

EAHP Position Paper on Single Unit Barcoding

Decreasing medication errors through the help of technology

Medication-related incidents account for the highest proportion of preventable harm and present a major public health burden.¹ While the scale, nature, and reporting of errors varies between European countries, the rate of medication errors in hospitals range from 0.3% to 9.1% from prescribing, 1.6% to 2.1% from dispensing, and around 13.7% during medication administration.^{2,3} A significant portion of these errors led to extended hospital stays, unnecessary readmissions, and ultimately to higher healthcare costs.⁴ Many of the reported errors are preventable through comprehensive and systematic approaches to patient safety throughout the medication use processes. One of the measures that can help lower medication-related incidents is single unit barcoding.^{5,6,7} This process is described as barcoding a single item of medicine on an individual packaged component for individual patient use. For example, the individual tablet/capsule within a perforated multi-dose blister pack, a syringe, a vial or an ampoule. It encompasses two primary use cases: it enables bedside scanning to reduce medication administration errors and entry of medication administration into electronic health record (EHR). Unit dose barcoding confers patient-level benefits through the reduction of medication errors, economic benefits via avoidance of adverse events, and organisational benefits by aligning with the complex and context-specific nature of medicines use in hospital settings. When used correctly, it can contribute to safer and more efficient patient care.

To achieve this aim:

- (1) EAHP calls on national governments and hospital managements to enable the use of single unit barcoding within healthcare systems to increase patient safety.
- (2) EAHP urges national governments and hospital administrations to establish funding programmes that support hospitals in updating their digital infrastructure.
- (3) EAHP recommends that hospital managers advocate for the introduction of single unit barcoding within hospitals to support the comprehensive management of medicines information.
- (4) EAHP recommends the involvement of healthcare professionals, including hospital pharmacists, in the implementation of barcode medication administration systems and to provide sufficient and appropriate training to end users.
- (5) EAHP strongly supports the wider implementation of single unit barcoding across additional settings, including home care, nursing homes and residential care facilities.

Enabling significant improvements for patient safety

Single unit barcoding and bedside scanning of medications have proven to be an efficient way to reduce medication errors and adverse drug events. Consequently, several European countries are using single unit barcoding as a measure to prevent errors and increase patient safety. Although not mandatory for the hospitals in their countries, some hospitals in Spain⁸, Denmark⁹, and the Netherlands¹⁰ have implemented single unit barcoding with positive results in reducing the occurrence medication errors. Some hospitals in the UK have gone a step further to enhance patient safety and are linking their actions in the field of barcoding to closed-loop medicines administration.¹¹ 'Closed loop medicines administration' is defined as a process that integrates automated and intelligent systems to completely close the inpatient medication management and administration loop. Such drug management systems can reduce medication error rates and identify the type of error potentially avoided. It also confirms the five rights of medication

administration in real time: the right patient, right medication, right dose, right route, and right time. This can free up the limited time of hospital pharmacists who can then focus on other clinical aspects.

To increase patient safety, countries across Europe should be encouraged to increase the uptake of single unit barcoding since electronic medication administration helps identify incorrect and omitted medications as well as cancelled or changed medication orders.¹² Furthermore, a well-implemented and interoperable closed-loop system in conjunction with unit-dose barcoding can also support personalised medicine.¹³

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Therefore, manufacturers are recommended to include single dose barcodes on each ampoule, vial or cell of the blister of their medicinal products to allow their use within healthcare systems. The single dose coding of the blister pack takes into consideration two main forms:

- Basic: GS1 DataMatrix containing the GTIN only. Used when more detailed forms cannot be applied for manufacturing reasons, e.g. lack of space.
- Advanced: GS1 DataMatrix containing the GTIN, Batch/Lot information and the Expiry Date.

With each form using the GS1 Specifications as follows:

- GTIN will utilise the Application Identifier, AI (01).
- Batch/Lot will utilise the AI (10) and
- Expiry Date will utilise the AI (17).
- The Expiry Date will be encoded in the form YYMMDD.

EAHP acknowledges the benefits of advanced and basic coding forms to improve patient safety. While the advanced form of coding is preferred and especially recommended for new products, the implementation of the basic coding would provide many of the benefits from unit dose coding when starting from scratch. EAHP also supports the human readable information included in basic regulatory requirements. Through this, internal hospital systems can then be linked with the GTIN information in the code which in turn can provide all the basic product information (e.g. product name, strength, form etc). Manufacturers must then ensure that the product information related to the GTIN is easily accessible. While providing a general recommendation, the position paper also notes that there can be different ways to implement single unit barcoding such as through pharmacy driven unit-dose automation.

Assisting in the comprehensive management of medicines

The nature of medicines used in hospitals means that products that are dispensed in multiple-dose blisters often must be cut, separated and split from their blister package during dispensing for patient/ward use. Therefore, without an identifying barcode, information may be absent from the individual dose and subsequently an accurate control at the bedside is not feasible. Barcoding of the single dose of medicine administered in hospitals would improve this situation by always making the tracking and tracing of the dose within the hospital possible. To fully use the potential that single unit barcoding holds, significant investments are needed to improve the digital infrastructure. Feedback collected from EAHP's member associations in the summer of 2023 shows that some countries are already working towards enhancing digitalisation in hospitals, while others are lagging.¹⁴ **EAHP urges national governments and hospital administrations to establish funding programmes that support hospitals in updating their digital infrastructure.**

However, implementing barcoding systems within hospitals can introduce risks to existing work processes as adoption requires significant efforts to reengineer the responsibilities and workflow of healthcare professionals involved in the medication administration process.¹⁵ Although this approach offers significant patient safety benefits, technical and practical challenges, time pressures, and incomplete integration into workflows can act as barriers to compliance and may lead to workarounds that introduce new risks of error.¹⁶ To successfully integrate the technology, each healthcare institution should assess its specificities to not negatively disrupt the workflow.¹⁷ In addition, healthcare professionals involved in the process should receive appropriate training on the new tools and their responsibilities within barcoded medication administration. Ensuring the ease of use of new systems and the involvement of end-users in their implementation or improvement can reduce the risk of issues on workflow while improving compliance. Furthermore, a simple to use barcode assisted administration system can better guarantee a safe continuation of care by personnel with less experience such as during a crisis where essential personnel may be reassigned elsewhere. Therefore, to be properly implemented, **EAHP recommends the involvement of hospital pharmacists in the implementation of barcode scanning for medication administration and to provide sufficient and appropriate training to end users.**

Supporting the comprehensive management of medicines information in the interests of systems and outcomes improvement

As costs of medications for all health systems continue to increase, accurate information on how medicines are used by patients, in what dosage forms and for what conditions becomes even more valuable in terms of making evidence-based improvements in patient care. Single unit barcoding technology offers valuable opportunities to hospitals as barcoding data can support increased understanding of the overall medication use on a range of wards. In addition, as implementing a new system can be costly, healthcare institutions should carefully evaluate which barcode-reading technology best meets their needs, whether through dedicated scanners, repurposing existing devices, or using smartphone-based applications. Costs may also be reduced by the introduction of these technologies by improving overall system efficiency for example by reducing the need for physical double-checks by healthcare professionals, enabling them to focus on other tasks. **EAHP recommends that hospital managers advocate for the introduction of single unit barcoding within hospitals to support the comprehensive management of medicines information.**

Helping to prepare health systems for an ageing society

Ageing is one of the greatest social and economic challenges for European Society of the 21st century. Due to this ongoing demographic shift, health systems will need to adapt to provide adequate care over longer periods while maintaining financial sustainability. Given the high incidence of polypharmacy in older populations and the increasing use of new potent medicines, reducing medication errors through single-unit barcoding is a particularly important strategy for supporting health in ageing populations and reducing hospital re-admission.¹⁸ Single unit barcoding, through its role in reducing medication errors, can provide essential support to health systems in addressing the challenges of an ageing population. Its patient safety benefits also extend beyond the hospital setting to other care environments. **EAHP strongly supports the wider implementation of single unit barcoding across additional settings, including home care, nursing homes and residential care facilities.**

- ¹ World Health Organisation, 2023. Patient safety. Available at: <https://www.who.int/news-room/fact-sheets/detail/patient-safety>.
- ² European Collaborative Action On Medication Errors and Traceability (ECAMET). (2022). The urgent need to reduce medication errors in hospitals to prevent patient and second victim harm [White paper]. Available at: <https://ecamet.eu/wp-content/uploads/2022/03/ECAMET-White-Paper-Call-to-Action-March-2022-v2.pdf>.
- ³ Jessurun, J.G. et al. Prevalence and determinants of medication administration errors in clinical wards: A two-centre prospective observational study. *J Clin Nurs*. 2022 Jan 23;32(1-2):208–220. Doi: 10.1111/jocn.16215
- ⁴ World Health Organisation. 2023. Key facts about medication errors in the WHO European Region. Available at: <https://www.who.int/europe/publications/key-facts-about-medication-errors-mes-in-the-who-european-region>
- ⁵ Truitt E, Thompson R, Blazey-Martin D, NiSai D, Salem D. Effect of the Implementation of Barcode Technology and an Electronic Medication Administration Record on Adverse Drug Events. *Hosp Pharm*. 2016;51(6):474–483.
- ⁶ Poon EG, et. al. Effect of bar-code technology on the safety of medication administration. *N Engl J Med*. 2010 May 6;362(18):1698–707. doi: 10.1056/NEJMs0907115. PMID: 20445181.
- ⁷ Shah K, et. al. Bar Code Medication Administration Technology: A Systematic Review of Impact on Patient Safety When Used with Computerized Prescriber Order Entry and Automated Dispensing Devices. *Can J Hosp Pharm*. 2016 Sep-Oct;69(5):394–402. doi: 10.4212/cjhp.v69i5.1594. Epub 2016 Oct 31. PMID: 27826157; PMCID: PMC5085324
- ⁸ Morcillo GG, Oliver A, Rodriguez J, et al 2SPD-024 Unit dose system evaluation *European Journal of Hospital Pharmacy* 2018;25:A20. https://ejhp.bmj.com/content/25/Suppl_1/A20.2. El Libro Blanco de la Farmacia Hospitalaria 2019. Situación de los Servicios de Farmacia Hospitalaria en España: Infraestructura, Recursos Y Actividad, available at: https://www.sefh.es/bibliotecavirtual/informe-situacion-sfh-2019/libro_blanco_de_la_farmacia_hospitalaria.pdf?ts=20200902164230.
- ⁹ Risør BW, Lisby M, Sørensen J. Complex automated medication systems reduce medication administration errors in a Danish acute medical unit. *Int J Qual Health Care*. 2018 Jul 1;30(6):457–465. <https://www.ncbi.nlm.nih.gov/pubmed/29590354>
- ¹⁰ P Helmons, Barcoded medication administration (BCMA) in Healthcare YES, WE SCAN!, available at: <https://www.gs1.org/sites/default/files/docs/healthcare/2019.Noordwijk/Presentations-Day3/06.Day3-Barcoded-Medication-Administration-Pieter-Helmons.pdf>
- ¹¹ Bhatti, S. Adoption of closed loop medicines administration into the NHS. (2021, February 12). *The Pharmaceutical Journal*. <https://pharmaceutical-journal.com/article/opinion/adoption-of-closed-loop-medicines-administration-into-the-nhs>
- ¹² TL Rodziewicz, B Houseman, JE Hipskind. Medical Error Reduction and Prevention. [Updated 2023 May 2]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK499956/>.
- ¹³ For example: in recent years, Germany has closely integrated the hospital information system and the unit dose system to fully benefit from single unit coding by ensuring a link between the medication and the patient. For example, When scanning a patient wristband and one (or more) blister packs, nursing staff not only receive an identification of whether the patient and the medication (often for 24 hours) belong together, but also, where applicable, whether there have been any subsequent changes to the prescription by the doctor following the blister packing process at the pharmacy.
- ¹⁴ European Association of Hospital Pharmacists (EAHP). 2024. EAHP investigation of the hospital pharmacy profession in Europe assess and advance hospital pharmacy! results 2022/2023. https://eahp.eu/wp-content/uploads/2024/11/2022_2023_eahp_investigaton_report.pdf
- ¹⁵ Leapfrog Group. (2024). Factsheet: Bar code Medication administration. <https://ratings.leapfroggroup.org/sites/default/files/2024-03/2024%20BCMA%20Fact%20Sheet.pdf>
- ¹⁶ Jessurun, J.Q., et.al. Effect of automated unit dose dispensing with barcode scanning on medication administration errors: an uncontrolled before-and-after study. (2021, October 18). *International Journal for Quality in Health Care*. <https://academic.oup.com/intqhc/article/33/4/mzab142/6400413>
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- ¹⁸ Global Burden of Cardiovascular Diseases and Risks 2023 Collaborators. Global, Regional, and National Burden of Cardiovascular Diseases and Risk Factors in 204 Countries and Territories, 1990–2023. *J Am Coll Cardiol*. 2025 Dec 2;86(22):2167–2243. doi: 10.1016/j.jacc.2025.08.015.