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The Case for a Unique Digital Patient ID Scheme in Nigeria

Emeka Chukwu*

Namek Solutions, Area 11, Abuja, Nigeria

Abstract

Uniquely identifying patients in the health system has eluded the Nigerian health sector players. Digital health tools are being deployed to address different challenges in the Nigerian health system with little showing any sign of scale. Despite global interest in digital identity system and its potential to improve health outcome, little progress has been registered in Nigeria. Nigeria has a convoluted patient identity system at the time of writing with patient identity local to health facility and sometimes department. Functional Identification systems like civic registration of birth, election, and financial services, to mobile telephony identity schemes are variously in place in Nigeria. These functional identity systems were reviewed for size of enrolees, data quality, and possibility of use as health functional identity system. Health sector stakeholders have two options to address the identity crisis. Either to adopt one of the existing functional identity systems or a combination of them or to setup a Master Patient Index (MPI) based client registry for the health system. This work having reviewed the factors necessary to adopt a functional identity system, recommends deployment of State based client registries as a way of addressing this challenge. The recommended framework of action is to develop a policy and strategy to guide implementation, implement as appropriate at different levels and then monitor while improving as appropriate. A good functional identity system will take into consideration necessary behaviour changes, staff workload, State autonomy, political interest, patient privacy, technology and return on investment concerns including total cost of ownership even for open source technology solutions.

Keywords: Master Patient Index (MPI); Digital identity; Patient identifier; ID; mHealth; Client registry; eHealth

Introduction

Health system in Nigeria is weak and faces many daunting challenges. Poor health indices persist despite huge investment in the last decade. Routine health [1,2] facility generated data often cannot be relied on for planning or for critical decision-making. Health facilities are increasingly employing digital health tools with limited scalability. This holds true irrespective of any definition of the word 'scale'. Duplicate patient records have dogged the health system in general and digital tools in particular. Scalability of these tools has been hampered by lack of unique patient identity system [3]. Evidence show that the society's most vulnerable remain the ones most without any form of Identifiers. They are [4] often financially excluded, and do not have access to essential social benefits including health. Sustainable planning and deployment of other social services like housing, electricity, Internet, and water all requires citizen demographic information. There have been several cross-sector attempts to address this identity crisis in Nigeria and globally. This growing need was aptly highlighted in Sustainable Development Goal (SDG) target 16.9: "By 2030, provide legal identity for all, including birth registration" [5]. In addition, properly implemented and managed patient identification schemes can significantly influence attainment of under listed SDG targets amongst others.

1. Social Protection for the most vulnerable (SDG 1.3).
2. Access to economic resource including finance (SDG 1.4).
3. Assistance dealing with Shock and Social disaster (SDG 1.5).
4. Reduce Global MMR (SDG 3.1).
5. Ending preventable deaths of new-borns and under 5 (SDG 3.2).
6. Ending epidemics of AIDs, Malaria, neglected tropical diseases and combating hepatitis, water-borne and other communicable diseases (SDG 3.3).
7. Empower women (SDG 5a and SDG 5b).

These SDG targets affect directly or indirectly the health status of citizens. Digital identifiers have great potential in big data analytics, disease surveillance and other intelligent systems. Proper patient identification ensures efficient care administration, and movement of patient information within and between healthcare organizations. Healthcare delivery involves many stakeholders with varying responsibilities. At the health facility level, wrong identification has been linked to discharge of infants to wrong parents, testing errors, medication inaccuracies, wrong person procedures, and transfusion mistakes [6]. Without correctly identifying care beneficiaries, accountability will remain elusive. At organizational level, Health insurance claims and care administration continue to be prone to both errors and manipulation. A functional patient identification system helps to ensure significant cost savings through waste reduction and duplicate treatments reduction. There are no accurate information on the cost and frequency of mismatch errors in health care delivery in Nigeria. What is clear is that a huge proportion of medical mistakes still occur in medical practice and most of are linked to this patient identity crisis. The UK government performed an audit on identity of patient and care administration in select hospitals, and found that 34% of patients did not have their identifiers on them [7]. The research found that even where identifiers exist, provider hand-overs and related communication challenges introduce chances of patient misidentification. This readily points to the scale this can assume in low and middle-income countries most of which have not even deployed patient identifier strategy.

Current Status

Functional Identification systems in Nigeria vary from civic registration of birth, election, financial services, to mobile telephony identity schemes. At the same time, countries have various schemes for patient specific identifiers depending on their level of advancement.

***Corresponding author:** Emeka Chukwu, M.Sc., Namek Solutions, Garki, Area 11, Abuja, Nigeria, E-mail: emekac@nameksolutions.com

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This spotlight on Nigeria attempts to show the scale of patient identity crisis facing Nigeria and by extension other developing countries, and outline a framework to address this crisis.

Patient identifier

In Nigeria, Identification systems for patients at most health facility (primary, secondary or tertiary) are local to the health facilities. The case is the same irrespective of their ownership-private or public. Patient information are currently scattered across multiple departments, and facilities and each health institution uses their individual identifiers that cannot be used beyond the facility or sometimes department. The numbering nomenclature often times cannot be understood beyond the generating health facility. Consider a hypothetical case of a pregnant woman 'Uduak' that registers at a Primary Health Center (PHC) near her. A patient number is generated for her at her first visit, if she gets tested at the clinic's laboratory, a new identification may be created depending on the health facility. In a case that Uduak requires specialist care and needs to be referred, she may get a new registration at the referral center. If she decides to change health facility for any reason, either because she wants to deliver close to hear relatives or simply needed medical care while traveling, she will get a new registration. And all these happen even when she remembers or has her registration information from previous health facilities. This scenario gets further complicated for some health facilities as numbering scheme change at the beginning of every year.

Other identifier schemes

This analysis reviewed the National Civil Registration and Vital Signs (CRVS), National Identity Number (NIN), the Bank Verification Number (BVN), the Voter Identification Number (VIN), Mobile Station International Subscriber Number (MSISDN) Number, the International Passport Number and the Driver's License (DL) number, National Health Insurance Scheme (NHIS) Number, and Healthcare Facility Patient number (often called Card Number). They were analysed with focus on the relevant background information including administering body, the structure, and function and citizen coverage where possible. Table 1 tabulates the different identity schemes reviewed and their functions.

The perceived qualities of information captured in the respective organization database were then categorized into three: Low, Medium and High Qualities. Identity schemes classified with low quality are those with no clear evidence of a scalable database and there are reported cases of integrity issues. Systems with clearly defined and functional databases, but have cases of integrity including duplicate data is classified as medium quality. High quality systems are classified as such if they have clear and functional databases and have little or no instances of integrity including duplication and identity thefts.

The top three identification databases by size, quality, and health-function were analysed. Their usability as a functional identifier system for the health sector was assessed. As indicated in Figure 1, the MSISDN registration by the telecommunications operators is the largest with over 100million-registered subscribers. This is closely followed by the Voter's VIN and then the Bank's BVN with 68 million and 27 million respectively. Of this three, only the BVN has not been fraught with data integrity issues. On the other hand, NIN and the International passport number have also not had issues of data integrity of late. Though they both still have challenges enrolling a critical mass of the population. The international passport currently captures the privileged and still boasts of less than 3% of Nigerian citizens. In addition, the international passport number changes with each issue of a passport and thus not dependable for public health surveillance and related functions. The NIN multipurpose card's functionality has not been activated or adequately socialized for citizens. Only six [5,6] ID schemes were found to have direct or indirect health related functionality; NIN, the NHIS number, the Health facility numbers, MSISDN number, and the Certificate of Birth Number (COB). The COB number issued as part of birth certificate does not seem to have significance beyond its presence on the COB. The COB appears to have multiple issuing authorities, particularly at different times of government.

The BVN appeared in all three criteria for a scalable system of citizen identification as described in Figure 1. It is among the top three in quality, health functional application and large enrolment base. However, BVN is not legally empowered to serve as the defacto identifier system in Nigeria. The BVN also has the disadvantage that it currently does not captures citizens that are 18 years and below. In addition, BVN enrolment only happens at financial institutions thus excluding the financially disadvantaged. And business interests influence these institutions' distribution and thus little social consideration is given to their branch establishment. The NIN has high quality data in its database, but still struggle with citizen coverage. NIN has the same challenge of currently enrolling persons from age 16 years only. The NIN card has functions for health care, financial transactions and a host of others.

S. No.	Identifier Initials	No. of Digits	Organization Responsible	Citizen coverage (Million)	Perceived Quality of information	Wait time to collect	Eligibility Age (Years)	Relative Distance	Cost
1	COB No.	8	NPC	~=3	Low	~<60 days	At birth	LGA	Free
2	NIN	11	NIMC	~=10	High	Years	16+	State capital	Free
3	BVN	11	CBN	=25	High	1 week	18+	LGA (Business driven)	Free
4	VIN	19	INEC	=68	Mid	1 week	18+	LGA	Free
5	MSISDN	11	Telecoms providers	~=100	Mid	1 day	Any age	Ward (business driven)	Free
6	NHIS No.	8	NHIS	~=10	Low	1 month	Any age	LGA	Free
7	Card No.	Variable	Health facility	Unknown	Low	1 day	Any age	-	≤$5
8	Passport No.	8	NIS	~=10	High	1 week	Any age	State capital	~<$100
9	Driver License	12	FRSC	~=5	Low	1 day	18+	State capital	~<$50

COB No.: Certificate of Birth Number; NIN: National Identity Number; BVN: Bank Verification; Number; VIN: Voter Identification Number; SIM No.: Subscriber Identifier Number; NHIS No.: National Health Insurance Scheme Number; Card No.: Patient Card Number; NPC: National Population Commission; NIMC: National Identity Management Commission; CBN: Central Bank of Nigeria; INEC: Independent National Electoral Commission; NIS: Nigeria Immigration Service; FRSC: Federal Road Safety Commission; LGA: Local Government Area; N/B: The 'perceived quality of data' collected and the information on 'wait time to collect' are based on users experience

Table 1: Nigeria's plethora of identification systems.

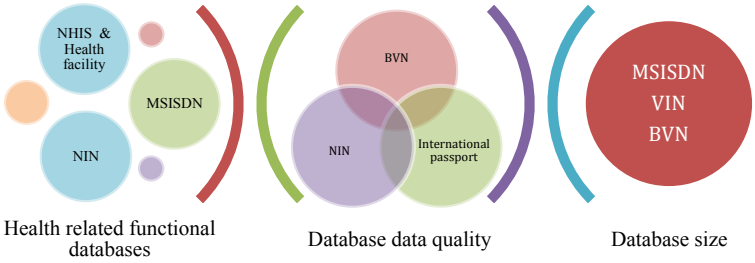

Figure 1: The three characteristics of a scalable database for citizen identification.

To deploy and use NIN as a functional identifier at the health facilities require huge investment. The same argument goes for MSISDN, while it has the highest citizen enrolment, due to the simple registration process, and multiple registering telecommunications operators, it does not meet the criteria of unchanging and uncontroversial. Clients often own multiple MSISDN numbers and sometimes change their numbers at will.

Available Options

To effectively and efficiently deliver quality healthcare to her citizen, Nigeria's healthcare administrators need to agree and standardize either a means of uniquely identifying patients across the health system. Two options can be identified based on Timothy and Dixon:

1. Adopting a unique code or set of codes designed to uniquely identify a patient in a health system.
2. Developing a system with a combination of demographic or related attributes used to describe a patient uniquely. Adopting a unique identification code will mean adopting one of the different identification systems or defining a new health identity scheme that will face the same challenges other functional ID systems currently face. Such a system need to have the following attributes: Unique, Unchanging, Inexpensive, Uncontroversial, Ubiquitous, and Uncomplicated [7-9]. No functional identity system under consideration currently has all these attributes.

Not having a single identifier that meets these criteria is not exclusive to Nigeria's health system8. The option left is to consider an aggregate of people demographic attributes like First Name, Last Name, Sex, MSISDN, Date of Birth and Main Phone No. etc. This will mean agreeing on a standardized Master Patient Index (MPI) to support Client Registry deployments in the health system. The MPI supported client registry will provide a single source of truth for all other Patient Indexes (PI) deployed across different health enterprises in the health system. This second option will require the use of a matching algorithm to identify an individual patient uniquely or to a certain degree of certainty. Factors that may hinder ability to uniquely identify the patient are quality of data concerns, privacy concerns, how to deal with conflict when they arise, and what should consensus on algorithm matching be.

Recommended Strategy

That Nigeria needs to fix her patient identification crisis is general knowledge, what is surprising is that policy makers are not acting to address this crisis. This work recommends deployment of client registries to host and manage the Master Patient Index (MPI). This may require an inter-agency multi-stakeholder committee working collaboratively for this goal. The World Bank digital identity toolkit developed for Africa will prove a valuable resource [10].

Master Patient Index (MPI)

A foundation base identifier is required as an enrolment driver for the MPI. In general, enrolment drivers have to be incentivized. In the Nigerian case, MSISDN number is recommended as the base identifier that should be incentivized for use as a foundation identifier. One major characteristic that militates against the MSISDN number now is that patients still have more than one phone number. A service based incentive that allows for discounted service or other form of incentive tied to an MSISDN can help patients maintain one MSISDN for service purpose. An example will be an incentive scheme that counts service uptake and match with other algorithm to generate an incentive like reduced cost of medication. Health facility number (or Patient Index) can be generated as part of the patient's MPI using mobile phone Unstructured Supplementary Service Data (USSD) or Short Message Service (SMS) as entry interface. Two sets of numbers are expected-Patient Index (PI) and MPI. The PI is provided at health facility for filing and indexing, while the MPI helps in identification of the patient within the system using the set of attributes. When patients move across health facilities, the PI may change, but the MPI remain the same. For cases where there is no network to generate the MPI, the patient's PI will be used until the new MPI is generated. These categories of patient folders are filed separately at the health facility records unit until their MPI are generated. The MPIs centrally hosted within a state's client registry system can be generated from the client's mobile number with the help of the health worker.

Other mandatory attribute the patient need at the point of registration will include but not limited to Sex, First Name, Last Name, and Health Facility No. Similarly, optional attributes will include DOB, NIN, BVN, and Marital status. Considering the autonomous status of the 36 states in the country, identifiers should be managed within a state. What this means is that a patient can only be uniquely identified within a state's client registry. This does not preclude that the standards for matching will need to be developed at the National level or by the first state to deploy a client identification algorithm. This will also set the stage for an integrated and uniform health sector identification that addresses the numerous challenges.

The metadata for sex, name and DOB are straightforward. But that for, Health Facility No will need to use the facility registry numbering scheme and made available to health providers for use at point of care. This will ensure that health providers know their health facility numbers. The PI generated and provided the health providers for indexing purpose will be serial within the health facility, but used only locally. This number is different from the patients MPI generated and stored in the client registry database system. The patient MPI does not change through the life of the patient and is unique to the patient. The MPI is a combination of multiple PIs and other attributes across the health system. Ability to properly match a patient using

registered attribute will depend on the balance between data quality and the matching algorithm. Irrespective of the algorithm, matching efficiency will improve if records base indicators match. Stakeholders have to decide if to adopt deterministic matching algorithm across the individual health enterprise (in this case states) or adopt probabilistic matching.

Client Registry

Framework of action: This framework proposes three main courses of action–designing a patient identity policy framework, implement the framework, and monitor and then integrate last-mile as appropriate. This framework of action serves as a recommendation for how to develop an algorithm for patient identification and matching for the health system.

Reducing and if possible eliminating mistakes matching patients with their care is one of the key ways to improve patient safety [7]. The MPI addresses the need for a single source of truth for patient identity information at least at state level. To solve the identity crisis in the health sector nationally, a combination of interventions should be prioritized. This is in the backdrop of funding challenge facing Nigeria and most low-income economies. To avoid the dangers of miss-identification and fast-track deployment of MPI, Nigeria needs to define a policy that enforces unique person identification for health service delivery. When designing this policy, the responsibility of patient identification should be unmistakably placed on the health care provider prior to care administration [6].

Once a policy framework is in place to guide deployment of the MPI, relevant structures should follow. Wristbands have been used in some countries to support implementation of similar policy [7]. Some countries have adopted wristbands with their defined unique identity numbers (in this case MPI) and names for patient identification. Others use colour coding supported identification on these identity bands. Though wristbands should be deployed with caution as when not standardized, significant challenges arise especially as providers across multiple hospitals can easily misread coding. Care must be taken to ensure two information required for identification are present on the band. Some countries use name and date of birth, but any two combination agreed to by stakeholders will be appropriate, but not the patient room number [6].

The core of client registry is a matching algorithm that accommodates differences between data sources (e.g. PIs). Such an algorithm will prepare and clean the data if necessary, automatically detect errors and deviations; separate likely matches from unlikely matches and flag record pairs as same individual. Most client registry systems are highly specific to certain demography or population and cannot simply be replicated. Specific contexts require careful planning and investment to execute and monitor. World Health Organization in her policy brief "Patient Identification" suggested clear protocol for patient identification among member states. Amongst others, the protocol should incorporate into training and continuing professional development procedure for checking patient identity. The policy brief also recommended patient education and involvement in identity capture and use at the health facility level. Barcode based identification system, Biometrics, Radio frequency Identifies and near frequency identifiers are emerging technologies that can be adopted with care. Poor penetration of technology infrastructure will pose the biggest challenge to adoption of these innovative identification management schemes at health facilities (Figure 2).

One thing is clear, proper patient identification require careful planning, particularly at country level. African countries have worked to improve health systems through numerous initiatives. Poor attention to the challenge of patient identification must be reconsidered to adequately strengthen the health systems in Africa and most of developing countries. Decision makers need to prioritize investment in foundational components of the health system to ensure fully functional, cost effective, effective and efficient health system.

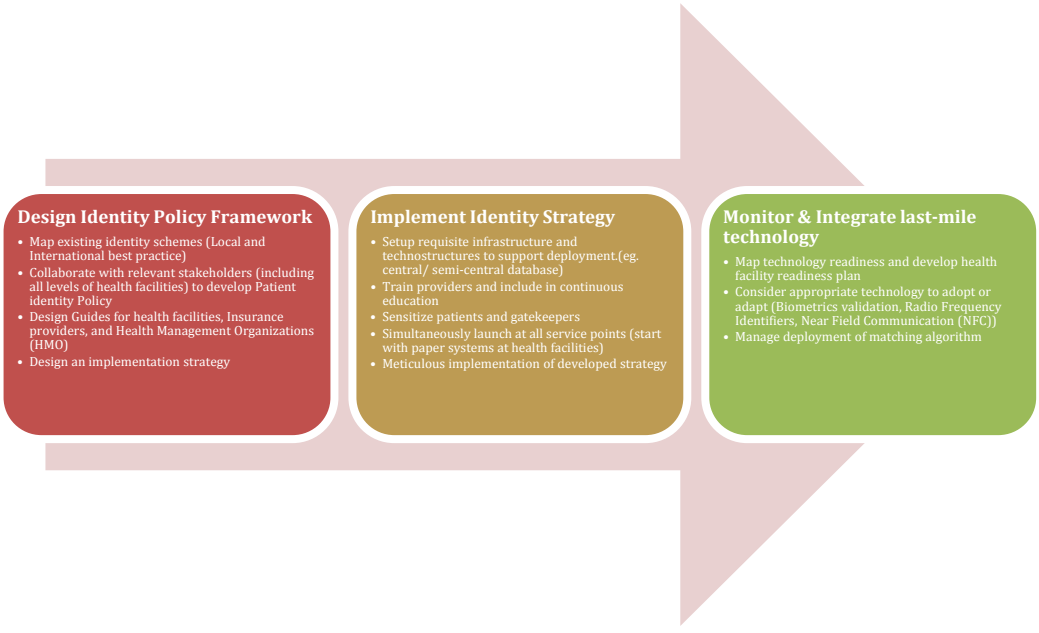

Figure 2: Proposed harmonized digital identifier framework of action.

General Consideration

Stakeholders globally have had to deal with other granular barriers while implementing 'challenge proof' patient identification system for their citizens [11].

- Behaviour change-Consensus among the many health sector stakeholders is required for successful implementation.
- Staff: There is a slight chance that the workloads of health workers will increase with the responsibility to properly validate patients.
- Regional/State autonomy: Historical process of identification varies by geographic region. Most countries have regional and state autonomy in governance system. Nigeria is one of those countries with strong State government autonomy. This autonomy extends to the health sector, and autonomous health system structure does not encourage standardization. In the Nigerian context patient identification and algorithm matching system will work best at state level.
- Political interests: Past initiatives at a national identity schemes has been largely frustrated by politicians from certain regions who see this as a means to check bloated electoral numbers and hence will frustrate any form of standardized identification. On the other hand, corporate establishments are aware and leveraging the benefits of identification for their businesses. The national health sector policy makers should provide leadership and develop guidelines for patient matching algorithm for states as appropriate.
- Technology investment: Depending on matching algorithm chosen, the level of base technology infrastructure may be lacking and may require huge technology investments.
- Software Errors: Software errors have been shown to be fatal in health care delivery and needs to be avoided in implementing identity-matching algorithms.
- Entry Errors: Implementation must factor in data entry errors, which can come in form of phonetic misrepresentation, typographical inaccuracies, and morphological confusion [8].
- Patient fraud: Deployments should provide for and address issues of patients using health cards belonging to others to access service, or manipulating algorithm matching demographic information.
- ROI Evidence: There is limited evidence to support Return on Investment (ROI). And this can and has posed significant barrier to marketing this investment in client registry to decision makers.
- Patient privacy: Patient information is at the risk of compromise if appropriate measures are not in place to secure them. Security of access mode from internal users and even external hackers should be prioritized using existing health privacy laws [12].
- Loss of documents: Protocol for dealing with cases of loss of identity document has to be developed as part of any algorithm developed.
- Poor literacy: In Nigeria, majority of the rural poor can neither read nor write. As such, a mechanism to ensure they are included in deciding on such an algorithm is important.
- Vendor lock in-technology deployments in support of patient identification supported by governments must consider total cost of technology ownership even if the system is an open source solution.
- Stateless persons: There is risk of creating stateless persons if the regulation for identification matching becomes tightened. Guidelines for managing persons like this need to be factored.

Conclusion

Unified Identifiers have been shown to increase impact and reach of health and other social services. This advantage notwithstanding, Nigeria and most developing countries still struggle with uniquely identifying patients. To yield the desired health sector goals and benefits, patients seeking care at health facility level needs to be uniquely identified. While there are two options to choose from in defining a unique patient identifier, this work has recommended patient matching algorithm to generate a unique master patient index that uniquely identify a patient within a health system at sub-regional (state) level. The MPI is the foundation for a state client registry that will ensure a patient is uniquely identified within a state. This then becomes the basis for a national integrated client registry.

Data quality, integrity, coverage, cost of enrolment and validation should be considered in developing a client registry. Evidence has shown cases of reduced errors after implementation of structured patient ID schemes. The Framework for impact through unified identity scheme in the health sector will then be to design an identity policy and strategy, implement the strategy and monitor and improve on the progress. All facets of the health system stand to benefit from a properly implemented client registry. Digital health tools will inch closer to scalability when states deploy MPI based client registries.

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