

USE OF UNIQUE HEALTH IDENTIFIERS IN UNIVERSAL HEALTH COVERAGE PROGRAMS FOR HEALTH INSURANCE SCHEMES

DISCUSSION PAPER

August 2019

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Samuel Mills



WORLD BANK GROUP
Health, Nutrition & Population

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Health, Nutrition and Population (HNP) Discussion Paper

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Health, Nutrition and Population (HNP) Discussion Paper

Use of Unique Health Identifiers in Universal Health Coverage Programs for Health Insurance Schemes

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Paper part of a series that the World Bank Health, Nutrition and Population Global Practice has commissioned.

Abstract: The World Bank Group (WBG) Data Council endorsed the 2016–2030 Civil Registration and Vital Statistics (CRVS) Action Plan in December 2015. The CRVS plan aims to achieve universal civil registration (CR) of births, deaths, and other vital events for all individuals by 2030. The WBG has been working closely with development partners to provide the requisite support to countries through three interlinked initiatives: the Strategic Action Program for Addressing Development Data Gaps, Identification for Development, and the Global Financing Facility.

The WBG recently commissioned country case studies on Colombia, Gabon, Slovenia the Republic of Korea, and Thailand on how the use of a unique identification number (UIN) has facilitated universal health coverage (UHC). The Identification for Development (ID4D) initiative recently published [Integrating Unique Identification Numbers In Civil Registration](#), which provides guidance on options for linking a birth registration number in the civil registration system with the UIN in the national civil identification system. However, there is limited guidance on assigning Unique Health Identifiers (UHIs) in health programs toward the achievement of UHC.

This guidance note provides options for assigning UHIs for health programs that are linked to a national (central) system for issuing UINs for a more secure and trusted verification of identities and for health programs in countries without a national unique identification system. Part II describes the importance of UHIs. Part III presents selected country examples of the use of UHIs. Some key governance and technical issues based on country examples are summarized in Part IV. Part V offers recommendations, including an offline option for assigning UHIs for remote areas without Internet connectivity.

Keywords: Unique health identifiers, unique identification numbers, health insurance schemes, universal health coverage

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LIST OF ACRONYMS

AIRA	American Immunization Registry Association
ASTM	American Society for Testing and Materials
BR	Birth Registration
BSN	Netherlands UIN (<i>Burger Servicnummer</i>)
CDC	Centers for Disease Control and Prevention
CHI	Canada Health Infoway
CR	Civil registration
CRVS	Civil registration and vital statistics
EHR	Electronic Health Record
GP	General Practitioner
HIT	Health Information Technology
HNP	Health, Nutrition, and Population
ID	Identification
ID4D	Identification for Development
IHI	Individual Healthcare Identifier
IIS	Immunization Information Systems
ISO	International Organization for Standards
IT	Information Technology
MOH	Ministry of Health
MPI	Master Patient Index
NHI	National Health Index
NHIA	National Health Insurance Administration
NHIS	National Health Information Strategy
NHS	National Health Services
NIST	National Institute of Standards and Technology
NNPR	Norwegian National Population Register
PID	Personal Identification Number
PDS	Personal Demographic Service
PPS	Personal Public Service
RA	Registration Authority
RR	Resident Registration
SHI	Statutory Health Insurance
SSN	Social Security Number
UHC	Universal health coverage
UHI	Unique Health Identifier
UK	United Kingdom
UIN	Unique Identification Number
US	United States
WBG	World Bank Group
ZZZS	Health Insurance Institute of Slovenia (<i>Zavod za Zdravstveno Zavarovanje Slovenije</i>)

ACKNOWLEDGMENTS

This guidance note was prepared by Sanjay Dharwadker, WCC Smart Search & Match, Utrecht, Netherlands, with inputs from Samuel Mills, World Bank, Washington D.C. The authors are grateful to the World Bank for publishing this report as an HNP Discussion Paper.

PART I – INTRODUCTION

The World Bank Group (WBG) Data Council endorsed the 2016–2030 Civil Registration and Vital Statistics (CRVS) Action Plan in December 2015. The CRVS plan aims to achieve universal civil registration (CR) of births, deaths, and other vital events—including reporting the cause of death and providing access to legal proof of registration—for all individuals by 2030. The WBG has been working closely with development partners to provide the requisite support to countries through three interlinked initiatives: the Strategic Action Program for Addressing Development Data Gaps; Identification for Development; and the Global Financing Facility.

The WBG’s Health, Nutrition, and Population (HNP) Global Practice contributes to the WBG goals of ending extreme poverty within a generation and boosting shared prosperity by helping countries improve HNP outcomes and reduce impoverishment due to illness. Enabling countries to achieve universal health coverage (UHC) is a primary way to attain this goal, by ensuring that all people have access to the quality, essential HNP services they need without enduring financial hardship. Countries cannot implement effective and efficient UHC programs without knowing how to accurately identify everyone in a population, including the poor and other marginalized populations to target them with essential and quality health services. The WBG recently commissioned country case studies on Colombia, Gabon, Slovenia, the Republic of Korea, and Thailand on how the use of a unique identification number (UIN) has facilitated UHC.

The Identification for Development (ID4D) initiative recently published [Integrating Unique Identification Numbers In Civil Registration](#),¹ which provides guidance on options for linking a birth registration (BR) number in the civil registration system with the UIN in the national civil identification system. However, there is limited guidance on assigning Unique Health Identifiers (UHI) in health programs toward the achievement of UHC.

This guidance note provides options for assigning UHI for health programs that are linked to a national (central) system for issuing UINs for a more secure and trusted verification of identities and for health programs in countries without a national unique identification system. Part II describes the importance of UHIs. Part III presents selected country examples of the use of UHI. Some key governance and technical issues based on country examples are summarized in Part IV. Part V presents recommendations, including an offline option for assigning UHIs for remote areas without Internet connectivity.

PART II – THE IMPORTANCE OF UNIQUE HEALTH IDENTIFIERS

Many national healthcare systems have recognized the importance of UHI in improving the effectiveness and efficiency of health programs. For example, the National Health Information Strategy (NHIS) 2004 and subsequently the NHIS 2016 of the United Kingdom (UK)¹, which has proposed unique identification within the health sector, claims that UHI offers both economic and administrative benefits and ensures patient safety in the provision and management of high quality healthcare.

The lack of UHI for individuals is an important deficiency in the health information infrastructure in most countries. A method for unique identification, as well as a governance framework to support unique identification, is required to address this deficiency and significantly improve patient safety.

To be effective and maximize the potential benefits of UHI, the approach adopted must be able to bridge the primary, secondary and tertiary care domains, including the public, private and voluntary sectors, and must be able to support the shared care of clients/patients irrespective of the locations of service.

Recent public debate in the UK has addressed this through the consultation processes of the Health Information Bill.² The challenge is to select an identifier scheme that achieves an appropriate balance in terms of practicality, cost and privacy. Since the UK does not have a designated national identification (ID) number, this will be an important step.

Another relevant example is the *Recommendations for a Unique Health Identifier for Individuals in Ireland* in March 2009.³ The report found that the introduction of UHI would deliver tangible benefits in the areas of: patient safety, quality of care, efficiency, confidentiality, epidemiological and cost effectiveness. The report also found that a new system using UHI would be cost effective, represent international best practice, and would be more secure than using the Enhanced Personal Public Service (PPS) Number as the UHI for the country.

The UK report concluded that it is essential that an appropriate infrastructure and governance structure are in place prior to implementation of the new UHI.

Many countries have implemented UHI using varying approaches. The diverse experiences in implementing UHI provide policy makers with a rich source of information to better support successful planning and implementation of UHI.

In **Slovenia** the benefits of UHI include:

- Preventive care. For example, UHI in a healthcare database is used to identify those due for colorectal cancer (colonoscopy) screening
- An ability to perform detailed analysis of electronic health data for the monitoring and provision of health services
- The detection and prevention of fraud. Examples of fraud that UHI help to deter include the use of false documents for insurance registration; prescriptions of medications to persons without medical indications or larger than expected doses;

¹ <https://digital.nhs.uk/data-and-information/nhs-digital-data-and-information-strategy>

abnormal combination of drugs; and suspicious billing (for example, repeated billing for similar services in a short period, services not appropriate for age or sex, services that are illogical in relation to the age or sex of the person, etc.)

In **Korea** the benefits include:

- Use of UHI for enrollment and management of disease prevention and health promotion programs, such as the integration and management of vaccination records. This allows unvaccinated children to be easily identified and prevents double vaccination. UHI recipients can also check and manage their own vaccination history
- Use of UHI is used in Korea to enable the selection of undernourished children for meal aid programs.
- Service providers use UHI for enrollment and treatment of patients, enrollment and management of infectious and chronic diseases, and enrollment and management of the poor for the Medical Care Assistance program
- Patients can use UHI to access the medical record sharing portal
- Standardization of electronic health records (EHR) to facilitate referral and sharing of information across hospitals (as required by the 2017 Enforcement Decree of the Medical Act)
- Enhanced electronic claims reimbursement processing

In **Thailand** the benefits include:

- Healthcare providers and insurers use encrypted UHI to identify and enroll individuals for healthcare service provision, track delivery of health services, enhance claims reimbursement, detect claims duplication, and enable electronic healthcare services data exchange between payers and providers and among providers for continuity of care

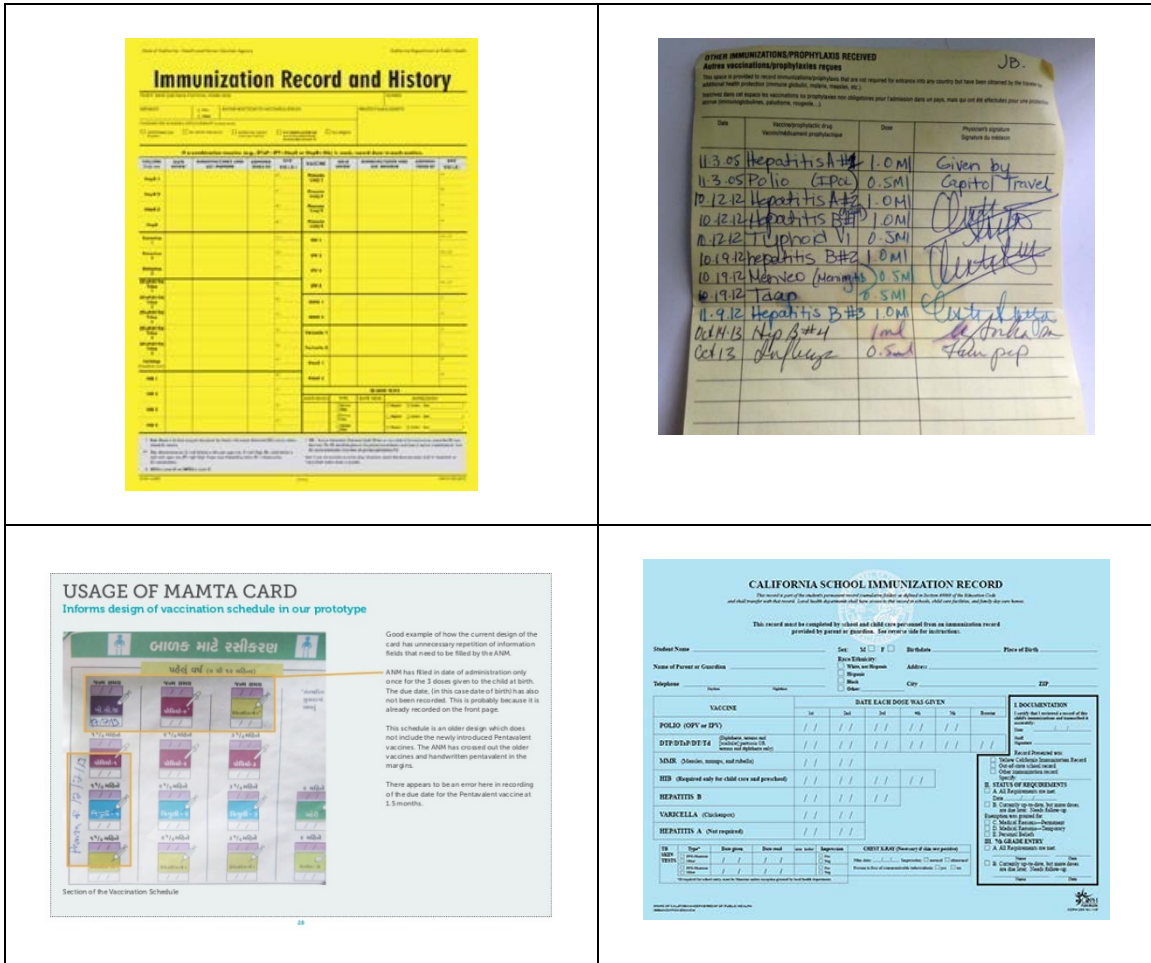
UHI may enhance the use of basic immunization cards. Many countries issue basic manually updated immunization cards. Below are some examples of immunization or vaccination cards that are manually filled out.

The obvious weakness of such a system is that if the card is lost or not updated, the content and continuity are lost. However, it is possible to marginally strengthen such a system of manual cards by systematically assigning a UHI to each child at the time of immunization that can be later used for healthcare activities throughout the life of the individual.

The need for UHI is even more acute in low- and middle-income countries. For example, a report from Nigeria⁴ states that uniquely identifying patients has eluded Nigerian health sector stakeholders. The system maintains a convoluted patient identity system, with patient identity localized to a specific health facility and sometimes to a government department. Functional identification systems for civil registration of birth, participation in elections, financial services, and mobile telephony are unevenly implemented in Nigeria. As stated in the referred report, these functional identity systems were reviewed for size of enrollees, data quality, and possibility of use as a health functional identity system.

Options for Nigerian health sector stakeholders include adopting one of the existing functional identity systems or a combination of them or establishing a Master Patient Index (MPI)-based client registry for the health system.

Figure 1: Examples of Immunization Cards



A recommended framework of action is to develop a policy and strategy to guide implementation at different levels of the healthcare system and monitor progress. A good functional identity system will take into consideration necessary behavioral changes, staff workload, national autonomy, political interests, patient privacy, technology, and return on investment concerns, including the total cost of ownership for open source technology solutions.

PART III – COUNTRY EXAMPLES OF UNIQUE HEALTH IDENTIFIERS (UHI)

Worldwide, national health records typically incorporate unique identifiers using one of the following four methods:

1. Countries have UIN and UHI that are the same as the UIN
2. Countries have UIN and health-specific UHI that are or are not linked to the UIN
3. Countries do not have UIN but have developed universal UHI
4. Countries do not have universal UHI and use ad-hoc and local identification numbers

A few country examples are presented to describe this range of methods.

COUNTRY TYPES AND CASES

Table 1: Countries that have UIN and UHI that are the same as the UIN

Type	Country	Observations
1*	India	Portal-based digital systems have been proposed, with UHI linked to UIN (Aadhaar – India’s national identification system). Currently, the systems are localized to insurance companies or health providers. National and state government employees have a UHI that is not linked to UIN.
1	Israel	National UHI are the same as UIN.
1*	Japan	The National Health Network is being implemented but not yet fully interoperable. A UIN system is also currently being implemented (primarily for social security and tax systems). A separate UHI will be assigned to each individual and only linked in the back-end to the UIN to meet privacy requirements.
1	Korea	A universal UHI is based on the national UIN (Resident Registration [RR]) (currently being implemented).
1	Netherlands	No centralized system is in place and regional systems are not fully interoperable. However, UIN (Burger Servicnummer [BSN]) are currently used as UHI.
1	Norway	A national strategy is in place and universal UHI have been allotted to each person, not linked to UIN. However, the local systems are not fully standardized and interoperable.
1	Slovenia	A chipcard-based system is shared by patients, insurance companies, health service providers and health professions. UHI exist but are not linked to UIN. Chipcard addresses data privacy.
1	Thailand	Each UHI is the same as the UIN Personal Identification Number (PID) that is issued at birth.

1**	United States (US)	Systems are local to each health service provider. The Social Security Number (SSN) is a form of UIN and is widely used, however not mandatory.
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* Countries currently implementing the strategy of common UIN and UHI.

** In the US, the SSN is most commonly used both as a UIN and a UHI.

Table 2: Countries that have a UIN and a health-specific UHI that is or is not linked to the UIN

Type	Country	Observations
2	China	Implemented by service providers. No UHI, but local patient identifiers are linked to the Insurance ID and / or Citizen ID.
2	Denmark	Digital health records with UHI, linked. Systems are regional but adhere to national standards. Privacy ensured through encryption.
2	France	Chipcard-based “SESAM-Vitale” system is shared by patients, insurance companies, health service providers and health professionals. UHI exist but are not linked to UIN. Chipcard addresses data privacy.
2	New Zealand	Identification systems are currently local to individual health service providers. A national standard is being evolved that will make such systems harmonized and interoperable.
2	Singapore	National health information system implementation is in progress.
2	Sweden	Systems are decentralized and administered by city councils. However, the quality of data is good.
2	Taiwan	Chipcard-based system shared by patients, insurance companies, health service providers and health professions. UHI exist but are not linked to UIN. Chipcard addresses data privacy.

Table 3: Countries that do not have UIN but have developed universal UHI

Type	Country	Observations
3	Australia	National Digital eHealth records have been used since 2016 and are Interoperable.
3	Germany	Chipcard-based system is shared by patients, insurance companies, health service providers and health professions. UHI exist but are not linked to UIN. Chipcard addresses data privacy.

3	UK	The National Health Services (NHS) assigns a UHI to each person (there are no UIN in the UK). A fully digitalized health information system is being implemented.
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Table 4: Countries that do not have universal UHI and use ad-hoc and local identification numbers

Type	Country	Observations
4	Canada	Regionally administered with a federal information system. System is not yet fully interoperable or widely used.
4	Italy	A new national health information system is in place, but UHI have not been implemented.
4	Switzerland	Systems are local. An optional national health system is also in place.

The above cases demonstrate the diversity of national practices for assigning a UHI. However, greater standardization and interoperability on a national scale, while at the same time ensuring data privacy, are important for the process of assigning a UHI. UHIs in select countries are discussed below in more detail.

UHI – AUSTRALIA

Each Individual Healthcare Identifier (IHI), which is the UHI in Australia, consists of a unique, content-free 16-digit identifier. It is in the process of being assigned to all Australian residents and others accessing healthcare in Australia. Each number applies to only one person and is used in health information records alongside the person’s name and date of birth. There are three components to the number:

- Digits 1 to 5: correspond to the issuer and will be the same for all IHIs issued. This number is 80036 and is assigned by ISO to describe the number used for health and issued in Australia.
- Digit 6: denotes whether the number identifies an individual, a healthcare practitioner or a healthcare organization.
- Digit 7 to 15: identify the individual and correspond to ISO standard ISO-7811-3.
- Digit 16: verifies the IHI’s validity

The IHI format complies with International Standards Organization (ISO) standards ISO-7812, ISO-7811-3 requirements and the Australian standard for healthcare identification, AS-5017, 2006(33;36).

The method of validating the IHI number uses the check digit at the end of the number. This digit electronically verifies that the number is a valid IHI and is computed using the Luhn formula modulus 10 in accordance with ISO standard ISO-7812(36). Validating the UHI in this way does not verify the identity of the individual possessing the number.

UHI – GERMANY

The format of the unique identifier is a 10-digit alphanumeric sequence, which is referred to as the health insurance number, or *Krankenversichertennummer*.

Case identifiers and family member identifiers are optionally attached to the *Krankenversichertennummer* to identify specific episodes of care. However, the initial 10-digit *Krankenversichertennummer* does not change and is assigned for the lifetime of the insured. This number is based on the German social security number equivalent and generated by running a one-way algorithm.

This is further suffixed by a 9-digit health insurance company identifier, the *Kassennummer*. A check-digit is added in the twentieth position, which is used to validate the entire 20-digit UHI.

Notes on the German UHI

The German health system is decentralized and based on statutory social insurance provided by over 1,100 insuring organizations. The Ministry of Health and Social Security has the responsibility to provide the legislative framework in which the insurance companies are obliged to operate.

The Modernization of Public Health Insurance Act, 2003 (*Gesetz zur Modernisierung der Gesetzlichen Krankenversicherung, 2003*) provides for the introduction of an electronic health card (*elektronische Gesundheitskarte (eGK)*) which came into effect on January 1, 2006.

The eGK replaces the previous health insurance card (*Krankenversichertenkarte*). The modernization bill requires the creation of a UHI, the *Krankenversichertennummer*. The format of this number is used by all public health insurance companies to ensure that it does not change should the individual change insurance providers.

The implementation of a unique identifier is part of Germany's strategy to modernize its health services. Germany's e-health strategy aims to ensure more citizen-oriented services, support patient-centered care, improve quality and services, reduce costs, and provide better data for health systems management

UHI – REPUBLIC OF KOREA

In Korea, the RR number assigned at the time of BR provides access to benefits through the national health insurance throughout a person's life. Korean citizens are sent letters about free health examinations and receive a variety of services tailored to each life stage. The information that individuals report on their family relationships, such as births, deaths, marriages, and divorces, is used to investigate population dynamics and is important to understanding social developments. For example, these data provide information about social structure and family trends. The data are used to establish social and economic plans and policies on population, housing, healthcare, social welfare, education, and traffic.

The RR number is structured (i.e., it is not randomly generated) and includes date of birth, age, sex, area where the RR card was first issued, order of registration, and forgery status (during 2012). The current RR numbers use the 13-digit numbering system established in an amendment to the resident registration law (2001)². This law established the requirement that citizens aged 17 years and older must have a number. The first six digits of the RR number consist of the date of birth, and the last seven digits combine a sex identifier with the place of issuance of the RR number.

The first digit of the second part of the RR number represents an individual's gender and period of birth. Men who were born in the 1800s are assigned "9," and women who were born in the 1800s are assigned "0." Men born in the 1900s are assigned "1," and women born in the 1900s are assigned "2." Males born in the 2000s are assigned "3," and females born in the 2000s are assigned "4." The second through fifth digits indicate the individual's RR application location and the first issuer of the RR number, which identifies the first issuance location. The sixth digit is the individual's sequential registration position among people with the same surname in the same application location on the same registration date. The last number is an error correction number that checks the correctness of the RR number, which makes it possible to identify counterfeit or otherwise incorrect numbers. The RR number is highly sophisticated and reveals a significant amount of personal information that, if disclosed, might seriously threaten an individual's privacy; consequently, great care should be taken with it. The use of the RR number has been strictly controlled after large-scale hacking during 2012 and 2013.

UHI - NEW ZEALAND

Each National Health Index (NHI) number, which is the UHI, is seven alphanumeric digits in length and is content-free. The number appears in the format 'ABC 1234,' with the alpha digits always displayed in uppercase letters to aid accurate transposition of the number and facilitate fewer data entry errors. The number is generated randomly and is content-free, and therefore contains no information about the individual it identifies.

The NHI number satisfies the most important of the fundamental criteria for UHI as defined by the American Society for Testing and Materials (ASTM) standards for EHRs⁵, in that it is atomic, unambiguous, can be made public and is supported by a secure network⁶.

The seventh digit of the NHI number acts as a check digit to verify that the number is a valid NHI number. This digit validates the number using a modulus 11 calculation similar to the validation method used for the NHS number in England and Wales. This method of validation does not verify the identity of an individual; rather, it verifies the validity of the number itself and is therefore only useful for electronic transactions on systems equipped with the algorithm to run the modulus 11 calculations.

Since the benefits of using a unique identifier have become apparent over time and following a comprehensive independent review commissioned by the Ministry of Health

² <https://web.archive.org/web/20120217141209/http://www.glin.gov/view.action?glinID=74209>

(MOH)³, the NHI system was upgraded and has been rolled out to primary care. Comprehensive use of the NHI number is intended to enable:

- Accurate identification: Different people with the same or similar names will have different NHI numbers, ensuring that the information pertaining to one does not get confused with that pertaining to the other.
- Linking of health information: Data held about the same individual in many different databases can be brought together for the purposes of obtaining maximum information regarding a particular patient, as well as analysis and research.
- Consistency over time: When people change their names for any reason, the NHI number remains the same, thus ensuring longitudinal consistency with respect to information held about that person.

UHI – NORWAY

The identification of persons (and persons as patients) in Norwegian healthcare is based on a hierarchy of registries that assign and manage identifiers. The hierarchy consists of three levels:

The national person registry: The Folkeregisteret assigns F numbers to Norwegian citizens and D numbers to identify temporary residents. F and D numbers are assigned in general and are not related to healthcare.

The national patient registry: Norsk Helsenett assigns FH numbers to individuals who are to be provided healthcare. A link is provided to F and D numbers if these are known. However, FH numbers are also provided to individuals who have no F and D numbers such as overseas visitors and newborn babies.

The regional patient registry: The health regions may also assign H numbers to identify persons who are to be provided healthcare and for whom an FH number cannot be accessed. This facility is usually temporary in nature and an H number is assigned when, for example, the National Patient Registry is unavailable or can't be reached. An H number can also be assigned during emergencies where large numbers of identifiers need to be assigned within a short timeframe.

UHI – SLOVENIA

In the Republic of Slovenia, individuals have three different identification numbers: the PID, tax number and the health insurance number.

Slovenia was among the first countries to introduce a health insurance card (HI card), which is a chip card. The health insurance card system was designed in 1996 and fully introduced at the national level in 2000. The HI card does not carry a picture. The card

³ <https://www.health.govt.nz/system/files/documents/pages/nz-health-system-independent-capability-capacity-review-oct15.pdf>

was well received by all users of the system: insured patients, health service providers and all four insurance companies. Its use has become routine and it is fully incorporated into the Slovenian health system. The use of the card is twofold: it is used as a unique identification document, and to verify the patient's insurance status and check his/her medical data. The data can also be updated by the card holder autonomously through self-service terminals installed throughout the national territory.

Despite frequent updates and functional expansion, the card requires ongoing long-term review to meet modern technological and other (i.e., legal) demands, and to facilitate further development. In 2006, the Health Insurance Institute for Slovenia conceptualized a health insurance card based on smart card technology that could be constantly updated.

The health insurance ID card is based upon a national electronic registry for health insurance purposes, which is managed by the Health Insurance Institute of Slovenia, the ZZZS (*Zavod za Zdravstveno Zavarovanje Slovenije*).

Apart from the health insurance card, Slovenian citizens also have a personal ID card. The idea of merging the two cards has been reviewed, but the government considers this a high-risk option with respect to data protection and the elaborate requirements of different controllers. The proposal has been set aside until further notice.

UHI – THAILAND

At the registration of a birth, which needs to be completed within 15 days after birth, the Ministry of Interior (MOI) issues all Thai citizens a 13-digit PID. The first digit of the PID refers to nationality; the second to fifth digits refer to province and district codes of permanent address; the sixth to twelfth digits include the BR number; and thirteenth digit is a verification code or check digit.

Thailand uses the PID, which is the UIN as a universal identifier for both health as well as non-health services.

UHI - UNITED KINGDOM

The NHS Number consists of 10 digits: the first nine digits constitute the identifier and the tenth is a check digit that ensures its validity. The display format of the NHS Number in NHS systems usually takes the 3-3-4 format, because this format aids accurate reading and reduces the risk of transposing digits when information is taken from a screen.

The American Society for Testing and Materials identified 30 criteria that a robust UHI system should satisfy. The NHS Number passes most of the ASTM criteria. The NHS Number is generated randomly, is content free, and therefore contains nothing which could be used to identify a patient or any personal information. The NHS Number is atomic, unambiguous, can be made public, and is supported by a secure network.

The tenth and last digit of the NHS Number is a check digit used to confirm its validity electronically. The check-digit is validated using the mandatory modulus 11 algorithm. There are five steps in the validation of the check digit. This validation method does not verify the identity of an individual; it simply assures that the number is a valid NHS Number.

HEALTH LEVEL SEVEN (HL7)-BASED IMMUNIZATION RECORD SYSTEM – UNITED STATES

The HL7-based immunization record has become a widespread phenomenon. Approximately 86 percent of babies born every year are immunized. Some countries have very elaborate computerized systems for maintaining immunization records, while others have very basic systems, such as a manually updated immunization card.

The US implements one of the more elaborate computerized systems. The Immunization Information Systems (IIS) are centralized, population-based repositories of immunization-related information. They receive and share data on individual clients/patients with other systems, including EHR systems.

HL7 is a nationally recognized standard for electronic data exchange between systems housing health care data. The HL7 standard supports this two-way exchange of information because it defines a syntax or grammar for formulating the messages that carry this information. It further describes a standard vocabulary that is used in these messages. It does not depend on specific software and is therefore platform independent.

The HL7 standards for immunization records represent the collaborative effort of the American Immunization Registry Association (AIRA) and the Centers for Disease Control and Prevention (CDC) to improve inter-system communication of immunization records. The effort has received input from the National Institute of Standards and Technology (NIST) to improve the capacity to test conformance with the corresponding Implementation Guide.

Among other things, the Implementation Guide facilitates the exchange of immunization records between different systems and thus includes:

- sending and receiving immunization histories for individuals
- requesting immunization histories for individuals
- requesting an evaluated history and forecast for individuals
- responding to requests for immunization histories by returning immunization histories
- responding to requests for evaluated history and forecast
- acknowledging receipt of immunization histories and requests for immunization histories
- reporting errors in the messaging process
- sending observations about an immunization event (this may include patient eligibility for a funding program, reactions, forecasts and evaluations)

However, HL7 is a generic system and leaves the definition of the UHI to the end user. As no policy exists, service providers have either provided their own identifiers or resorted to using the SSN. The use of the SSN as a health identifier has been debated widely in the US.

Current developments include the unprecedented funding to support the effective implementation of health information technology (HIT) and health information exchange (HIE). Further, the American Recovery and Reinvestment Act of 2009 has given new urgency to the need for a national health identifier. Because no unique personal identifier has been established, many providers are increasingly using the SSN as a unique identifier. However, guidance is also being provided on limiting the use of the SSN in patient identification practices and suggests other unique identifier options.

The Health Insurance Portability and Accountability Act of 1996 attempted to streamline patient identification by requiring organizations to create a UHI for every patient. However, in 1998, political and privacy concerns caused the US Congress to include a section in the Omnibus Appropriations Act that prohibits the Department of Health and Human Services from using federal funds to implement the UHI requirement "until legislation is enacted specifically approving the standard."

It has been observed that in the ensuing two decades, technology has advanced dramatically, and many of the privacy concerns surrounding the UHI now can be addressed with technology and sound business practices underpinned by federal and state regulation.

USEFUL PRACTICES

Some of the useful practices to emerge from the above country examples include:

- Countries that have UHI in place can reap the benefits of cost-saving, data sharing and convenience. Therefore, countries that do not have a strategy and policy for a nationally consistent system of UHI should consider introducing one.
- UHI can be generated using structured and random number schemes. Structured number schemes have the advantage of being able to be generated at a local level but provide identifying characteristics such as age, location and sex, which reveal private information.⁷ Random number schemes are preferred since they do not provide identifying information but can only be generated centrally and distributed to local offices or service providers in areas without regular online connectivity.
- If a country already has a UIN system in place, and if UIN are assigned at birth, the UHI could be made equivalent to each UIN, or linked to it. This will strengthen the case for universal inclusion within a country. If an individual UHI is initially used for the immunization record, it will provide a great foundation for a lifelong health record. A careful study should be made to ensure that this is administratively possible, and opinions should be sought from various stakeholders.
- There could be conflicting demands placed on health records: the need for rapid access in case of emergencies, and the need to adhere to a high level of individual privacy and data protection. Careful consideration should be

given to this in the architectural design and implementation of such systems.

Further country details are provided in Appendix A.

PART IV – KEY GOVERNANCE AND TECHNICAL ISSUES BASED ON COUNTRY EXAMPLES

Based on the country examples noted above, some governance and technical issues to consider when establishing UHI are described below.

HEALTH IDENTIFIER GOVERNANCE

An example of governance issues can be drawn from the UK, where the use of the NHS Number and access to the Personal Demographics Service (PDS) are governed by the National Information Governance Board for Health and Social Care, which was established as a statutory body in the Health and Social Care Act 2008.

All access to and sharing of personal health information in the UK is governed by the Data Protection Act UK and specifically by the NHS Code of Practice for Healthcare Professionals 2006. All NHS staff who are authorized to access the Spine, the portal to England's information technology (IT) infrastructure for health and social care that connects over 23,000 different healthcare IT systems across 20,000 health organizations, can access the PDS service at the appropriate security level, which is assigned locally. NHS Connecting for Health put in place the NHS Number Program to help NHS commissioned providers, working toward the goal of achieving complete adoption of the NHS Number as a UHI in the UK, as mandated in the NHS Operating Framework 2008/9.

The NHS Number was developed with individual security and privacy in mind. Information cannot be ascertained about an individual through the number alone, and it is unlikely that staff will associate a number with an individual in the same way that they would a name. There is no mechanism for a member of the public to access information about an individual from an NHS Number. All NHS staff have a duty to treat information as confidential, and security procedures are in place to ensure that access to patient information is limited by passwords, smartcards and role-based access controls. To gain access to the PDS, NHS staff must individually and organizationally sign up and agree to use the PDS in accordance with the NHS standards of security and confidentiality.

The information governance controls protecting patient information include the following:

- There are Registration Authorities (RA) within each trust or healthcare organization. These authorities register all healthcare professionals who are allowed access to NHS Care Records Service systems that can directly or indirectly access the Spine.
- Each trust has a guardian of patient confidentiality known as a Caldicott Guardian, who helps ensure legitimate use of the PDS and all Spine-related systems.
- A trust may act as an RA on behalf of general practice staff. The RAs ensure that the healthcare workers are who they claim to be by requiring them to present various forms of identification.

- Once registered, staff are issued with a smart card, which validates their identity, without which staff are unable to access the PDS.
- Individual organizations are responsible for allocating role-based access levels to staff. Role-based access controls, linked to the identity of each authorized healthcare professional, control precisely what they can see and do when logged onto the system.
- Search controls constrain how healthcare professionals can look up details of individual patients.
- Sensitive record controls prevent staff from accessing PDS information when records are flagged as sensitive.
- There are specific PDS audit logs and these are available to authorized users via a national portal, the Enhanced Reporting Service. In addition, local systems will audit their own events, which are directly available to appropriately authorized local users.

Patients cannot request that their data cannot be stored on the PDS, as it is necessary for some information to be held about everyone who is a patient of the NHS. However, individuals can opt for their NHS Number not to be attached to certain clinical records that may be of a sensitive nature, for example in relation to sexual health.

Contact details must be held to satisfy legal requirements for maintenance of general practitioner (GP) registers, to ensure that each individual presenting for care is an English resident and therefore eligible for free care, which helps to ensure that the right information is associated with the right individual and allows healthcare providers to contact individuals when necessary. There are cases where access to a patient's demographics record must be limited, for example, for an adoption. These records are managed by the National Back Office, part of the NHS Connecting for Health, to ensure privacy of these sensitive records.

The NHS Number Implementation Guide lists the allowed uses of the NHS Number. The allowed uses were defined by alignment to the benefits that can be gained from each use. For example, the number can be used as the identifier on electronic referrals and prescriptions and to support correct and accurate identification of individuals and their medical records, thereby reducing duplication of records and clinical risk. The NHS Number can also be used to enable multi-agency involvement within health and social care, streamlining the patient experience and underpinning the strategic aim of a patient-centered NHS.

IDENTITY DOMAIN

Norway provides another useful case to further explore the technical nature of the UHI.

An Identity Domain is defined as a set of software applications that share the same person/patient identifier and use them under a common policy. Each and every Identity Domain contains at least one Identity Source (an application that assigns new Identities).

Examples of a PID are:

All healthcare applications in Norway are part of the Norwegian PID, as they all have the ability to use F and D and FH numbers, assigned by a central registry application. The Norwegian National Population Register (NNPR) also known as the Folkeregister acts as the Identity Source for F and D Numbers.

The health system used in Bergen, for example, shares the Patient Identities it assigns with all other software applications used in Helse Vest (Western Norway regional health authority). All software applications used in Helse Vest are part of one and the same regional PID.

Note that the health system and all other software applications used in Helse Vest are part of both the regional PID and the Norwegian PID.

The Laboratory application in Stavanger assigns its own patient identifiers to all patients. This identifier is internal to the laboratory application only. It is never shared with any other application. This application forms its own PID. Note that the Laboratory application is part of its own PID, the Regional PID as well as the Norwegian PID.

The Folkeregister, which is part of the Norwegian PID, has no knowledge of any identifiers assigned regionally in Bergen, because the Folkeregister isn't part of the regional PID.

A software application in a regional PID shall not send any of its locally assigned identifiers to any applications outside of the regional PID (e.g. software applications in other regions or the Folkeregister).

TYPES OF IDENTIFIERS

In Norway, most patients treated are registered in the Norwegian Person Registry (the Folkeregister, which manages the national Norwegian PID) and have a unique 11-digit number. Three types of identifiers exist:

1. The F-number: this identifier is also used to identify the patient. The F-number is assigned to persons living in Norway on a permanent basis.
2. The D-number: Persons not living in Norway on a permanent basis can in some circumstances be registered in NNPR with a unique 11-digit number (a D-number).
3. The FH-number: Persons can be assigned a temporary identifier, for example, persons not living in Norway, newborn babies, or emergency patients. An FH-number may be linked with a F-number or D-number at a later point in time.

A patient may have one or more other patient identifier assigned within a regional healthcare organization (regional PID). These identifiers are not communicated outside of the organization (i.e., outside of the Identity Domain in which they were created).

Identifiers assigned and used within a Regional PID may include: a temporary identifier, whereby an application within the organization may assign an emergency/temporary identifier (H-Number) to a patient; an application internal identifier, whereby an application

within the regional healthcare organization assigns a unique internal identifier. Most of these identifiers are linked to either an F-Number, a D-Number, or a FH-Number. The linking may occur at some later point in time.

METHOD OF LINKING IDENTIFIERS

Various person/patient registries in the Norwegian system use a linking mechanism with the following key characteristics:

- Links are unidirectional in nature, from a less preferred (less reliable) identifier to a more preferred (more reliable) one, for example, a link from an FH-Number to an F-Number.
- Any queries for information related to identifiers that are linked to a more reliable identifier are processed as if the query was sent using the more reliable identifier. For example, if one queries for the demographics data of a person with FH-number "A," and A is known to be linked to the F-number "B," then the service will return the demographics details associated with B.
- The link structure will be maintained as a flat structure with a maximum depth of one. Any structures with a depth greater than one will be collapsed (based on the transitive nature of the links) into a structure with depth of one.

For example: if A is linked to B, and B to C, then the resulting link structure will consist of A-to-C and B-to-C.

Consider one structure, A-to-C and B-to-C, and another structure E-to-G and H-to-G and K-to-G, and we link E (which is G) to A (which is C), then the resulting structure will be A-to-C and B-to-C and E-to-C and G-to-C and H-to-C and K-to-C. C has six child nodes; the overall structure has a depth of one.

Any unlinking (if the linking was done in error) will have to be done based on the six links in the flattened structure, the link E-to-A (which caused the erroneous structure to come into existence) no longer exists and as such can't be undone.

PART V – CONCLUSION AND RECOMMENDATIONS

Implementing national UHI is very important to save costs and provide data sharing and access, while ensuring individual privacy and data protection through techniques such as encryption. A federated approach can reinforce health information strategies while enabling governments to continue with policies of decentralized records, which should be interoperable and standardized.

If countries assign UIN at birth, the best practice is to use the same numbers as UHI. This ensures that the chances for exclusion are minimized.

If a country's systems are fully computerized, and the computer infrastructure is available in every corner of the country, many options are possible and include: issuing UIN at BR, retrieving individual UIN at the time of immunization, and referring to the UIN during subsequent healthcare activities and implementing as UHI. This becomes especially feasible once a Digital Birth Certificate is implemented as it provides an opportunity to automatically incorporate a UIN with the digital birth certificate, which can be provided to the family immediately or very soon after birth.

However, the 2018 World Bank report on [Integrating Unique Identification Numbers In Civil Registration](#)⁸ provides a simpler option that can be implemented online as well as offline, and does not necessarily require a computer or Internet access at the time of assigning UHI.

ONLINE ISSUANCE OF UHI

At the time of enrollment into a health insurance scheme or registration for healthcare, a local office or service provider with online connectivity completes the enrollment form and then accesses the central database to generate a single UHI which is then assigned to the individual. The real-time deduplication process (using one-to-many comparison) ensures uniqueness of the UHI generated.

OFFLINE OPTIONS FOR ASSIGNING UHI

It is envisaged that the two options described below can be implemented with minimal resources in the most remote areas of any country that may not have a computer infrastructure or Internet connectivity.

Use of pre-generated machine-readable stickers

Central health office issues blocks of UHI numbers (machine-readable stickers) that local healthcare providers or local health insurance offices can assign to individuals upon registration.

This process has two pre-requisites:

- A policy in place that each UHI will be a random number, since that is preferred from the privacy point of view
- Pre-printed rolls of stickers with random numbers that can be affixed to a healthcare/insurance registration card, including an immunization card. Such stickers

Central office-controlled process

Individuals are enrolled in a health insurance scheme or are registered at a local healthcare provider but are not immediately issued UHI. The application is transferred to a central office that issues UHI, which is printed on a health insurance or healthcare card and sends the cards back to the local office in batches to be distributed to the individuals.

For both offline options, issuance of multiple UHI for a single person remains a challenge since individuals can enroll in a health insurance scheme or register for healthcare at different locations with no way for a real-time deduplication process using a central database. Duplications can be minimized by collecting other attributes of the individual at the time of enrollment or registration, such as a UIN, photograph, signature, and biometrics (e.g., fingerprint, facial recognition, voice recognition, iris scan, retinal scan).

APPENDIX A HEALTH INFORMATION TECHNOLOGIES IN VARIOUS COUNTRIES

AUSTRALIA

The Australian Digital Health Agency, established in July 2016, has national responsibility for the digital health strategy. An interoperable national electronic health (e-health) program based on personally controlled unique identifiers is now in operation. Around 5 million patients and more than 9,000 providers (two-thirds of whom are in primary care) are part of the program.

The system caters to prescription information, medical notes, referrals, and diagnostic imaging reports. Patients can add information about allergies, adverse reactions, and their preferences for healthcare in exceptional circumstances.

CANADA

Deployment and acceptance of health information technologies has been gradual but positive in recent years. Canada has a federal polity, therefore provinces and territories are responsible for developing their own electronic information systems, with support from a federal organization – the Canada Health Infoway (CHI). However, there is no national strategy for implementing EHRs and no designated national patient identifier.

According to CHI, provinces have systems for collecting data electronically for the majority of their populations, but interoperability is limited. In 2014, only 42 percent of general practitioners (GPs) reported using exclusively electronic records to enter and retrieve patient clinical notes, and 38 percent used a combination of paper and electronic charts. In the same survey, 87 percent of GPs reported that their patients were not able to access their personal health record for any function, and only 6 percent reported that patients could request appointments online. It is expected that these figures have improved since then.

CHINA

Most health care providers in China have set up their own EHR system. Within hospitals, EHRs are also linked to the health insurance systems for payment of claims, with unique patient identifiers – either an insurance ID or the citizenship ID.

EHR systems vary significantly by hospital and are usually not integrated or interoperable. Patients are usually required to bring with them a printed health record if they want to see doctors in different hospitals. Even if hospitals are owned by the same local bureau of health or affiliated with the same universities, different EHR systems may be in use.

Patients generally do not yet use EHR systems for accessing information, scheduling appointments, sending secure messages, refilling prescriptions, or accessing doctors' notes.

DENMARK

Information technology (IT) is used at all levels of the health system in a decentralized manner as part of a national strategy supported by the National Agency for Health IT. Therefore, each region has deployed its own electronic patient record system for hospitals that adheres to national standards for compatibility.

Danish general practitioners have been consistently ranked first in an assessment of overall implementation of EHRs. All citizens in Denmark have a unique electronic personal identifier, which is used in all public registries, including health databases.

The government has implemented an electronic medical card containing encrypted information about each patient's prescriptions and medication use. This information is accessible by the patient and all relevant health professionals. General practitioners also have access to an online standard medical handbook with updated information on diagnosis and treatment recommendations.

Attempts to develop national clinical databases to monitor quality in primary care were aborted in 2015, as they were found to violate privacy rights and to endanger the trust between GPs and their patients.

Denmark also has a national IT portal (sundhed.dk) with variable access rights for health staff and the wider public. It provides general information on health and treatment options and access to individuals' own medical records and history. For professionals, the site serves as an entry to medical handbooks, scientific articles, treatment guidelines, hospital waiting times, treatments offered, and patients' laboratory test results. The portal also provides access to available quality-of-care data for primary care clinics, all of which use IT for electronic records and communication with regions, hospitals, and pharmacies.

FRANCE

The initiative to fully integrate EHRs has faced multiple delays, and the integration of information systems between health care professionals and hospitals remains limited.

However, the second-generation "SESAM-Vitale" chip card is operational and provides each French citizen an ID for engaging with French health service providers as well as insurance providers. Germany and France constitute important examples of chip card-based health ID systems.

A pilot EHR project (*dossier médical personnel*) covers about one percent of the population and just under 1,000 hospitals. Hospital- and office-based professionals and patients have unique electronic identifiers, and any health professional can access individual records and enter information subject to patient authorization. Interoperability is ensured via the chip on patients' health "SESAM-Vitale" cards.

By French law, patients have full access to the information in their own records, either directly or through their GP. The sharing of information between health and social care professionals is currently not permitted but will be tested as part of the *Paerpa* program for hospice residents.

The government has created a national agency (*L'Agence des systèmes d'information partagés de santé*) for expanding the uptake and interoperability of existing health information systems.

GERMANY

As of 2015, electronic medical chip cards are used nationwide by all the statutory health insurance (SHI) organizations, which total about 1,100. The chip cards carry encrypted information about an individual's name, address, date of birth, and the sickness fund to which the individual subscribes, along with details of insurance coverage and the person's status regarding supplementary charges.

Also, in 2015, the German Federal Cabinet passed a bill for secure digital communication and health care applications (E-Health Act), which provides concrete deadlines for implementing infrastructure and electronic applications and introduces incentives and sanctions for variances from agreed schedules.

SHI-accredited physicians receive additional fees for transmitting electronic medical reports, collecting and documenting emergency records as well as for managing and reviewing basic insurance claims data online. From July 2018, SHI physicians who do not participate in online review of the basic insurance claims data will receive reduced remuneration.

Furthermore, to ensure greater safety in drug therapy, patients who use at least three prescribed drugs simultaneously, receive an individualized medication plan. This medication plan has been included in the electronic medical record.

Further details of the German system are provided in a subsequent section.

INDIA

In 2015, the Ministry of Health and Family Welfare set up a National Health Portal that provides the public with information on diseases, health services, health programs, and insurance schemes. In addition, a Health Statistics Information Portal has been established to provide information and data on health indicators, compiled from multiple sources.

Recognizing that multiple health information systems are in use across the public and private sectors, the ministry has proposed creation of the National e-Health Authority (NeHA) to set regulations and standards. This would be responsible for developing health information systems and enforcing laws and regulations related to the privacy and security of patient health information in India.

To serve its 1.3 billion population, India has approximately 5,000 hospitals and 30,000 dispensaries in urban areas, and another 5,000 community health centers, 25,000 primary health centers and 150,000 health sub-centers in rural areas.

Once NeHA is fully operational, states will be able to develop systems to suit their needs and priorities, provided they are consistent with standards set by the authority.

Convergence of the individual identifier between healthcare and Aadhaar is also underway, beginning with a pilot to integrate Aadhaar registration with BR.

ISRAEL

All health plans have EHRs that link all community-based providers, including primary care physicians, specialists, laboratories, and pharmacies. GPs work with EHRs as well. Hospitals are also computerized but are not fully integrated with the health plan EHRs. However, Israel's MOH is leading a major national health information exchange project to create a system for sharing relevant information across all hospitals and health plans.

Each citizen's identification number also functions as a unique patient ID.

Patients have the right to get copies of their medical records from hospitals and health plans, and patients can access some components of their EHR online, but full records are not generally available. Efforts are under way to set up secure messaging systems linking patients and their GPs.

ITALY

The New Health Information System (*Nuovo Sistema Informativo Sanitario*) has been implemented incrementally since 2002 with the goal of establishing a universal system of electronic records connecting every level of care. It provides information on services, resource use, and costs, but does not encompass all areas of health care. In general, primary care is not included. However, hospital, emergency, outpatient specialist, residential, and palliative care, as well as pharmaceuticals are generally included. The system currently registers administrative information on care delivered, but medical information appears to be more difficult to gather.

No unique patient identifier exists at the national level.

A core component of the New Health Information System is the nationwide clinical coding program known as 'bricks' (*mattoni*), one of the most mature elements of Italy's developing electronic health program. It aims to define a common language for classifying and codifying concepts; to share methodologies for measuring quality, efficiency, and appropriateness of care; and to allow an efficient exchange of information between the national and regional authorities.

Some regions have developed computerized networks to facilitate communication between physicians, pediatricians, hospitals, and territorial services and to improve continuity of care. These networks allow the automatic transfer of patient registers and of information on services provided, prescriptions for specialist visits and diagnostics, and laboratory and radiology test outcomes.

A few regions have also developed personal EHRs, accessible to individual patients, that contains all their medical information, such as outpatient specialty care results, medical prescriptions, and hospital discharge instructions. Personal EHRs are meant to provide support to patients and clinicians across the whole process of care, but diffusion remains limited. There is also a slow shift under way from paper to electronic prescriptions.

JAPAN

EHR networks have been developed only as experiments in selected areas. Interoperability between providers has not been generally established. Experiments are under way to make personal health information available to patients and providers via cloud computing.

The Social Security and Tax Number System, a system of unique identifiers implemented in 2016, will be phased-in for health care services, including medical records, in late 2018 or early 2019.

NETHERLANDS

Authorities are currently working to establish a central HIT network to enable providers to exchange information.

All Dutch patients have a unique identification number (BSN).

Virtually all general practitioners have a degree of electronic information capacity. For example, they use an EHR and can order prescriptions and receive lab results electronically. At present, all hospitals have EHRs.

Electronic records are not nationally standardized or interoperable between domains of care. In 2011, hospitals, pharmacies, after-hours general practice cooperatives, and organizations representing general practitioners set up the Union of Providers for Health Care Communication (*De Vereniging van Zorgaanbieders voor Zorgcommunicatie*), responsible for the exchange of data via an IT infrastructure named AORTA. However, the data are not centrally stored, and patients must approve their participation in this exchange and have the right to withdraw. Access to their own files is granted by providers upon request to the patients.

NEW ZEALAND

The ability to access and share accurate clinical information is central to the report titled “New Zealand Health Strategy – Future Directions (18th April 2016), with increasing emphasis on investing in regional hospital systems that support and enable integrated care.

In 2015, the MOH announced the Digital Health Work Program 2020. The program aims to ensure appropriate access to health and wellness information facilitated by a single EHR. The electronic record will collect and present existing core health information in a single view, accessible by consumers and clinicians. Data will also be able to be shared with social-sector professionals.

Current levels of interoperability between health information systems are limited. However, the ability to provide services such as structured electronic transfer of information is increasing. Primary care providers can transfer patients’ records securely between practices, send electronic referrals, and receive electronic hospital discharge summaries.

Well over a third of primary care practices have implemented a patient portal, and a large number of patients have registered to access their information through the portal. This advancement supports the Health Strategy's goal of enabling health care consumers to have an active role in managing their own health, to engage more conveniently with the system, and to move services closer to home.

Providers in community, hospital, and specialist settings in one of New Zealand's four regions can now access a shared view of clinical information, and the other three regions are reviewing their information systems to enable information sharing. Implementation of electronic prescribing is under way in primary care and in hospitals. The use of telehealth to deliver services remotely is also increasing.

The Health Information Standards Organization promotes the development and use of standards to ensure interoperability between systems. The Systematized Nomenclature of Medicine—Clinical Terms (SNOMED CT) has been endorsed as a national standard for clinical terminology in New Zealand. Every person who uses health and disability support services has a unique national health number, facilitating the process of building interoperable systems.

NORWAY

A national strategy for HIT was initiated in 2016 and is the responsibility of the Directorate of eHealth.

Every resident is allotted a unique PID, which is used in primary care and for hospitals' medical records.

GPs use secure messaging to request prescriptions or to address patients' questions. Some GP and specialist outpatient offices have electronic booking, while most hospitals do not. All patients have the right to see or get a copy of their complete record, including doctors' notes, however there is no electronic method for doing so yet. A project has already been initiated to give all inhabitants access to their core medical records in the near future.

The National Health Network, to which every health service provider in the country is attached, is charged with providing efficient and secure electronic exchange of patient information between all relevant parties within the health and social services sector. It provides secure telecommunication for GPs, hospitals, nursing homes, pharmacists, dentists, and others.

HIT in primary care is fragmented, and some areas of service lack resources and equipment for its implementation. Still, virtually all GPs use electronic patient records and transmit prescriptions electronically to pharmacies. HIT is also used for referrals, for communication with laboratories and radiology services, and for sick leave. Most GPs receive electronic discharge letters from hospitals. Where after-hours emergency care is organized within the same patient record network as primary care, patient histories remain available, and primary care providers are able to access information regarding emergency visits. All hospitals use electronic records.

The lack of standardized, structured electronic records in primary and secondary care precludes automatic data extraction, hence there is still insufficient data for quality improvement at local and national levels.

SINGAPORE

Singapore is building a sophisticated national EHR system. The system collects, reports, and analyzes information to aid in formulation of policy, monitoring of implementation, and sharing of patient records. The long-term goal is to allow medical professionals to access clinical data on patient treatment and safety.

When fully developed, the system will allow data to be accessed and viewed in appropriate formats by medical professionals, patients, and researchers. Data will come from public hospitals' and polyclinics' electronic medical record systems, among other sources. There are plans to enable patients to view and possibly contribute to their personal health records in the near future.

SWEDEN

Both the quality of information technology systems and their level of use are high in hospitals and in primary care, although the type of systems used vary by care setting and by county council. Nearly all Swedish prescriptions are e-prescriptions. Patients increasingly can access their electronic medical records to schedule appointments or view personal health data, although this access varies among county councils.

SWITZERLAND

In 2027, Switzerland implemented a law addressing the national electronic patient record that aims to increase care coordination, quality of treatment, patient safety, and efficiency in the health care system.

Insured persons are free to opt into such a record and to decide who is allowed to have access to specific details of their treatment-related information. The records are being stored in a decentralized mode. Providers have to seek permission of certified organizational units of health specialists and their institutions to be able to access patient records. Whereas ambulance services are not obliged to join such an arrangement, hospitals and long-term care institutions are legally bound to join and to offer their services using an electronic patient record.

A national e-health coordination service called eHealth Suisse, an administrative unit of the Federal Office of Public Health (FOPH), has been in place under the joint responsibility of the federal and cantonal governments. The confederation provides partial funding for the development of the infrastructure for the electronic patient record.

A GP e-health system is still at an early stage of adoption, and there are ongoing discussions about incentives for physicians to adopt new technologies. Hospitals are generally more technologically advanced. Some have merged their internal clinical systems in recent years and hold interdisciplinary patient files. However, the extent of this integration varies greatly among hospitals and among cantons.

TAIWAN

To make it convenient to access care, everyone in Taiwan carries an electronic National Health Insurance (NHI) chip card with a unique personal health identifier.

The chip card contains encrypted personal information, insurance data, the six most recent medical visits, diagnoses, drug prescriptions, drug allergies, major illnesses, organ donation consent, palliative care directives, and public health records (including immunizations).

Providers are required to report to the National Health Insurance Administration (NHIA) on a 24-hour basis for each patient visit and service delivered, thus enabling the tracking of individual and national aggregate service utilization in nearly real time. This provides the NHIA with a good sense of overall expenditures at any point in time and helps it to identify and manage heavy users of NHI services.

The card also helps the government identify and track public health threats and infectious disease outbreaks, as it did in the 2003 Severe Acute Respiratory Syndrome epidemic.

The NHI card has made administration simpler and more efficient. Its administrative costs accounted for less than 2 percent of total NHI expenditures.

Two recent personal health information innovations, both IT-driven, are worthy of note:

- The NHI PharmaCloud, a cloud-based, patient-centered drug information system that the NHIA introduced in 2013. Taking advantage of the vast database NHIA has created since its inception, PharmaCloud enables doctors (during clinic and outpatient visits, house calls, and emergency department care) and pharmacists to know in real time a patient's medication history for the past three months. PharmaCloud also provides prescribers clinical and safe-use information to help prevent drug adverse reactions and reduce waste.
- My Health Bank, introduced in 2014, is another cloud-based innovation that provides comprehensive health and medical records for any insured person upon request. Records can be updated at any time. In addition to increasing the transparency of important personal health information, the initiative is intended to assist patients in self-managing their health.

All hospitals and clinics use electronic patient medical records. However, owing to a lack of infrastructure investment, NHI systemwide interoperability does not yet exist and inter-hospital exchange of patient medical records is limited.

UNITED KINGDOM

The NHS assigns a number to every registered patient that serves as a unique identifier. All GP patient records are computerized and GP practices are contractually obligated to offer patients the choice of booking appointments and ordering prescriptions online. Practices are also required to offer patients access to their detailed encrypted record including information about diagnoses, medications and treatments, immunization and test results.

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There is no uniform policy for a patient identifier. However, the use of the national SSN is widespread.

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To make it convenient to access care, everyone in Taiwan carries an electronic National Health Insurance (NHI) chip card with a unique personal health identifier.

The chip card contains encrypted personal information, insurance data, the six most recent medical visits, diagnoses, drug prescriptions, drug allergies, major illnesses, organ donation consent, palliative care directives, and public health records (including immunizations).

Providers are required to report to the National Health Insurance Administration (NHIA) on a 24-hour basis for each patient visit and service delivered, thus enabling the tracking of individual and national aggregate service utilization in nearly real time. This provides the NHIA with a good sense of overall expenditures at any point in time and helps it to identify and manage heavy users of NHI services.

The card also helps the government identify and track public health threats and infectious disease outbreaks, as it did in the 2003 Severe Acute Respiratory Syndrome epidemic.

The NHI card has made administration simpler and more efficient. Its administrative costs accounted for less than 2 percent of total NHI expenditures.

Two recent personal health information innovations, both IT-driven, are worthy of note:

- The NHI PharmaCloud, a cloud-based, patient-centered drug information system that the NHIA introduced in 2013. Taking advantage of the vast database NHIA has created since its inception, PharmaCloud enables doctors (during clinic and outpatient visits, house calls, and emergency department care) and pharmacists to know in real time a patient's medication history for the past three months. PharmaCloud also provides prescribers clinical and safe-use information to help prevent drug adverse reactions and reduce waste.
- My Health Bank, introduced in 2014, is another cloud-based innovation that provides comprehensive health and medical records for any insured person upon request. Records can be updated at any time. In addition to increasing the transparency of important personal health information, the initiative is intended to assist patients in self-managing their health.

All hospitals and clinics use electronic patient medical records. However, owing to a lack of infrastructure investment, NHI systemwide interoperability does not yet exist and inter-hospital exchange of patient medical records is limited.

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The World Bank Group (WBG) Data Council endorsed the 2016–2030 Civil Registration and Vital Statistics (CRVS) Action Plan in December 2015. The CRVS plan aims to achieve universal civil registration (CR) of births, deaths, and other vital events for all individuals by 2030. The WBG has been working closely with development partners to provide the requisite support to countries through three interlinked initiatives: the Strategic Action Program for Addressing Development Data Gaps, Identification for Development, and the Global Financing Facility.

The WBG recently commissioned country case studies on Colombia, Gabon, Slovenia the Republic of Korea, and Thailand on how the use of a unique identification number (UIN) has facilitated universal health coverage (UHC). The Identification for Development (ID4D) initiative recently published [Integrating Unique Identification Numbers In Civil Registration](#), which provides guidance on options for linking a birth registration number in the civil registration system with the UIN in the national civil identification system. However, there is limited guidance on assigning Unique Health Identifiers (UHIs) in health programs toward the achievement of UHC.

This guidance note provides options for assigning UHIs for health programs that are linked to a national (central) system for issuing UINs for a more secure and trusted verification of identities and for health programs in countries without a national unique identification system. Part II describes the importance of UHIs. Part III presents selected country examples of the use of UHIs. Some key governance and technical issues based on country examples are summarized in Part IV. Part V offers recommendations, including an offline option for assigning UHIs for remote areas without Internet connectivity.

ABOUT THIS SERIES:

This series is produced by the Health, Nutrition, and Population Global Practice of the World Bank. The papers in this series aim to provide a vehicle for publishing preliminary results on HNP topics to encourage discussion and debate. The findings, interpretations, and conclusions expressed in this paper are entirely those of the author(s) and should not be attributed in any manner to the World Bank, to its affiliated organizations or to members of its Board of Executive Directors or the countries they represent. Citation and the use of material presented in this series should take into account this provisional character. For free copies of papers in this series please contact the individual author/s whose name appears on the paper. Enquiries about the series and submissions should be made directly to the Editor Martin Lutalo (mlutalo@worldbank.org) or HNP Advisory Service (askhnp@worldbank.org, tel 202 473-2256).

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