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Good Practices for the Implementation and Management of a National Master Patient Index

The World Health Organisation (WHO) defines eHealth as "the use of information and communication technologies (ICTs) for health." According to the WHO, "eHealth is concerned with improving the flow of information, through electronic means, to support the delivery of health services and the management of health systems."[1]

The South Africa National eHealth strategy (2012) provides a roadmap for the implementation of eHealth in the country. As part of the eHealth foundations section, it states the need for "implementation of a national patient master index for unique patient identification."[2]

The (South African) National Health Normative Standards Framework for Interoperability in eHealth (HNSF) was released in 2014 to provide guidelines around ensuring interoperability between the various systems in the health sector. Among the recommendations in the HNSF is the establishment of a patient registry to manage patients in the health system.

What is a Master Patient Index?

A Master Patient Index (MPI)—also referred to as a patient master index, patient registry, or a client registry—is an electronic database that holds demographic information on every patient who receives healthcare services.[3] The MPI aims to uniquely identify individuals by storing information such as name, date of birth, gender, etc., and assigning each individual a unique identifier.

Benefits of an MPI

An MPI is important in making available to health providers all the information relevant to a particular patient. If a client has received care at several different institutions—each with its own system for registering and managing patients—an MPI allows the different systems to exchange information and link all the records related to one patient. The health provider, therefore, has access to the patient's entire medical and treatment history, making it easier to ensure a continuum of care. The MPI:

- Maintains a central registry of all patients and their demographics, assigning a unique identifier to each patient, which can then be used to link to an enterprise-level electronic health record
- Eliminates duplicate patient registration entries that result due to changes in patient demographics (e.g., patient moved to another location), data entry errors during patient registration, or missing demographic information
- Enables healthcare workers to identify which health facilities a patient has visited to receive care.[4]

When an MPI is not in place, there is the risk that healthcare providers will treat a patient without having all the information they need to make effective diagnoses and provide the patient with the proper care.

How Does an MPI function?

The HNSF states: "Patient registry (or patient master index [PMI]): Maintains demographic information related to any of the patients within the system. One should be able to do searches in the registry based on demographic information (search by name, age, gender, etc.) and recording of patient demographic information (add/update patient demographic data, etc.)."[5] Some recommended core data elements for indexing and searching records include, but are not limited to:[6]

- Unique patient identifier
- Patient name
- Date of birth
- Gender
- Race

[1] National eHealth Strategy Toolkit, World Health Organisation and International Telecommunication Union 2012.
[2] National eHealth Strategy, South Africa 2012/13-2016/17; South Africa National Department of Health; 2012.
[3] http://searchhealthit.techtarget.com/definition/master-patient-index-MPI.
[4] Client Registry Planning and Implementation Guide, OHIE.
[5] National Health Normative Standards Framework for Interoperability in eHealth; South Africa National Department of Health, Council for Scientific and Industrial Research (CSIR); March 2014.
[6] http://healthinformatics.wikispaces.com/Master+Patient+Index.

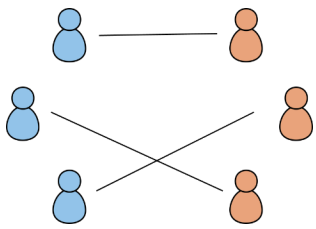
- Ethnicity
- Address
- Alias/previous name
- Biometrics such as fingerprints or face recognition
- National identification number/passport number

Maintaining a nationwide MPI requires processes for data cleaning, removing duplicates, and merging or splitting records where needed. A record that cannot be resolved by the MPI will not be correctly linked to the patient's electronic health record (EHR), which will affect the continuum of care. It is, therefore, important to ensure that health information identifiers are recorded whenever a patient seeks care. These identifiers are used to determine if a patient seen at two different facilities is the same person, even when their name is misspelled or they don't consistently use the same name. Conversely, identifiers can also be used to determine when patients with the same name are actually different people.

There are several key attributes that should be considered for an MPI:

Robust Matching Algorithms

An MPI must automatically match and link identifiers for the same patient from different systems, but do so without incorrectly matching records that are not for the same patient.[7]



An MPI must employ both deterministic and probabilistic methods to match records. A **deterministic** method searches for an exact match between attributes, while a **probabilistic** method searches for an approximate match between two records.[8]

For example, searching deterministically would not find a match between the names Thandi and Thandie, but a probabilistic method would flag them as a possible match.

This combination of matching methods would allow the MPI to link two records where a client used different names (e.g., their English and African names) on different occasions, but other aspects of their information (ID number, age, address, etc.) match up.

Francis Bongani Masike visits a health facility in Johannesburg in February. Two months later, while visiting his sister in Durban, he feels unwell and she takes him to a health facility in her neighbourhood. At the Johannesburg health facility, he registered as Frank Masike. In Durban, his sister registers him as Bongani Masike. At both health facilities, his date of birth and South African ID number are collected. Deterministic searches in the MPI will match his date of birth and South African ID number, while probabilistic searches will flag his names in the two systems as a possible match due to the common surname. The combination of these two methods will confirm that Frank and Bongani are the same person, and their records should be linked in one EHR.

Sound Plus Spelling

Language and localisation are big aspects of uncertainty when implementing an MPI. In contexts where names can be spelled differently depending on origin—or where misspellings are common—a patient's name might be entered differently at every location they visit, or even on different visits to the same location. For example, a person with the name Kathryn might have her name entered as Catherine or Katherine on different visits or at different locations.

In order to deal with these types of language- and culture-related factors, MPI algorithms should therefore also be structured around phonetic spelling and identification of names.[9]

Staff and Training

The quality of the data in an MPI is dependent on the staff that process and register patients at health facilities. Capturing information accurately during registration is the first line of defense, but people sometimes make mistakes.[10] The results of patient identification errors include:

- Duplicates—the patient is assigned a new medical record number
- Overlays—the patient is assigned another patient's medical record number
- Overlaps—more than one record number exists at different health facilities for the same patient.[11]

[7] http://healthcare-executive-insight.advanceweb.com/Features/Articles/Must-Haves-for-Your-Enterprise-Master-Patient-Index.aspx.
[8] http://www.openempi.org/.
[9] http://www.fortherecordmag.com/archives/042312p10.shtml.
[10] http://www.fortherecordmag.com/archives/042312p10.shtml.
[11] http://library.ahima.org/xpedio/groups/public/documents/ahima/bok1_039331.hcsp?dDocName=bok1_039331.

Data entry errors can result in clients being disconnected from any previous medical history that they may have. It is, therefore, important to ensure that staff who conduct patient registrations are competent and receive refresher trainings regularly.

Stringent Monitoring

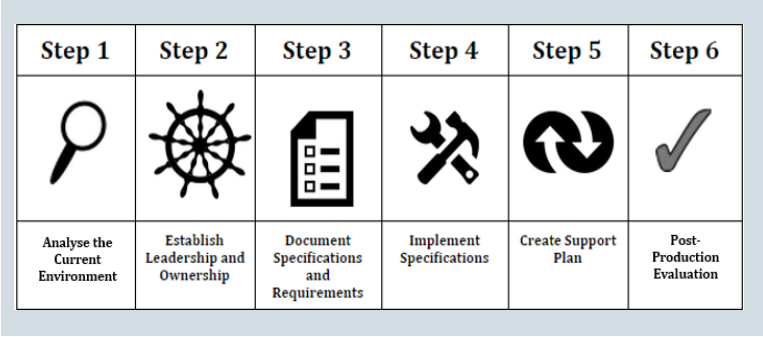
In addition to automated algorithms, consistent and stringent monitoring of the information contained in the MPI is needed to ensure data integrity. Client records are dynamic—patients can move, change their name, adopt or drop a nickname, etc.,—and this can often lead to duplicate entries in the MPI. It is important to remember that while good algorithms are necessary, they cannot replace the need for close human oversight in data governance and stewardship. A team of professionals should be responsible for evaluating the most difficult cases of mistaken identity and potential duplicate records The team will need to continuously monitor matching rules to determine whether the algorithms need to be tweaked.[12]

Implementing an MPI

The Open Health Information Exchange (OpenHIE or OHIE) community is a global community of practice that devotes itself to thinking about questions around implementing large-scale, national-level health information interoperability and sharing. OpenHIE has released the OHIE Client Registry Planning and Implementation Guide, which provides guidance for the end-to-end implementation of an MPI. The guide is based on past experiences and implementations, such as the implementation of a client registry in Rwanda. The guide presents a six-step framework for implementing an MPI, as follows:

Step 1: Analyse the Current Environment
Step 2: Establish Leadership and Ownership
Step 3: Document Specifications and Requirements

[12] http://www.fortherecordmag.com/archives/042312p10.shtml.



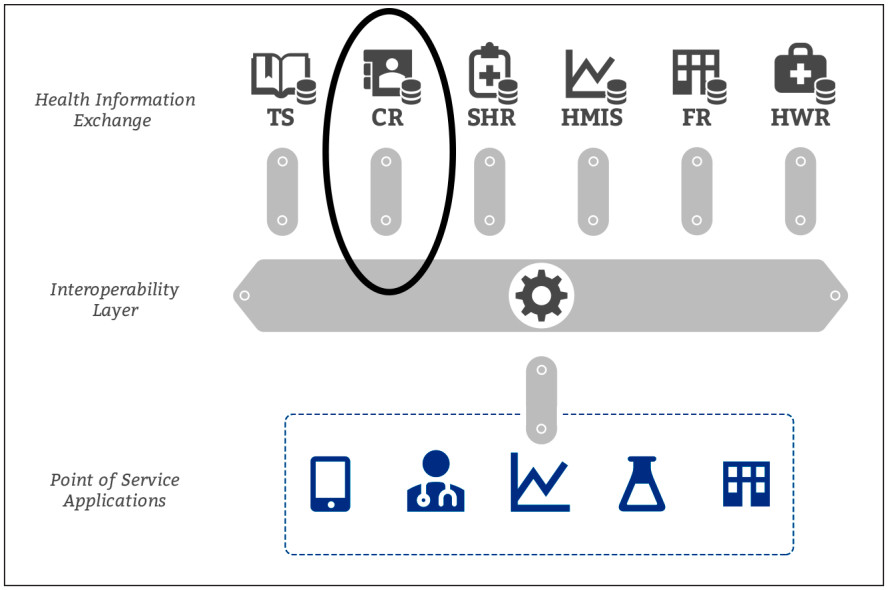
Step 4: Implement Specifications
Step 5: Create Support Plan
Step 6: Post-Production Evaluation

Step 1: Analyse the Current Environment

Analysing the environment is intended to lay the groundwork for MPI implementation by providing information about how a client registry can benefit the country, as well as who are the main stakeholders and systems to engage to make the MPI a reality. The diagram below shows a simplified version of a country's health information enterprise architecture, including the other systems that a client registry (CR) will need to exchange information with. Among these are the Terminology Service (TS), the EHR (called Shared Health Record—SHR—in the diagram), the Health Management Information System (HMIS), the Facility Registry (FR) and the Health Worker Registry (HWR).

As part of this process, it will be necessary to determine whether these other systems have been implemented in South Africa.

This step will also identify applicable standards, identify what existing patient identifiers are in use, identify constraints and challenges, and define what success will look like. The HNSF identifies two *Integrating the Healthcare Enterprise (IHE)* profiles that are relevant to a client registry in the South African context. The **Patient**



Identity Cross-Reference Manager (PIX) profile supports the cross-referencing of patient identifiers from multiple domains (e.g., clinic, laboratory, radiology, etc., systems) by storing all the identifiers associated with a specific patient from different domains in a central location. This allows any of the domains to query the central location for the identifiers associated with that patient in other domains. The **Patient Demographics Query (PDQ)** profile allows applications to search a central database for a patient using their demographic data as search criteria. The central database returns a list of patients meeting that criteria, from which the appropriate patient can be selected.[13] The MPI is the central location in both of these profiles.

Step 2: Establish Leadership and Ownership

This step establishes owners and subject matter experts (SMEs) that will guide the formation of the client registry. Stakeholder leadership is essential for the successful implementation of a MPI—effective leaders and SMEs should be identified and brought together to form a Stakeholder Leadership Group (SLG), which will define the scope, vet and prioritise use cases/user stories, and ensure agreement on data specifications of the client registry.

Step 3: Document Specifications and Requirements

A client registry should be responsive to local context and user needs. It is necessary to document what the MPI will do and how it should do it. This is done through use cases/user stories and data specifications. The creation of a client registry should be country-driven and user requirements-based, in order to ensure that the end solution will meet user needs and the local context.

Step 4: Implement Specifications

In order to implement the specifications created in Step 3 above, resources must be determined and a project plan must be put in place. This step includes selecting the software, determining hardware needs, defining the matching algorithm, and testing.

Step 5: Create Support Plan

A client registry is a living thing, and it can be expected that requirements and requests will evolve with time. Support strategies should be developed and should remain in place to triage requests for data, system enhancements, integrations, operations support, or general troubleshooting. The support team should include resources for operational support, software developer support, help desk support, and capacity building and training, among others.

In determining the level of support required, it is necessary to model the size and load of the database together with the effectiveness of the algorithms. A smaller database and/or highly effective algorithms would require a smaller support team than a large database or matching algorithms that need continuous verification. These conditions could potentially be modelled using a pilot project at a limited number of sites. The resource requirements to maintain confidentiality, integrity, and availability of the MPI will need to be reviewed on a regular basis.

Step 6: Post-Production Evaluation

Because the MPI is a living solution, it is important to capture lessons learned by documenting aspects of the project that went well along with aspects that could be done differently the next time. This will form the foundation for the iterative implementation process—new interfaces, user stories, or workflows may need to be added, and once the system is running and stabilised, the iterative development process can begin.

Conclusion

The MPI is the heart of effective patient management within the health information system. The MPI changes as patients are born, move facilities, or pass away. As such, it is constantly changing and requires continuous support to ensure that it remains accurate. The dynamic nature of the MPI is perhaps its biggest challenge. Implementation is not a one-time event, but an ongoing process—and this should be planned for and resourced accordingly.

[13] National Health Normative Standards Framework for Interoperability in eHealth; South Africa National Department of Health, Council for Scientific and Industrial Research (CSIR); March 2014.

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www.measureevaluation.org

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