Abstract

Digitalization of the Oncology Care Pathway: Integration of APOTECAchemo Robotic Compounding and the Electronic Health Record. Benefits for Safety, Quality, and Process Organization

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Introduction. The digitalization of the oncology care pathway is a key objective of Italy's National Recovery and Resilience Plan (PNRR), which supports the technological development of the National Health Service with the aim of reducing clinical risk, consistently with Ministerial Recommendation No. 14. The aim of this study was to evaluate the impact of integrating the APOTECAchemo robotic antineoplastic drug compounding system with the BiMind electronic health record on clinical traceability, gravimetric accuracy, preparation times, prescription workflow, and costs within the oncology pathway.

Methods. A retrospective observational study was conducted at the Antineoplastic Drugs Unit of Murri Hospital in Fermo between December 1, 2025, and February 28, 2026. A total of 1,340 preparations over 60 working days were analyzed according to management system (BiMind, n = 921; paper-based, n = 419) and compounding method (robotic, n = 362; biological safety cabinet, n = 559). Accuracy was evaluated using percentage gravimetric deviation. Economic analysis compared drug costs before and after system implementation. Statistical analyses were performed using LibreOffice Calc, with checks

conducted using Python 3.12.

Results. Digital implementation ensured 100% traceability of critical variables, including allergies and clinical alerts, whereas the paper-based system was associated with data loss. Robotic preparations achieved 100% compliance with Pharmacopeia limits (±10%); this parameter could not be calculated for manual compounding. Mean gravimetric error was −1.043% (SD 1.25). Median preparation times were 45 minutes for robotic compounding and 35 minutes for manual compounding. However, digitalization enabled advance scheduling of 21.5% of doses, improving workflow organization. Despite a 22.9% increase in workload, improved management of residual drugs was associated with a 7.2% reduction in the average cost per vial.

Discussion. The integration of robotic compounding systems and health information technologies improves the safety, quality, traceability, and sustainability of the oncology care pathway. Digitalization may support more efficient use of clinical and economic resources while strengthening process standardization and organizational management.

Keywords: Oncology Care Pathway, Robotic Drug Compounding, Digital Health Systems

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