

Creation, Use, and Maintenance of Unique Location Codes for In-country Health and Logistics Systems

A position paper on standardized location identifiers in
health care

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Acronyms

3PL	third-party logistics
AI	application identifier
DC	distribution center
ERP	enterprise resource planning
GEPIR	Global Electronic Party Information Registry
GHSC-PSM	Global Health Supply Chain-Procurement and Supply Management
GLN	Global Location Number
GTIN	Global Trade Item Number
LMIS	logistics management information system
LLMICs	low- and lower-middle income countries
MFL	Master Facility List
MO	GS1 Member Organization
PEPFAR	President's Emergency Plan for AIDS Relief
PIM	product information management
USAID	United States Agency for International Development
WHO	World Health Organization
WMS	warehouse management system

Executive Summary

This position paper provides a basis for understanding what is needed to successfully introduce, plan, and execute the steps and tasks for standardizing physical and digital locations in the health sector in low- and lower-middle income countries (LLMICs).

As LLMICs drive toward adopting global standards to realize supply chain efficiency, the desire is great to achieve end-to-end data visibility and product traceability, in particular, the ability to know exactly where trade items are at any point in the supply chain as they move from source to destination. This requires collaboration among trading partners to share standardized and unique information on who the supply chain parties are and a greater need to understand and facilitate local and global health trade and industry collaborations. This can be supported, in part, through adopting global data standards for location identification for all parties in the supply chain.

LLMICs are making efforts to create authoritative lists of all health facilities in a country, called Master Facility Lists, with guidelines from international aid organizations. However, these guidelines are locally based, do not identify global entities, and fall short in meeting the requirements for enabling end-to-end visibility in a digital supply chain. The GS1 Global Location Number standard provides the ability to identify a functional, physical, or legal entity uniquely anywhere on the globe.

This paper explores the concept of location standardization in creating efficiencies in supply chain functions, along with opportunities that countries may have to think through ways existing practices on location identification can be better aligned with global practices.

Background and Context

The USAID Global Health Supply Chain Program-Procurement and Supply Management (GHSC-PSM) project is committed to exploring industry innovations that will lead to a better, more efficient supply chain. GHSC-PSM has developed a suite of tools to support country programs with implementing global standards in public health supply chains in support of improving supply chain data visibility and commodity traceability. One tool is the Implementation Guidance for Pharmaceutical Traceability Leveraging GS1 Global Standards,¹ which includes a roadmap describing the capabilities required to implement traceability. The use of standardized trade item identifiers along with standardized location identifiers creates additional opportunities for supply chain visibility and is fundamental to achieving traceability. This paper explores how the principle of “location” is applied across supply chains and the value-add of standardizing how locations are identified and how data about those locations are captured and shared.

Traceability in health care enables parties to see the movement of pharmaceuticals or medical devices across the supply chain.² Health care supply chains are networked with complex relationships among different parties all interacting with health care commodities. Trade items change custody multiple times as they move from a manufacturer to an importer, wholesaler, third-party logistics (3PL) provider or distributor, warehouse, health facility, and ultimately a local pharmacy or hospital unit. Each transit point represents a location or legal entity in the supply chain that needs to be uniquely identified to document change in ownership or custody, ensure that commodities are delivered to and stored in the correct place, and ultimately provide important information for enabling product traceability and more efficient recall processes.

Problem Statement

Stakeholders managing public (e.g., government) and private-sector supply chains in low- and lower-middle income countries (LLMICs) recognize the challenge of having inaccurate, poor-quality, and incomplete location identification data. As a result, they have been undertaking the important work of standardizing location identification. In many cases, however, this initiative has been limited to a subset of locations such as health facilities rather than assessing the value and developing a strategy for standardized location identification across the full value chain. As such, domestic health-sector locations (e.g., health facilities) are often identified using a different set of standards as compared to national or international supply chain locations such as manufacturers and warehouses. The interconnection of these different data sources for location identification is a significant first step to comprehensive use within the supply chain.

Purpose and Scope

This paper is intended to create awareness on applying standardization of locations in health supply chains in LLMICs. It provides information for decision-makers and practitioners supporting health care supply chains to determine potential paths forward and implementation considerations to assess how to

¹ USAID GHSC-PSM (March 2019). Implementation Guidance for Pharmaceutical Traceability Leveraging GS1 Global Standards. Retrieved from <http://ghsupplychain.org/implementation-guidance-pharmaceutical-traceability-leveraging-gs1-global-standards>

² GS1 Healthcare traceability and GS1 standards. Retrieved from <https://www.gs1.org/industries/healthcare/traceability>

best leverage standardized location identification and associated data capture and data sharing in the supply chain.

Several different concepts are used in health care to denote location, including legal entities and physical locations or functions. Physical locations, legal entities, digital locations, and functions are discussed; however, for simplicity, the term location is used liberally throughout this paper to encompass all of these concepts.

Overview of Key Location Standards

This section describes the concept of location identifiers and associated master data with a focus on two principles used to normalize the use of location identifiers in the health sector in LLMICs: Global Location Number (GLN) and Master Facility List (MFL). These two concepts will be referenced throughout this paper with GLNs assigned by the location owner and MFLs identifiers assigned and maintained centrally by a designated national authority. In some cases, individual GLNs may be assigned by a GS1 Member Organization (MO) at the discretion of the organization who wishes to identify the location.

Global Location Number

The GLN³ is the globally unique GS1 identification number for locations and supply chain parties. It can be used to identify a functional, physical, or legal entity. The attributes defined for each GLN (e.g., name, address, location type, such as ship to, bill to, deliver to) help users to ensure that each GLN is specific to one unique location globally. A GLN acts as a database key that references location-specific information stored in a data repository maintained by an organization (e.g., drug regulatory information system, enterprise resource planning system).

The GLN provides a unique and unambiguous identification of:

- **Physical locations:** A site or an area within the site where a product was, is, or will be located, such as a warehouse or hospital wing or even a nursing station
- **Legal entities:** Any business, government body, department, charity, individual, or institution that has standing in the eyes of the law and the capacity to enter into agreements or contracts, such as a health system corporation
- **Functions:** An organizational subdivision or department based on the specific tasks being performed, as defined by the organization, such as an accounting department
- **Digital locations:** An electronic (non-physical) address that is used for communication between computer systems

Geisinger Health System GLN Program

Geisinger, a leading health care provider, uses a central sourcing model, in which most of the network's medical supplies are delivered to centralized locations and then are distributed to hospitals. Geisinger implemented a GLN program and enumerated GLNs for "ship-to" locations (distribution centers) and reconciled this information with its suppliers. Geisinger processed its first order using the GLN on August 17, 2009, and by October 5, 2009, the system was successfully using the GLNs in all supplier orders and order acknowledgements, with the correct products being received in the correct locations. With the GLN in place, the system is reaping the benefits of using consistent location identification, including streamlined communications with networked suppliers.

For more information, [click here](#).

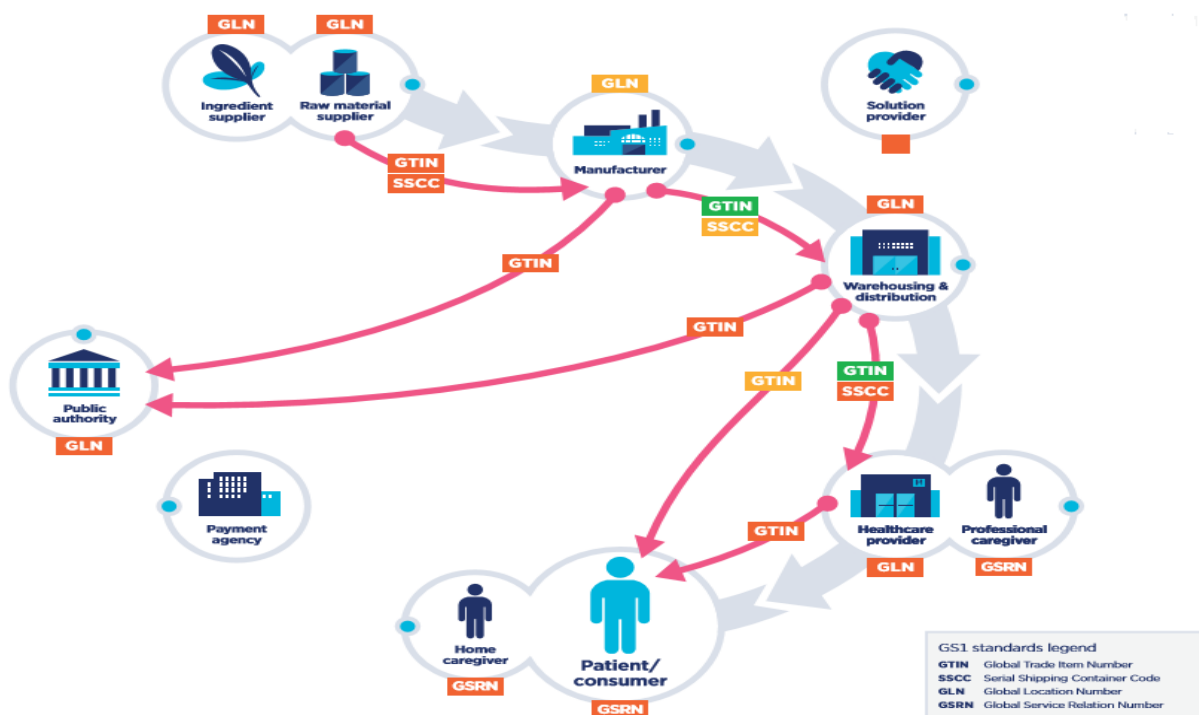
Some GSI MOs maintain GLNs in GLN registries. These registries are compiled using GLNs with associated attributes and definitions. Individual companies or organizations work with GS1 MOs⁴ to assign these identifiers to their locations, as well as determine the most applicable structure. For

³ GS1. Global Location Number. Retrieved from <https://www.gs1.org/standards/id-keys/gln>

⁴ GS1. How do you get a GLN. Retrieved from <https://www.gs1.org/1/glnrules/en/guideline/234>

example, a company may use a single location reference for multiple business processes (e.g., ordering, delivery, and payment) because each process is undertaken at the highest (corporate) level. However, an organization may also assign distinct location references to locations and functions within its organization. The owner of the location assigning the GLN is responsible for ensuring uniqueness of each location identified by a GLN. MOs provide training and tools to help their members in the assignment of GLNs. There are GSI MOs in 115 countries. The Global Electronic Party Information Registry (GEPIR)⁵ web application is used by GSI to maintain a small set of information on the organization associated to which a GSI Company Prefix (GCP) has been assigned. GEPIR also includes GLNs assigned by MOs to their members. The non-member countries may work with any GSI MO in the world to acquire a GCP or individual GLNs as needed so that they can be used in supply chain transactions thereby enabling healthcare digital thread.

Figure 1. GLN used to enable a health care digital thread⁶



Master Facility List

MFL identifiers and associated attributes are maintained in Facility Registries, an authoritative list of all health facilities in a country with a set of attributes to uniquely identify each facility.⁷ It is the primary source from which other facility lists in the country are validated and accessible. Authoritative organizations such as the World Health Organization (WHO) and President's Emergency Plan for AIDS Relief (PEPFAR) have been working with countries on standardizing how health facility lists are created, maintained, and shared in health care, including for supply chain (e.g., pharmacies and community distribution points) information systems. Currently, MFL identifiers are established nationally and do not

⁵ GS1. Global Electronic Party Information Registry. Retrieved from <https://gepir.gs1.org/>

⁶ GS1 (September 2018.) Healthcare Interactive Digital Thread. Retrieved from https://www.gs1.org/sites/default/files/18gsgl0203_d16_hc_digital_thread_interactive_pdf.pdf

⁷ WHO (2013) Creating A Master Health Facility List. Retrieved from https://www.who.int/healthinfo/systems/WHO_CreatingMFL_draft.pdf

extend to other global supply chain parties, such as manufacturers, suppliers, and other legal entities transacting in the supply chain. MFL identifiers do not have a standard code structure and may vary from country to country.

An MFL includes the data needed to accurately and uniquely identify each facility, such as facility name, unique facility identifier, location, and contact information, as well as administrative data to categorize the facility, such as facility type, ownership, and operational status. The MFL may also include information about the service capacity of the facility or type of services offered and number of beds.

Registries used to maintain MFL identifiers and associated attributes are called Facility Registries and are operated by designated institutions, usually a Ministry of Health. Facility Registries act as the central authority to collect, store, and distribute an up-to-date and standardized set of facility location identifiers and their associated master data. In addition to Facility Registries, facility location data are captured as an attribute in the record for existing enterprise resource planning (ERP) applications, warehouse management systems (WMSs), logistics management information systems (LMISs), and product information management (PIM) systems.

MFLs are considered in this paper as a stepping stone for countries to move toward a more comprehensive way of identifying locations in health care in a way that transcends country locations to the entire supply network, including identification of global supply chain parties. Also, since health facilities are continuously built and some closed out, the processes to update the MFL are a necessary step in making the MFL continuously relevant and useful. The absence of maintenance processes and an information system to manage the MFL is identified as a major limitation to using an MFL⁸.

Open Health Information Exchange

Recognizing the complexity of location data management and the importance of ongoing maintenance and potential integrations, two prominent international initiatives (Facility Registry and the Open Health Information Exchange) exist and provide open source applications for managing health location registries and enhancing the exchange of health data between information systems that house location data.

For more information about the Open Health Information Exchange, [click here](#).

⁸ OJPHI (2016) Potential use cases for the development of an electronic health facility registry in Nigeria: Key informant's perspectives. Retrieved from <https://europepmc.org/backend/ptpmcrender.fcgi?accid=PMC5266756&blobtype=pdf>

Location Standardization in Common Supply Chain Functions

This section describes the concept of location identifiers and associated master data across supply chain functions of procurement, distribution, and points of dispense. The distribution network for a public health supply chain can be complex, with trading partners across the private, public, and NGO sector and parallel distribution streams all interacting to facilitate the flow of commodities from manufacturer to points of dispense. Using standardized location identifiers and associated attributes enhances the speed and accuracy of supply chain functions and enables responsive and accurate product tracing.

Procurement and Order Management

All activities in the procure-to-pay process require accurate identification of certain locations (e.g., manufacture location, shipping address, billing location, purchase location) to ensure that supply chain processes are executed according to plan. Therefore, accuracy of location identification and alignment of location information between the buyer and seller are essential to efficient procurement. Standardized identification of global and country parties involved in procurement provides a common framework that all parties in the procure-to-pay process can use in supply chain transactions, from purchase order to delivery and payment. This enables accuracy in transactions and minimizes errors, such as re-shipment, loss of shipment, and invoicing and payment mistakes, and enables a more transparent flow of goods.

GLN Application at Children’s Health Ireland Hospital

When the Children’s Health Ireland Hospital received a recall notice, the hospital had to manually hunt through paper records to identify where the product came from and what patients had received that batch, as well as to locate the tins of product with that batch number. The hospital used GSI-GTIN, GSI-GLN to track commodities from supplier to dispensation unit. GLNs were also assigned to each location to which goods are dispatched. This resulted in the full visibility of all product in the hospital, including where the product came from and where it was dispensed. In the event of a recall, it now takes just minutes to locate or account for the affected product and where it was dispensed.

For more information, [click here](#).

Distribution Centers

Distribution Centers (DCs) receive, store, and distribute health commodities, a process that requires them to manage locations and subsequent master data about the parties they are receiving from and shipping to. Leveraging unique location identifiers, DCs can accurately and unambiguously manage who manufacturers the product, who ships the product, and who is intended to receive the product. GLNs have the added benefit of enabling a common nomenclature and identification approach for global and local entities that are involved in these processes. They provide this visibility in a common way across DCs (for example, multiple country medical stores) and a common approach for internal and external parties to communicate in the supply chain, upstream (e.g., global) and downstream (e.g., national, regional, local).

Health Facilities

Health care commodities delivered to service delivery points go through a network of supply chain parties, such as 3PLs or distributors and central medicals stores. By using the GLN and associated information, suppliers receiving the order electronically now know where to deliver the stock and who to invoice. Use of standards for identifying locations in hospitals ensures that orders are delivered to the correct delivery point. Use of GLNs in hospitals further supports an accurate and up-to-date record of all the stock ordered and delivered to each department or ward. In more advanced settings, standardized location identifiers are used for internal stockholding locations and bin locations for inventory management and good warehouse practices.

Intermountain Healthcare GLN Program

Intermountain Healthcare System was challenged with duplicated account information for the same supplier, which increased purchasing and payable touch points and resulted in data quality issues. Using GLNs, Intermountain Healthcare consolidated information from several sources and gained ownership of its GLNs and related data. By doing so, the system greatly reduced its maintenance efforts by going from 15,147 reconciled down from 370 GLNs that were truly needed.

For more information, [click here](#).

GS1 Standards for Location Identification, Capture, and Data Sharing

This section describes GLN application in providing a common language to **identify, capture, and share** supply chain data in a way that is accessible, accurate, and easy to understand across organizations.

Identification

Today's supply networks rely heavily on using data translations and mapping identifiers associated with various supply chain partners. Maintaining these data relies typically on manual processes. The ability to standardize definitions for names, addresses, contact information, roles, and additional data removes these complexities and ensures they remain the same for all stakeholders implementing the standard. With standardization, the needed information can be communicated once, stored in local systems, retrieved, and used.

The GS1 systems of standards provides clear, structured data standards and GLN Allocation Rules that organizations follow when allocating GLNs to ensure that their GLNs are globally unique and consistently formatted. The attributes defined for each GLN, such as the name, address, and location type, help to ensure that each GLN is specific to one unique location in the world. Refer to Annex A, GLN Attributes.

Data Capture

The GLN can be encoded into a data carrier that can then be scanned to retrieve the data from internal systems. In a more general supply chain context, entering a GLN into a system automatically by using a barcode (as opposed to manually typing it in) requires as minimal manual intervention as possible, thereby increasing speed and accuracy. Specifically, manual data capture leads to one keystroke (input) error in every 300 to 500 keystrokes when compared to one keystroke (input) error in every 350,000 in automated data capture.^{9,10} The use of GLNs in a data carrier is generally limited to the logistics function and applied on a logistics unit to identify the source or receiving party.

When a GLN is physically encoded in a barcode, additional indicators signify the type of location identified by the GLNs. For example, if a GLN is

Children's Health Ireland at Temple Street

The Children's Health Ireland Hospital was challenged with finding recalled products within the hospital, as no physical controls were in place to automatically ensure that recalled product was not subsequently issued to patients. To resolve this problem, by using GS1 barcode standards and GLNs assigned to each location to which goods are dispatched, the hospital saw operational efficiencies of reduced effort and time taken for a daily stock count from two people taking 15 minutes to manually reconcile stock to one person taking two minutes to validate through a scan. The four-way scanning of product, staff, patient, and location, combined with date/time stamping, allowed for the foundation of the traceability process, recording the who, what, where, and when of each dispensed item.

For more information, [click here](#).

⁹ Amerinet. Success Story, Supply Chain Management, "How Intermountain Healthcare Successfully Took Ownership of its GLN and is embracing GS1 Standards. Retrieved from

https://www.gs1us.org/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=604

¹⁰ GS1 Global Office (2017). Global standards - Barcodes and Serialization. Retrieved from

https://www.dcvmn.org/IMG/pdf/kreysa_workshop_25september2017_revised.pdf

barcoded on a logistics label applied to a shipping unit, the organization scanning the barcode may need to know the “ship-to” and “purchased-from” GLN. Application identifiers (AIs) are used to encode additional information besides the location identification into a barcode. The specific AI indicates the particular function of the location number represented in the barcode symbol, for example:

- AI (410) is used to identify a "ship to – deliver to" location
- AI (411) is used to identify a “bill to – Invoice to” location
- AI (412) is used to identify a “purchased from” location
- AI (414) is used to identify a physical location
- AI (415) is used to identify the invoicing party

An example of AI (410) and AI (412) encoded in the barcode as well as a human-readable interpretation is shown in Figure 2.

Figure 2. Ship-to and purchased-from GLNs encoded in a barcode



(410)0860000341417
(412)0860000341424

Data Sharing

Three main types of data are defined and shared in the health care supply chain: master data, transactional data, and event-based data. Identification of locations is a core component of managing each kind of supply chain data, as shown in Table I.

Table I. Supply chain data types

Data Type	Description
Master Data	Core information about the "who" in a trading relationship. The who can include the name, address, and identification codes of the buyer and seller plus details of shipping, delivery, and billing locations. ¹¹
Transactional Data	Information exchanged between two organizations about the products and services for which they are selling, ordering, delivering, receiving, invoicing, and paying. ¹² Data values include purchase-from-party; ship-to-party; ship-from-party; ship-for-party; bill-to-party.

¹¹ GS1 Master Data. Retrieved from <https://www.gs1ie.org/standards/data-exchange/master-data/>

¹² GS1 Ireland. Transaction Data. Retrieved from <https://www.gs1ie.org/standards/data-exchange/transactional-data/>

Event-based Data	Information used to identify where an event took place in a supply chain transaction. Data values include identifiers for the manufacturer, shipping dock, a warehouse, or a pharmacy.
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Annex A is an illustration of GLN attributes (e.g., street address, city/town, province, postal code) that are stored in a location identification database, which enables the data to be shared with trading parties. The use of global standards for location identifiers with the relevant hierarchical attributes increases the accuracy of location information among supply chain partners globally and eliminates the need to cross-reference and/or manually re-key information. This is in contrast to using national identifiers, which are limited to sharing with local parties. By creating single references to locations that each trading partner identifies as the same unlocks the potential for location data integration and data exchange among various supply chain systems.

Implementation Considerations in Using GLNs as the Standard Identifier in Country Supply Chains

Cost

No direct cost is associated with being a user of GLNs, i.e., with requesting GLNs from manufacturers or other trading partners, capturing GLNs in a repository, printing GLNs on barcodes, etc. However, direct costs are associated with registering with a GS1 MO to acquire a GS1 Company Prefix, which enables an organization to create and allocate GS1 Identification Keys, including GLNs, Global Trade Item Numbers (GTINs), and Serial Shipping Container Codes. Different MOs offer varying fee schedules, but generally these costs are minimal and not a barrier in implementing a global standards program.^{13,14,15,16} It is recommended that governments, trading partners, or other organizations that seek to register for and manage GLNs at scale contact their local or regional GS1 MO. The goal is to discuss objectives, pricing, and options within a given cost objective to best assess management of any costs associated with implementing a GLN program.

Supply Chain Information Systems¹⁷

Most ERPs, WMS, LMIS, PIM, or possibly even location (facility) master lists have the capability to add an attribute to capture GLNs associated with existing location identification records about a trade item which creates a link between the manufacturer and trade item, such as warehouse location records and supplier or manufacturer location records. However, to fully utilize the benefits of GLNs in enabling traceability, SCIMS may require an upgrade or patch to enable the use of GLNs and all its fixed attributes in transactions that track the chain of custody from manufacturer to service delivery point.

Governance

GLN programs require the development, execution, and supervision of policies and practices that standardize how location data are collected, stored, and shared in a way that enhances the value of location data among key stakeholders. The governance function addresses stakeholder buy-in and

United Nations (UN) Blue Numbers Registry

In an effort for farmers to adopt safer and more sustainable production practices, the United Nations Global Compact (UNGC), the UN Blue Number Registry, provides an open global online registry. It recognizes the contribution of millions of farmers and small agribusinesses to achieving Sustainable Development Goals.

GS1 partnered with UNGC to provide a global identification registration service so farms in every country can register and receive a GLN. GLNs are UN sponsored so no one is charged for a number and farmers can use their GLNs if they are reporting against any sustainability framework, such as the Food and Agriculture Business Practices. Farm sustainability information can be selectively shared with other stakeholders along the supply chain stemming from a farm's GLNs and associated master data on its profile and location.

GLNs in the UN Blue Numbers Registry provide visibility on farmers and trading partners globally practicing to possible buyers around the world and opening up and giving them access to international markets.

For more information, [click here](#).

¹³ GS1 South Africa. GS1 Barcode License and Registration Fees. Retrieved from: <https://www.gs1za.org/licence-and-registration-fees/>

¹⁴ GS1 Kenya. Membership Form. Retrieved from: http://gs1kenya.org/get_barcodes

¹⁵ GS1 Australia. Membership Schedule. Retrieved from:

<https://www.gs1au.org/api/sharepointlibrary/download?g=Ny,8yNi8yMD,IwI,DE6NDU6MDcgQU18R1MxYXUcZmVlcy1pbmRpdmlkdWFsLWJhcmNvZGUtbnVtYmVyLWFuZC1mdWxsLW1lbS0yMDIwLTIxLnBkZnxmaWxl>

¹⁶ GS1 United States. Fee Schedule. Retrieved from: <https://www.gs1us.org/upcs-barcodes-prefixes/get-a-barcode>

¹⁷ GHSC-PSM. 2020 GS1 SCIS Requirements. Retrieved from <http://www.ghsupplychain.org/GS1SCISReqs>

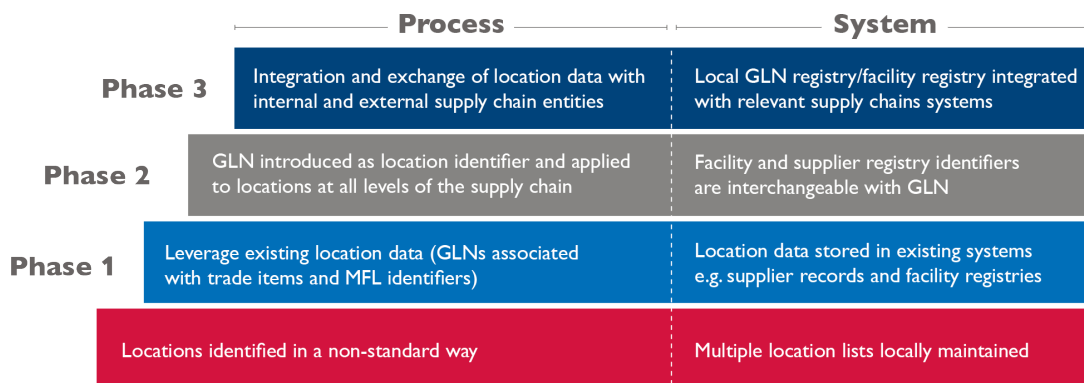
support in harmonizing and reconciling location lists to align with GLN standards and reach consensus on a single authoritative list for the country.

As part of the governance function, policies and guidelines for data collection and quality management are defined, agreed to, and communicated to all internal and external stakeholders. Governance functions maintain protocols for managing relocations and changes to location data and associated attributes. In some instances, the same identifier may be allocated to a combination of a legal entity, a location, or a role. Updated data information must be communicated to stakeholders. The business processes dictate organizational and master data changes that occur. Each scenario dictates whether a new identifier should be assigned.

Phased Implementation

Adoption of GLNs as a standard for location identification is often tied to the country’s current state and desired end-state for achieving traceability. Wide adoption of this standard may not be feasible without a phased approach. By starting with an analysis of the current state (e.g., no standard identifiers, a national system, or a limited scope such as facilities) and the desired end result (e.g., GLN for all entities across the value chain) to develop a plan for standardization. Figure 3 provides an illustrative three-phase approach.

Figure 3. : Approach to leveraging GLNs for country location identification



Phase 1: This phase in a country’s maturity toward standardized adoption of location identifier is leveraging what location data already exists to support supply chain functions. For example, countries may request or mandate GLN data associated with the trade item brand owner, manufacturer, or manufacturing location. These GLNs when used in combination with a GTIN can provide understanding on "who" and "what" is being traded in the health care supply chain to improve the ability to forecast and procure, and can contribute to reverse logistics functions. Unique identifiers and attributes in the MFL can continue to be used for “deliver to” with GLNs adopted as an attribute. Location data are hosted in a Facility Registry. SCIS is configured to consume and manage GLNs in facility and supplier location records, and uses GLNs for transactional data sharing, where they are available.

Phase 2: The concept of GLN for location identifiers and of location hierarchies is introduced with attribute definitions managed and maintained in a structured hierarchical approach. By creating these linkages between and among the different health care locations and functions within a supply chain, communication of this information internally and externally starts to take shape more efficiently and consistently. GLN identifiers are acquired for locations within the supply chain such as medical stores. SCIS is configured to allow for facility and supplier location identifiers to be interchangeable with GLN.

By leveraging the GLN and GS1 standard attributes through this approach, the uniformity created makes implementing location management much easier.

Phase 3: More seamless integration and data exchange of location data occurs at this phase via the GLN Global Index. This enables the efficient search of a company name or country by searching the GLN identification number thereby realizing economies of scale and potential cost and resource savings through the integration of the GLN and the related master data into all systems, both internal and external. The ongoing maintenance of data also reflects the gained efficiencies as when any time anything changes at a location, only the thing(s) that changes is communicated. This also allows for greater control of the data and leads to better data quality. By leveraging the GLN and serialized trade item identifiers, trade items can be traced across the supply chain, with each transfer of custody or transfer of ownership identified by the GLN of the receiving party.

Conclusion

Use of GLNs with GTINs and event data is key to achieving traceability in health care, enabling visibility into the movement of health commodities across the supply chain.¹⁸ Products can be traced backward to identify the history of the transfers and locations of a product, from the point of manufacture onwards. Products can also be tracked forward to see the intended route of the product toward the point of care. The use of the GLN and standardized associated data ensures the chain of custody of product along the supply chain can be understood by every trading partner, globally and locally, in the same way. However, this standard is not readily implemented in LLMICs where reliable data are most needed for efficient supply chain operations. LLMICs have adopted MFLs as a guideline to location identification and normalization.

In 2012, WHO established guidelines for creating MFLs in countries, but these guidelines still require domestication and process modeling for each country adopting them. This represents a gap in meeting requirements for countries to use, share, and exchange location data at a global level, a critical requirement for achieving traceability. MFLs present an opportunity for countries to incorporate the use of GLNs in supply chain functions. In initial stages of implementation, value can be realized in using GLNs already present on trade item barcodes without countries acquiring GLNs. With maturity, countries may more holistically incorporate into the MFLs the concept of GLNs and begin to identify, share, and exchange accurate information about locations in the health value chain at the national and global levels in a database, so they have everything they need to properly ship, deliver, and invoice for products.

¹⁸ GSI. Healthcare traceability and GSI standards. Retrieved from <https://www.gsi.org/industries/healthcare/traceability>

Annex A: GLN Attributes¹⁹

Attribute Field	Type	Field Length	Field Attribute Definition	Business Usage Notes
Company GLN	Numeric	13	The unique location identifier for the organization; the legal entity	The Global Location Number (GLN) is a GS1 key. The GLN can be used to identify physical locations and legal entities where there is a need to retrieve pre-defined information to improve the efficiency of communication with the supply chain. Only numbers are permitted.
Company Legal Name	Alphanumeric	80	Company's legal registered name	Matches the Government Registered Company Name.
Alternate Company Name	Alphanumeric	80	Alternate company name (i.e., doing business as, or also known as name (aka))	Only one alternate per company is allowed.
Location GLN	Numeric	13	The unique identifier for the location	The GLN is a GS1 key. It can be used to identify physical locations and legal entities where there is a need to retrieve pre-defined information to improve the efficiency of communication with the supply chain.
Location Name	Alphanumeric	80	The name assigned to the specific location	Must be unique within a given address.
Address 1	Alphanumeric	80	Street or postal address line 1. Includes the number of the location, street name, and any suffix (Crescent, Drive, Road, etc.)	Includes the number of the location, street name, and any suffix (Crescent, Drive, Road, etc.).
Address 2	Alphanumeric	80	Street address line 2. Identifies the floor or wing name of the location	When Address 3 is used, add Address 4. When Address 3 is not used, the additional identification described in Address 4 moves to Address 3.
Address 3	Alphanumeric	80	Street address line 3. Additional identification, such as a specific room or facility	When Address 2 is used, add Address 3. When Address 2 is not used, the additional identification described in Address 3 moves to Address 2.
Address 4	Alphanumeric	80	Street address line 4. Any additional reference area to the location: shelf, aisle, or direction	
City	Alpha	35	City name related to the location	Name related to the location. Only one city is allowed.
Province/ Territory/ State [code list]	Alpha	Code List	Province, territory, or state in which the city is located	Code List: ISO codes for provinces (based on Country selection) www.iso.org/iso/country_codes/background_on_iso_3166/iso_3166-2.htm

¹⁹ GS1 Canada (2011) Canada's Transition to the use of Global Location Numbers (GLNs) via Electronic Data Interchange (EDI). Retrieved from https://www.gs1ca.org/files/The_Transition_to_Global_Location_Numbers.pdf

Postal/Zip code	Alphanumeric	20	Postal or zip code assigned to the specific location	Free-form text and unformatted field, e.g., Canadian Postal Code will only be seven characters, including a space: M3B 3L1.
Country Name [code list]	Alpha	Code List	Country	Country Code List: ISO 3166-2 codes for countries URL: www.iso.org/iso/country_codes/background_on_iso_3166/iso_3166-2.htm
Language Code [code list]	Alpha	Code List	Language in which the location information was entered	Code List: ISO 639-1 codes for languages http://en.wikipedia.org/wiki/List_of_ISO_639-1_codes
Location Function [code list]	Alpha	Code List	Business function(s) for each location	Code List: Bill To, Order From, Ship To, Ship From, Remit To, Legal Entity Repeatable attribute
Location Type [code list]	Alpha	Code List	The type of facility or location	Code List: Head Office, Warehouse, Hospital, Clinic, Pharmacy, Mental Health, Community Health, Call Centre, Long Term Care, Emergency Medical Service (EMS), Correctional Facility, Nurse Station, Dock Door, Emergency Department, Operating Theatre (Additional codes to be added as required).
GLN Status [code list]	Alpha	Code List	Indicates the status of the GLN	Code List: A=Active, I=Inactive. An Active GLN is in use within the supply chain. An Inactive location is one that is no longer in use (i.e., location is closed, location has moved, location has been sold, a new GLN has been assigned, etc.).
Parent Location (GLN)	Numeric	13	Identifies the GLN parent of the location	One level up parent.
Date Last Updated	Date	Date/Time	Date and time when the location record was last updated	System generated value YYYY-MM-DD HH:MM:SS (with 24-hour clock)
Last Updated By [user]	Alphanumeric	User ID	User identification of individual who last updated the location record	System-generated value
Contact Name	Alphanumeric	70	Title, Department Name or Person for this location	If a contact name is entered, both the Contact Method and Contact Method Value are required.
Contact Method [code list]	Alpha	Code List	Method of contact	Code List: Email, Fax, Instant Messenger, Mobile Phone, Pager, Phone, SMS, Website. When this field is populated, the Contact Method Value must also be populated.
Contact Method Value	Alphanumeric	70	Value of the contact method used	Actual value; for example, phone number, email address. When this field is populated, the Contact Method must also be populated.