QUICK GUIDE

Key Considerations for Centralized National Pharmaceutical Traceability Approaches

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WELCOME TO TRACEABILITY

Over the last several years, the global health community has made significant investments in the adoption of global standards for traceability in the supply chain, aiming to increase visibility and availability of high-quality and safe essential medicines at the last mile. This quick guide provides key considerations for countries contemplating the implementation of **centralized approaches** for pharmaceutical verification and tracking and tracing of pharmaceuticals, including people, process, and technology factors. It focuses on centralized traceability approaches in healthcare based on GS1 standards, including use of the GS1 EPCIS standard that enables trading partners to share information about the physical movement and status of products as the products move through the supply chain.

THIS GUIDE IS FOR YOU

This quick guide is intended for use by national authorities and implementors who would design a national centralized traceability system, including

- Ministries of health
- Regulatory authorities
- Development partners

QUICK GUIDE ASSUMPTIONS

Centralized
Traceability data are stored in a single database or repository.[1]

Semi-Centralized
Traceability data are spread among a limited number of repositories

Distributed
Each in-scope entity for traceability system maintains its own traceability data

Countries may elect to implement a centralized, semi-centralized, or distributed traceability system. **Due to initial interest from USAID-supported countries in centralized systems, this guide is focused on centralized system and assumes:**

- GS1 health care standards will be used to facilitate item and location identification, data capture, and data exchange.
- A centralized system where serialized and event data is stored in one central data repository at the national level will be implemented.
- The central repository is managed by a singular national entity, such as a ministry, regulatory authority, or logistics management unit.
- Entities will be pursing serialized traceability. [2]
- The repository will manage the data authentication between a user and/or a system, the authorization of the user or system, and the access control for the user or system, for all supply chain parties.

For more information on other traceability systems, see GS1's Regulatory Roadmap.[2]

* While the quick guide assumes serialized traceability is being pursued, institutions may elect to implement alternative approaches, such as batch-level verification or track and trace based on specific contextual use cases and considerations.

TWO APPROACHES FOR TRACEABILITY

Traceability in supply chain is defined in this resource as the ability to identify, verify, track, and/or trace a product as it moves through the supply network. The common approaches for traceability are verification and track and trace.

TRACEABILITY

VERIFICATION

The business process of checking at any single point in the supply chain that the unique identifier printed on the item is assigned by the brand owner.

TRACK AND TRACE

The business process of tracking forward and tracing back a uniquely identifiable "traceable item" at any point along the entire supply chain from creation to the point of sale, use, or destruction. Track and trace requires trading partners to exchange data for defined events and provide the what, when, where, and why about trade items as they move through the supply chain.

Verification
Is the item that is to be dispensed/used genuine?

Verify Item
Is the item identifier valid?

Authenticate Item
Does the item have the expected overt or covert security features?

Track and Trace
Is the chain-of-custody or the chain-of-ownership of the item intact?

Track Item
Where is the item now and where is it going?

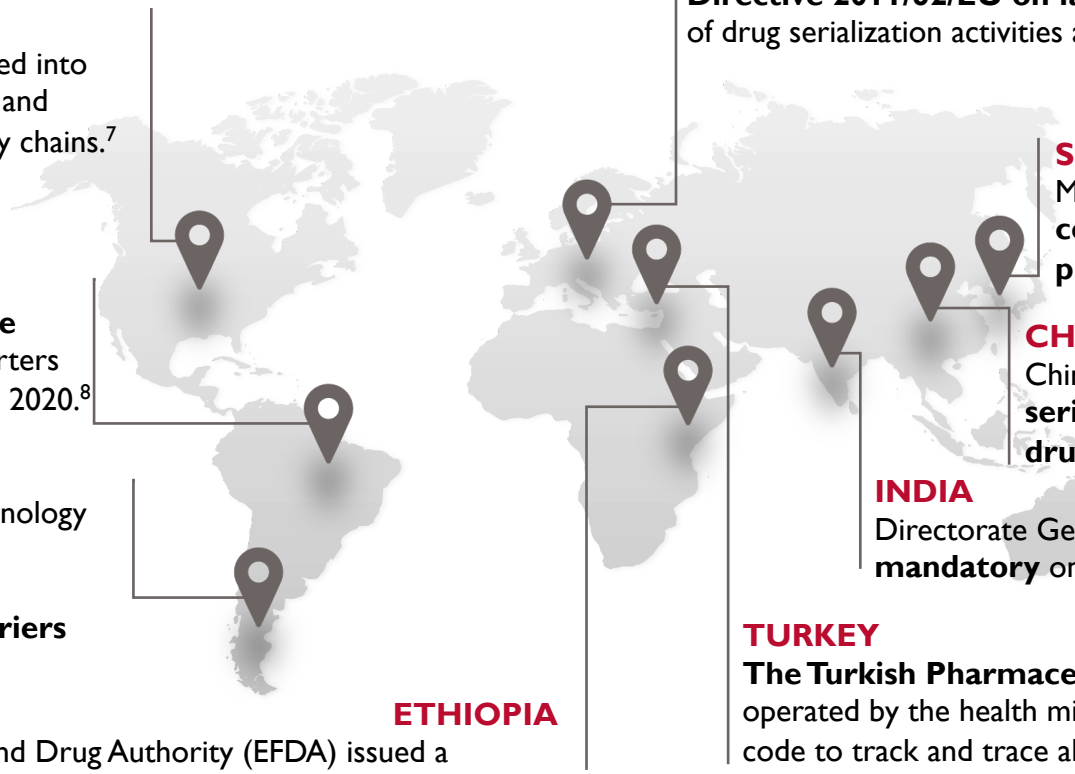
Trace Item
Where did the item come from, and who had custody/ownership of it?

CONSIDER STARTING WITH VERIFICATION

Countries pursuing traceability should choose the traceability approach that best meets the business needs; however, they should consider a phased approach starting with verification because it can address key supply chain security challenges and is less complex than track and trace.[3]

VERIFICATION	TRACK AND TRACE
Primary Objectives	
Verification of a product at a single point in the supply chain with the objective of identifying counterfeit product.	Identify the history, distribution, and location of product in the legitimate supply chain
Stakeholder Involvement	
Limits the number of stakeholders who must integrate their data systems and the number of data points that must be exchanged.	Multiple parties who own or are in custody of a product (manufacturers, wholesalers, and dispensers) need to capture, maintain, and exchange data about each serialized unit.
Data Connections	
Limited master and transaction data need to be exchanged by data sources and queried by health care providers/clients.	All parties in the supply chain subject to traceability scope must capture and exchange master, transaction, and event data.

EXAMPLES OF TRACEABILITY REGULATION AROUND THE WORLD



U.S.
Drug Supply Chain and Security Act was signed into law in November 2013 to standardize serialization and aggregation requirements for pharmaceutical supply chains.[7]

BRAZIL
Brazil National Agency of Sanitary Surveillance (ANVISA) began requiring manufacturers and importers to serialize and report all movements of medicines in 2020.[8]

ARGENTINA
The National Administration of Food and Medical Technology of Argentina (ANMAT) in 2015 **required all drugs containing active pharmaceutical ingredients in select lists to be serialized and contain data carriers adhering to GS1 standards.**[6]

ETHIOPIA
In 2019, Ethiopian Food and Drug Authority (EFDA) issued a Traceability Directive that mandates **standardized identification of pharmaceutical product based on GS1 standards.**

EU
Directive 2011/62/EU on falsified medicines demands a national enforcement of drug serialization activities across EU by 2019.[5]

SOUTH KOREA
Ministry of Health and Welfare has issued the law **controlling and indicating barcode of pharmaceutical products**

CHINA
China's State Food and Drug Administration has made **serialization mandatory for 502 pharmaceutical drugs** that fall into the essential drug list

INDIA
Directorate General of Foreign Trade has made **barcodes mandatory** on packaging for pharmaceuticals exported from India

TURKEY
The Turkish Pharmaceutical Track and Trace System (iTS). operated by the health ministry, provides each drug a unique DataMatrix code to track and trace all drugs

CENTRALIZED NATIONAL **VERIFICATION** APPROACH

- Process Considerations
- Policy Considerations
- Technology Considerations

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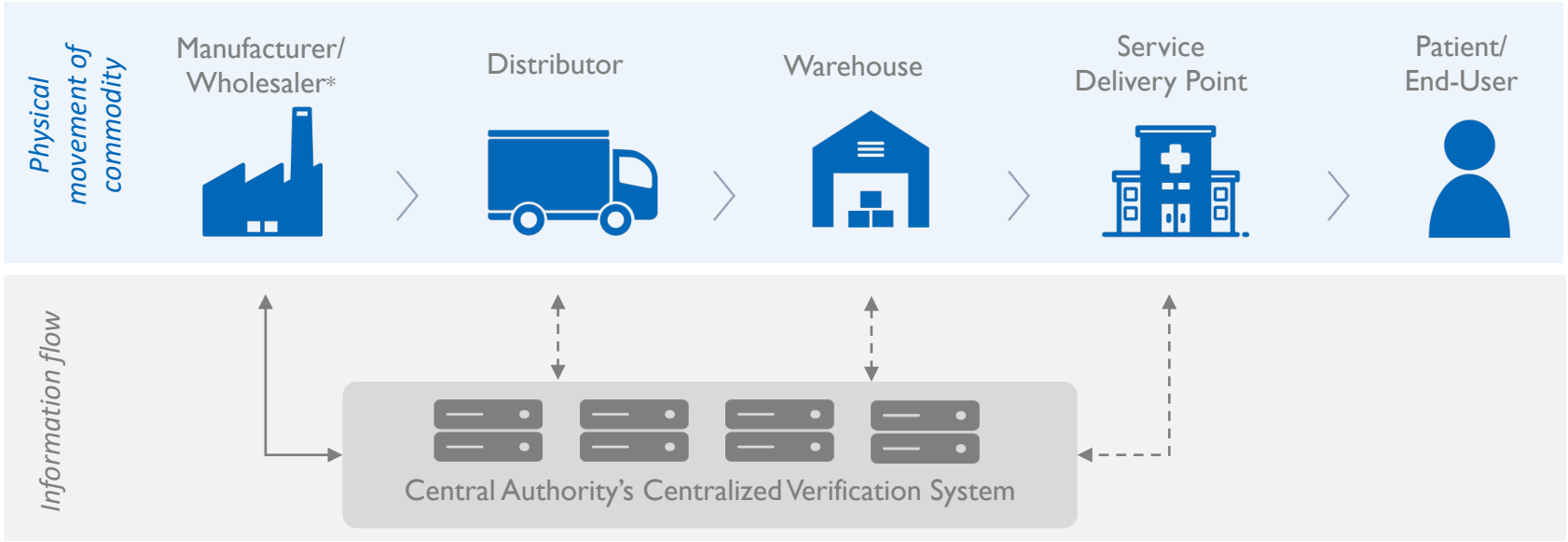
CENTRALIZED VERIFICATION OVERVIEW

Verification requires, at a minimum, that trading partners at the end of the supply chain check the validity of a trade item's unique identifier and update its status (e.g., decommissioned). Before a product is dispensed in health centers, pharmacies, or health posts to patients or consumers, verification requires that the SGTIN (GTIN + serial number) unique identifier on a trade item's packaging be validated by comparing it with information provided by the brand owner or manufacturer of the trade item.



* A manufacturer or wholesaler may share data with a third-party platform before it is sent to a centralized national repository. This has not been depicted in this diagram.

VERIFICATION POLICY CONSIDERATIONS

National governments should consider issuing mandates (laws, regulations, directives, etc.) that define, govern, and establish an appropriate incentive structure for the verification program. Key elements of regulation include product scope, identification, capture, and data exchange requirements. The business need and/or challenge the country wishes to address through verification help design these regulatory elements. This slide summarizes key considerations for a point-of-dispense or point-of-consumption verification.

Countries may conduct market assessments and/or pilot programs to inform and help determine local manufacturers' and other supply chain parties' ability to comply with transition periods for the traceability mandate.

PRODUCT SCOPE – *which products are subject to the regulation*

In-scope and out-of-scope products must be clearly identified in regulations. *Regulators should* consider a phased approach to products in scope for verification, such as starting with pharmaceutical products with a high rate of fraud such as malaria products while excluding from requirements initially, for example, over-the-counter drugs.

IDENTIFICATION – *how trade items and logistics units must be uniquely identified that enter the market*

Regulators should issue mandates that define requirements on how trade items and logistics units must be identified.

DATA CAPTURE – *how identification data should be encoded in data carriers on specific packaging levels*

In health care, aligning data carrier requirements with global standards and market trends is recommended. The printing of data carriers on packaging enables the automated data capture for verification. [9]

DATA EXCHANGE – *what data must be exchanged when*

Regulators should define what data manufacturers/brand owners/market authorization holders (MAHs) must exchange and when with national authorities through the established central database.

VERIFICATION PROCESS CONSIDERATIONS

Once a health care worker verifies an item by comparing the SGTIN on the dispensing unit to information held in the national system, they dispense the product to the patient. Simultaneously, the status of the SGTIN of the pack is set to "decommissioned/supplied" in the national system. Should the information on the pack differ from that in the repository ("serial number does not exist in repository") or the status of the serial number is already "decommissioned" (the product was already supplied or recalled), the pack authenticity cannot be verified and an alert is raised. Countries should consider having measures in place to investigate such incidents.

Countries should consider the following capabilities to enable this process:

- SGTINs are added to a central database at least at the dispensing unit, typically the trade item secondary packaging levels
- GTINs can be linked to transactional data (serial number, batch/lot, and expiration date), are maintained in a central database, and can be used for the verification process(es)

VERIFICATION TECHNOLOGY CONSIDERATIONS

Countries may first seek to use existing technologies before considering new ones. Current enterprise resource planning (ERP) systems, drug regulatory information systems (DRISs), logistics management information systems (LMISs), and warehouse management information systems (WMSs) may be used if they can:

- Support using the EPCIS standard to store SGTINs and enable event data exchange between MAHs and national authorities
- Manage item master data
- Capture GTIN, batch/lot, expiry dates, and serial numbers as commodities enter the market
- Support downstream trade partners to validate unique GTINs, batch/lot numbers, and serial numbers against stored data

In addition to meeting the systems requirements outlined above, partners must also have access to the hardware required to scan barcodes to conduct the verification process.

One Model:
The European Union (EU) Verification

The 2011 EU's Falsified Medicines Directive (FMD) [9] requires supply chain parties to verify a medicine's authenticity at the point of origin and the point of dispense to prevent counterfeit prescription drugs from entering the pharmaceutical supply chain.

All manufacturers must print a unique identifier on the outer packaging of medicines and send that identification data to the European Medicines Verification System (EMVS) and state verification systems.

Health facilities that dispense products must verify their authenticity against the data submitted.

This system is a minimum requirement for EU member countries. Each country may require additional traceability of pharmaceutical products.

CENTRALIZED NATIONAL **TRACK AND TRACE** APPROACH

- Policy Considerations
- Process Considerations
- Technology Considerations

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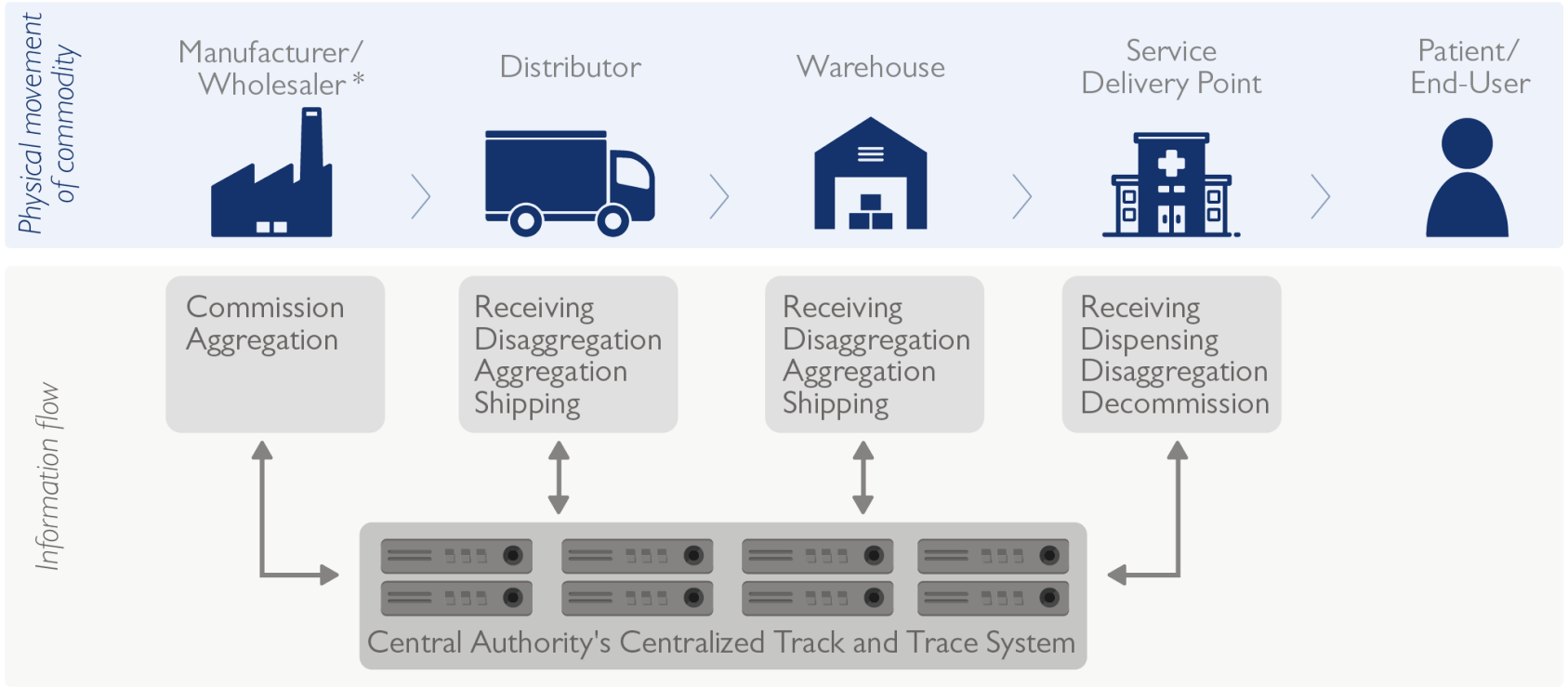
CENTRALIZED TRACK AND TRACE OVERVIEW

A centralized national track and trace system validates a pharmaceutical product at specific points in its journey through the supply chain by storing event data from relevant supply chain parties in a central data repository. This system enables real-time tracking throughout the supply chain, stock management for timely detection and prevention of stock-outs, targeted product recalls, and reduction of reimbursement fraud, theft, and medication errors.

A single national entity—often a ministry, regulatory authority, or logistics management unit—usually manages a central national track and trace system. For all supply chain parties, the repository manages the data authentication between a user and/or a system, the authorization of the user or system, and the access control for the user or system.



* A manufacturer or wholesaler may share data with a third-party platform before the data are sent to a centralized national repository. This has not been depicted in this diagram.

TRACK AND TRACE POLICY CONSIDERATIONS

National governments should consider issuing mandates (laws, regulations, directives etc.) that define, govern, and establish an appropriate incentive structure for the track and trace program. The mandates should address identification, data capture (barcoding), aggregation, and data exchange informed by the business need and/or challenge the country wishes to address through track and trace. Countries may conduct market assessments and/or pilots to help determine local manufacturers' and other supply chain parties' ability to respond and to schedule transition periods for the track and trace mandate.

PRODUCT SCOPE – *which products are subject to the regulation*

In-scope and out-of-scope products must be clearly identified in regulations. *Regulators should* consider a phased approach to mandating in-scope products, for example, starting with products with a high rate of fraud, such as malaria products while excluding from requirements initially, for example, over-the-counter drugs. This phased approach may be appropriate for countries unable or unwilling to invest in implementing full traceability for all pharmaceutical products.

IDENTIFICATION – *how trade items and logistics units must be uniquely identified that enter the market*

Regulators should issue mandates that define requirements to uniquely identify in-scope products for verification, including globally unique trade item identifier, batch/lot number, and expiry date.

DATA CAPTURE – *how identification data should be encoded in data carriers on specific packaging levels*

In health care, aligning data carrier requirements with global standards and market trends is recommended. The printing of data carriers on packaging enables the automated data capture for verification. The application of data carriers enables the automated data capture for track and trace.

DATA EXCHANGE – *what data must be exchanged when*

Regulators may mandate the data exchange standards—such as GS1 EPCIS standards—that allow supply chain partners to capture information about supply chain events (e.g., shipping or receiving) and securely and efficiently share information with trading partners. Capturing and sharing data, both internally and across trading partners, provides visibility into the history of manufacturing, shipping, receiving, and more. This adds to an already complex network of data capture and sharing, requiring careful consideration to match traceability strategy and objectives with the technology capabilities across trading partners.

Regulators should consider this complexity when drafting regulation, including the number of parties and systems that must be established, maintained, regulated, and enforced.

TRACK AND TRACE PROCESS CONSIDERATIONS *(1 of 2)*

Countries may use the GS1 EPCIS standard for exchanging traceability event data in a way that enables traceability events to be communicated. Countries will have to decide what events need to be recorded for their track and trace system to meet requirements. The table below illustrates key EPCIS events related to track and trace and the party responsible for performing the functions in a chain-of-custody model

The illustrative What, Where, When, and Why of traceability events

	WHAT objects are the subject of this event *(GTIN + Serial Number = SGTIN)*	**WHERE** this occurred and where the objects went after that *GLN of physical location*	**WHEN** this event took place	**WHY** this event took place
Manufacturers/ Wholesalers	Allocate and retain SGTIN for item	Record GLN where the item/cases/pallet was commissioned	Record the date and time of commissioning the item	Commission Aggregation
Distributors	Assign and record SSCC of pallet Record package (SGTIN) Transaction Information & Transaction History, and Transaction Statement	Record GLN of ship-to-party Record transferring ownership of the product.	Record the date and time of shipment of package	Receiving Disaggregation Aggregation Shipping
Warehouses	Record package (SGTIN) Transaction Information & Transaction History, and Transaction Statement	Record GLN of ship-to-party	Record the date and time of shipment receipt and transfer to next location	Receiving Disaggregation Aggregation Shipping
Service Delivery Points	Record package (SGTIN) Transaction Information & Transaction History, and Transaction Statement Decommission SGTIN	Record GLN of service delivery point Record "ship-from" GLN	Record time package was received	Receiving Dispensing Disaggregation Decommission

TRACK AND TRACE PROCESS CONSIDERATIONS *(2 of 2)*

Track and trace requires the ability to share event and transactional data throughout the supply chain related to the "Why," "Where" "When," and "What" of unique events as captured in the Track and Trace Process Considerations section of this guide..

Aggregation and serial number management are key components of this process for effective traceability. Aggregation is the creation of a hierarchical relationship between a containing object and the collection of objects contained within. Aggregation requires unique identification of the containing object: SGTIN if it is a trade item, or SSCC if it is a logistics unit. For example, when a pallet is shipped, the hierarchical relationship of all serial numbers associated with the collection (the aggregation) are recorded as the collection is built (e.g., serial number of the pallet, serial numbers of all cases on the pallet, serial numbers of all items in each case on the pallet). The receiving supply chain partner receives an electronic communication detailing the aggregation (i.e., the serialized numbers and the hierarchical relationship of those serialized numbers within the collection), which ensures that the integrity of the collection has remained intact.

Countries should consider the following capabilities for a centralized track and trace technology solution to enable this process:

- Unique serial numbers are assigned at the trade item secondary and tertiary packaging levels.[12]
- Serial numbers are captured and exchanged across supply chain systems as transactions occur
- Linkage of a unique serial number with its associated GTIN, batch/lot, and expiration date is maintained in a central database and can be referenced by trading partners
- Supply chain processes are adjusted to manage items at the aggregated or unique serialized item level (e.g., receiving, inventory management, picking, packing, shipping)
- Use of SSCCs can enable aggregation and disaggregation of serial numbers as logistics units and trade item packs are dismantled and/or repackaged throughout the supply chain

TRACK AND TRACE TECHNOLOGY CONSIDERATIONS

To enable centralized track and trace, *supply chain stakeholders must* be able to capture and exchange product event and transactional data with a central database. To achieve this, each stakeholder must have the following technological capabilities:

- Systems capable of capturing data scanned from 1D and 2D data carriers at the trade item secondary and tertiary pack levels
- Supply chain systems able to send and receive transactional data electronically to and from supply chain participants, such as vendors, warehouses, and facilities
- Ability to manage event data exchanged using the GS1 EPCIS standard
- Technology to capture an event and associate it with a specific item and entity through GTIN and GLN, respectively
- Systems that enable aggregation and disaggregation of serial numbers as logistics units are dismantled and/or repackaged through the supply chain

Countries should aim to leverage existing technologies before considering new ones. Current ERP systems, DRISs, LMISs, and WMSs may be used if these can:

- Manage item and facility master data
- Capture, retain, and transmit inbound event data—including batch/lot and/or serial numbers—as commodities enter the country
- Capture, retain, and transmit event data, including batch/lot and/or serial numbers, as reported by trading partners as product custody or ownership changes through the supply chain

In addition to meeting the system requirements outlined above, partners must also have access to the hardware required to scan barcodes to record the serial number upon receipt, dispatch, and/or dispensing to a patient.

One Model: The Turkey Track and Trace Program

In 2012, Turkey became the first country in the world to implement a full track and trace system to secure its domestic pharmaceutical supply chain.[13]

The program was implemented in a phased approach. Phase 1 focused on manufacturers and pharmacists obliged to make sales notifications. Phase 2 required the cross-checking of movements of a product between each actor with the regulated domestic supply chain by comparing sales and purchase notifications.

Four factors drove the successful implementation of pharmaceutical track and trace:

1) The political determination to eliminate reimbursement fraud
2) A large pharmaceutical market dominated by a single payer
3) Medicine reimbursement being contingent on verified dispensing and prescription
4) Flexibility to adapt the system according to the needs of stakeholders during implementation

GLOSSARY OF TERMS

Term	Definition
Batch/lot	Associates an item with information the manufacturer considers relevant for traceability of the trade item.
Drug Regulatory Information System (DRIS)	A tool that facilitates the submission of product data, including pharmaceuticals and medical devices, to regulatory agencies to gain authorization for distributing products in the market,
Electronic product code information services (EPCIS)	An open standard that allows businesses to capture and share supply chain information about the movement and status of goods, both within their enterprise and with their business partners.
Event data	The information generated by an item as it moves through the supply chain. It includes the what, where, when, and status of an object each time the item's RFID tag is read.
Global Location Number (GLN)	The GS1 identification key used to identify physical locations or parties. The key comprises a GS1 Company Prefix, location reference, and check digit.
Global Trade Item Number (GTIN)	The GS1 identification key used to identify trade items. The key comprises a GS1 Company Prefix, an item reference and check digit.
GS1	A neutral, not-for-profit, global organization that develops and maintains the most widely used supply chain data standards in the world.
Logistics management information system (LMIS)	A system of records and reports – whether paper-based or electronic – used to aggregate, analyze, validate, and display data (from all levels of the logistics system) that can be used to make logistics decisions and manage the supply chain.
Market authorization holder (MAH)	Any legal entity that holds marketing authorization by the country-designated body or organization to distribute and sell its pharmaceutical products in a given country.
Primary packaging	The first level of packaging for the product marked with a data carrier either on the packaging or on a label affixed to the packaging. For non-sterile packaging, the first level of packaging can be in direct contact with the product. For sterile packaging, the first level of packaging can be any combination of the sterile packaging system and may consist of a single item or group of items for a single therapy such as a kit.
Secondary packaging	The level of packaging marked with a data carrier that may contain one or more primary packages or a group of primary packages containing a single item.

GLOSSARY OF TERMS (cont'd)

Term	Definition
Serial number	A code, numeric or alphanumeric, assigned to an individual instance of an entity for its lifetime. Example: a unique individual item may be identified with the combined Global Trade Item Number (GTIN) and serial number.
Serial Shipping Container Code (SSCC)	The GS1 identification key used to identify logistics units. The key comprises an extension digit, GS1 Company Prefix, serial reference, and check digit.
Serialized Global Trade Item Number (SGTIN)	A common term for the combination of a GTIN and serial number
System	An organized framework or method.
Tertiary packaging	The highest level of packaging that may include a pallet that contains (one or usually) several cases or a case that contains (one or usually) several items in its primary or secondary packaging. Tertiary packaging may refer to either a logistic unit or a trade item.
Track and Trace	The business process of tracking forward and tracing back a uniquely identifiable "traceable item" at any point along the entire supply chain from creation to the point of sale, use, or destruction. Track and trace requires trading partners to exchange data for defined events and provide the what, when, where, and why about trade items as they move through the supply chain.
Trade Item	Any item (product or service) upon which there is a need to retrieve predefined information and that may be priced, or ordered, or invoiced at any point in any supply chain.
Transactional data	The information exchanged between two organizations about the products and services they are selling, ordering, delivering, receiving, invoicing, and paying for.
Unique Identifier	A numeric or alphanumeric string captured in a machine-readable data carrier and human-readable form on the label of the pharmaceutical package that is associated with a single product or product group.
Verification	The business process of checking at any single point in the supply chain that the unique identifier printed on the item is assigned by the brand owner.
Warehouse management system (WMS)	Consists of software and processes that allow organizations to control and administer warehouse operations from the time goods or materials enter a warehouse until they move out.

WHERE TO LOOK FURTHER

This quick guide provides a summary of information in existing resources to highlight key considerations for countries contemplating the implementation of centralized traceability approaches. For more detailed information, please see these resources:

- WHO Policy Paper on Traceability of Medical Products (2021)
- GS1 Regulatory Roadmap: Traceability of Medicinal Products (2018)
- RxGPS Toolkit: Implementation Roadmap & Model Regulation
- Existing Technologies and "Track and Trace" Models in Use and to be Developed by Member States

ENDNOTES

1. *WHO Policy Paper on Traceability of Medical Products (2021)*. Retrieved from https://www.who.int/publications/i/item/policy-paper-on-traceability-of-medical-products
2. *GS1 Regulatory Roadmap: Traceability of Medicinal Products (2018)*. Retrieved from https://www.gs1.org/docs/healthcare/Public-Policy/GS1_Healthcare-ROAD-MAP_FINAL.pdf
3. *Position Statement: Benefits and Complexity of Common Serialization Models (2017)*. Retrieved from https://www.rxgpsalliance.org/wp-
4. https://www.gep.com/white-paper/thank-you?sourcenid=164&type=whitepapers&source_pageurl=https%3A//www.gep.com/white-papers/track-and-trace-in-the-pharmaceutical-industry-serialization-strategies-and-a-roadmap-for-procurement
5. https://ec.europa.eu/health/sites/default/files/files/committee/76meeting/pharm706_2iv_falsified_implementation.pdf
6. https://page.systechone.com/hubfs/2020-Regulatory-Updates/Systech-Argentina-RegUpdate_01-2020.pdf?hsLang=en
7. https://www.optelgroup.com/en/blog/drug-supply-chain-security-act-dscsa/
8. http://portal.anvisa.gov.br/rastreabilidade/grupos-de-trabalhocontent/uploads/2017/06/RxGPS_Serialization-Models-Position-Statement-010917.pdf
9. *Source: Parmaksiz et al. 2020. What Makes a National Pharmaceutical Track and Trace System Succeed? Lessons From Turkey. Retrieved from https://www.ghspjournal.org/content/8/3/431*
10. Position paper on use of *GS1 DataMatrix in Healthcare (2019)*. https://www.gs1.org/sites/default/files/docs/healthcare/Publications_position-papers/19.GS1Healthcare-2D-Use-Position-Paper-2019.pdf
11. GS1 EPCIS Reference Website: Diagram adapted from: https://www.gs1.org/standards/epcis
12. For additional guidance on application of identifiers (ie GTINs) and data carriers by packaging level, please see the policy guidance documents in the GHSC-PSM Traceability Planning Framework Toolkit (https://www.ghsupplychain.org/globalstandards)
13. *Parmaksiz et al. 2020. What Makes a National Pharmaceutical Track and Trace System Succeed? Lessons From Turkey. Retrieved from https://www.ghspjournal.org/content/8/3/431*