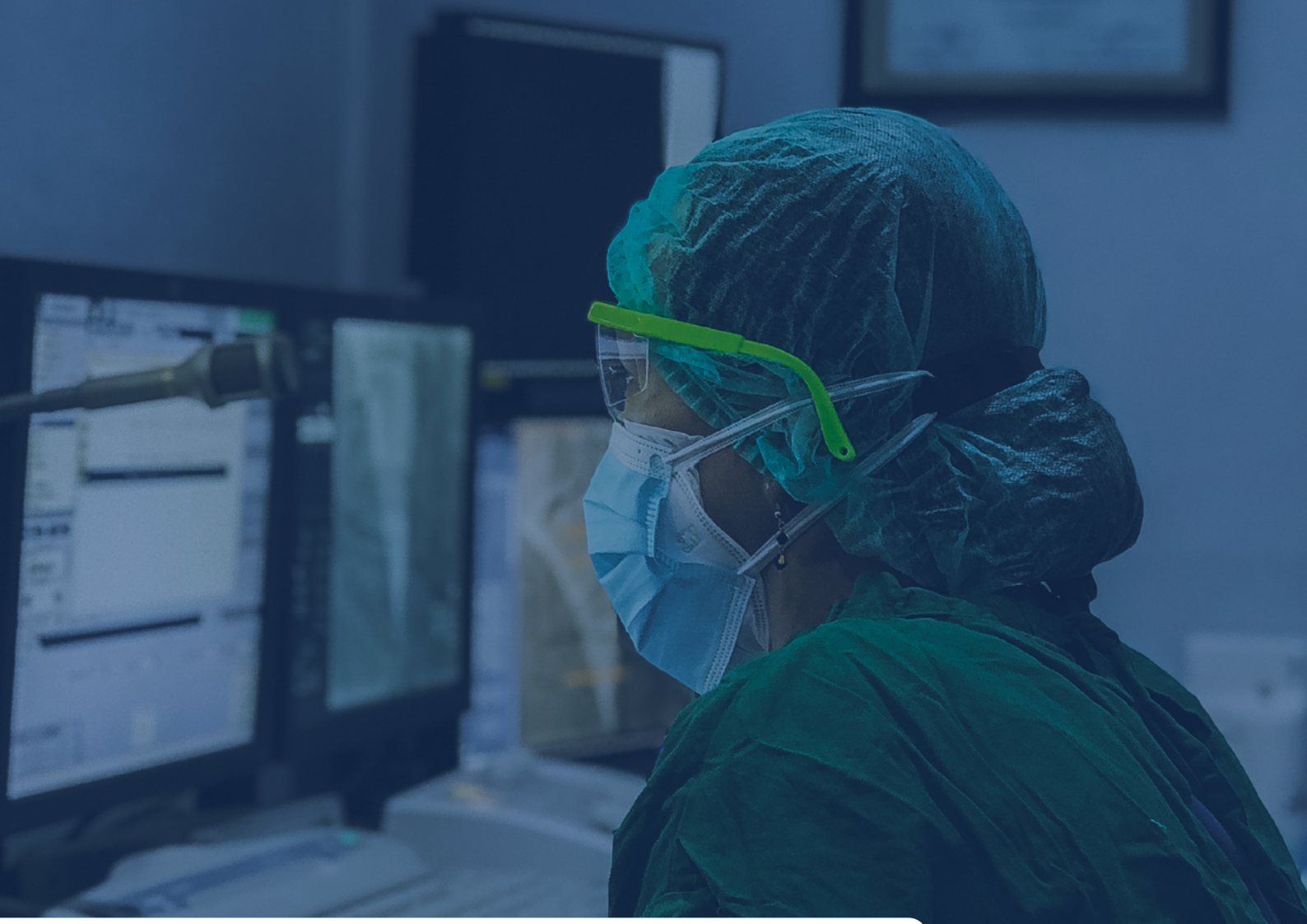

GS1 UK

Enhancing electronic health record systems with GS1 standards: improving patient identification and patient safety

Contents

Copyright information

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Purpose of this document

The purpose of this white paper is to demonstrate how the GS1 Global Service Relation Number (GSRN) can support the adoption of national patient identifiers, such as the NHS number, in an electronic health record (EHR) or electronic patient record (EPR) system and meet the requirements for positive patient identification. To put this into context, it is useful to understand the drive towards a paperless NHS at the point of care with fully accessible EHRs, enabling healthcare staff across the country to provide immediate care and treatment. Additionally, this paper will explore how other GS1 standards can be utilised within EHR systems to identify places or products for improved healthcare delivery.

Conclusion and considerations appear at the end of the paper in addition to references and the appendix.

This paper has been created in collaboration with Oracle Health, Dedalus, Epic, Royal Papworth Hospital NHS Foundation Trust and NHS England.

Introduction

GS1 is an independent body which provides globally recognised open standards, and related products and services, to support business communications globally and locally. GS1 has 120 not-for-profit Member Organisations operating across 150 countries, supporting more than two million members worldwide. GS1 UK has more than 60,000 members across many sectors, including retail and healthcare.

In UK healthcare systems, GS1 standards have been proven to improve patient safety and enhance clinical effectiveness by reducing unwarranted clinical variation and driving operational efficiencies, irrespective of clinical settings.

Case studies demonstrating the proven benefits can be found here. This is achieved by creating unique identifiers for every person, every product and every place, allowing data to be captured consistently and accurately at the point of interaction and shared between parties from the manufacturer through to the point of care.

GS1 UK has established multi-year partnership agreements with healthcare governing bodies across the UK to increase the adoption of GS1 standards across the various health systems. This approach supports the strategic aims for each of the four nations, where the implementation of open data standards in healthcare will enable traceability and interoperability. This will allow information to flow seamlessly between systems and organisations. Wales and Scotland have agreed to utilise GS1 standards to uniquely identify staff throughout their employment journey.

The Department of Health and Social Care (DHSC) has long aimed to digitally transform the NHS and facilitate seamless data sharing (interoperability) among the numerous organisations within the healthcare system. The National Audit Office (NAO) report 'Digital Transformation in the NHS' highlights that digital transformation poses a significant challenge and notes that the NHS has a history of failures in this area from which it has not learned. As part of the report, interoperability of IT systems and data is noted as a key challenge to existing plans for digital transformation. The NHS faces significant challenges with inconsistent data representation and fragmented information across multiple siloed systems. These inefficiencies hinder effective clinical decision-making and patient care.

To address these issues, there is a concerted effort to streamline clinical information flow and minimise data wastage.

GS1 standards play a crucial role in supporting these efforts by enabling standardised data exchange and interoperability.

This aligns with the NHS 10-Year Health Plan (to be published) for transitioning from analogue to digital and could be further strengthened by integrating GS1 standards as foundational building blocks within the Medical Device Outcome Registry (MDOR).

These standards ensure seamless data exchange enabling essential attributes to be captured for outcomes and registry programmes. The government's policy paper *A Plan for Digital Health and Social Care* (available here) further outlines these priorities, emphasising the need for structured data and interoperable systems across healthcare.

To emphasise this point and enhance digital transformation efforts, this paper explores how encoding the NHS number/national patient identifier within the GSRN, alongside adherence to national standards such as ISB 0099, ISB 0149 and DAPB0108, provides a foundation for positive patient identification.

This approach ensures accurate patient identification while also improving the traceability of products, assets, and staff within the NHS, further enhancing patient safety and operational efficiency. Alongside the core data standards, the upcoming Data Use and Access Act aims to modernise the UK's data governance framework, enhancing the accessibility and interoperability of health data while ensuring robust safeguards. Its implications for EHRs includes supporting the use of the NHS number, streamlining data sharing across healthcare providers and supporting NHS transformation efforts in compliance with evolving regulatory standards.

While the GSRN represents a minimum standard, this paper will later discuss broader system requirements essential for achieving a truly interoperable and patient centred healthcare ecosystem which provides a foundation for positive patient identification.

The implementation of GS1 standards within the EHR is crucial for enhancing patient safety, operational efficiency and data accuracy in healthcare. The purpose of this paper is to explore the importance of integrating the national patient identifier (e.g. NHS number) into a consistent standardised barcode format.

GS1 standards ensure seamless scanning and accurate patient identification across clinical systems, significantly reducing the risk of misidentification. This standardised approach improves the reliability of patient records and supports safer clinical decision making. Similarly, scanning drug products within Electronic Prescribing & Medicines Administration (ePMA) systems helps to verify correct medication administration through unique GS1 identifiers.

The adoption of GS1 standards for medical devices mitigates safety risks by linking patients to devices with precision, while broader product identification including implants and oxygen cylinders, enhances traceability. Blood tracking, document tracking, staff identification and location management, further benefit from GS1 standards, ensuring structured and reliable data management across healthcare settings.

Importance of standards in healthcare

In the rapidly evolving landscape of healthcare, the need for consistent and reliable information exchange has never been more critical.

Standards are essential as they provide a common framework that ensures interoperability, safety and quality across the healthcare system. GS1 and other relevant standards (such as ISO or HL7 FHIR) play a crucial role in EHR systems by ensuring the accurate and efficient exchange of healthcare information. These standards, developed and maintained by GS1 in conjunction with its members, users and partners, standardise information such as product or people identification and data sharing across various industries, including healthcare.

Scan4Safety, led by the Department of Health and Social Care (DHSC), was launched to enhance patient safety, improve operational efficiency, and reduce costs within NHS hospitals. The aim of Scan4Safety is expressed in the four 'Ps' – people, product, place and process. Many NHS trusts have implemented Scan4Safety across multiple use cases and the programme is supported by NHS England patient safety directorate.

This means that each of the identifiers used for patients, products and places are globally unique. GS1 standards pertain to the identification processes. By linking a globally unique identifier to a patient's EHR, these standards enhance the accuracy and reliability of positive patient identification.

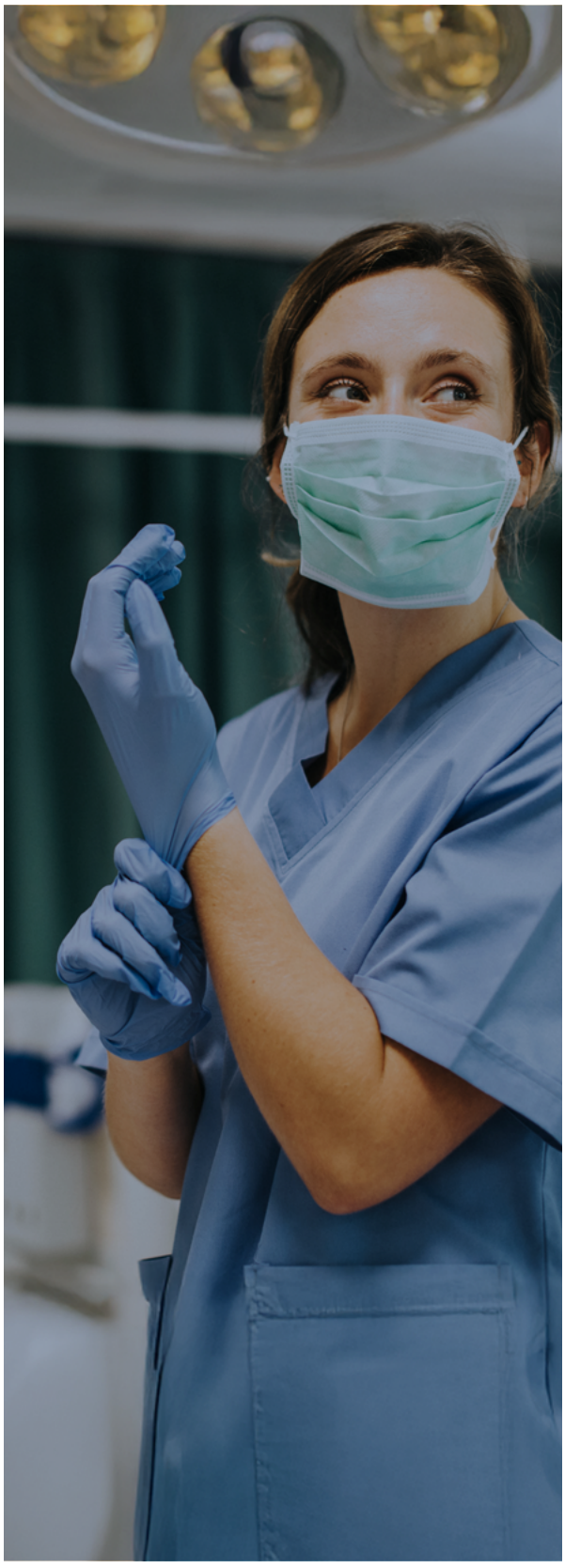
In September 2021, NHS England published the Digital Clinical Safety Strategy, establishing what is needed for digital technologies to enable safety across healthcare. The strategy acknowledges the Scan4Safety programme, which has led to a decrease in errors related to patient identification and supports the NHS Patient Safety Strategy's aim to build safer systems and safer cultures.

Scanning programmes utilising barcode technology, such as Scan4Safety, have significantly decreased errors in patient and device identification.

The Professional Records and Standards Body (PRSB) core information standard is a key benchmark for recording and sharing clinical and care-related information within healthcare records, ensuring consistency, accuracy, and interoperability of healthcare data, also defining how the clinical data should be recorded and shared with the EHR. GS1 standards are included in PRSB standards and frameworks.

Despite efforts to promote interoperability, challenges persist due to inconsistent adherence to standards, compounded by legacy systems and reliance on traditional paper-based or simplistic electronic formats. Concerns are raised within specific sectors such as mental health and community care, fearing that the focus on digitising hospital records may neglect appropriate digital solutions for other healthcare entities.

Recommendations from the Hewitt Review of Integrated Care Systems (ICSs) advocate for a comprehensive data-sharing standards framework to enhance interoperability across organisational boundaries, including GP practices, social care, and voluntary organisations. The document calls for collaboration between the DHSC, NHS England, and integrated care systems (ICSs) to devise a standards framework tailored to the diverse needs of various healthcare sectors.



Positive patient identification

In an effort to enhance patient safety and streamline healthcare processes, accurate patient identification remains a top priority. Ensuring that each patient is correctly identified at every point of care touchpoint is crucial to preventing medical errors and improving overall treatment outcomes.
The NHS England DCB1077 standard, known as Automatic Identification and Data Capture (AIDC) for Positive Patient Identification, facilitates the accurate, timely and safer identification of NHS patients in England through barcodes. This standard outlines the methods for encoding NHS approved patient identifiers into a consistent standardised format within an NHS approved barcode, the 2D GS1 DataMatrix. The DCB1077 standard uses the GSRN to uniquely identify patients by associating it with the NHS number and other patient identifiable information, which significantly reduces the risk of incorrect patient identification.

By designing the wristband in a consistent manner for scanning, it ensures that the NHS number is accurately encoded and easily readable for processing downstream.
This standardised approach minimises the risk of misidentification, as it provides a reliable method for capturing and verifying patient information. This approach ensures compliance with NHS England's patient clinic risk standards DCB0160 and DCB0129, integrating essential patient data into a unified barcode system, therby significantly reducing the chances of incorrect patient identification and enhancing overall patient safety.
NHS England mandated the implementation of data standards DCB1077, DAPB0108, and ISB0099 to ensure the precise and unique identification of patients. These standards collectively ensure that patient identifiers are uniformly captured across the nation in a standardised format. Additionally, the adoption of ISO/IEC 15426-2 and ISO/IEC 15415 standards complements these efforts by providing guidelines for barcode quality and verification, further enhancing data integrity.

As a result of the success of the Scan4Safety programme, other nations within the UK have initiated similar initiatives. NHS Wales are advancing towards establishing a Welsh Health Circular which underscores the necessity of establishing a fundamental standard for the application of AIDC technologies within the NHS. This standard aims to enhance patient safety, clinical effectiveness and operational efficiency.

The recently published National Learning Report (NLR) by the Health Safety Services Investigation Body (HSSIB) referenced the risks associated with patient identification and made the following safety observations:

Improving patient safety through future improvement programmes involves prioritising high-risk situations like handovers and care transfers, implementing multiple controls such as new technologies, and standardising processes. Healthcare organisations can enhance safety by applying user-centred design principles to optimise clinical settings for positive patient identification.

Designers of patient identification processes should conduct effective equality impact assessments and consider specific patient groups vulnerable to misidentification

Implementing EHR systems compliant with risk management standards can also enhance patient safety

Adopting a safety management system approach helps healthcare services understand and mitigate risks associated with positive patient identification

EHR providers such as Epic, Dedalus, Nervecentre Software, Oracle Health and System C have demonstrated that they can produce a DCB1077-compliant wristband with trust local configuration.

Current challenges

Despite ongoing advancements in digital health infrastructure, the accurate identification of patients remains a critical vulnerability within the healthcare system, with inconsistencies in identification practices continuing to pose significant risks to patient safety and care quality.

Patient misidentification

Patient identification currently depends on utilising an inconsistent combination of personal information including the NHS number, date of birth, and name. This often results in errors and challenges in precisely matching patients to their records. Over the past few years, the HSSIB has undertaken multiple investigations and produced reports regarding patient misidentification. These investigations encompass cases where patients have been mistakenly identified as someone else, resulting in incorrect treatment. One instance highlighted in the HSSIB's local integrated investigation pilot 1, released in 2021, recounts a scenario where a patient was admitted under the NHS number of another patient, receiving care under the wrong identity until the error was detected on the seventh day of admission. Furthermore, according to a recent HSJ investigation, "hospitals harm hundreds of patients annually due to misidentification errors. These errors can result in incorrect treatments, medication mistakes, and even fatalities, underscoring the urgent need for improved identification systems."

Inconsistent use of the national patient identifier for positive patient identification

The inconsistent use of national patient identifiers across the UK, including NHS numbers, in England and Wales, CHI numbers in Scotland, and HCN in Northern Ireland, intensifies challenges in EHR integration and patient safety. Nevertheless, GS1 barcoding and numbering standards offer a universal, machine-readable solution for accurate patient identification, even when national patient identifiers are used inconsistently. According to the 2022 House of Commons research briefing on patient health records: Access, sharing and confidentiality, the effective sharing and management of patient health records are critical for improving healthcare delivery and safeguarding patient confidentiality. The briefing emphasises that for safety and efficiency reasons, the NHS number should be used as a universal identifier across all healthcare settings, including social care. This ensures seamless integration of patient records, reduces misidentification risks, and improves interoperability. Standardised approaches like GS1 can further support accurate data sharing and streamline the integration of EHRs across systems.

Data quality and accuracy

Inaccurate or incomplete patient information can create identification challenges. Errors in recording names, addresses, or contact details can result in misidentification, potentially leading to incorrect treatment or diagnostic decisions.
The Never Event data published by NHS England 2023/24 presented 370 incidents, including nine instances of incorrect blood transfusions and 37 cases of incorrect implants being inserted into patients.[1]

Technology integration

Similar to the challenges faced by suppliers integrating NHS CIS2 authentication, where conformance with the NHS Spine and ensuring secure authentication is highly complex, EHR providers also encounter significant difficulties in technology integration. The interoperability between different healthcare systems, especially when providers use varying EHR systems, mirrors the authentication challenge, leading to inefficiencies in cross-referencing patient data. The HSSIB recently conducted an investigation on EHR systems, finding a lack of interoperability between the EHR and other relevant health provider systems across services.

Data governance and standardisation

Standardising patient data formats and terminology is complex but crucial. Lack of standardisation hinders patient identification and data sharing, leading to fragmented care. This document addresses NHS data silos, emphasising the importance of interoperability. The PRSB core information standard, OpenEHR specification, and GS1 standards advocate for standardisation and a shared language, with the PRSB standard as a key benchmark.

[1] Henneman PL, Fisher DL, Henneman EA, et al. Patient identification errors are common in a simulated setting. Ann Emerg Med. 2010 Jun;55(6):503-9. doi: 10.1016/j.annemergmed.2009.11.017. Epub 2009 Dec 23. PMID: 20031263.

Why GS1 standards are important in EHR systems

Consistent utilisation of the national patient identifier (e.g. NHS number) can aid positive patient identification

Accurate patient identification, including the national patient identifier (e.g. NHS number), at the point of arrival is crucial for ensuring patient safety throughout their healthcare journey. Printing the patient's wristband with this identifier upon arrival ensures that the NHS number is consistently used to retrieve the correct electronic patient record. This standardised approach minimises the risk of misidentification, as any errors in initial identification can carry through subsequent encounters. Establishing a patient's correct identity from the outset is therefore essential to maintaining accuracy and continuity of care. Not only does the data need to be correct, but the system must also have the ability to hold GS1 identifiers from the outset.

Data accuracy and patient safety

Utilising standardised barcodes and identifiers for healthcare products minimises data entry errors, enhancing patient safety and hospital operations through real-time data capture and efficient resource management. This approach, integrated with data registries ensures the principle "scan once, use many times", thereby reducing the risk of misidentification and ensures that the right patient receives the right treatment. General Practice: The Good Practice Guidelines for GP electronic patient records **(available here)** highlight the importance of safe and effective use of digital tools and services. These guidelines aim to ensure that patient safety is prioritised in the management of EHRs. By integrating GS1 standards, healthcare providers can enhance the accuracy and reliability of patient information, thereby reducing the risk of errors and improving overall patient safety. [2,3]

Efficiency and cost reduction

Standardised data formats and GS1 standards for labelling medical products enhance healthcare operations by automating inventory management, optimising supply chain logistics, and minimising errors. These improvements lead to significant cost savings, reducing litigation costs and ensuring the correct execution of medical procedures, as evidenced by patient-level costing initiatives like the Manchester case study **(available here).**

Traceability

GS1 standards enable quick and precise traceability of healthcare products during recalls or adverse events, which is crucial for identifying affected patients and mitigating risks. Adopting AIDC technologies enable organisations to improve accuracy by completing accurate data collection, improve efficiency due to faster data processing whilst enhancing traceability and compliance across various processes and operations.

Compliance

Adherence to GS1 standards helps meet regulatory requirements, ensuring legal and ethical standards are upheld across healthcare operations. This includes compliance with crucial clinical risk management standards such as DCB0129 and DCB1077, which govern the safety of health IT systems and help manage clinical risks associated with EHR and other health technologies.

Global reach and interoperability

The worldwide use of GS1 standards supports consistency and compatibility in international healthcare operations and supply sourcing, enhancing NHS supply chain optimisation and transparency. GS1 standards help facilitate seamless data exchange among various healthcare stakeholders, promoting effective communication and collaboration across the healthcare ecosystem.

Supporting the trusts and health boards to meet their own standards

GS1 standards play a crucial role in ensuring compliance with national and international regulatory requirements, such as medical device traceability and pharmaceutical tracking. Additionally, they align with local information governance processes within NHS trusts and health boards, helping to ensure that patient data and healthcare operations adhere to strict privacy, security and data management protocols.

System and hardware agnostic

Enabling seamless data integration across diverse platforms, ensuring consistent and efficient operations for businesses worldwide. GS1 standards are compatible with, and able to function across, a variety of systems, platforms and technologies without requiring specific adaptations.

Connected fragmented data

Patient data may be stored in different EHR systems across various healthcare settings, including primary care, hospitals, and specialist clinics. Fragmentation of data across multiple systems can make it challenging to establish a complete and accurate patient record. A recent **extract** published by L. Warren et al. stated how many patients underwent fragmented healthcare journeys involving transitions of care between different hospitals, leading to ineffective sharing of health data and hindering the delivery of safe, high-quality care.

[2] Barmecha, J., Last, Z. (2023). Electronic Health Record and Patient Safety. In: Agrawal, A., Bhatt, J. (eds) Patient Safety. Springer, Cham. https://doi.org/10.1007/978-3-031-35933-0_9

[3] Huang, E.Y., Jackson, G.P. (2022). Quality, Safety, and the Electronic Health Record (EHR). In: Romanelli, J.R., Dort, J.M., Kowalski, R.B., Sinha, P. (eds) The SAGES Manual of Quality, Outcomes and Patient Safety. Springer, Cham. https://doi.org/10.1007/978-3-030-94610-4_21

From theory to practice

We propose incorporating the national patient identifiers (e.g. NHS number) into a GS1 DataMatrix 2D barcode, specifically within the GS1 GSRN identifier as shown in the example below. This will enable AIDC by scanning the barcode at the point of care or use. Healthcare provider organisations are already adopting this approach, and NHS England has mandated its implementation as part of the DCB1077 information standard.

Figure 1: Example of a GS1-compliant patient wristband with encoded information

This GS1 barcode has the capacity to also encode other patient identifiers as shown in the NHS England's DCB1077-compliant patient identity band example above.

There are 12 GS1 Identification Keys which are used to uniquely identify a broad range of objects and entities to support business processes. The table below describes the Identification Keys which can be used to support NHS processes.

Requirement	Importance
Product (GTINs)	The EHR system must support granular tracking of consumables and devices, ensuring full traceability from procurement to use
Place (GLNs)	Accurate location tracking is essential for inventory management and patient care, providing clarity on where items are stored and used
Person (GSRNs)	Positive patient identification is crucial for safety and traceability, linking consumables and devices to patient records
Assets (GIAIs)	Full lifecycle tracking of medical devices, equipment or samples, including maintenance, usage, and decommissioning
Process	Streamlined workflows that integrate procurement, inventory management and utilisation processes to enhance operational efficiency
National standards	Full alignment with Scan4Safety and other NHS compliance mandates to ensure the NHS trust meets both current and future regulatory requirements

Table 1: A summary of the importance of GS1 standards for use is EHR systems

System primary purpose of GS1 standards	GS1 standard	Use case
Electronic health record (EHR) or Electronic patient record (EPR)	**GSRN**	Patient identification Staff identification
	SRIN	Episode of care identification
	GTIN	Product or service identification
	GLN	Place or party identification
Patient administration system (PAS)	**GSRN**	Patient identification Staff identification
	SRIN	Episode of care identification
	GLN	Place or party identification
Electronic Prescribing and Medicines Administration (ePMA)	**GSRN**	Patient identification Staff identification
	GTIN	Product identification
	GLN	Place or party identification
	GDTI	Prescription identification
Radiology	**GSRN**	Patient identification Staff identification
	GLN	Place or party identification
	GIAI	Asset or equipment identification
	GDTI	Request or film or report identification
Emergency (ED)	**GSRN**	Patient identification Staff identification
	SRIN	Episode of care identification
	GTIN	Product identification
	GLN	Place or party identification

System primary purpose of GS1 standards	GS1 standard	Use case
Pharmacy information system	GSRN	Patient identification Staff identification
	GTIN	Product identification
	GLN	Place or party identification
	GDTI	Prescription identification
Medicines management or Electronic medicine management (eMM)	GSRN	Patient identification Staff identification
	GTIN	Product identification
	GLN	Place or party identification
	GDTI	Prescription identification
Patient Level Information and Costing System (PLICS)	GSRN	Patient identification
	GTIN	Product identification
	GLN	Place or party identification
	GIAI	Asset identification
	GRAI	Returnable asset identification
	GDTI	Document identification
Patient medication record (PMR)	GSRN	Patient identification Staff identification
	GTIN	Product identification
	GLN	Place or party identification
	GIAI	Asset identification

System primary purpose of GS1 standards	GS1 standard	Use case
Theatre management system	GSRN	Patient identification
		Staff identification
	SRIN	Episode of care identification
	GTIN	Product or service identification
	GLN	Place or party identification
	GIAI	Asset identification
	GDTI	Document identification
Laboratory information management system (LIMS)	GSRN	Patient identification
		Staff identification
	SRIN	Episode of care identification
	GTIN	Product identification
	GLN	Place or party identification
	GIAI	Asset identification
	GDTI	Sample identification
		Document identification
Picture archiving and communication system (PACS)	GSRN	Patient identification
		Staff identification
	SRIN	Episode of care identification
	GTIN	Product identification
	GLN	Place or party identification
	GIAI	Asset identification
	GDTI	Document identification

System primary purpose of GS1 standards	GS1 standard	Use case
Breast milk tracking systems	GSRN	Patient (mother/baby) identification
		Staff identification
	SRIN	Episode of care identification
	GTIN	Product identification
	GLN	Place or party identification
	GIAI	Asset identification
	GDTI	Document identification
Inventory management systems (IMS)	GTIN	Product identification
	GLN	Place or party identification
	GSRN	Patient identification
	GIAI	Asset identification
	GDTI	Document identification
Enterprise resource planning (ERP)	GTIN	Product identification
	GLN	Place or party identification
	GIAI	Asset identification
	GDTI	Document identification
Purchase-to-pay (P2P)	GTIN	Product identification
	GLN	Place or party identification
	SSCC	Logistics unit identification
Catalogue management system	GTIN	Product identification
Pharmacy stock management systems	GTIN	Product identification
	GSRN	Patient identification
	GLN	Place or party identification

System primary purpose of GS1 standards	GS1 standard	Use case
Finance management system	GTIN	Product identification
	GLN	Place or party identification
Human resource management systems	GSRN	Staff identification
Facilities management system	GTIN	Product identification
	GLN	Place or party identification
	GIAI	Asset identification

Table 2: An overview of the various modular units within an EHR system, and where the GS1 Identification Key can sit and support the given use case

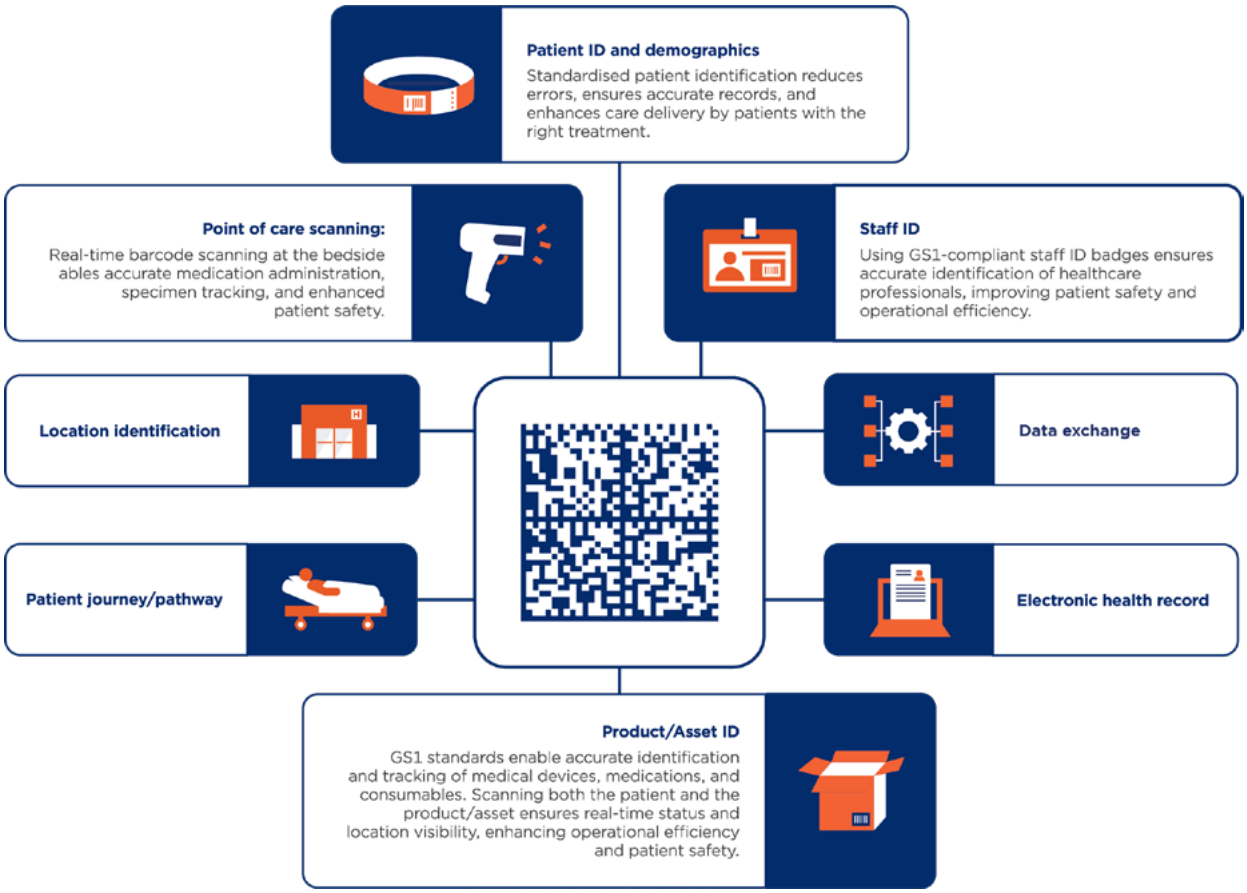


Figure 2: An overview of the benefits of GSRN implementation

Additional use cases for GS1 standards in EHRs

This infographic illustrates additional use cases for GS1 standards within EPRs, highlighting their role in improving safety, traceability, and operational efficiency across medicines, medical devices, documents, staff identification, and location tracking.

Figure 3: The application of GS1 standards for additional use cases

Beyond the standard of care

Opportunities for clinical trials and research are increased, positioning the UK as a hub for research activities. A barcoded NHS number within a GS1-compliant wristband ensures positive patient identification, assisting in streamlined access to a patient's EHR and precise data retrieval for research purposes. This facilitates the efficient location of patient data, expediting research processes. Beyond clinical research, the integration of GS1 standards within EHR systems may support various other healthcare functions.

Implementation of live bed state management, remote monitoring, and virtual wards supports efficient patient care.

It also aids in managing overseas patients or those receiving clinical care abroad, facilitating additional opinions when necessary.
Live bed state management ensures real-time visibility of hospital capacity, optimising resource allocation and reducing delays in patient admissions and transfers.

Additionally, GS1 standards, including GLNs for healthcare facilities and GTINs for medical products, enhance supply chain visibility and traceability. Traceability and recall management for implants, medications, and medical devices strengthens patient safety by preventing errors and ensuring compliance with regulatory requirements.

Accelerating clinical research

- GS1-compliant wristbands with barcoded NHS numbers ensure accurate patient identification.
- Streamlined access to EHRs enables faster, more precise data retrieval.
- Positions the UK as a global hub for clinical trials and research.

Enhancing patient care & hospital efficiency

- Live bed state management and virtual wards improve care coordination
- Real-time visibility of hospital capacity reduces delays in admissions and transfers
- Supports remote monitoring and care for overseas patients

Strengthening Safety & Supply Chain Traceability

- GLNs and GTINs improve traceability of implants, medications, and medical devices
- Enhances recall management and regulatory compliance
- Boosts patient safety by preventing errors

Conclusion

The integration of GS1 standards within EHR systems presents a significant opportunity to enhance patient identification, streamline workflows, and improve overall patient safety. A key component of this is the GSRN, which helps ensure positive patient identification at each stage of a patient's journey. The GSRN holds the national patient identifier, making it a critical element in adopting the national patient identifier (e.g. NHS number) as part of the EHR and embedding it within systems. Incorporating the national patient identifier (e.g. NHS number) within a barcode on a patient wristband ensures seamless identification, reducing errors and enhancing patient safety.

Beyond the GSRN, other GS1 standards, such as the GTIN for medical products identification and the GLN for location identification, work together to strengthen interoperability, data accuracy, and traceability within healthcare settings. When implemented in cohesion, these standards provide a robust foundation for enhancing EHR systems, ensuring that patient information is accurate, accessible, and aligned with national healthcare priorities.

As the NHS and other healthcare organisations continue their digital transformation journey, adherence to GS1 standards will play a crucial role in creating a more efficient and transparent healthcare ecosystem. The implementation of these standards requires strategic planning, training, and collaboration among stakeholders, but the long-term benefits may outweigh the initial challenges. Ultimately, the adoption of GS1-compliant digital health systems supports safer, more effective, and patient-centred healthcare, aligning with the broader objectives of improved efficiency, cost savings, and most importantly patient outcomes and experiences.

Appendix

GS1 standards key technical considerations for EHR solution providers

Identification of the patient	Would the proposed solution be capable of generating a GS1 Global Service Relation Number (GSRN) on a patient wristband that complies with the DCB1077 standard for use across clinical settings?
	Would the proposed solution be capable of reading a GS1 Global Service Relation Number (GSRN) on a patient wristband that complies with the DCB1077 standard for positive patient identification across clinical settings?

Additional key GS1 Identification Keys as part of the Scan4Safety programme

Identification of staff	Can the proposed solution read a GS1 Global Service Relation Number (GSRN) from a staff ID badge to accurately identify staff members in clinical settings, ensuring it distinguishes between staff IDs and other identifiers like the NHS number?
Identification of the product used in the care facility (e.g. implant, anaesthetic)	Consider whether the solution can read a serialised GS1 Global Trade Item Number (SGTIN) barcode to identify and capture the product used on a patient, as well as capture associated information (e.g., batch/lot number, expiry date) from the barcode within the clinical setting.
	Consider whether the solution can use the serialised GS1 Global Trade Item Number (SGTIN) as the identification key for products assigned to patients, along with other associated GS1 information (e.g., batch/lot number, expiry date), within the clinical setting for information exchange (e.g., through an external interface/data feed).

Identification of the patient and/or assigned asset location	Would the proposed solution be capable of reading a GS1 Global Location Number (GLN) in a GS1 barcode to identify and capture the physical location of a patient within the clinical setting?
	Would the proposed solution be capable of reading a GS1 Global Location Number (GLN) in a GS1 barcode to identify and capture the physical location of a patient and the asset assigned to them within the clinical setting?
	Would the proposed solution be capable of using a GS1 Global Location Number (GLN) in a GS1 barcode as the identification key for the patient location within the clinical setting for information exchange (e.g. through an external interface/data feed)?
Identification of the asset used (e.g. bed, trolley, equipment)	Consider whether the solution can read a GS1 barcode and/or RFID tag to identify and capture assets assigned to patients within the clinical setting?
	Consider whether the solution can use the GS1 Global Individual Asset Identifier (GIAI) as the primary identification key for assets within the clinical setting for information exchange (e.g., through an external interface/data feed).

GS1 Identification Keys

GS1 Identification Key and format	What use cases can it support?	Why is this Key important?	Additional information (e.g. guidance, case studies)
Global Service Relation Number (GSRN) This Key is used to identify the: • NHS Patient • Person providing a service from the NHS or within the NHS (e.g. staff, volunteer, medical student) This Key is an 18-digit number which starts with the GCP, followed by the service reference* (the identifier portion), and ends with the check digit. The service reference defined for patient identification in NHS England and NHS Wales is the patient NHS number.  	This Key is a core enabler within the NHS for a multitude of use cases that involve positive patient identification or staff identification.	The **GSRN** is globally recognised, system agnostic, and enables seamless sharing of patient information across organisational boundaries. Unlike NHS numbers or medical record numbers (MRNs), which are not universally unique and risk misidentification, the GSRN ensures true uniqueness. It is specified in the **DCB1077 standard** for encoding NHS-approved identifiers on barcoded patient wristbands.	NHS England requirements: • DCB1077 standard • Newborn screening blood spot card GS1 UK guidance: Staff identification (currently undergoing an update) GS1 UK case studies: • Positive patient identification • E-obs
Global Trade Item Number (GTIN) This Key is used to identify the: • Medical device (e.g. an implant) • Levels of product packaging • Service (e.g. a procedure) This Key is a number which exists in four formats. The 13-digit GTIN (GTIN-13) is a commonly utilised format in healthcare, which starts with the GCP followed by the item reference (the identifier portion) and ends with the check digit.  	This Key is a core enabler within the NHS for a multitude of use cases that involve the identification of products or services.	The **GTIN** is globally recognised, system agnostic, and essential for sharing product information across systems, ensuring supply chain visibility, tracking, and patient safety. It aids in authenticating products, identifying counterfeit items, and reducing harm to patients. Mandated by the NHS eProcurement Strategy since 2014, GTINs are key to compliance with the DHSC's coding requirements, supporting GS1 and PEPPOL standards. The MHRA has also indicated plans to authorise GS1 for medical device identification.	GS1 UK guidance: Barcoding OPCS-4 codes GS1 UK case studies: • Inventory management • Purchase-to-pay

Global Location Number (GLN) This Key is used to identify the: • Physical location (e.g. hospital site, ward, shelf space, bed-bay, requisition point) • Hospital provider organisation (e.g. NHS trust) • Department This Key is a 13-digit number which starts with the GCP, followed by the service reference (the identifier portion), and ends with the check digit.  	This Key is a core enabler for a multitude of use cases within the NHS that involve the identification of locations.	The **GLN** is globally recognised, system agnostic, and streamlines purchase-to-pay processes while enabling location tracking across organisations and supply chains. It is a core requirement of the NHS Framework Agreement, mandating compliance with GS1 and PEPPOL standards since 2020/2021.	GS1 UK case study: • Patient tracking
Global Individual Asset Identifier (GIAI) This Key is used to identify the: • Asset (e.g. medical equipment, reusable medical devices, surgical instruments and trays, IT, and catering equipment) • Pathology sample This Key can be up to 30 characters in length which starts with the GCP followed by the individual asset reference in alphanumeric format (the identifier portion).  	• Asset management • Surgical instrument traceability • Pathology management	The **GIAI** is globally recognised and system agnostic. Utilising the GIAI across systems makes it easier for asset and pathology sample information to be shared. The sharing of this data enables the tracking and tracing of assets and pathology samples within an organisation or between organisations.	GS1 UK guidance: • Asset management • Surgical instrument traceability • Pathology management • GS1 UK case study: Asset management
Global Returnable Asset Identifier (GRAI) This Key is used to identify the returnable items such as: • Pallet bases • Roll cages • Plastic containers used in the movement of goods This Key can be up to 30 characters in length which starts with the GCP followed by the Item reference in a numeric format (the identifier portion). The GRAI can also include an alphanumeric serial component, which identifies the individual asset within a given asset type. The definition of the Serial Number is at the discretion of the asset owner or manager at the hospital site.  	• Asset management • Surgical instrument traceability • Pathology management	The **GRAI** is globally recognised and system agnostic. Utilising the GRAI across systems makes it easier for returnable assets and equipment information to be shared. The sharing of this data enables the identification, tracking, and management of returnable assets within an organisation or between organisations.	GS1 UK guidance: • Asset management • Surgical instrument traceability • Pathology management • GS1 UK case study: Asset management

Global Document Type Identifier (GDTI) This Key is used to identify the: • Paper medical record • Case note • Patient letter • Instructional or promotional leaflet • Paper medical report This Key is 13 digits in length comprising of a GCP, a Document Type, a Check Digit. There is also the option of including an additional serial number component.	• Medical record management • Document tracking	The **GDTI** is globally recognised and system agnostic. Utilising the GDTI across systems makes it easier for information about documents to be shared. The sharing of this data enables the tracking and tracing of documents within an organisation or between sites and other organisations.	GS1 UK case study: Record management

GS1 data carriers

Data carrier	Reader characteristics	Further guidance to meet GS1 and NHS requirements
GS1-128 linear barcode  (01) 0 9501101 53000 3 • 48 Alphanumeric capacity • Supports any GS1 Identification Key • Supports data associated with GS1 Identification Keys	• Information encoded within a GS1-128 barcode can be read by any barcode reader, ranging from light beams to optical devices (e.g. camera scanner in a smartphone) • Readers will scan the barcode manually • The scanning needs to be done in line of sight • Single barcodes can be scanned at once	Sections 3, 5 and 7 of the GS1 General Specifications GS1 Healthcare Implementation Guideline GS1 Human Readable Interpretation (HRI) Implementation Guideline
GS1 DataMatrix 2D barcode  (17) 050101 (10) ABC123 (01) 04012345678901 • This is the preferred data carrier in healthcare • Can carry more data than a GS1-128 barcode, larger sizes carry more data • Can be encoded with built in error correction, so symbol can still be read if damaged.	• Information encoded within a GS1 DataMatrix barcode can be read by an optical device (e.g. camera scanner in a smartphone) • Readers will scan the barcode manually • The scanning needs to be done in line of sight • Single barcodes can be scanned at once	Sections 3, 5 and 7 of the GS1 General Specifications GS1 Healthcare Implementation Guideline GS1 Human Readable Interpretation (HRI) Implementation Guideline GS1 DataMatrix Guideline
Passive RFID  • Not battery powered • Little/no intelligence • Can be embedded in a normal label or in a protective plastic casing if they are subject to heavy treatment	• Information encoded within a passive RFID tag can be read by a reader by a radio wave • Fixed readers: • Typically located in corridors and entrances and exits • If fixed readers are in a room, then its contents can be monitored continuously, and warnings generated of any equipment entering or leaving the room • Mobile readers: • Can be based on a trolly that is moved around a hospital going through each room on a weekly or monthly basis • Can be as a handheld wand which can be used to scan items within a room, cupboard, or patient bedside. The handheld wand can beep when it finds specific tags and beeps louder as it gets closer to a tag.	Sections 3, 5 and 7 of the GS1 General Specifications GS1 Healthcare Implementation Guideline EPC Tag Data Standard

- Can show the location of assets on maps and floor plans
- Communicate with the asset system via Wi-Fi or on returning to a docking station

GS1 enabled systems in healthcare

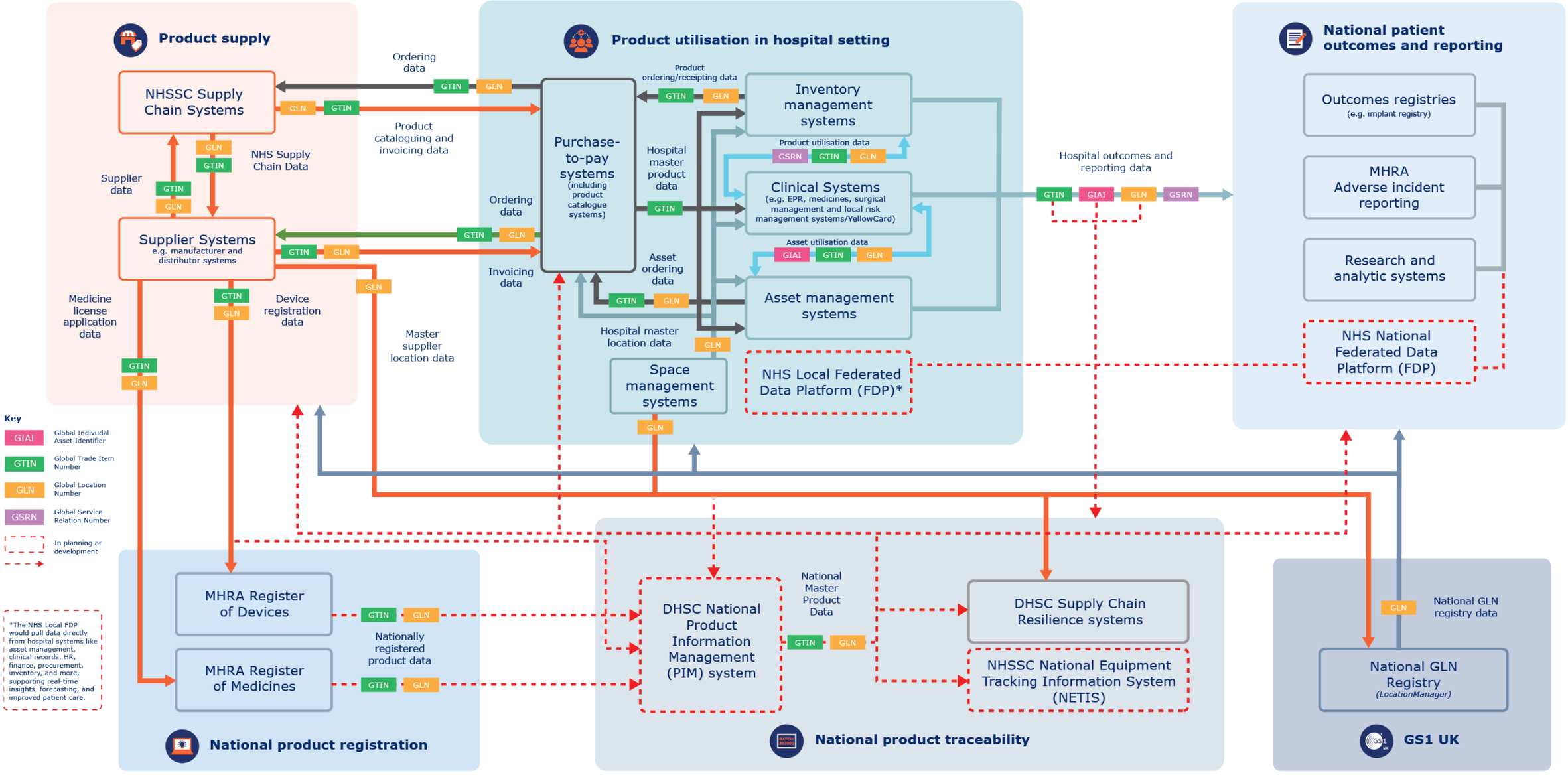


Figure 4: Diagram illustrating how and where information flows between systems and where GS1 standards fit in.

This diagram illustrates how GS1 standards can enable the systems and information flows during the product registration, utilisation, and outcomes and reporting of medical devices.

A medicinal product or medical device is registered with the MHRA using data from the supply system, which includes the GLN to identify the manufacturer and the GTIN to identify the product. Once registered, the product data is sent to the DHSC's National Product Information Management (PIM) system, the central source for master product data supporting supply, utilisation, traceability, patient outcomes, and reporting.

In hospitals, procurement or purchase-to-pay systems (P2P) place orders using the product GTIN and the supplier's GLN, sourced from suppliers or NHS Supply Chain systems. Invoicing data, including the product GTIN and GLNs, is sent back to the P2P system. Patient wristbands with the barcoded NHS/national identifier enable tracking of GTIN labelled medications, medical devices, and GIAI or GTIN labelled equipment within EHRs, inventory management, and asset management systems.

When a product is delivered and used on a patient, clinical systems such as the EHR synchronise product utilisation data with inventory and asset management systems. This ensures accurate stock levels and triggers reordering when supplies run low. Hospital outcomes and reporting data, including GTIN/GSRN encoded patient product utilisation, is then submitted to systems supporting hospital outcomes and reporting, such as the MHRA adverse incident reporting, research and analytics platforms, and the NHS National Federated Data Platform (FDP). Each NHS trust will have a local platform connected to the National FDP.

Abbreviations

2D	2-dimensional
AIDC	Automatic Identification and Data Capture
CHI	Community Health Index (Scotland)
CIS2	Care Identity Service 2
CLMA	Closed loop medicines administration
DHSC	Department of Health and Social Care
EHR	Electronic health record
EPR	Electronic patient record
ePMA	Electronic Prescribing and Medicines Administration
ERP	Enterprise resource planning
FDP	Federated Data Platform
GCP	GS1 Company Prefix
GDTI	Global Document Type Identifier
GIAI	Global Individual Asset Identifier
GLN	Global Location Number
GRAI	Global Returnable Asset Identifier
GSRN	Global Service Relation Number
GTIN	Global Trade Item Number
HCN	Health and Care Number (Northern Ireland)
HL7	Health Level Seven
HRI	Human Readable Interpretation
HSSIB	Health Services Safety Investigation Body
ICS	Integrated care system

IEC	International Electrotechnical Commission
IMS	Inventory management system
ISO	International Organisation for Standardisation
LIMS	Laboratory information management system
MDOR	Medical Devices Outcome Registry
MHRA	Medicines and Healthcare products Regulatory Agency
NAO	National Audit Office
NHS	National Health Service
NLR	National learning report
P2P	Purchase-to-pay
PACS	Picture archiving and communication system
PAS	Patient administration system
PEPPOL	Pan-European Public Procurement Online
PIM	Product Information Management
PLICS	Patient Level Information and Costing System
PMS	Pharmacy management system
PRSB	Professional Record Standards Body
RFID	Radio-Frequency Identification
SGTIN	Serialised Global Trade Item Number
SRIN	Service Relation Instance Number
SSCC	Serial Shipping Container Code
WHO	World Health Organisation

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