Moving from **Paper-Based Systems** to **Electronic Systems** in **South Africa**

In 2005, the World Health Assembly recognized e-Health as the way to achieve cost-effective and secure use of information and communications technologies (ICTs) for health and related fields, and urged its member states to consider drawing up long-term strategic plans for developing and implementing eHealth services and infrastructure in their health sectors.

The South African government published its National eHealth Strategy for 2012 to 2016 in September 2012.

The South African National eHealth Strategy aims to "provide a clear roadmap that guides the health system from a largely paper-based system with some electronic data collection to an integrated, interoperable, national patient-based information system that improves the efficiency of clinical care, produces the indicators required by management, and facilitates patient mobility."[1]

To identify the current state of eHealth in South Africa, the eHealth strategy referenced the landscape analysis of health information systems (HIS) in developing countries, funded by the Bill & Melinda Gates Foundation. This landscape analysis identified five stages of eHealth implementation based upon data flow and collection, data utilization and integration, resources and capacity, scope, and scale. The report placed South Africa at Stage 3, but the South African National eHealth Strategy noted that some provinces are at Stage 2, others at Stage 4, while some may have various regions or districts at Stages 1, 2, and 3.

As a foundational step for a national eHealth system, the South African National Department of Health commissioned work to develop standards for eHealth with a specific focus on interoperability. The resulting report (called the *Health Normative Standards Framework for Interoperability in eHealth in South Africa,* or HNSF for short) determined that the vast majority of clinics, community health clinics (CHCs), and rural hospitals, in the majority of provinces, currently operate under a paper-based information system.

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[1] NDoH. 2012. "National eHealth Strategy, South Africa 2012/13-2016/17."

Stages of eHealth Implementation

Stage 1 – paper-based systems for collecting district health indicators,

Stage 2 – optimization of paper systems through simplifying indicators and reducing duplication,

Stage 3 – migration of traditional district health information systems to electronic storage and reporting,

Stage 4 – introduction of operational ICT systems as a source of data for HIS,

Stage 5 – a fully comprehensive and integrated national HIS.

Standards Applicable in South Africa

Identification standards
including ISO 22220:2011 Identification of subjects of healthcare

Messaging standards
including HL7 V2.X Health Level Seven Version 2.X (X is 7 at this stage)

Coding and terminology standards
including ICD-10 (MIOS) International Classification

Content and structure standards

Electronic health record standards
ISO/TR20514:2005 ISO 18308:2011

Health specific security standards

General IT standards

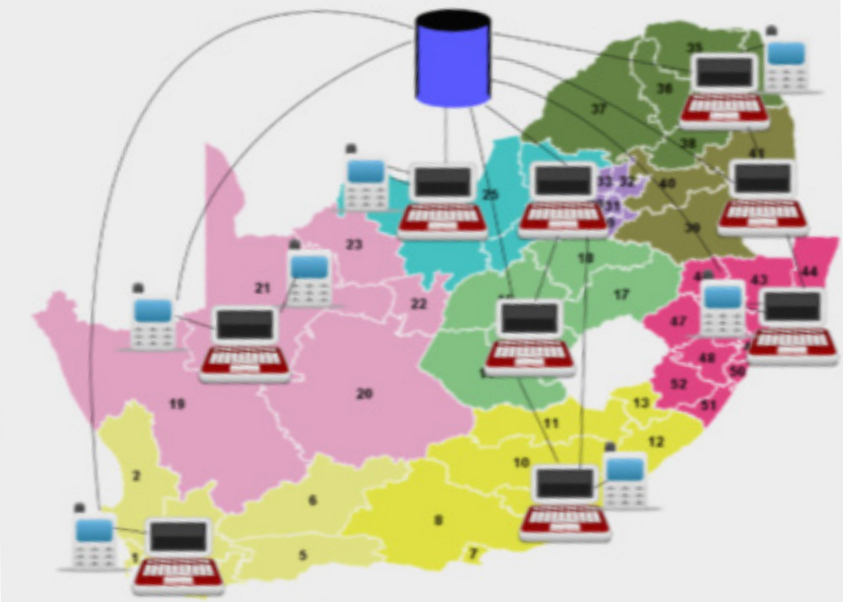
Other standards could apply, depending on the decisions taken for the implementation of eHealth in South Africa, for example health cards, biometrics, barcode, and infrastructure-specific standards.

It further noted that:

"In order to enable such a health information system to prepare for integration into an eHealth system based on a national shared electronic health record (EHR), the first step is to align the paper-based records to those required and stored in the EHR.

This would, as a first step, be done by:

- **Using standardized forms for all medical records** requests/results for pathology (laboratory) tests, request/results for radiology examinations, prescriptions, referrals, etc., according to the norms prescribed in the HNSF for data structure and content standards, and clinical terminology and classification standards.
- **Aligning patient identifiers** with the relevant national population index or patient-master index (PMI)."[2]



The South African eHealth Standards

The HNSF in South Africa advised that the IHE (Integrating the Healthcare Enterprise) profiles, and their underlying standards, be used as a starting point for the HNSF.

The framework noted that there will need to be some "localization of standards to ensure they support healthcare service delivery in the context of the South African burden of disease and provide all data necessary for the derivation of the National Indicator Data Set (NIDS)."[2]

However, many of the common specific data items are clearly defined by the standards given. These include the structure of the patient ID, and name and address.

[2] CSIR & NDoH. (2013). Health Normative Standards Framework for Interoperability in eHealth in South Africa.

The Means to Identify a Patient

At the time of writing, only the South African ID has been approved for use as the patient identifier. However, it is important to understand that the standards consider a **patient identifier list** and not just a single number or code: it is a list of identifiers.

Depending on what the department of health chooses in the future, this means that a person may have a number of identifiers and all of them will refer to the same individual. For example, Mpho Lastname may have a South Africa ID, a facility-issued identifier, a mobile health application issued identifier, and a Provincial Health Identifier on their list.

These identifiers would be linked on the list so that Mpho Lastname can be recognized by any of these identifiers and the other identifiers returned when requested. According to HL7 (Health Level 7 – the standard that is underlying the patient identifier list) the information for each identifier in the list must be in the following format:

- **Identifier Type Code**: National ID, passport etc...
- **Assigning Authority**: Country, facility etc...
- **ID Number**

To allow for maximum interoperability, there should be a number of identification types. This will allow all people eligible to receive care to be registered.

Patient Name

To adhere to the standards, the patient name must be held in the HL7 XPN (eXtended Person Name) format. This means that patient name should be split up as follows:

- **Prefix**: Mr., Mrs., Dr. etc…
- **Given Name or First Name**
- **Middle Initial or Name**
- **Family Name or Last Name**
- **Suffix**: Jnr, Snr, etc…
- **Degree**: MBA, etc…

Various other standard data fields are also defined for the patient address and contact details. Dates should be in YYYY-MM-DD format.

Aligning paper-based forms and electronic systems

There have been a number of studies comparing the use of paper-based systems to electronic systems. In a study on the concordance of information in parallel electronic and paper-based patient records (Mikkelsen, 2001) it was found that parallel use of electronic and paper-based patient records resulted in inconsistencies between the record systems. It was concluded that "*when implementing electronic record systems intended to operate in parallel with paper-based systems,* **the focus should be on securing the validity of all versions of the record**."[3]

These findings were supported by a study comparing paper-based with electronic patient records published in the *Journal of American Medical Informatics* (Jürgen Stausberg 2003).

The authors also concluded that health professionals should be aware of this situation and combine the information from both records whenever possible. However, the authors also noted that "it may be too expensive to strive for a total concordance between paper and electronic data sets, which often are used for dramatically different purposes in medical practice."[4]

Examples of a Patient ID

To adhere with the standards, any ID should have an Identifier Type (e.g., national ID or passport), an assigning authority (e.g., a country, a province or a facility) and an ID number

An example of the South African ID in this format is:

NI, ZAF, 1234567890123

An example of a Mozambique Passport in this format is:

PPN, MOZ, 123456789

An example of a facility issued ID in this format may be:

FI, <Facility Code>, JF12345

A person may have more than one identifier. For example a person with a South African ID, passport and facility identifier registered may have a list as follows:

- **NI, ZAF, 1234567890123**
- **PPT, ZAF, 678128912**
- **FI, 123456, MPHO123**

[3] Mikkelsen G, Aasly J. Concordance of information in parallel electronic and paper-based patient record. Int J Med Inform. 2001; 63:123–31.
[4] Jürgen Stausberg, Priv-Doz Dr med, Dietrich Koch, Josef Ingenerf, Dr Rer Nat, and Michael Betzler, Prof Dr Med. 2003. "Comparing Paper-based with Electronic Patient Records: Lessons Learned during a Study on Diagnosis and Procedure Codes." Journal of the American Medical Informatics Association, Sept-Oct: 470-477.

There are two major reasons behind the differences between the paper-based and electronic record-based systems:

1) The data fields are not the same in paper and electronic versions.
2) The data has not been transcribed correctly.

There are a number of methods available to improve the accuracy of data entry. **Paper-based and electronic-based form design** with good practices applied is important. **Where possible, the electronic and paper forms should match in terms of the sequence of fields and the way the fields are visually displayed**.

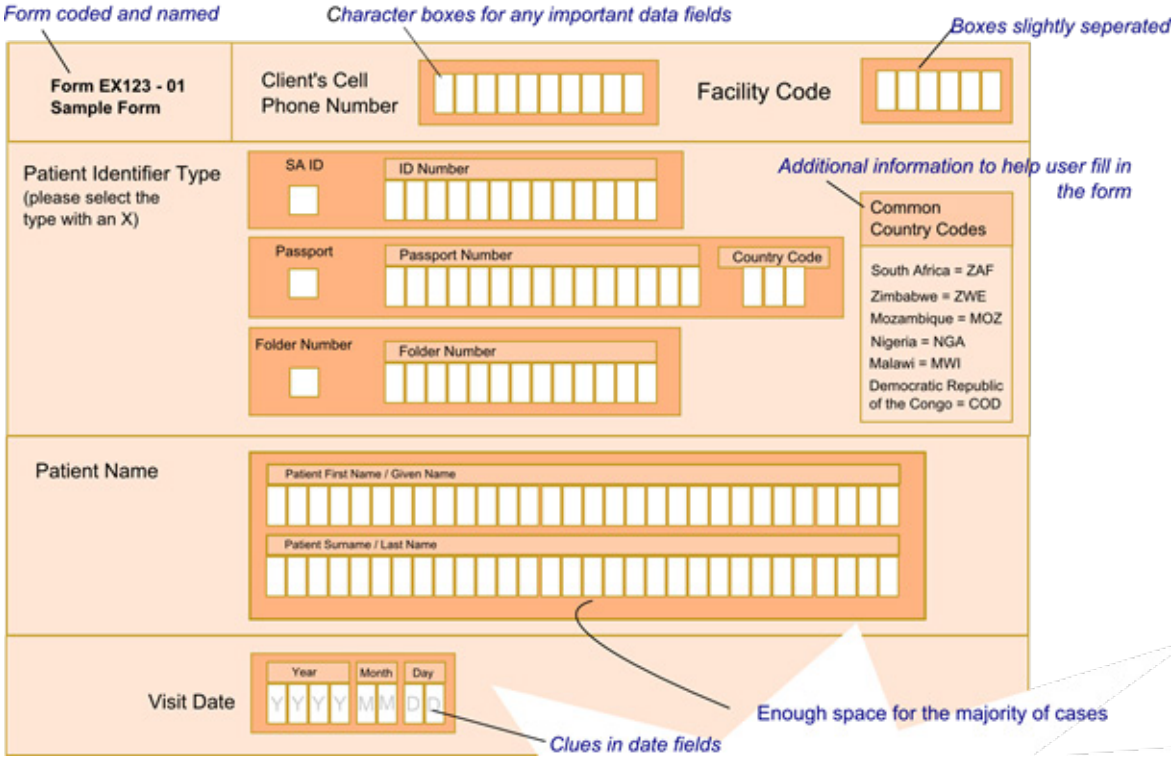
Common mistakes in the design of forms include trying to fit too much in too small a space, not allowing enough space for the field, having an illogical or unclear flow to the questions, and not providing enough information that will allow people to enter the correct response as often as possible.

Double entry is a technique which can reduce errors in transcription. In double entry, two people independently enter the data and a computer-based checking algorithm is used to identify when there are differences. This method is resource-intensive but has been shown to be better than read aloud or visual checking methods.

Validation techniques and correct use of user interface types can be effective in reducing data entry errors. For example, verifying that a South African ID is 13 digits long will highlight a number of potential issues and a date picker on an electronic form will ensure that a date does not get entered in the wrong format.

Adaptive feedback is also a method to reduce data errors. Adaptive feedback is essentially a method of validation that learns from past mistakes or provides guidance based upon previous answers. An example of adaptive feedback is providing a data entry person with suggestions based on previously entered names that closely match the name entered.

An example form with some good practices applied



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