Member States, industry, civil society, academia, and EU agencies to support the goals of the Critical Medicines Act, addressing vulnerabilities in global pharmaceutical supply chains.

The strategic report of the Critical Medicines Alliance[5], published in February 2025, outlines actionable priorities to strengthen supply resilience, including enhanced visibility of medicine stocks and cross-border coordination mechanisms. It highlights the need for a clear framework for EU and national contingency stocks to avoid fragmented responses and ensure that stockpiled medicines can be reallocated quickly across countries in times of shortage. The report states:

> *"A clear framework covering both national and EU contingency stocks is needed [..]. to ensure that solidarity mechanisms are effective, and Member States have mechanisms that allow them to share the stock in time of need".*

Moreover, the report stresses that obligatory stock levels must be based on historical data, product criticality, and anticipated demand patterns. Real-time data sharing and collaboration between Member States, EMA, and institutions like the ECDC are essential to anticipate shortages and avoid both over- and understocking:

> *"Enhancing supply-demand planning through better data collection and collaboration with institutions [...] is critical for ensuring medicinal product security across Europe".*

Hospitals are central to these efforts. Digital tools for inventory tracking, predictive analytics and supply chain management allow hospitals to forecast needs, avoid stockouts, and optimise medicine substitution protocols. For example, clinical decision support systems can automatically suggest safe therapeutic alternatives when a stock is low, ensuring uninterrupted treatment. Digital inventory systems also help hospitals report shortages to national authorities and engage in regional redistribution networks. Integrating hospital-level data with EU-level stock visibility tools will be key to the success of solidarity-based reallocation mechanisms in the CMA. Real-time analytics, alerts for low stock thresholds, and communication across hospital networks strengthen supply chain resilience and patient safety.

Additionally, while the EU faces ongoing medication shortages, hospitals continue to waste large quantities of medicines due to the lack of automation and digital systems for medication management. According to a study by LIUC–Cattaneo University[6],

[5] Critical Medicines Alliance. Strategic report of the Critical Medicines Alliance. 2025. Available at: 3da9dfc0-c5e0-4583-a0f1-1652c7c18c3c_en

[6] Orsini. F.F.; Bellavia. D.; Schettini. F.; Foglia. E. The impact of automation and digitalization in hospital medication management: economic analysis in the European countries. Healthcare 2025. 13. 1604. https://doi.org/10.3390/healthcare13131604

implementing such systems could prevent over €574 million worth of medication waste in EU hospitals.

Call to action 2

EHMA calls on the European Commission, the European Parliament, and Member States to ensure that the final version of the Critical Medicines Alliance includes concrete provisions requiring national IT systems to collect real-time hospital medicine stock data and connect with EU-level platforms, such as the ESMP and the forecasting models proposed in the Critical Medicines strategic report. Appropriate funding instruments must also be established to support this effort.

A robust digital infrastructure is essential to enable timely medicine reallocation during crises, improve safety stock estimates, reduce medication waste, and uphold the principle of solidarity among Member States.

Pharmaceutical Strategy for Europe

In April 2023, the European Commission, through its proposals for a reformed Pharmaceutical Strategy, placed a strong emphasis on tackling the ever-growing problem of medicines shortages. Key elements included a new European alert system that provides earlier notifications of shortages and withdrawals by companies, standardised reporting criteria, mandatory shortage prevention plans, and coordinated management of shortages by the national competent authorities and the EMA. The reform would reinforce and strengthen the obligation of companies to ensure a proper and continuous supply.

Following a successful exercise of amendment submissions to the proposed revision of the EU Pharmaceutical Legislation, the European Parliament's ENVI Committee voted on and adopted two reports on 19 March 2024 – the Directive on medicinal products for human use and the Regulation on the authorisation and supervision of medicinal products for human use and governing rules for the EMA.

On 10 April 2024, MEPs adopted these proposals to revamp the EU Pharmaceutical Legislation. Among the key objectives of the regulation, is increasing access to medicines by ensuring the security of supply and addressing shortages of medicinal products. The European Health Management Association, through the EPACT Alliance, produced several position papers advocating for key amendments on two critical healthcare issues for health managers: pharmacovigilance and patient safety and the visibility and traceability of medicine stocks in hospitals[7]. The EPACT position paper on the availability and shortages of medicines in hospital settings draws attention to pharmacists' roles in both primary and hospital settings and their contribution to managing and mitigating medication shortages.

EHMA and the EPACT Alliance advocated for the adoption of several amendments to the pharmaceutical package. The following amendments were successfully adopted in plenary by the European Parliament's ENVI Committee:

- (Regulation – Article 121 paragraph 2a) Facilitated the establishment of interoperable national IT systems with the EMSP, enabling automated information exchange and preventing reporting duplication.
- (Regulation – Article 121 paragraph 1 point b a) Advocated for a system allowing patients to report medicinal product shortages and requiring hospital

[7] European Health Management Association (EHMA). Proposed Amendments to the Pharmaceutical Legislation. 2023. Available at: https://ehma.org/proposed-amendments-to-the-pharmaceutical-legislation/.

pharmacies to electronically communicate stock data to mitigate supply shortages.

- (Regulation – Article 121) Highlighted the importance of sharing information on hospital medication stocks with regulatory agencies for the ESMP to manage and prevent shortages.
- (Directive – Recital 137) Recognised hospitals as key stakeholders in managing and mitigating the impact of shortages on patients and healthcare professionals.

Additionally, EHMA and the EPACT Alliance call on the EU Institutions to include medication errors within the definition of adverse reactions in both the proposed Regulation and Directive. Currently, both files are in the hands of the Council, which has not yet adopted its position.

Call to action 3

EHMA and the EPACT Alliance urge the Council of the EU to preserve the Parliament-adopted provisions on hospital stock data, IT system interoperability, stakeholder recognition, and reporting mechanisms. These amendments are essential to strengthening hospital resilience, preventing shortages, and ensuring a digitally enabled medicines supply system that puts patients and safety first.

FUNDING REQUIRED TO DIGITALISE EUROPEAN HOSPITALS' MEDICATION MANAGEMENT PATHWAYS: IS IT PROFITABLE?

Medicine shortages continue to disrupt care delivery across Europe, leading to treatment delays, increased hospital burden, and higher costs. While the issue is long-standing, recent global events have deepened supply vulnerabilities and highlighted the urgent need for data-driven coordination and investment in digital infrastructure.

One of the core pillars for implementing the priorities identified through the Critical Medicines Alliance and the Critical Medicines Act is ensuring real-time visibility of medicine stocks across the EU. The strategic report[5] makes it clear: effective reallocation of medicines, demand forecasting, and solidarity-based distribution depend on Member States having robust, interoperable IT systems capable of sharing real-time data on medicine inventories, including from hospitals. To meet this ambition, **targeted funding is urgently needed to upgrade hospital digital infrastructure.**

Call to action 4

EHMA and the EPACT Alliance urge national health ministries and managing authorities to design strategic investment plans for hospital pharmacy automation, digital traceability, and medication governance. These plans should include stakeholder needs assessments, readiness mapping, and alignment with national digital health agendas to ensure effective use of EU funds and improved care outcomes.

Visibility of stock levels across the supply chain - encompassing wholesalers, distributors, and hospital and community pharmacies - is essential to:

- Detect and manage shortages earlier through real-time alerts.
- Enable fair distribution of contingency stocks between Member States.
- Anticipate demand surges using historical and epidemiological data.
- Support therapeutic substitution in times of limited availability.

Currently, most hospitals in the EU lack the digital maturity to participate in such a system. Manual inventory practices remain common, resulting in inaccurate data, delayed reporting, and fragmented stock management. As highlighted in EHMA's report[8], hospital pharmacists often lack the tools to provide real-time electronic stock updates, creating a significant barrier to implementing the CMA's objectives. The lack of real-time visibility undermines procurement strategies, contributes to either overstocking or sudden shortages, and hampers coordinated response efforts at both the national and EU levels. Moreover, disconnected systems prevent hospitals from aligning with central tools like the European Shortages Monitoring Platform, reducing the potential impact of EU-level monitoring and mitigation measures.

A study by LIUC–Cattaneo University[6] assessed the economic viability of five digital technologies in acute care hospitals. **The analysis revealed a total estimated investment in Europe of €3.55 billion, an average payback time of 4.46 years and a total estimated annual savings in Europe of €1,96 billion. The average Return on Investment (ROI) was 167%, and the total Net Present Value (NPV) was 8.21 billion over**

[8] European Health Management Association (EHMA). Assessing national-level capacity to provide data on hospitals' medication inventories. 2024. Available at: Visibility-of-stocks-Nov-2024.pdf

10 years. The analysis also revealed that the Payback Time is close to 2 years in high-GDP countries and 4-5 years in lower-GDP ones. The aim is to provide hospital administrators and policymakers with a data-driven framework that evaluates the feasibility of automation investments, considering hospital size and the national healthcare context. Understanding the financial magnitudes is key to constructing a compelling business case.

Financial magnitudes

- The **Payback Time** is the period required for an investment to generate sufficient cash flows to recover the initial investment cost.

$$\text{Payback Time} = \frac{\text{Initial Investment}}{\text{Annual Cash Inflow}}$$

- The **Internal Rate of Return (IRR)** is the discount rate at which the Net Present Value of all cash flows (both positive and negative) from a project equals zero. It represents the expected annualised rate of return of the investment.

$$\sum_{t=0}^{N} \frac{C_t}{(1+r)^t} = 0$$

Where:

- C_t = *net cash flow at time t*
- N = *number of periods*

- The **Return on Investment (ROI)** is a percentage measure of the profitability of an investment, indicating the efficiency of the capital employed:

$$\text{ROI} = \frac{(\text{Total Costs} - \text{Total Savings})}{\text{Total costs}}$$

- The **Net Present Value (NPV)** evaluates the profitability of an investment by calculating the difference between the present values of cash inflows and outflows over the project's duration (average European inflation rate 2.15%), with a positive NPV indicating that the project is expected to generate profit.

$$\sum_{t=2024}^{2034} \frac{\text{Net Cash Flow}}{\left(1 + \text{inflation rate}\right)^t}$$

Methodology

This study follows Bonnabry and François's approach,[9] evaluating the economic impact of five automation technologies - inventory robots, unit dose systems, automated dispensing cabinets (ADCs), smart pumps with Drug Error Reduction Systems (DERS), and oncology medication traceability - across EU27+UK, using a 10-year analysis (2024-2034) for a standardised 561-bed hospital.

The economic analysis incorporates the average European inflation rate to ensure consistency and comparability over time. A 10-year period was selected to reflect the standard lifecycle of healthcare technologies, from setup and implementation to full integration and maturity, enabling a thorough assessment of both short-term

[9] Bonnabry. Pascal. and Olivia François. 'Return on Investment: A Practical Calculation Tool to Convince Your Institution'. European Journal of Hospital Pharmacy: Science and Practice. vol. 27. no. 2. Mar. 2020. pp. 111–13. PubMed. https://doi.org/10.1136/ejhpharm-2018-001733.

outcomes and long-term value. This timeframe ensures that all relevant costs and benefits are accounted for, offering decision-makers a clear and realistic basis for evaluating automation investments in hospital environments. To assess the potential national impact, the findings from the 561-bed hospital model were proportionally extrapolated using the total number of hospital care beds in each country, as reported by Eurostat. This method offers a systematic and cautious estimation of how automation technologies might affect national healthcare economies, enabling adjustments to suit the specific context of each healthcare system.

- **Investment calculation:** Investment cost estimates for five automation technologies were based on public procurement data and EU tender databases (e.g. TED - Tenders Electronic Daily) to ensure transparency and real-world accuracy.[10] Prices were standardised across EU27+UK with VAT adjustments. Technologies were chosen for their role in medication logistics, clinical safety impact, and relevance in the literature.
- **Economic benefits:**
  - **Direct benefits:** Savings from reduced personnel hours and minimised drug waste, calculated using efficiency gains and literature data.
  - **Indirect benefits:** Cost reductions from optimised inventory management and fewer medication administration errors, with estimates based on improved efficiency and error rates in automated systems.
- **Economic metrics:** ROI, NPV, and PBT were calculated for each country to assess the financial feasibility of automation investments.

Adjustments were made for country-specific factors, including the number of hospital beds (Eurostat data), average healthcare salaries (SalaryExpert), ICU and non-ICU stay costs, technology penetration rates (European Collaborative Action on Medication Errors and Traceability - ECAMET), and average drug prices.

The following table shows the investment required by country (EU27+UK) by type of technology.

Country	Inventory Robot	Automated Dispensing Cabinets	Unit Dose System	DERS	Med, Traceability System (Oncology)	Total
	Investment EUR	Investment EUR	Investment EUR	Investment EUR	Investment EUR	Investment EUR
Austria	9.537.524	42.477.016	15.245.165	8.831.041	7.139.199	83.229.945
Belgium	17.572.407	32.090.235	2.440.612	10.982.754	7.321.836	70.407.844
Bulgaria	17.134.280	39.108.994	19.038.089	7.900.807	5.711.427	88.893.597
Croatia	5.762.476	13.152.852	6.402.752	2.657.142	1.920.825	29.896.047
Cyprus	1.059.581	2.765.181	828.924	486.542	201.825	5.342.053
Czechia	9.518.597	42.392.722	15.214.912	8.813.516	7.125.032	83.064.779
Denmark	3.551.425	12.004.555	3.946.027	1.973.014	2.643.838	24.118.859
Estonia	2.290.903	5.414.049	1.527.269	763.634	946.907	10.942.762
Finland	2.940.295	9.938.809	3.266.994	1.633.497	2.188.886	19.968.481
France	116.594.957	265.082.878	31.157.584	76.254.086	65.922.887	555.012.392
Germany	103.801.385	462.297.452	165.920.343	96.112.394	77.699.282	905.830.856
Greece	15.334.439	39.587.888	11.996.330	7.041.324	2.920.845	76.880.826
Hungary	16.463.752	37.578.515	18.293.058	7.591.619	5.487.917	85.414.861
Ireland	5.411.715	11.161.662	6.013.017	3.006.508	3.607.810	29.200.712
Italy	58.197.246	150.243.911	45.528.458	26.723.225	11.085.190	291.778.030
Latvia	3.760.824	8.887.886	2.507.216	1.253.608	1.554.474	17.964.008
Lithuania	5.163.697	12.203.267	3.442.464	1.721.232	2.134.328	24.664.988
Luxembourg	741.385	1.834.928	0	411.881	197.703	3.185.897

[10] Mathy. Caryn. et al. 'Automated Hospital Pharmacy Supply Chain and the Evaluation of Organisational Impacts and Costs'. Supply Chain Forum: An International Journal. vol. 21. no. 3. Jul. 2020. pp. 206–18. DOI.org (Crossref). https://doi.org/10.1080/16258312.2020.1784687.

Malta	587.631	1.517.048	459.711	269.831	111.93	2.834.221
Netherlands	15.980.608	39.552.005	0	8.878.116	4.261.496	68.672.225
Poland	64.939.682	153.470.733	43.293.122	21.646.561	26.841.735	310.191.833
Portugal	10.920.430	29.220.155	1.198.401	7.265.307	6.561.246	55.165.539
Romania	40.134.571	91.607.157	44.593.967	18.506.496	13.378.190	208.220.381
Slovakia	10.002.195	22.830.010	11.113.550	4.612.123	3.334.065	51.891.943
Slovenia	3.505.086	8.000.360	3.894.540	1.616.234	1.168.362	18.184.582
Spain	31.305.709	81.263.924	0	25.065.029	9.207.562	146.842.224
Sweden	5.032.795	17.011.895	5.591.994	2.795.997	3.746.636	34.179.317
Total EU27	577.245.596	1.632.696.089	462.914.499	354.813.518	274.421.434	3.302.091.136
United Kingdom	22.885.042	127.568.647	44.670.503	30.925.733	29.688.703	255.738.628
Total EU27 + UK	600.130.638	1.760.264.736	507.585.002	385.739.250	304.110.137	3.557.829.763

Results

The analysis highlights significant variability across the EU27+UK countries.

- **Investment costs:** The study findings confirm the economic viability of hospital automated and digital technologies, with an estimated total investment cost of €3.55 billion, an average Payback Time of 4.46 years in high-GDP countries to 7 years in lower-GDP nations, aligning closely with Bonnabry's estimated PBT of 4.46 years.
- **Annual Savings:** Total savings were estimated at €1.96 billion annually, reflecting their large populations, high costs, and lower existing automation levels.
    - **Human resources:** Automation reduces the time healthcare staff spend on repetitive logistical tasks like drug picking, transport, restocking, and paperwork. To estimate the value of these time savings, studies were analysed comparing staff workload (in FTEs) in automated versus manual hospital settings. Based on these, we calculated the yearly workload for medication logistics in a 561-bed hospital without automation. Efficiency gains from each technology were applied to estimate time saved, which we then monetised using national wage data by staff category. This approach was used across all countries to consistently assess human resource savings and show how automation frees up time for clinical care,[11] estimated at €486 million annually.
    - **Drug wastage reduction:** Automation improves drug use through stock rotation and real-time inventory tracking to prioritise soon-to-expire medicines, reducing waste. Literature-based data[12] on baseline expiry rates and automation-related reductions, estimate the yearly volume of expired drugs per class. These were valued using average unit prices. The cost difference between automated and manual systems represents the estimated annual savings of €616 million.
    - **Inventory savings:** Maintaining efficient inventory levels is crucial for hospital logistics, particularly in times of financial constraint. Manual systems often result in overstocking, particularly of rarely used drugs, tying up capital in unused supplies. Automation enhances visibility, reorder accuracy, and stock rotation, helping hospitals reduce inventory levels. The inventory reduction savings were estimated at €133 million by comparing average stock values in

[11] Ahtiainen. Hanne Katriina. et al. 'Safety. Time and Cost Evaluation of Automated and Semi-Automated Drug Distribution Systems in Hospitals: A Systematic Review'. European Journal of Hospital Pharmacy: Science and Practice. vol. 27. no. 5. Sep. 2020. pp. 253–62. PubMed. https://doi.org/10.1136/ejhpharm-2018-001791.

[12] Yoo. Sooyoung. et al. 'Economic Analysis of Cloud-Based Desktop Virtualization Implementation at a Hospital'. BMC Medical Informatics and Decision Making. vol. 12. Oct. 2012. p. 119. PubMed. https://doi.org/10.1186/1472-6947-12-119.

automated and manual settings, using literature-based reduction rates.[13] Holding costs were calculated using an annual rate from the European Central Bank to reflect capital opportunity costs.

- **Medication errors:** Though considered an indirect benefit, medication administration errors reduction was included due to its strong clinical and economic impact. Using data from observational studies, we applied reported error rates to a standard 561-bed hospital for technologies like inventory robots, Unit Dose Systems, and dispensing cabinets. For Drug Error Reduction Systems and Oncology Traceability Systems, improvements were estimated in error detection. Errors were categorised by severity; each was linked to added hospital days based on prior studies. A weighted average of extended stays per error was calculated and multiplied by country-specific inpatient costs to estimate the economic impact of €733 million.

- **NPV:** The total NPV for EU27+UK was €8.21 billion, highlighting the long-term benefits of automation.
- **ROI:** The average ROI was 167%, confirming automation's financial viability.
- **PBT:** The average PBT was 4.46 years.

The summary results are shown in Table 3 of the study[6].

Table 3. Economic impact of automated technologies on all European Healthcare Services.

Technology	Investment	HR Efficiency Savings	Wastage Reduction Savings	Inventory Reduction Savings	MAE Reduction Savings (Indirect Benefit)	Total Annual Savings	ROI	NPV	Payback Time
Inventory Robot	−600,130,638 EUR	105,401,590 EUR	298,558,225 EUR	61,611,921 EUR	8,807,528 EUR	474,379,264 EUR	253%	2,871,105,529 EUR	2.75
UDDS	−507,585,002 EUR	100,732,484 EUR	98,798,224 EUR	0 EUR	14,016,421 EUR	213,547,129 EUR	88%	843,421,857 EUR	5.5
ACDs	−1,760,264,736 EUR	98,356,058 EUR	182,768,227 EUR	72,386,386 EUR	238,727,714 EUR	592,238,384 EUR	22%	887,897,647 EUR	7.33
DERS	−385,739,250 EUR	19,952,327 EUR	0 EUR	0 EUR	208,915,013 EUR	228,867,340 EUR	114%	1,031,345,807 EUR	3.75
Med, Traceability System	−304,110,137 EUR	162,230,625 EUR	36,029,794 EUR	0 EUR	262,662,674 EUR	460,923,093 EUR	360%	3,046,279,644 EUR	2.25
Total	−3,557,829,764 EUR	486,673,083 EUR	616,154,470 EUR	133,998,307 EUR	733,129,349 EUR	1,969,955,209 EUR	167%	8,213,739,492 EUR	4.46

In a time of constrained healthcare budgets, this study provides a structured and practical methodology for assessing the economic feasibility of automation and digitalisation in healthcare systems. By calculating ROI, NPV, and PBT, it equips hospital pharmacists and administrators with critical tools to make data-driven, strategic investment decisions.

Though some cost estimates are approximations, the adaptability of the proposed calculation tool ensures greater precision when applied to specific contexts. The consistently positive ROI observed across diverse settings emphasises the value of economic evaluations in driving sustainable health management. This framework lays a solid foundation for informed investments in automated technologies, enabling healthcare systems to enhance efficiency, reduce costs, and deliver high-quality care.

Funding required to ensure real-time and accurate visibility of stocks

Medicine shortages continue to threaten European healthcare systems, resulting in the discontinuity of care and increasing costs. This problem predates 2020 but has been exacerbated by the COVID-19 pandemic and an unstable geopolitical situation. Multiple ongoing initiatives have been set up worldwide to tackle shortages at every level of the pharmaceutical supply chain.

[13] Bertolotti. Francesco. et al. 'A Prediction Framework for Pharmaceutical Drug Consumption Using Short Time-Series'. Expert Systems with Applications. vol. 253. Nov. 2024. p. 124265. ScienceDirect. https://doi.org/10.1016/j.eswa.2024.124265.

Visibility of stocks throughout the supply chain, encompassing wholesalers, distributors, and retail and hospital pharmacies, is critical to prevent and manage medicine shortages:

- Real-time data sharing among pharmaceutical companies, healthcare providers, and regulators will allow for the early identification of potential shortages, facilitating a timely response. This system would also enable accurate demand forecasting, helping pharmaceutical companies anticipate demand increases and prevent medicine shortages.
- It ensures proper stockpiling management by preventing disproportionate stock levels, distributing stockpiles fairly among Member States based on their current stock situation through a solidarity mechanism.
- It supports effective management of shortages and the identification of alternative medicines during crises.

Member States must develop advanced IT systems to gain a comprehensive and real-time understanding of medication inventory levels across the supply chain. However, due to the low level of digitalisation in hospital medication management, most hospitals in the EU are not yet equipped to provide real-time inventory data in electronic format, limiting the effectiveness of shortage management. At present, many hospitals still rely on manual, outdated inventory systems, which slow down response times and limit the visibility of stock levels.

An EHMA report[8] reveals that manual inventory management in hospitals leads to inaccurate records due to human errors and time-consuming updates, causing discrepancies between actual stock levels and recorded data. The lack of real-time monitoring prevents timely responses to shortages, increasing the risk of stockouts and costly emergency procurement. Tracking expiry dates manually is challenging, often resulting in expired medicines being kept on shelves, leading to safety risks and financial losses. Additionally, manual systems operate in isolation, creating data silos and preventing seamless integration with hospital management systems.

A key finding of the report highlights the importance that National Competent Authorities place on the visibility of medication stocks. Regulatory bodies emphasise the need for real-time inventory data to enhance supply chain resilience and prevent shortages. However, survey results from pharmacists included in the report indicate a significant gap in hospitals' capacity to provide real-time stock data in electronic format. Many facilities still rely on manual tracking methods, limiting their ability to respond efficiently to fluctuating demand and supply chain disruptions.

Without real-time visibility of inventory levels, procurement remains inefficient, with static ordering patterns that fail to adapt to demand fluctuations. The inability to anticipate spikes in demand leads to stockouts or overstocking, misallocating resources and increasing waste. When hospitals react to shortages at the last minute, urgent large-scale orders across the EU can strain the supply chain, exacerbate medicine shortages and drive-up costs.

The solution

Digital and automated tools, such as inventory robots, automated dispensing cabinets and connected IT systems, can provide full visibility of medicine stocks, demand projections, and ordering processes for hospitals. Inventory robots in hospital pharmacies provide real-time and electronic inventory data of medicines stored in the pharmacy warehouse, while automated dispensing cabinets located in the wards provide real-time and electronic inventory data from the wards' inventory IT systems

connect all these electronic real-time inventory data to provide full visibility of stocks in the hospital.

Based on the LIUC-Cattaneo University's study[6], the EU should invest €2,360 billion in hospitals to ensure real-time and electronic medicines inventory stock reporting, with the following details by country (EU+27):

Country	Inventory Robot	Automated Dispensing Cabinets	Total
	Investment EUR	Investment EUR	Investment EUR
Austria	9.537.524	42.477.016	52.014.540
Belgium	17.572.407	32.090.235	49.662.642
Bulgaria	17.134.280	39.108.994	56.243.274
Croatia	5.762.476	13.152.852	18.915.328
Cyprus	1.059.581	2.765.181	3.824.762
Czechia	9.518.597	42.392.722	51.911.319
Denmark	3.551.425	12.004.555	15.555.980
Estonia	2.290.903	5.414.049	7.704.952
Finland	2.940.295	9.938.809	12.879.104
France	116.594.957	265.082.878	381.677.835
Germany	103.801.385	462.297.452	566.098.837
Greece	15.334.439	39.587.888	54.922.327
Hungary	16.463.752	37.578.515	54.042.267
Ireland	5.411.715	11.161.662	16.573.377
Italy	58.197.246	150.243.911	208.441.157
Latvia	3.760.824	8.887.886	12.648.710
Lithuania	5.163.697	12.203.267	17.366.964
Luxembourg	741.385	1.834.928	2.576.313
Malta	587.631	1.517.048	2.104.679
Netherlands	15.980.608	39.552.005	55.532.613
Poland	64.939.682	153.470.733	218.410.415
Portugal	10.920.430	29.220.155	40.140.585
Romania	40.134.571	91.607.157	131.741.728
Slovakia	10.002.195	22.830.010	32.832.205
Slovenia	3.505.086	8.000.360	11.505.446
Spain	31.305.709	81.263.924	112.569.633
Sweden	5.032.795	17.011.895	22.044.690
Total EU27	577.245.596	1.632.696.089	2.209.941.685
United Kingdom	22.885.042	127.568.647	150.453.689
Total EU27 + UK	600.130.638	1.760.264.736	2.360.395.374

The study shows that the high profitability of these investments for the EU is driven by savings in the reduction of wasted medication, medication inventory, and inefficiencies in the process.

- Robots: the average ROI in 10 years is 253% and the payback time is 2.75 years.

Country	Inventory Robot	Inventory Robot	Inventory Robot	Inventory Robot	Inventory Robot	Inventory Robot	Inventory Robot ROI	Inventory Robot NPV EUR	Inventory Robot Payback Time
	Investment EUR	HR Efficiency Savings EUR	Wastage Reduction Savings EUR	Inventory Reduction Savings EUR	MAE Reduction Savings (Indirect)	Total Savings EUR			
Austria	9,537,524	-2,677,887	-5,318,178	-1,097,485	-156,887	-9,250,437	320%	-56,236,844	2
Belgium	17,572,407	-4,763,417	-8,788,508	-1,813,639	-259,263	-15,624,827	276%	-87,730,558	2
Bulgaria	17,134,280	-830,112	-7,806,219	-1,610,929	-230,285	-10,477,546	173%	-55,876,212	3
Croatia	5,762,476	-405,847	-2,415,304	-498,434	-71,252	-3,390,837	155%	-16,434,051	3
Cyprus	1,059,581	-85,896	-506,289	-104,480	-14,936	-711,600	199%	-3,991,610	3
Czechia	9,518,597	-3,492,428	-5,188,877	-1,070,802	-153,073	-9,905,179	364%	-65,441,247	2
Denmark	3,551,425	-1,082,681	-1,870,432	-385,991	-55,178	-3,394,282	322%	-21,465,708	2

Estonia	2,290,903	-213,491	-809,371	-167,026	-23,877	-1,213,765	127%	-5,297,560	4
Finland	2,940,295	-776,859	-1,293,507	-266,934	-38,159	-2,375,458	263%	-14,741,125	3
France	116,594,957	-23,963,002	-55,160,788	-11,383,247	-1,627,254	-92,134,292	255%	-566,889,586	3
Germany	103,801,385	-23,641,149	-61,820,802	-12,757,640	-1,823,726	-100,043,318	322%	-622,429,538	2
Greece	15,334,439	-1,631,499	-7,031,650	-1,451,085	-207,435	-10,321,670	196%	-55,991,686	3
Hungary	16,463,752	-913,016	-6,792,002	-1,401,631	-200,365	-9,307,014	129%	-37,339,855	3
Ireland	5,411,715	-1,330,238	-3,315,354	-684,172	-97,804	-5,427,568	342%	-34,607,617	2
Italy	58,197,246	-10,936,904	-34,861,599	-7,194,208	-1,028,424	-54,021,136	304%	-327,920,917	2
Latvia	3,760,824	-288,731	-1,339,672	-276,461	-39,521	-1,944,385	116%	-7,881,271	4
Lithuania	5,163,697	-396,434	-1,839,400	-379,587	-54,263	-2,669,684	124%	-11,874,390	4
Luxembourg	741,385	-167,356	-383,466	-79,134	-11,312	-641,269	291%	-4,132,653	2
Malta	587,631	-88,685	-283,161	-58,435	-8,353	-438,634	231%	-2,549,685	3
Netherlands	15,980,608	-4,057,855	-8,210,314	-1,694,320	-242,206	-14,204,695	294%	-88,300,454	2
Poland	64,939,682	-4,966,744	-22,756,516	-4,696,145	-671,322	-33,090,726	106%	-120,556,135	4
Portugal	10,920,430	-1,563,248	-5,327,766	-1,099,464	-157,170	-8,147,647	229%	-46,720,000	3
Romania	40,134,571	-2,727,393	-17,670,319	-3,646,533	-521,278	-24,565,523	153%	-109,694,626	3
Slovakia	10,002,195	-1,048,285	-4,218,929	-870,639	-124,459	-6,262,312	161%	-28,773,102	3
Slovenia	3,505,086	-939,458	-1,505,260	-310,633	-44,405	-2,799,757	245%	-15,776,756	3
Spain	31,305,709	-5,206,229	-16,336,699	-3,371,320	-481,936	-25,396,184	249%	-143,074,795	3
Sweden	5,032,795	-1,690,249	-2,266,855	-467,799	-66,873	-4,491,776	291%	-27,252,913	2
Total EU27	**577,245,596**	**-99,885,092**	**-285,117,237**	**-58,838,174**	**-8,411,016**	**-452,251,520**	**250%**	**-2,578,980,894**	**3**
United Kingdom	22,885,042	-5,516,497	-13,440,988	-2,773,747	-396,512	-22,127,744	329%	-141,329,149	2
Total EU27 + UK	**600,130,638**	**-105,401,590**	**-298,558,225**	**-61,611,921**	**-8,807,528**	**-474,379,264**	**253%**	**-2,720,310,043**	**3**

- ADCs: the average ROI in 10 years is 22% and the payback time is 7.33years.

Country	Automated Dispensing Cabinets	Automated Dispensing Cabinets	Automated Dispensing Cabinets	Automated Dispensing Cabinets	Automated Dispensing Cabinets	Automated Dispensing Cabinets	ADC ROI	ADC NPV	ADC Payback Time
	Investment EUR	HR Efficiency Savings EUR	Wastage Reduction Savings EUR	Inventory Reduction Savings EUR	MAE Reduction Savings (Indirect) EUR	Total Savings EUR			
Austria	42,477,016	-3,330,725	-4,771,350	-1,889,720	-6,232,230	-16,224,025	34%	-33,206,716	6
Belgium	32,090,235	-2,396,951	-3,233,084	-1,280,481	-4,222,980	-11,133,496	20%	-14,057,340	7
Bulgaria	39,108,994	-1,084,398	-3,589,316	-1,421,569	-4,688,283	-10,783,566	0%	437,818	over 10 years
Croatia	13,152,852	-341,090	-1,110,562	-439,844	-1,450,591	-3,342,087	-11%	3,138,680	over 10 years
Cyprus	2,765,181	-75,748	-266,163	-105,415	-347,656	-794,983	4%	-243,065	10
Czechia	42,392,722	-1,074,645	-4,655,344	-1,843,775	-6,080,705	-13,654,469	16%	-16,078,638	8
Denmark	12,004,555	-986,488	-1,273,636	-504,431	-1,663,595	-4,428,151	32%	-8,927,853	6
Estonia	5,414,049	-179,318	-385,321	-152,609	-503,298	-1,220,546	-21%	2,596,971	over 10 years
Finland	9,938,809	-729,463	-880,790	-348,842	-1,150,468	-3,109,561	14%	-3,220,562	8
France	265,082,878	-17,200,629	-25,263,440	-10,005,728	-32,998,533	-85,468,330	17%	-107,571,072	8
Germany	462,297,452	-33,049,912	-55,464,245	-21,966,927	-72,446,139	-182,927,223	41%	-431,561,390	6
Greece	39,587,888	-1,925,701	-3,656,889	-1,448,332	-4,776,546	-11,807,468	6%	-5,762,508	9
Hungary	37,578,515	-1,002,977	-3,122,977	-1,236,872	-4,079,161	-9,441,988	-16%	13,036,748	over 10 years
Ireland	11,161,662	-888,126	-1,377,476	-545,557	-1,799,228	-4,610,386	48%	-12,257,144	5
Italy	150,243,911	-8,405,259	-18,130,170	-7,180,556	-23,681,217	-57,397,201	35%	-120,509,066	6
Latvia	8,887,886	-186,043	-637,784	-252,598	-833,060	-1,909,485	-26%	5,156,987	over 10 years
Lithuania	12,203,267	-255,744	-875,692	-346,823	-1,143,810	-2,622,069	-24%	6,699,946	over 10 years
Luxembourg	1,834,928	-211,861	-191,189	-75,721	-249,727	-728,498	45%	-1,959,036	6
Malta	1,517,048	-82,032	-147,261	-58,324	-192,349	-479,966	14%	-479,647	8
Netherlands	39,552,005	-2,923,760	-4,093,503	-1,621,255	-5,346,840	-13,985,357	27%	-24,767,037	7
Poland	153,470,733	-4,622,264	-10,833,812	-4,290,792	-14,150,880	-33,897,748	-27%	86,828,881	over 10 years
Portugal	29,220,155	-1,118,407	-2,871,759	-1,137,376	-3,751,027	-8,878,570	9%	-5,789,569	9
Romania	91,607,157	-2,202,736	-8,124,849	-3,217,892	-10,612,493	-24,157,970	-11%	21,005,960	over 10 years
Slovakia	22,830,010	-881,563	-1,939,872	-768,297	-2,533,817	-6,123,550	-9%	4,271,938	over 10 years
Slovenia	8,000,360	-167,032	-692,122	-274,119	-904,034	-2,037,306	-11%	1,908,494	over 10 years
Spain	81,263,924	-4,416,519	-8,542,769	-3,383,412	-11,158,371	-27,501,071	19%	-34,016,945	700%
Sweden	17,011,895	-770,674	-1,543,574	-611,341	-2,016,181	-4,941,770	3%	-1,288,881	1000%
Total EU27	**1,632,696,089**	**-90,510,064**	**-167,674,950**	**-66,408,609**	**-219,013,218**	**-543,606,841**	**20%**	**-676,614,045**	**7**
United Kingdom	127,568,647	-7,845,993	-15,093,277	-5,977,777	-19,714,496	-48,631,543	37%	-109,240,844	600%
Total EU27 + UK	**1,760,264,736**	**-98,356,058**	**-182,768,227**	**-72,386,386**	**-238,727,714**	**-592,238,384**	**22%**	**-785,854,889**	**7**

Funding required to minimise medication errors in oncology under the Europe's Beating Cancer Plan

The CraNe Joint Action (Network of Comprehensive Cancer Centres-Preparatory activities on creation of National Comprehensive Cancer Centres and EU Networking)[14] has been proposed for funding as part of the Europe's Beating Cancer Plan. This initiative aims to establish an EU-wide network connecting recognised national Comprehensive Cancer Centres (CCCs) in each Member State by 2025. The key objectives of the CraNe Joint Action include:

- Establishing the essential administrative, professional, and quality-related conditions for developing Comprehensive Cancer Centre Networks.
- Connecting national CCCs with broader EU-level Comprehensive Cancer Care Networks (CCCNs).
- Assessing the feasibility and long-term sustainability of a structured CCC network across the EU.

One of its specific objectives is to develop tools and instruments that enable Member States to establish quality-assured CCCNs, ensuring that 90% of eligible patients have access to high-quality early detection, screening, diagnosis, treatment, and support by 2030, as well as enhancing cancer research and training of health professionals. The CraNe JA has already published the standard for CCCs that sets out the requirements to be met.[15] Within this framework, the digitalisation of medication pathways is recognised as a central enabler for safe and efficient oncology care. The CraNE standards clearly state under Point 6.2.10:

> *"An electronic drug prescription and administration system which controls the entire drug pathway and interfaces with the patient record should be available."*

This requirement reflects the critical importance of digitising every step of the medication process - from prescribing to administration to documentation - to reduce human error and ensure seamless communication between clinical teams.

Based on the LIUC-Cattaneo University study[6], the investment required in the EU to implement drug prescription and administration systems amounts to €274 million, with an outstanding ROI of 350%. The reduction of drug waste and the prevention of medication errors in oncology (high-risk medication and high-risk patients) drives such a significant ROI. The ROI is largely driven by reductions in medication errors, improved treatment accuracy, and lower drug waste in oncology departments. Country-level breakdowns show clear financial viability, with rapid payback periods due to savings in high-cost cancer drugs and avoided adverse events.

To meet the goals of the Europe's Beating Cancer Plan, Member States must incorporate this digital infrastructure into national cancer care strategies, with financial support through EU4Health, Cohesion Funds, and Horizon Europe research and innovation actions.

[14] CraNE4Health European Network of Comprehensive Cancer Centres. https://crane4health.eu/

[15] CraNe Joint Action WP10. Standard for Comprehensive Cancer Care Networks (CCCN). 2021. Available at https://www.ipaac.eu/res/file/outputs/wp10/cccn-standard.pdf.

Call to action 5

EHMA urges the EU institutions and Member States to prioritise the funding and implementation of electronic prescription and administration systems in oncology as part of the CraNE Joint Action and the Europe's Beating Cancer Plan. These systems must be interoperable, traceable, and integrated with patient records to fulfil the requirements outlined in CCC standards and ensure patient safety, treatment efficacy, and cost-efficiency across EU cancer care networks.

The following table shows the investment, ROI, and Payback by country:

Country	Investment	ROI	Payback years
Austria	7.139.199 €	518%	2
Belgium	7.321.836€	449%	2
Bulgaria	5.711.427€	107%	3
Croatia	1.920.825€	139%	3
Cyprus	201.825€	345%	2
Czechia	7.125.032€	231%	2
Denmark	2.643.838€	511%	2
Estonia	946.907€	198%	2
Finland	2.188.886€	437%	2
France	65.922.887€	389%	2
Germany	77.699.282€	447%	2
Greece	2.920.845€	317%	2
Hungary	5.487.917€	126%	3
Ireland	3.607.810€	493%	2
Italy	11.085.190€	351%	2
Latvia	1.554.474€	118%	3
Lithuania	2.134.328€	118%	3
Luxembourg	197.703€	1106%	1
Malta	111.930€	344%	2
Netherlands	4.261.496€	512%	2
Poland	26.841.735€	132%	3
Portugal	6.561.246€	231%	2
Romania	13.378.190€	85%	4
Slovakia	3.334.065€	208%	2
Slovenia	1.168.362€	237%	2
Spain	9.207.562€	314%	2
Sweden	3.746.636€	393%	2
TOTAL EU27	**274.421.434€**	**350%**	**2**
United Kingdom	29.688.703€	453%	2
Total EU27+UK	**304.110.137€**	**360%**	**2**

Funding required to prevent medication errors in Intensive Care Units (ICUs)

Medication errors take on relevance for critical patients, whose medication is one of their main therapeutic resources.[16,17] The fact that many of these medications are considered to be high risk and are used intravenously, together with the seriousness and complexity of such patients' conditions, as well as the need for close communication between the different professionals, are all factors that raise the risk of adverse events occurring. More medication errors occur in paediatric and neonatal Intensive Care Units (ICUs) than in adult units. Indeed, it is estimated that medication errors occur 8 times more in the neonatal ICUs than in ones for hospitalised adults[18,19].

A systematic review of empirical studies examining the prevalence and nature of medication errors in paediatric and neonatal ICUs conducted from January 2000 to March 2019 revealed that medication errors are a common issue in these units.[20] In paediatric ICUs, errors occurred at a rate of 14,6 per 100 prescriptions and 6,4 to 9,1 per 1.000 patient-days. Errors ranged from 5,5 to 77,9 per 100 prescriptions and between 4 and 35,1 per 1.000 patient-days. The most frequent errors were found during the prescription and administration stages, with dosage errors being the most prevalent in both paediatric and neonatal patient populations.

There are multiple plans and strategies aimed at preventing medication errors, with different levels of complexity in terms of implementation.[21] From education and training, reporting systems, continuous improvement schemes and accreditation. Numerous scientific bodies, alliances and societies back electronic traceability systems being introduced as the most efficient way to reduce medication errors.[22] In the case of the ICU, the role of medication traceability in preventing medication errors is fundamental. Medication traceability in the ICU includes the following systems:[23]

- Automated dispensing cabinets improve efficiency and reduce the rate of medication errors. Direct connections for electronic prescriptions and automated

[16] Hartel. Maximilian J.. et al. 'High Incidence of Medication Documentation Errors in a Swiss University Hospital Due to the Handwritten Prescription Process'. BMC Health Services Research. vol. 11. Aug. 2011. p. 199. PubMed. https://doi.org/10.1186/1472-6963-11-199

[17] Jolivot. Pierre-Alain. et al. 'An Observational Study of Adult Admissions to a Medical ICU Due to Adverse Drug Events'. Annals of Intensive Care. vol. 6. no. 1. Feb. 2016. p. 9. BioMed Central. https://doi.org/10.1186/s13613-016-0109-9.

[18] Morimoto. Takeshi. et al. 'Incidence of Adverse Drug Events and Medication Errors in Japan: The JADE Study'. Journal of General Internal Medicine. vol. 26. no. 2. Feb. 2011. pp. 148–53. PubMed. https://doi.org/10.1007/s11606-010-1518-3.

[19] Tully AP. Hammond DA. Li C. Jarrell AS. Kruer RM. Evaluation of Medication Errors at the Transition of Care From an ICU to Non-ICU Location. Crit Care Med [Internet]. 2019 Apr [cited 2019 Mar 18];47(4):543–549. http://insights.ovid.com/crossref?an=00003246-201904000-00007

[20] Alghamdi. Anwar A.. et al. 'Prevalence and Nature of Medication Errors and Preventable Adverse Drug Events in Paediatric and Neonatal Intensive Care Settings: A Systematic Review'. Drug Safety. vol. 42. no. 12. 2019. pp. 1423–36. PubMed Central. https://doi.org/10.1007/s40264-019-00856-9.

[21] Brennan. T. A.. et al. 'Hospital Characteristics Associated with Adverse Events and Substandard Care'. JAMA. vol. 265. no. 24. June 1991. pp. 3265–69. Available at Hospital characteristics associated with adverse events and substandard care - PubMed

[22] Hartel. Maximilian J.. et al. 'High Incidence of Medication Documentation Errors in a Swiss University Hospital Due to the Handwritten Prescription Process'. BMC Health Services Research. vol. 11. no. 1. Aug. 2011. p. 199. BioMed Central. Available at https://pubmed.ncbi.nlm.nih.gov/15078649/.

[23] Bobb A. Gleason K. Husch M. Feinglass J. Yarnold PR. Noskin GA. The Epidemiology of Prescribing Errors: The Potential Impact of Computerized Prescriber Order Entry. Arch Intern Med. 2004;164(7):785–792. Available at https://pubmed.ncbi.nlm.nih.gov/15078649/.

dispensing systems also enhance the quality of the dispensing process and increase its efficiency.[24,25]

- Another key solution is the Smart pumps with DERS systems (Dose-error reduction software) to prevent programming errors. Numerous studies carried out show the benefits of smart pumps in preventing errors in programming them.[26]
- Smart pumps allow organisations to create, edit, and maintain drug libraries with dose, duration, and concentration limits to alert clinicians when parameters are programmed outside of the facility-accepted ranges. A routine update of the drug library is recommended.[27,28]

Delays in activating drug libraries on infusion pumps have been reported.[29] A retrospective review of data from 12 health systems by DeLaurentis et al, revealed that median delays in updating drug libraries ranged from several days to months.[30] Additionally, Poppe and Eckel described a process improvement initiative at an academic medical centre that led to an 80% activation rate within 22 days after the drug library release. These delays in activation have been shown to impact patient safety. For instance, an evaluation at one health system found that over 50% of pumps were still using outdated drug libraries, which contributed to 22,6% of alerts being triggered.[31] The authors highlighted that outdated libraries can cause inconsistencies for pump users, potentially lead to patient harm due to incorrect drug limit configurations, and create confusion that might result in bypassing the drug library altogether.

Infusion centres have been developed, where nursing staff can manage and monitor multiple infusion pumps across a unit or floor through a central computer or tablet. These systems allow for the review of infusion activities, including events, alerts, and alarms related to issues such as blockages, air in the line, pressure alarms, bolus administration and infusion nearing completion. They also facilitate the centralised update of infusion pump drug libraries, ensuring all devices use the latest libraries, reducing the risk of using outdated ones and preventing patient harm. Additionally, these systems enable real-time monitoring of a patient's fluid balance and infusion volumes while also managing pressure within the lines.

According to the ECAMET survey[1], errors are only tracked through the Drug Error Reporting System in infusion pumps, with just 8% of facilities utilising central infusion

[24] Cuesta López. I.. et al. 'Impact of the Implementation of Vasoactive Drug Protocols on Safety and Efficacy in the Treatment of Critically Ill Patients'. Journal of Clinical Pharmacy and Therapeutics. vol. 41. no. 6. Dec. 2016. pp. 703–10. PubMed. Available at https://pubmed.ncbi.nlm.nih.gov/27699815/.

[25] Parry. Angela M.. et al. 'Factors Contributing to Registered Nurse Medication Administration Error: A Narrative Review'. International Journal of Nursing Studies. vol. 52. no. 1. Jan. 2015. pp. 403–20. PubMed. Available at https://pubmed.ncbi.nlm.nih.gov/25443300/.

[26] Drug Interactions Checker - Medscape Drug Reference Database. Available at https://reference.medscape.com/drug-interactionchecker.

[27] Ohashi K. Dalleur O. Dykes PC. Bates DW. Benefits and Risks of Using Smart Pumps to Reduce Medication Error Rates: A Systematic Review. Drug Saf. 2014;37(12):1011-20. Available at https://pubmed.ncbi.nlm.nih.gov/25294653/.

[28] Sentinel Event Alert 63: Optimizing Smart Infusion Pump Safety With DERS. Jt Comm J Qual Patient Saf. 2021;47(6):394 7. Available at https://pubmed.ncbi.nlm.nih.gov/25294653/.

[29] Hsu. Kang-Yu. et al. 'Tracking the Progress of Wireless Infusion Pump Drug Library Updates- A Data-Driven Analysis of Pump Update Delays'. Journal of Medical Systems. vol. 43. no. 3. Feb. 2019. p. 75. PubMed. Available at https://pubmed.ncbi.nlm.nih.gov/30756252/.

[30] DeLaurentis. Poching. et al. 'Prevalence of Wireless Smart-Pump Drug Library Update Delays'. American Journal of Health-System Pharmacy: AJHP: Official Journal of the American Society of Health-System Pharmacists. vol. 75. no. 15. Aug. 2018. pp. 1140–44. PubMed. Available at https://pubmed.ncbi.nlm.nih.gov/29950393/.

[31] DeLaurentis. Poching C.. et al. 'Investigating Delays in Updates to Infusion Pump Drug Limit Libraries'. AMIA ... Annual Symposium Proceedings. AMIA Symposium. vol. 2016. 2016. pp. 490–95. Available at https://pubmed.ncbi.nlm.nih.gov/29950393/.

systems. A study by LIUC-Cattaneo University[6] has estimated the investment required for the installation of central systems for pumps in ICUs across the EU, along with the associated return on investment and payback period. The average ROI across the EU is outstanding at 112%, with a payback period of just two years.

The following table shows the data by country:

Country	DERS Investment	ROI	Payback years
Austria	8.831.041€	178%	3
Belgium	10.982.754€	182%	3
Bulgaria	7.900.807€	64%	5
Croatia	2.657.142€	50%	5
Cyprus	486.542€	112%	4
Czechia	8.813.516€	73%	4
Denmark	1.973.014€	399%	2
Estonia	763.634€	53%	5
Finland	1.633.497€	404%	2
France	76.254.086€	118%	3
Germany	96.112.394€	85%	4
Greece	7.041.324€	108%	4
Hungary	7.591.619€	39%	6
Ireland	3.006.508€	240%	2
Italy	26.723.225€	114%	3
Latvia	1.253.608€	46%	5
Lithuania	1.721.232€	50%	5
Luxembourg	411.881€	218%	3
Malta	269.831€	121%	3
Netherlands	8.878.116€	119%	3
Poland	21.646.561€	44%	5
Portugal	7.265.307€	157%	3
Romania	18.506.496€	49%	5
Slovakia	4.612.123€	66%	5
Slovenia	1.616.234€	53%	5
Spain	25.065.029€	159%	3
Sweden	2.795.997€	383%	2
TOTAL EU27	**354.813.518€**	**112%**	**4**
United Kingdom	30.925.733€	145%	3
Total EU27+UK	**385.739.250€**	**114%**	**4**

EUROPEAN UNION FUNDING PROGRAMMES

The provision of health is a national competency. Nevertheless, the European Union has established various funding programmes to invest in its strategic goals, especially within the areas of social and economic cohesion and development, research and innovation, digital connectivity and strengthening its EU competitiveness under the European Single Market.

Several European Union funding instruments currently support digital innovation, healthcare transformation, and supply chain resilience. Key programmes include the EU4Health Programme, Cohesion Policy Funds (2021–2027), the Recovery and Resilience Facility (RRF), Digital Europe, and Horizon Europe. These instruments provide opportunities to co-finance digital health tools, strengthen health workforce capacities, and improve hospital infrastructure across Member States.

While these programmes offer important pathways, **investments in hospital-level digitalisation of medication management systems remain largely fragmented and underfunded.** Critical areas such as e-prescription, clinical decision support, automated dispensing, real-time stock tracking, and system interoperability - particularly in high-risk settings like oncology - often fall between existing programme priorities. **In the context of growing medicine shortages, increased cancer incidence, and urgent EU-level ambitions such as the Critical Medicines Act, the Europe's Beating Cancer Plan, and the European Health Data Space, there is a clear need for more targeted funding.**

Based on the aggregated investment needs outlined in the LIUC-Cattaneo University study[6], **it is estimated that approximately €3.3 billion is required to digitalise and automate medication management in hospitals over the next Multiannual Financial Framework (2028–2035)**. This includes investments in software, integration with patient records, hardware and robotics, staff training, and ongoing data security measures.

Call to action 6

EHMA and the EPACT Alliance call on the European Commission to develop a dedicated funding programme focused specifically on the digitalisation and automation of hospital medication management, with a total investment of €3.3 billion under the next Multiannual Financial Framework (2028–2035). This programme should complement EU4Health, support implementation of the Critical Medicines Act, and directly fund interoperable IT systems, e-prescribing tools, stock monitoring technologies, and smart automation across EU hospitals.

By establishing a dedicated funding stream, the EU can ensure that the digital backbone needed to prevent medication shortages, reduce errors, and support hospital resilience becomes a shared European priority, delivering tangible results for patients, professionals, and national health systems alike.

RECOVERY AND RESILIENCE FACILITY (RRF)

The implementation of the Recovery and Resilience Facility (RRF), which is central to the NextGenerationEU recovery instrument, is progressing rapidly and fostering ongoing reform and investment across Member States. Through the Facility, the Commission raises funds by borrowing on the capital markets (issuing bonds on behalf of the EU). These are then available to the Member States in the form of a grant

or a loan, to implement ambitious reforms and investments that make their economies and societies more sustainable, resilient and prepared for the green and digital transitions, in line with the EU's priorities; and address the challenges identified in country-specific recommendations under the European Semester framework of economic and social policy coordination.

The RRF has a budget of €650 billion in grants and loans, making it a vital instrument for facilitating significant investments and reforms that aim to drive the EU's green and digital transitions, as well as bolster the resilience and competitiveness of its economies. Since the RRF's launch, more than 900 reforms are currently underway to reduce bureaucratic hurdles, thereby accelerating business processes for obtaining permits and licenses, which is intended to enhance the competitiveness of EU industries. Additionally, RRF initiatives have led to substantial energy savings of 34 million megawatt-hours, and over 11.8 million individuals have participated in educational and training programs.

By the end of 2024, the Commission expects to disburse over €300 billion from the RRF. To date, it has already distributed over €267 billion, representing more than 40% of the available funding. The acceleration in implementation follows initial delays in 2023, which were caused by the geopolitical landscape, inflation, supply chain issues, and the need to adopt REPowerEU chapters. The Council has endorsed 26 of these chapters, which are essential for diversifying energy supplies, expediting the green transition, and providing support to vulnerable households.

To benefit from support under the Facility, EU Member States have submitted national plans outlining the reforms and investments they will implement by the end of 2026, with clear milestones and targets. **Each plan had to allocate at least 20% of their budgets to digital measures.** Member States can only amend their plans if the national government demonstrates that objective circumstances render the implementation of certain targets unfeasible, such as inflation, supply chain shortages, or a better alternative to fulfil the intended objective. The Facility is performance-based. The European Commission releases the funds only when a country has achieved the agreed targets included in its plan. *Information on the informal expert group on the implementation of the RRF can be found here.*

In July 2024, updated guidance introduced simpler processes for Member States, particularly regarding plan revisions, aimed at addressing implementation challenges. Additionally, Member States now benefit from streamlined reporting requirements and clearer guidance on integrating RRF with other EU funding sources to optimise synergies.

The Commission is committed to ensuring high transparency standards in RRF implementation. The latest report includes a detailed analysis of data concerning the 100 largest recipients of RRF funding. It also clarifies various concepts within the RRF framework, including eligibility for reforms and investments, recurring expenditures, the issue of double funding, and the classification of final recipients of funds. Protecting the EU's financial interests remains a top priority for the Commission. To this end, it has enhanced its audit and control frameworks, conducting 17 risk-based ex-post audits from September 2023 to August 2024. By the end of 2023, all Member States had undergone at least one audit.

Progress in the implementation of recovery and resilience plans can be followed through the Recovery and Resilience Scoreboard, an online portal established by the Commission in December 2021 which features an interactive map detailing projects funded by the RRF. *For more information on the RRF and its impact can be found here.*

Comparative analysis of Member States' Recovery and Resilience Plans

Several European countries have outlined specific strategies to digitally transform their healthcare systems, with plans varying from modernising IT infrastructure to undergoing major digital enhancements. The level of commitment on comprehensive digitisation versus other priorities, like infrastructure and workforce, varies within the different national plans. Cyprus, Denmark, Estonia, Finland, Italy, Luxembourg, Malta, Poland, Spain, and Sweden have stated commitments to embrace comprehensive digital solutions and technological advancements within healthcare. Bulgaria, France, and Ireland have signalled intentions to improve digitalisation but without detailed strategies for implementation. Croatia, Czech Republic, Greece, and Slovenia emphasise infrastructure upgrades and healthcare resilience more than digitalisation. Their plans involve consolidating health information systems, acquiring new medical equipment, improving integrated care, and drafting a patient safety strategy.

Croatia's Recovery and Resilience Plan

Croatia's RRP recognises the need to modernise hospital pharmacy operations and strengthen medication safety across its health system. The Croatian government allocated over €25 million to transform two key areas: the central preparation of parenteral drugs and the distribution of medicines in unit-dose format.

€8.27 million was allocated for the central preparation of all parenteral preparations in 8 Croatian hospitals, including investment in isolator technology and digital gravimetric systems. These upgrades aim to ensure microbiological safety, improve dosing accuracy, and enable outcome tracking. The centralised model reduces preparation errors in clinical wards and allows pharmacy teams to apply standardised protocols, contributing to more consistent and transparent care. €17.25 million was dedicated to the introduction of a unit-dose therapy distribution system in 40 hospitals, replacing bulk supply and manual repackaging at ward level with centrally prepared, barcode-labelled, patient-specific medication doses. These systems are often paired with pharmacy automation (e.g. automated unit-dose packaging machines and dispensing cabinets) and reviewed by pharmacists for interactions or errors before delivery. This model supports a closed-loop medication administration process that enhances traceability, reduces waste, and lowers medication-related adverse events.

The measures are to be implemented by 2026 and integrated into Croatia's national hospital information infrastructure. These investments directly address medication safety, stock control, and workforce optimisation, core pillars of the EU's Pharmaceutical Strategy, Critical Medicines Act, and Beating Cancer Plan.

Italy's Recovery and Resilience Plan

Currently undergoing revision, the second component of Italy's RRP focuses on investments for the innovation, research and digitalisation of the National Health Service. For this purpose, €8.63 billion is allocated to replacing obsolete technologies in hospitals, improving information systems and digital health tools, and strengthening human resources, amongst others. To strengthen the technological infrastructure and tools of hospitals, investments will be dedicated to data collection, processing, and analysis, with an overall aim to strengthen Electronic Health Records which should be fully implemented by all regions in June 2026. A proposed budget line is included to fund 100 innovative drug logistics projects in the revised Plan.

Germany - The Hospital Future Act (Krankenhauszukunftsgesetz - KHZG)

An example of process transformation within Germany's Digitalisation Strategy for Health and Care is cross-sectoral medication management. Medication management is one example of where digital tools and systems can contribute to greater medication safety, leading to economic gains. Long recognised as lagging in the uptake of digital tools and the modernisation of its health system, the KHZG supports a series of policy and legislative decisions to support Germany's transition to a digitalised healthcare system.

As a key measure to reinforce Germany's economic and social resilience, the Hospital Future Act (KHZG) aims for 50% of hospitals to improve their digital maturity by at least two levels in at least two categories by 2025. With an overarching aim to boost investments in IT infrastructure and digital health solutions that can help simplify internal processes and relieve medical staff in their day-to-day work, the Hospital Future Act is known to be 'the biggest digital health investment opportunity in Europe'.

Digital modernisation will be supported with funds to the value of €4.3 billion, of which €3 billion from the RRF and €1.3 by federal states, using the Krankenhauszukunftsfonds (Future Hospitals Fund). With €2 million per hospital and around €8.000 per bed, hospitals should make investments in emergency capacities, digital infrastructure, developing and strengthening regional care structures, and IT security. Of eleven eligible projects under the legislation, digital medication management systems, digital care and treatment documentation, and establishing partially or fully automated clinical decision support systems are included.

The establishment of digital medication management systems in German hospitals is anticipated to provide information on all drug-related treatments throughout the entire care process and increase patient safety from drug therapy. Emphasis is also placed on the interoperability of systems, including technical, structural, process and multidisciplinary communications. Funding can also cover investments in qualified staff who are needed to implement and run the proposed measures. To speed up the uptake of digitalisation, including closed-loop medication management systems, the Act imposes penalties on hospitals that obtain funding but fail to introduce eligible digital services by 2025.

The act is a unique opportunity for German hospitals to modernise their medication management systems and create a resilient hospital pharmaceutical supply chain that can absorb shocks from unexpected events, supporting Germany's pathway to digital transition.

Poland's Recovery and Resilience Plan

The RRP for Poland was accepted in July 2024. The plan supports the accessibility and effectiveness of the Polish healthcare system, with €4.4 billion of investments in, for instance, support of hospitals and medical universities. €1.3 billion is about to be dedicated to healthcare digitalisation, including digital medication management solutions. However, due to the late release of the RRF, those solutions will also be possible to fund from other categories, such as oncology, long-term care and general hospitals. This means that hospitals and ambulatory care centres have a wide range of flexibility in possible funding sources.

Slovenia's Recovery and Resilience Plan

In its RRP, Slovenia allocated €11.6 million to advance the robotic preparation and storage of medicines in hospital pharmacies. The aim is to reduce human error in dispensing and optimise medicine inventory, while improving transparency and

traceability. The investment covers both automated storage systems (for precise inventory control and environmental safety) and robotic dispensing units that prepare and label medicines in a controlled, standardised way. These technologies are designed to integrate with national digital prescribing systems and hospital information platforms. The reform also includes workflow redesign in pharmacy logistics and staff training, to enable digital integration of pharmacy services with ward-level medication administration. Real-time inventory data is expected to improve ordering practices, reduce expiry-related waste, and support more efficient use of pharmaceutical budgets.

Implementation is expected to contribute to a more transparent, data-driven hospital pharmacy system, strengthening resilience and responsiveness in routine operations and emergencies alike.

Call to action 7

EHMA urges EU Member States to explicitly include investments in the digitalisation and automation of hospital medication management systems within their Recovery and Resilience Plans. These investments are critical to improving medication safety, preventing shortages, and enhancing operational efficiency in hospitals. Aligning national RRPs with the goals of the Critical Medicines Act, the Europe's Beating Cancer Plan, and the EU Pharmaceutical Strategy will ensure that EU funding translates into tangible system improvements at the hospital level.

EU4HEALTH PROGRAMME

The EU4Health Programme is a is valuable financial support to the health sector, with an initial budget of €5.3 billion for the 2021-2027 period, then reduced to €4.4 billion, following the revision of the 2021-2027 Multiannual Financial Framework (MFF). Established by Regulation (EU) 2021/522, the EU4Health Programme complements Member States' policies with four general objectives and ten specific areas of intervention. It aims to improve health through disease prevention, particularly cancer, and fosters international cooperation. The programme also focuses on protecting people by addressing cross-border health threats, complementing national stockpiling of essential products, and ensuring access to affordable medicinal products and medical devices. Additionally, EU4Health seeks to strengthen health systems by reinforcing health data and digital tools, enhancing healthcare access, and promoting integrated work among national health systems while developing EU health legislation and evidence-based decision-making.

Available funds

The European Commission has entrusted the Health and Digital Executive Agency (HaDEA) with executing the EU4Health Programme that is implemented through a blend of calls for proposals and calls for tenders, designed to ensure that EU health goals are met effectively across Member States.

Action grants are central to supporting a wide range of health-related projects and initiatives aligned with EU4Health priorities. They fund specific projects proposed by organisations or consortia that respond to open calls and are selected based on merit, relevance, and potential impact. **Operating grants** provide sustained funding to certain organisations whose regular activities significantly contribute to the EU4Health program's objectives.

HaDEA also provides **direct grants to specific beneficiaries** that play critical roles in European healthcare. A prominent example is the European Reference Networks (ERNs), which bring together experts across Member States to tackle rare and complex diseases. By funding these networks, HaDEA enables cross-border collaboration, ensuring that specialised knowledge and services are available to patients with unique health needs, regardless of their location within the EU.

Additionally, in collaboration with Member States and eligible non-EU countries, HaDEA facilitates **Joint Actions and other direct grants** that allow national health authorities to collaborate on issues of shared concern, such as epidemic preparedness or chronic disease management. These direct grants empower health authorities to coordinate and share resources, thereby enhancing public health response capabilities across borders.

Finally, HaDEA manages **service procurement via structured calls for tenders**, selecting providers to deliver specific health-related services. In an open procedure, any eligible economic operator can submit a tender to provide the service, and those selected sign a service contract with HaDEA. This process ensures a broad and competitive selection, encouraging a high-quality pool of providers. Under a framework contract, only operators who have previously qualified within a pre-determined framework are invited to tender. Successful operators then enter into specific contracts, allowing HaDEA to engage specialised expertise while streamlining the procurement process.

Through these mechanisms, HaDEA not only administers funds but also oversees the efficient allocation of resources to projects that deliver tangible health benefits across Europe. This structure supports the EU overarching objectives, enabling advancements in healthcare quality, accessibility, and resilience. By combining grants, direct funding, and structured procurement. HaDEA fosters innovation, bolsters health system capacities, and ensures that critical health infrastructure and services are developed and maintained for the long-term benefit of European citizens.

Digitalisation under the EU4Health Programme and priority objectives

For the 2021-2027 period, the EU4Health priority areas are strengthening resilience for cross-border health threats, the Europe's Beating Cancer Plan, and the Pharmaceutical Strategy for Europe. Reinforcing health data, digital tools and services, and the digital transformation of healthcare are included as areas of intervention. The European Commission underscores the benefit of digital tools and services to improve prevention, treatment and monitoring, alongside its potential to increase the overall efficiency of the health sector[32].

To date, calls under the EU4Health Programme have largely supported actions related to the European Health Data Space. However, considering the strategic importance of hospitals' medication management pathways in recent EU policies and legislative updates, actions of relevance in the EU4Health Programme could be dedicated to boosting patient safety from medication harm and enhancing the visibility of medicines supporting crisis preparedness, health systems and the health workforce, and digital transformation.

For example, the 2024 EU4Health Programme includes funding for direct grants to Member States' to strengthen digital capabilities in cancer centres in the EU. Recognising the importance of digitalisation and the opportunity to improve the deployment of digital interventions for cancer patients, this joint action will enhance the digital capabilities of cancer centres, particularly in Eastern Europe. Using

[32] European Commission. Digital health and care. Available at: Digital health and care - European Commission

guidelines, protocols, and best practices developed under previous projects, such as the joint action CraNE, and in the context of the planned EHDS (e.g. eHealth Network guidelines), project actions should support a better collaboration between cancer centres by improving prevention, detection, and care. Actions should contribute to aligning the infrastructures of cancer centres with relevant EHDS infrastructures and build upon interoperability specifications. These systems are essential not only for precision and safety in oncology care, but also for the visibility and traceability of medicines within hospitals, which is a central recommendation of the CMA.

The CMA strategic report[5] calls for interoperable systems that can inform EU-wide stock visibility, enhance demand forecasting, and enable solidarity-based reallocation of critical medicines during shortages. Despite this, many hospitals across the EU lack automated tools such as automated dispensing cabinets and pharmacy robots. These technologies are essential to reduce medication errors, minimise waste, and support staff in managing increasingly complex treatment protocols, particularly in oncology, where medication errors are most dangerous and costly. The estimated investment required to equip EU hospitals with these automation systems amounts to €2.4 billion[6].

EU4Health Programme development and adoption

The European Commission, often through the Directorate-General for Health and Food Safety (DG SANTE), drafts a proposal for a new EU4Health Programme. This proposal is based on health policy priorities, feedback from stakeholders, public health challenges, and strategic objectives such as crisis preparedness, health system strengthening, and innovation in healthcare. Then, the Commission launches a public consultation via the Have your say - Public Consultations and Feedback portal for relevant stakeholders, including Member States, healthcare professionals, industry representatives, and patient organisations. An impact assessment is also conducted to evaluate the Programme's potential effects on public health, healthcare access, and economic factors. This ensures that the Programme effectively addresses actual needs and identifies the best allocation of resources.

Areas and strategic orientations of the Programme are decided upon consultations with EU countries and third countries associated with the programme (Iceland, Moldova, Norway, and Ukraine), via their National Focal Points (NFPs). NFPs are national experts who have assisted in the implementation, dissemination, and information on the impact of the Programme in their respective countries since 2014. NFPs receive regular updates about funding opportunities, related events, and initiatives. NFPs can promote funding opportunities by advising on eligibility and technical issues, discussing project ideas, providing a 1:1 meeting and offer a pre-submission proposal review. *Find out who your NFP is and what support is available here.*

The newly elected European Parliament has appointed two rapporteurs to oversee preparations for the EU budget beyond 2027. Their primary responsibility is to shape the Parliament's position on the next Multiannual Financial Framework, which will guide the EU spending priorities. This groundwork is crucial as it will influence the Parliament stance in advance of the European Commission's formal MFF proposals, expected by June 2025. Through the ordinary legislative procedure, both the Parliament and the Council negotiate the terms of the EU4Health Programme. The Parliament health committee plays a central role in evaluating the proposal. The Council Working Party on Public Health also assesses it. Amendments can be proposed, and both institutions must reach an agreement before final approval. Once both the Parliament and the Council agree on the terms, the Programme is formally adopted through a legislative act - usually a regulation - which provides the legal basis for implementing the

EU4Health Programme. This regulation outlines the objectives, budget, funding mechanisms, and reporting requirements.

After adoption, the programme is entrusted to HaDEA for implementation. HaDEA issues calls for proposals and manages grants, direct funding, and procurement activities. Throughout the Programme, the Commission monitors its impact and progress with regular reports and evaluations. This assessment helps refine the Programme over time and provides insights for future initiatives.

COHESION POLICY FUNDS 2021 – 2027

The Parliament's Resolution on cohesion policy as an instrument to reduce healthcare disparities and enhance cross-border cooperation highlighted that a lack of basic infrastructure, well-trained personnel, and quality services is the main reason why **high-quality infrastructure and adequately trained personnel should be a priority for all national and regional governments**[33]. To improve access, efficiency and quality in healthcare, **the Resolution stresses the need to use advanced technologies including e-health services and encourages the use of cohesion funds to "radically upgrade the digital capabilities of healthcare systems"**. The Resolution further called on the Commission and Member States to use cohesion policy instruments to promote the digitalisation of medication services in hospitals, including traceability systems, to reduce medication errors, to improve communication between care units, and to simplify bureaucracy.

With €392 billion available for the period 2021-2027, health is one of the five policy objectives of the Cohesion policy. The European Regional Development Funds (ERDF)[34] and the European Social Fund Plus (ESF+)[35] Regulations place a strong emphasis on the resilience of national health systems. The sector is eligible to receive support under the More competitive and smarter Europe for research and innovation to support medical businesses, digitalisation and e-health, and More social Europe through support for healthcare and long-term care services.

Investments in health can address areas including infrastructure and sustainable systems, e-health, and cross-border cooperation. The ERDF and the ESF+ can be deployed to support health service modernisation and access to healthcare, particularly in countries facing challenges in terms of access to affordable, sustainable, high-quality services. The scope of support under Article 5 of the ERDF Regulation allows for the purchase of critical medical supplies and equipment for strengthening the resilience of health systems. The ESF+, on the other hand, supports well-adapted working environments addressing health risks, supporting the health workforce, strengthening public administration capacities and actions improving the effectiveness and resilience of health care systems and long-term care services, according to Article 4 of the ESF+ Regulation. Under the Common Provisions Regulation

[33] European Parliament. European Parliament resolution of 8 March 2022 on cohesion policy as an instrument to reduce healthcare disparities and enhance cross-border health cooperation (2021/2100(INI)). Available at: https://www.europarl.europa.eu/doceo/document/TA-9-2022-0058_EN.html.

[34] European Union. Regulation (EU) 2021/1058 of the European Parliament and of the Council of 24 June 2021 on the European Regional Development Fund and on the Cohesion Fund. 24 Dec 2024. Available at: Regulation - 2021/1058 - EN - EUR-Lex

[35] European Union. Regulation (EU) 2021/1057 of the European Parliament and of the Council of 24 June 2021 establishing the European Social Fund Plus (ESF+) and repealing Regulation (EU) No 1296/2013. 24 Jun 2021. Available at: Publications Office

intervention fields to track health-related investments for the 2021-2027 period include digitalisation in health care and health infrastructure.[36]

Call to Action 8

EHMA calls on the European Commission and Member States to explicitly include digitalisation and automation of hospital medication management systems as a priority investment area under the 2028–2035 Cohesion Policy Funds. These investments are essential to enhance patient safety, reduce medication errors, strengthen crisis preparedness, and modernise hospital infrastructure, especially in regions with limited digital capacity. Integrating this priority into national and regional operational programmes will ensure a more resilient and equitable health system across the EU.

[36] European Union. Regulation (EU) 2021/1060 of the European Parliament and of the Council of 24 June 2021 laying down common provisions on the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund, the Just Transition Fund and the European Maritime, Fisheries and Aquaculture Fund and financial rules for those and for the Asylum, Migration and Integration Fund, the Internal Security Fund and the Instrument for Financial Support for Border Management and Visa Policy. 24 Jun 2021. Available at: Publications Office

COUNTRY CASE STUDIES

Ireland – Improving patient safety and quality of care in oncology settings

Incorrect implementation of cancer treatments, such as chemotherapy or radiotherapy, poses significant risks to patients. Errors in medication dosage or administration routes, particularly with chemotherapy agents, can lead to severe adverse effects, including toxicities and even fatal outcomes if not intercepted in time.[37] To tackle this problem and to improve quality in cancer care treatment for oncology and haemato-oncology patients, Ireland's National Cancer Information System (NCIS) facilitates hospitals to implement quality, efficient systemic anti-cancer therapy, in line with Ireland's National Cancer Strategy (2017-2026), under the guiding principles of the Sláintecare programme.[38] In addition to functionalities improving medication safety, the NCIS provides a longitudinal cancer systemic therapy treatment record and supports cross-island, remote, multidisciplinary team meetings.

The NCIS project went live in 2019 and is led by the Irish Health Service Executive's National Cancer Control Programme. It is a computerised system that can record information about a patient's cancer case, diagnosis, and systemic therapy treatment. Digitalisation of medication management is a key enabler of the NCIS. It was created in response to requirements identified by health professionals delivering cancer care services. The aim is to introduce the NCIS to all 26 public hospitals in Ireland providing cancer services. The goal of the NCIS is to deliver a clinical information system to support the care of oncology and haemato-oncology patients. Access to the patient's longitudinal cancer systemic therapy treatment record is available through the NCIS.

Key concerns, such as the lack of information-sharing systems between hospitals, difficulties in obtaining patient records and the absence of a centralised IT system. have been addressed by the NCIS. The platform ensures that all relevant healthcare providers have access to patients' data in an appropriate and timely manner. In addition, the NCIS has several key functionalities which can be used by various healthcare professionals, including prescribing, electronic medication administration records, support for aseptic compounding, multidisciplinary team meetings and medication management. A single deployment makes access to cancer data possible in a standardised way and overcomes many of the barriers associated with a shared record. This standardisation and collection may also support a broader research application. This project is making a significant difference for patients receiving systemic anti-cancer therapy, enabling digital support for prescribing and administering of medicinal cancer treatments.

The implementation of the NCIS is a priority for Ireland's National Cancer Control Programme. Currently live in 15 out of 26 sites, implementers have identified benefits from automated digital tools within the system to include supporting healthcare workers to plan, prescribe, verify, manufacture and administer Systemic Anti-Cancer Therapy (SACT). Additionally, the economic use of people and medicines, and supporting adherence to the five rights of medication administration have been

[37] Ranchon. F.. Salles. G.. Späth. H.M.. et al. Chemotherapeutic errors in hospitalised cancer patients: attributable damage and extra costs. BMC Cancer 11. 478 (2011). Available at: https://doi.org/10.1186/1471-2407-11-478.

[38] Sláintecare Principle 1: Population health perspective; Principle 2: Person-centred; Principle 3: Health and wellbeing; Principle 4: Equity; Principle 5: Coordination of care; Principle 6: Self-care and self-management; Principle 7: Top of licence practice and teamwork; Principle 8: Supported by technology; Principle 9: Quality and safety

highlighted by both St. Vincents University Hospital[39] and University Hospital Galway[40]. It is anticipated that the NCIS may support broader research applications in the future. For now, the availability of a centralised IT system has boosted information sharing, patient safety and addressed data accessibility challenges connected with the portability of patient records.

Italy – Lombardy region operational plan to digitalise 40 hospital facilities

Under Mission 6 – Health of Italy's National Recovery and Resilience Plan,[41] the Italian government has committed €4.05 billion to strengthening the country's hospital infrastructure and increasing digital readiness. While the plan does not allocate specific funding for the digitalisation of medication management, the investments support key enabling conditions that can be leveraged for pharmacy and medication pathway modernisation.

One core intervention focuses on the digital transformation of Emergency and Acceptance Departments (DEA), including electronic triage systems, data-driven monitoring tools, and integration with Electronic Health Records. The Information Systems Organisational Unit of the General Directorate of Welfare coordinated the activities of identifying and classifying technical interventions aimed at the complete digitisation of 40 hospital facilities belonging to 28 Aziende Socio-Sanitarie Territoriali (ASST) in the Lombardy Region. Technical activities proposed by each ASST as part of their digitalisation plan included the implementation of an evolved Electronic Medical Record with new features, including the refinement of the pharmacotherapy process from prescription to administration at the patient's bedside, and the introduction of clinical decision support systems. Automated drug logistics systems were also introduced to hospital pharmacies with automated cabinets for the computerised management of drug handling and integration with application modules for the management of pharmacotherapies implemented as part of Electronic Medical Records.

Although no dedicated line exists for medication management digitalisation, the technological and structural investments under Mission 6 offer Italian hospitals a platform to:

- Pilot closed-loop medication systems integrated with DEA and EHR upgrades.
- Leverage infrastructure funding to co-invest in digital prescribing, preparation, and inventory tools.
- Align hospital innovation strategies with EU initiatives, such as the Critical Medicines Act and European Health Data Space.

The area of greatest impact was highlighted to be the Electronic Medical Record applied to the management of inpatient episodes for acute, sub-acute and high-intensity care (ICU, Sub-intensive Care, Coronary Care Unit) and to the management of outpatient specialty care pathways. In their report, the Region of Lombardy states that the digitisation of the entire hospital process offers the opportunity to manage in a transparent, effective, and simple way all diagnostic and treatment activities that are carried out in inpatient settings, improving collaboration between professionals, simplifying internal processes, increasing the level of safety for patients, enhancing

[39] St. Vincent's University Hospital. St. Vincent's University Hospital Transforms Cancer Care with National Cancer Information System (NCIS) Implementation. Available at: https://www.stvincents.ie/st-vincents-university-hospital-transforms-cancer-care-with-national-cancer-information-system-ncis-implementation/.

[40] Saolata. New Innovative Information System for Cancer Treatment Implemented at UHG. Available at: https://www.saolta.ie/news/new-innovative-information-system-cancer-treatment-implemented-uhg

[41] European Parliament. Italy's National Recovery and Resilience Plan. Jul 2025. Available at: Italy's National Recovery and Resilience Plan

the clinical scope information assets, and implementing hospital-territory integration scenarios. The RRP also supports a wider structural reinforcement of hospitals, with emphasis on energy efficiency, facility modernisation, and connectivity - critical prerequisites for the deployment of pharmacy robots, automated dispensing cabinets, and centralised medication tracking platforms.

Ukraine – Digitalising medication management pathways in times of crisis

Ukraine's path to digitalising its medication management began following its 2015-2016 healthcare reform. The Medical Procurement of Ukraine (MPU) was established in 2018 to ensure transparency and efficient public procurement aimed at enhancing the availability and accessibility of quality medicines and medical products. The strategic goals of the MPU include conducting effective procurement of medical and medicinal product supplies under the centralised Ministry of Health Programs. To achieve this, the development and deployment of information and analytical tools are instrumental. Despite the full-scale invasion of Ukraine, the necessity to develop and adapt mechanisms for crisis conditions, the disruption of logistical routes, the COVID-19 pandemic, and an unstable economic situation, 62% of centralised procurement programmes were fulfilled by July 2023, and 77% of goods were delivered to end customers.

Ukraine's healthcare sector has implemented several digital tools to revolutionise the medical supply chain. In 2016, the public procurement system was transformed, mandating all public entities to conduct electronic procurement exclusively through the Prozorro system. This system effectively prevented the possibility of orchestrating corrupt activities. The transition to Prozorro was characterised by a comprehensive strategy that included legal reforms aligned with the Law on Public Procurement, technological advancements, and meticulous stakeholder engagement.

In 2018, the MPU developed MedData, which is used for the annual demand collection of medicines and medical devices. All hospitals submit information on 100% of the annual region's demand and bi-weekly reports on medical supply stock to ensure the supply of the region and the absence of gaps in the availability of medicines.

In 2019, the first state-operated online marketplace, called the Prozorro Market, was established as a subsequent step in transforming the public procurement framework. This platform showcases a selection of products frequently sought after by government entities, including complex procurement items such as ambulances, MRIs, electricity and fuel, including simpler procurement items such as stationery. The medical segment is overseen by the MPU. This platform facilitated a decrease in administrative expenses for public entities, expedited procurement processes, and enhanced reliability due to the thorough vetting and qualification of suppliers.

In 2022, the Cabinet of Ministers of Ukraine (CMU) approved the Ministry of Health's proposal to implement MedData as the primary tool. This facilitated ensuring interaction between MedData and state electronic information systems, aiming to enhance the efficiency of procuring and distributing medicines and medical devices. During the COVID-19 response, MedData functionalities were expanded to include the delivery, storage, usage, and movement of COVID-19 vaccines between warehouses and hospitals at national, regional, and local levels. This enhanced functionality significantly contributed to the State's capacity to address challenges, including managing and overseeing the vaccine supply chain based on data analytics and management. Furthermore, the MedData dataset was leveraged to generate COVID-19 vaccination certificates.

With the onset of a full-scale war initiated by Russia against Ukraine, the health sector faced the formidable task of efficiently coordinating and monitoring substantial volumes of medical humanitarian aid. The MPU team responded by developing a comprehensive solution in MedData for managing information on humanitarian supplies that come to Ukraine through the Ministry of Health. This solution has been developed to qualitatively track the distribution of humanitarian aid tailored to the specific needs of various regions and institutions. This system contributes to mitigating corruption risks and guarantees effective aid distribution to its designated beneficiaries.

In the face of the war's challenges, the MPU undertook a concerted effort to mitigate the disruptions in the medical supply chain. In collaboration with NGOs and business support, the MPU successfully deployed a cloud-based solution to engage suppliers to deliver critical goods to hospitals quickly. These initiatives represent a substantial advancement in the healthcare sector, contributing to heightened efficiency, transparency, and cost-effectiveness in procurement and humanitarian aid processes.

In July 2023, the Cabinet of Ministers of Ukraine Resolution No. 688 mandated hospitals to exclusively conduct procurements through the Prozorro Market, aligned with the National List of Medicines. This strategic alignment yielded a significant average savings of 20% in 2023, contributing to the reallocation of saved funds by hospitals for the purchase of additional essential medical goods.

The MPU is actively addressing the complexities of digitising internal and external medical supply processes. In the forthcoming year, the strategic focus involves the development of cutting-edge tools tailored for the IT healthcare ecosystem. Simultaneously, they are committed to enhancing the MPU landscape by implementing an Enterprise Resource Planning system. This integration optimises the end-to-end supply chain processes for efficiently delivering medical goods to hospitals. Looking ahead, the MPU is embarking on developing the e-Stock system that will monitor and analyse medical supplies. Anticipated outcomes include enhanced supply visibility, precise management and tracking of drug stocks in hospitals, and reliable delivery of medical resources.

The MPU's endeavours to digitise the nation's supply chain management infrastructure are significantly fortified by the backing of esteemed international partners, including the European Union Delegation, the United States Agency for International Development (USAID), the World Bank, and other influential entities. These collaborative synergies underscore their unwavering commitment to implementing state-of-the-art solutions and propelling advancements within the healthcare ecosystem. From 2020 to 2023, the MPU's dedicated endeavours yielded impressive results, as more than €225 million of state funds were effectively saved through centralised procurement mechanisms. These efforts facilitated the acquisition and distribution of cutting-edge medical equipment tailored for oncology treatment, MRI diagnostics, vaccines, Spinal Muscular Atrophy medications, and other critical healthcare necessities.

CONCLUSIONS

This paper identified a critical gap in Europe's healthcare systems: despite growing digital capabilities in other areas, hospital medication management remains under-digitalised, exposing patients and staff to unnecessary risks and inefficiencies. The digitalisation and automation of these pathways are vital to improving patient safety, reducing errors, strengthening resilience, and enhancing health system sustainability.

This transformation is not only technically feasible, but also economically sound, policy-supported, and increasingly urgent. Major EU initiatives such as the Critical Medicines Act, the Pharmaceutical Strategy, and the Europe's Beating Cancer Plan all reinforce the need to modernise how medicines are prescribed, tracked, and administered in hospitals. Hospitals play a central role in crisis response, yet lack the tools needed to monitor stock levels, prevent shortages, or scale interventions rapidly.

The results from our case studies - spanning Germany, Ireland, Italy, and Ukraine - highlight practical examples of how digitalisation leads to improved safety, operational efficiency, and staff satisfaction. The LIUC-Cattaneo University study confirms that targeted investment in electronic prescribing and automation can deliver a return on investment of over 300%, especially in oncology settings. However, access to funding is inconsistent, and most hospitals still rely on manual systems.

Interpreting these findings reveals a disconnect. While the EU has created funding frameworks (EU4Health, RRF, Cohesion Funds), digital medication management remains overlooked. Without prioritisation, countries risk missing strategic opportunities to future-proof their hospital systems and meet upcoming policy and regulatory obligations. To close this gap, EHMA calls on EU institutions, Member States, and health managers to:

- Establish a dedicated EU programme of €3.3 billion (2028–2035) to support the digitalisation and automation of medication management in hospitals.
- Include this priority across all EU funding instruments, including EU4Health, Cohesion Funds, and Recovery and Resilience Plans.
- Allocate €274 million under EU4Health to implement electronic prescribing and drug administration systems across cancer centres, supporting compliance with CraNE Standard 6.2.10.
- Ensure real-time visibility of medication stocks through national IT systems interoperable with the European Shortages Monitoring Platform, as foreseen under the Critical Medicines Act.
- Include digital medication management infrastructure in Cohesion Fund Operational Programmes and national digital health strategies.
- Mandate stock data reporting and medication traceability in all new investments made under EU health and resilience programmes.
- Support training and capacity-building for hospital pharmacists and clinical governance teams to implement these tools effectively.

Now is the time to act, so that no patient experiences a preventable error, no medicine is wasted due to poor tracking, and no hospital is left behind in the digital era.

Annex I - Existing tools to support and advance the digitalisation of the medication process and their level of use

Digital tool	Description	Level of use
Pharmacy information systems & central logistic pharmacy robots (vs shelves and manual control of inventory)	Pharmacy information systems integrated and connected with logistic robots and ward automated medication dispensing cabinets to break down supply chain silos in the hospitals. A pharmacy robot is an automated solution for reception, storing, and dispensing medication.	66% of hospitals have pharmacy information systems to manage pharmacy inventory, but **only 18% of hospital pharmacies have robots for inventory management**, and most pharmacies manage medicine inventory through manual shelves and counting.
Electronic medication prescription (CPOE) (vs manual prescription)	The process of a medical professional entering and sending medication orders and treatment instructions electronically via a computer application instead of on paper charts.	94% of hospitals surveyed have CPOEs, but **only one-fifth are integrated with a clinical decision support system, and just half of CPOEs are available for all patients** in Intensive Care Units (ICUs), oncology wards. **CPOE's integration with wider hospital systems is limited.** Only 50% electronic medical records, 33% with medication cabinets and less than 20% with infusion pumps.
Automated dispensing cabinets (ADCs) (vs shelves and manual control of inventory in the wards)	ADCs are computerised drug storage devices that allow drugs to be stored and dispensed near the point of care, while controlling and tracking drug distribution. Hospital pharmacies have traditionally provided drugs to the wards through the ward-stock system. ADCs are designed to replace non-automated ward stock storage and have facilitated the transition to alternative delivery models and more decentralised medication distribution systems.	**Availability of ADCs is poor**. Only 25% of ICUs, 16% of Oncology wards and 14% of oncology ambulatory settings have access to ADCs.
Electronic compounding systems	To support medication preparation, including unit dose systems to ensure medication doses prepared/compounded are the right ones and ensure traceability through global standards for identification and barcoding, such as employing GS1 standards.	Availability of Electronic compounding systems is low, 80% of medication is prepared outside of central hospital pharmacies and most frequently manually. **Only 14% of ICUs, 31% and 11% of oncology wards. oncology-ambulatory or one-day hospital areas have access to electronic compounding systems.**
Barcode medication administration (BCMA)	Using global standards, e.g. GS1 barcoding standards, connected to electronic prescription systems and electronic health records in wards to check the right patient, the right medication, and the right time.	**BCMA using global barcoding standards is available in less than 30% of hospitals**. ICU BCMA is available in one-quarter of hospitals and in less than half of oncology settings.

Smart pumps with Dose Error Reduction Systems (DERS)	To prevent programming errors, new smart pumps include full connectivity and interoperability with electronic systems, including auto-pump programming and auto-documentation functionalities to prevent errors and increase efficiency.	Access to smart pumps connected to infusion pumps is insufficient, as **less than 20% of hospitals have this equipment**. Furthermore, less than 15% of hospitals monitor infusions from a central location.