



International Review of Unique Health Identifiers for Individuals

February 2010

About the Health Information and Quality Authority

The Health Information and Quality Authority is the independent Authority which was established under the Health Act 2007 to drive continuous improvement in Ireland's health and social care services. The Authority was established as part of the Government's overall Health Service Reform Programme.

The Authority's mandate extends across the quality and safety of the public, private (within its social care function) and voluntary sectors. Reporting directly to the Minister for Health and Children, the Health Information and Quality Authority has statutory responsibility for:

Setting Standards for Health and Social Services – Developing person-centred standards, based on evidence and best international practice, for health and social care services in Ireland (except mental health services)

Monitoring Healthcare Quality – Monitoring standards of quality and safety in our health services and implementing continuous quality assurance programmes to promote improvements in quality and safety standards in health. As deemed necessary, undertaking investigations into suspected serious service failure in healthcare

Health Technology Assessment – Ensuring the best outcome for the service user by evaluating the clinical and economic effectiveness of drugs, equipment, diagnostic techniques and health promotion activities

Health Information – Advising on the collection and sharing of information across the services, evaluating, and publishing information about the delivery and performance of Ireland's health and social care services

Social Services Inspectorate – Registration and inspection of residential homes for children, older people and people with disabilities. Monitoring day- and pre-school facilities and children's detention centres; inspecting foster care services.

Table of Contents

1	Introduction	6
2	England	8
2.1	<i>Purpose of the Identifier</i>	9
2.2	<i>NHS Number Format</i>	9
2.3	<i>NHS Number Validation Method</i>	10
2.4	<i>Dataset Associated with the NHS Number</i>	10
2.5	<i>Technical Architecture</i>	10
2.7	<i>Features of the NHS Number</i>	14
2.8	<i>NHS Number Privacy Concerns</i>	14
2.9	<i>Lessons Learned</i>	16
3	Newfoundland and Labrador (Canada)	17
3.1	<i>Purpose of the Identifier:</i>	18
3.2	<i>UPI / Client Registry Number Format</i>	18
3.3	<i>UPI Client Registry Number Validation Method</i>	19
3.4	<i>Dataset Associated with the Registry</i>	19
3.5	<i>UPI / Client Registry Architecture</i>	20
3.6	<i>UPI / Client Registry Governance</i>	21
3.7	<i>Features of the UPI / Client Registry</i>	22
3.8	<i>Privacy Concerns and Consent Process</i>	22
3.9	<i>Lessons Learned</i>	23
4	Australia	25
4.1	<i>Purpose of the Identifier</i>	25
4.2	<i>IHI Number Format</i>	26
4.3	<i>IHI Validation Method</i>	26
4.4	<i>Dataset Associated with the IHI</i>	26
4.5	<i>IHI Architecture</i>	28
4.6	<i>IHI Governance</i>	29
4.7	<i>Features of the IHI</i>	29
4.8	<i>UHI Privacy Concerns and Consent Process</i>	30
4.9	<i>Lessons Learned</i>	31
5	New Zealand	32

5.1	<i>Purpose of the Identifier</i>	32
5.2	<i>NHI Number Format</i>	33
5.3	<i>NHI Validation Method</i>	33
5.4	<i>Dataset Associated with the NHI</i>	33
5.5	<i>NHI Architecture</i>	34
5.6	<i>NHI Governance</i>	34
5.7	<i>Features of the NHI Number</i>	35
5.8	<i>NHI Privacy Concerns and Consent Process</i>	35
5.9	<i>Lessons Learned</i>	36
6	Germany	37
6.1	<i>Purpose of the Identifier</i>	37
6.2	<i>Krankenversicherthe number Format</i>	37
6.3	<i>Krankenversicherthe Validation Method</i>	38
6.4	<i>Dataset Associated with the Krankenversicherthe</i>	38
6.5	<i>Krankenversicherthe Architecture</i>	38
6.6	<i>Krankenversicherthe Governance</i>	38
6.7	<i>Assignment of the Krankenversicherthe - Registration</i>	39
6.8	<i>Access to Krankenversicherthe System</i>	39
6.9	<i>Features of the Krankenversicherthe</i>	39
6.10	<i>Krankenversicherthe Privacy Concerns and Consent Process</i>	39
6.11	<i>Lessons Learned</i>	39
7	Conclusions	41
8	Appendices	42
8.1	<i>Appendix 1 - Modulus 11 Calculation</i>	42
8.2	<i>Appendix 2 – Dataset Associated with the NHS Number</i>	43
8.3	<i>Appendix 3 – NHS Number and the Criteria for Selection of a UHI</i>	45
8.4	<i>Appendix 4 – Newfoundland and Labrador UPI/ Client Registry and the Criteria for Selection of a UHI</i>	50
8.5	<i>Appendix 5 – IHI Australia and the Criteria for Selection of a UHI</i>	55
8.6	<i>Appendix 6 – NHI New Zealand and the Criteria for Selection of a UHI</i>	60

Table of Figures

<i>Figure 1:</i>	<i>Simplified Spine Architecture</i>	<i>11</i>
<i>Figure 2:</i>	<i>UPI/CR Source System Structure</i>	<i>20</i>
<i>Figure 3:</i>	<i>HI Service Conceptual Operating Model</i>	<i>28</i>

1 Introduction

Being able to identify an individual uniquely is essential for patient safety in the provision and management of high quality healthcare.

The National Health Information Strategy 2004 (NHIS) states that a system for unique identification within the health sector is required to promote the quality and safety of client/patient care⁽¹⁾. The NHIS proposed that unique identification within the health sector be based on the Personal Public Service (PPS) Number⁽²⁾. *Building a Culture of Patient Safety: Report of the Commission of Patient Safety and Quality Assurance* (2008) also recommends the introduction of a unique health identifier (UHI) highlighting the contribution it could make to improved patient safety and quality⁽³⁾. The forthcoming Health Information Bill will allow for the introduction of a UHI⁽⁴⁾.

Pursuant to the Health Act 2007, section 8 (1) (k) having regard to section 8 (2) (d), the Health Information and Quality Authority is required to provide advice to the Minister and the Health Service Executive (HSE) about deficiencies identified by the Authority in respect of health information.

The absence of a UHI for individuals is the single most important deficiency in the health information infrastructure in Ireland.

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 for the people of Ireland. In order to be effective and maximise the potential benefits of a 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. This deficit required public debate, which was addressed through the consultation processes of the forthcoming Health Information Bill. The challenge is to select an identifier scheme that achieves an appropriate balance in relation to practicality, cost and privacy.

The Authority published *Recommendations for a Unique Health Identifier for Individuals in Ireland* in March of 2009⁽⁵⁾. The main findings of the report were that the introduction of a UHI would deliver tangible benefits from patient safety, quality of care, efficiency, confidentiality, epidemiological and cost effectiveness perspectives. Based on the available evidence, and in the interests of patient safety and efficient use of resources, a New UHI would be cost effective, represent international best practice and would be more secure than using the Enhanced PPS Number as the UHI for Ireland⁽⁵⁾.

Another of the recommendations from this report was that it is essential that an appropriate infrastructure and governance structure are put in place prior to

implementation of the New UHI ⁽⁵⁾. The aim of this report is to document the governance and infrastructural arrangements for the UHI in the following countries:

- England
- Newfoundland and Labrador
- Australia
- New Zealand
- Germany

England, Newfoundland and Labrador, and New Zealand have implemented a UHI using varying approaches. Australia and Germany are both planning to implement a UHI in the near future. The diverse experiences of each of these countries in implementing a UHI provides the Authority with a rich source of information to better inform successful planning and implementation of a UHI in Ireland.

This document reviews each of the unique health identifiers for the above countries under the following headings.

1. Purpose of the identifier
2. Format of the identifier
3. Validation methods
4. Dataset associated with the identifier
5. Technical architecture
6. Features of the UHI
7. Privacy Concerns
8. Lessons Learned

2 England

The National Health Service (NHS) was launched in 1948 and since then it has grown to become the world's largest publicly-funded health service. With the exception of charges for some prescriptions and optical and dental services, the NHS remains free at the point of use for anyone who is resident in the United Kingdom (UK). This covers a population of more than sixty million people. Although funded centrally from national taxation, NHS services in England, Northern Ireland, Scotland and Wales are managed separately. While some differences have emerged between these systems in recent years, they remain similar in most respects and are perceived as belonging to a single, unified system.

Across the UK, the NHS employs more than 1.5 million people, of which the NHS in England employs 1.3 million people and caters for the health needs of over 50 million of the population. The Department of Health England has overall responsibility for the NHS, with a cabinet minister reporting as UK Secretary of State for Health to the Prime Minister. The Department of Health England has control of England's ten strategic health authorities (SHAs), which oversee all NHS activities in England. In turn, each SHA is responsible for the strategic supervision of all the NHS trusts in its area⁽⁶⁾.

NHS Connecting for Health is a directorate of the Department of Health England. It was formed in 2005 with the primary role of delivering the National Programme for IT (NPFIT) in England. In order to deliver components of this programme, such as the electronic sharing of patient information, it is vital that complete adoption of the UHI - the NHS Number - across health and social care services in England is achieved. The NHS Number in its current format, was developed in 1996 to replace many different numbering systems used in the NHS England.

The NHS Number programme has been put in place to provide support and guidance to help NHS commissioned providers in working towards that goal, as defined in the NHS Operating Framework 2008/9⁽⁷⁾. The framework document mandates the use of the NHS Number as the unique patient identifier in all relevant administrative and clinical systems and in all communications with patients. NHS Connecting for Health has published the document, *NHS Number Programme Implementation Guidance*, to aid healthcare organisations in realising this objective⁽⁸⁾. The onus is on each individual NHS organisation in England to use this guide to assess their current level of use of the NHS Number and to undertake the necessary upgrades and training programmes necessary to achieve full adoption. NHS Connecting for Health envisage that full adoption of the NHS Number can be achieved across NHS services in England by the end of 2010. The guidelines for implementation state that communication with staff from board level, intensive training and clear definition of staff roles together with detailed assessment of current systems and their compatibility with the use of the NHS Number are key to efficient successful implementation of the programme⁽⁸⁾.

The Personal Demographics Service (PDS), implemented by NHS Connecting for Health, will become the single authoritative source of demographic information and the NHS Number. It enables NHS providers to access the NHS Number and to allocate a unique NHS Number at the point of care where one does not already exist. The cost of implementation of the PDS on its own is not available at present, nor is any detail on whether trusts, organisations or NHS Connecting for Health will fund the cost of full implementation⁽⁹⁾.

2.1 Purpose of the Identifier

In September 2009, the National Patient Safety Agency (NPSA) published an updated Safer Practice Notice (SPN) for the use of the NHS Number. The SPN was developed based upon the NPSA's evidence that use of the NHS Number will significantly improve patient safety. It states that the NHS Number should be known and used by NHS staff and patients in order to reduce the clinical risk to the patient⁽¹⁰⁾.

According to the SPN, the NHS Number will:

- Minimise the clinical risks caused through misallocation or duplication of patient information
- Ensure that the patient record being viewed by a clinician is unique to the patient
- Resolve some of the barriers to safely sharing information across healthcare settings
- Assist with long term follow up processes and clinical audit⁽¹⁰⁾

The document *The NHS Plan, a plan for investment, a plan for reform* requires that the patient is placed at the heart of the NHS⁽¹¹⁾. It is recognised by NHS Connecting for Health that in order to support patient-centred delivery of care, it is essential that each patient can be identified accurately at every encounter with the health and social care system. The consistent use of the NHS Number supports this by linking up elements of a patient's record across healthcare organisations providing a way of checking the information is about the right patient. The NHS Number is the unique patient identifier at the most significant point of interchange between the patient and provider⁽¹¹⁾.

2.2 NHS Number Format

The NHS Number consists of ten 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 ideally should be in 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 (ASTM) identified 30 criteria that a robust unique health identifier should satisfy⁽¹²⁾. The NHS Number passes the majority of the ASTM criteria (see appendix 3). The NHS number is

* 3space3space4, not hyphenated, e.g. 123 456 7891

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⁽¹²⁾.

2.3 NHS Number Validation Method

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 Modulus 11[†] algorithm and the use of this algorithm is mandatory. There are 5 steps in the validation of the check digit (See appendix 1). This validation method does not verify the identity of an individual; it simply assures that the number is a valid NHS Number⁽¹³⁾.

2.4 Dataset Associated with the NHS Number

The demographic information associated with the NHS Number is detailed in full in appendix 2. This information includes a core identifying dataset that can be used to searching for an individual on the PDS system, or when verifying the identity of an individual in possession of an NHS Number (e.g. name, place of birth, date of birth). It does not contain any clinical information about the individual.

2.5 Technical Architecture

The PDS database is part of a national network of NHS systems known as the NHS Care Record Spine (see figure 1 below)⁽¹⁴⁾. These systems allow for electronic referrals and appointment booking, communications between health and social care providers and electronic prescribing. Members of the public can also access part of the Spine in order to gain information about providers or to view the demographic information held about them on the PDS. The central hub of the Spine system is the Transaction and Messaging Service (TMS). This system routes all information between the various Spine systems.

[†] Modulus 11 is a simple arithmetic function used to validate a number

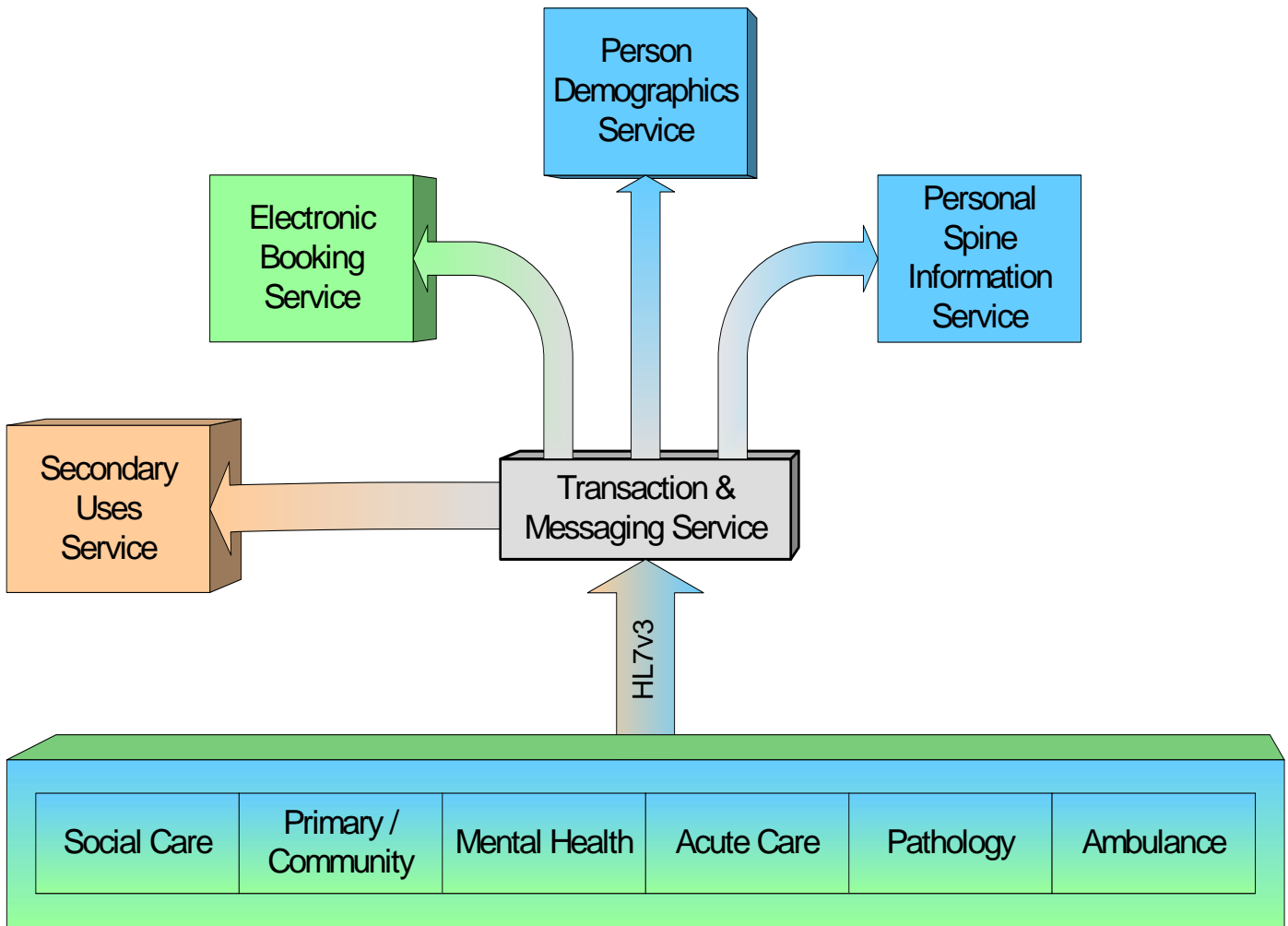


Figure 1: NHS Connecting for Health, Simplified Spine Architecture⁽¹⁴⁾

2.6 NHS Number Governance

The use of the NHS Number and access to the PDS service is governed by the National Information Governance Board for Health and Social Care (NIGB) which was established as a statutory body in the Health and Social Care Act 2008⁽¹⁵⁾. All access to and sharing of personal health information in the UK is governed by the Data Protection Act UK⁽¹⁶⁾ and specifically by the *NHS Code of Practice for Healthcare Professionals 2006*⁽¹⁷⁾. All NHS staff who are authorised to access the spine can access the PDS service at the appropriate security level which is assigned locally.

The NHS Number Programme has been put in place by NHS Connecting for Health to provide support and guidance to help NHS commissioned providers in working towards the goal of achieving complete adoption of the NHS Number as a unique health identifier in England, as mandated in the *NHS Operating Framework 2008/9*⁽⁷⁾.

The NHS Number was developed with individual security and privacy in mind. Information cannot be ascertained about an individual through their 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 their NHS Number. All NHS staff have a duty to treat information as confidential and security procedures should be in place to ensure that access to patient information is limited by passwords, smartcards and role-based access controls. In order to gain access to the PDS, NHS staff must individually and organisationally sign-up and agree to use the PDS in accordance with the NHS standards of security and confidentiality⁽¹⁸⁾.

The information governance controls protecting patient information include the following:

- there are Registration Authorities (RA) within each trust or healthcare organisation. These will 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 they present various forms of identity
- once registered, staff are issued with a smartcard, which validates their identity, without which staff are unable to access the PDS.
- individual organisations are responsible for allocating role-based access levels to staff. Role-based access controls, linked to the identity of each authorised healthcare professional, control precisely what they are able to see and do when logged on to the system.

- search controls that constrain how healthcare professionals are able to search and look up the details of individual patients
- sensitive record controls that prevent staff from accessing PDS information when records are flagged as sensitive
- specific PDS audit logs capturing:
 - tracing, retrievals and confirmation of an NHS Number
 - Updates to the PDS
 - Allocation of NHS Numbers
 - Merges and unmerges of demographics records
- the availability of audit logs to authorised users via a national portal (the Enhanced Reporting Service). In addition, local systems will audit their own events, which are directly available to appropriately authorised local users.

In the future, the PDS will generate alerts to privacy officers in specific circumstances where actions have been taken by NHS healthcare professionals which may constitute a breach of confidentiality⁽⁹⁾.

Patients cannot request that their data is not 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 which may be of a sensitive nature, for example in relation to sexual health. In particular, 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, to help ensure that the right information is associated with the right individual and to allow 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⁽¹⁸⁾.

The NHS Number Implementation Guide lists the allowed uses of the NHS Number ⁽⁸⁾. 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, 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 centred NHS.

2.7 Features of the NHS Number

The American Society for Testing and Materials (ASTM) identified 30 criteria that a robust unique health identifier should satisfy⁽¹²⁾. The Authority adapted these criteria in 2008 in consultation with stakeholders⁽¹⁹⁾. The NHS Number satisfies most of the criteria deemed to be fundamental (see appendix 3).

There are two extremely important criteria that are fundamental to the successful implementation of a UHI, namely that the number is assignable and accessible in real-time at the point of care.

Individuals are allocated an NHS Number either at birth, in the primary care setting or at the first point of contact with the NHS. In the primary and secondary care settings, the decision is made locally as to which members of staff have the authority to assign new NHS Numbers in cases where the individual does not have one. The NHS Number Implementation Guidance document provides information on role-based access levels for various staff⁽⁸⁾.

An NHS Number will be issued to a patient irrespective of their entitlement to care. A new NHS Number can be assigned at the point of care in real time by those authorised to register new patients on the PDS. As possession of an NHS Number does not entitle the bearer to free or subsidised care, new NHS Numbers are routinely assigned to overseas visitors who require health or social care⁽⁸⁾.

The NHS Number can be traced, accessed or verified in real time by approved NHS staff at the point of primary or secondary care through the PDS system. Role-based access controls, linked to the identity of each authorised healthcare professional, control precisely what they are able to see and do when logged on to the system. Each NHS organisation decides the level of access to the PDS for each of their staff. The PDS is accessed by NHS Staff via a secure N3 connection using the NHS staff identity smartcard. It allows staff to search for an individual's NHS Number by inputting name and date of birth and it also allows staff to verify who an NHS Number identifies. The NHS Connecting for Health Website provides instructions for NHS staff in how to trace NHS Numbers on the PDS; however, detailed information about accessing and using the PDS is only available on a secure network to NHS staff^(8;20).

2.8 NHS Number Privacy Concerns

It is of fundamental importance that the Unique Health Identifier is secure in order to protect the privacy of the bearer. There are a number of the ASTM criteria which related to this; for example, the number should be healthcare focused, content-free and it should be possible to make the number public without revealing any information about the individual it identifies. The NHS Number satisfies these criteria in relation to privacy⁽¹⁹⁾.

The National Patient Safety Agency (NPSA) published a Safer Practice Notice (SPN) for the NHS Number in September 2008 which mandated the use of the NHS Number as the national patient identifier^(8;9). The main purpose of the NHS number is to enhance patient safety. However it is vital that there are strict and robust safeguards to protect the service user's privacy.

Any individual accessing NHS Services will be allocated an NHS Number as its use as a Unique Health Identifier for NHS Services has been mandated; therefore, individual consent is not required in order to allocate a new number. The dataset associated with the NHS number includes a consent field stating whether the individual consents to being contacted by NHS staff (see appendix 2).

Strict and robust safeguards are in place to protect the security and confidentiality of every patient's NHS Healthcare record, including the demographics information stored in the PDS.

These include:

- The use of 'smart cards' with a Personal Identification Number (PIN). These are individually issued to staff that will be using the NHS Care Records Service and accessing the PDS, following training
- The level of access to the NHS Care Records Service and the PDS will be determined by the role the staff member has with the patient – for example, a consultant will see more detail than a receptionist who will only see the information needed to process an appointment, not the full NHS Care record (role-based access).
- NHS Care Records will only be accessible in an identifiable form to authorised health care professionals who have a justifiable clinical or legal reason to see the information. For NHS research and management purposes, the data may be used in an anonymised format
- There will be a log kept of those who use the NHS Care Records Service to access a care record, showing who they are and what they added or changed. The patient can ask to see this information
- The PDS will not itself hold any clinical information or sensitive data items such as ethnicity or religion

2.9 Lessons Learned

The following are some of the lessons learned from the NHS experience:

- buy-in from the primary care organisations is essential to successful implementation as the majority of secondary care workload is referred from the primary care setting
- extensive training is required across all levels of staff to ensure UHI and demographic data integrity as much as possible
- full use of the UHI can only be achieved by implementation of a single national system holding a defined standardised dataset
- a national health and social care staff and public awareness campaign to explain the benefits of the UHI to individuals is necessary to encourage people to provide their UHI at point of care. NHS Connecting for Health are currently developing an NHS Number Communications Toolkit which contains promotional information about the NHS Number for both NHS staff and patients. It includes documentation and pamphlets explaining the benefits of using the number from both the clinical and individual perspectives. It also informs health and social care trusts on how to advertise the benefits of the NHS Number in their area, providing posters and other promotional materials⁽²¹⁾
- the upgrading of local IT systems so that they are compatible with the UHI system and dataset is necessary
- early review of costs aligned to the benefits to patients and clinicians that can be achieved is necessary to ensure cost effectiveness and efficiency. In August 2009, Dr Stephen O'Brien MP, commissioned an Independent Review of NHS and Social Care IT, chaired by Dr Glyn Hayes⁽²²⁾. This review estimates the cost to date of the National Programme for IT, of which the NHS Number and Spine network is a major component, is GB£12.7 billion; however, there is uncertainty around this figure as a full audit by the Department of Health England has yet to be undertaken. It also states that the costs incurred to date have surpassed and are now disproportionate to the intended benefits of the programme.

3 Newfoundland and Labrador (Canada)

The Department of Health and Community Services govern the health and social care services in Newfoundland and Labrador. The Canadian federal government sets standards and assists with funding for health and social care while there is provincial responsibility for the administration and delivery of services. All residents of Newfoundland and Labrador are entitled to public health insurance coverage by Medical Care Plan (MCP), the publicly funded organisation which operates under the Department of Health and Community Services⁽²³⁾. As a result of this, public health insurance system, there are very few private health insurance options, with policies available only to cover healthcare not provided for by the MCP for example, some types of dental work.

The Newfoundland and Labrador Centre for Health Information (NLCHI) was established in 1996 and is directly accountable to the Department of Health and Community Services⁽²⁴⁾. The role of the NLCHI is to provide quality information to health professionals, the public and people involved in policy making and management of the health system. Collaborating with stakeholders, NLCHI has a provincial mandate to develop and manage a Health Information Network (HIN) as a means of achieving the best possible health care for the province. The cornerstone of the HIN is the Unique Person Identifier (UPI)/Client Registry (CR)⁽²⁵⁾.

The NLCHI implemented a provincial UPI/CR in 2001. In partnership with Canada Health Infoway, enhancements to the original UPI/CR system were completed in February 2005, using Best of Breed components (CR1 project). Canada Health Infoway defined these components by looking at client registries throughout Canada in order to identify best practice. These enhancements were designed to create a reusable client registry solution, which can be shared with other jurisdictions across Canada⁽²⁵⁾.

Actual costs closely paralleled projected costs for the Newfoundland and Labrador UPI/CR project. The Total Cost of Ownership (TCO) was based on the development, implementation and maintenance of a province-wide Client Registry system that serves a population of approximately 520,000. The TCO of the Newfoundland and Labrador Client Registry was \$8,935,999 Canadian dollars (CAD), with an ongoing annual cost of approximately \$600,000 CAD. More difficult to quantify are the investments of time and expertise that were made available by regional health boards and other participants throughout the project life cycle. Items included in the detailed breakdown of costs for each phase of system development were categorized under four major headings; Human resources, establishment of the technical environment, administrative expenses and other associated costs.

An evaluation of the UPI/CR system was carried out in 2005 and it noted that population size should be considered when using the Newfoundland and Labrador TCO to determine resources required to implement and maintain a similar system in another

jurisdiction⁽²⁶⁾. In addition, it noted that the TCO reflects the fact that the final UPI/CR product was developed in two separate phases (the original UPI/CR and CR1), which involved unavoidable duplication of some costs. The NLCHI has stated that these costs would likely not be incurred in other jurisdictions or countries if they proceeded directly to the implementation of the Best of Breed Client Registry solution (CR1)⁽²⁶⁾.

3.1 Purpose of the Identifier:

The UPI/CR is a provincial database, which contains the most current demographic information on clients of the provincial health and community services system, and facilitates the appropriate linkage of client records across source systems. The UPI/CR will enable person-specific clinical information to be consolidated from multiple regions and sources as the HIN is further developed⁽²⁶⁾.

The purpose of the UPI/CR is to:

- provide a central database of clients of the health and community services system
- identify accurately an individual during an encounter with the health system
- confirm an individual's eligibility for free medical care coverage
- maintain the accuracy of client indexes in users' local systems
- identify newborns for metabolic screening
- provide for the linking of health information in the proposed Electronic Health Records (EHR)⁽²⁷⁾

3.2 UPI / Client Registry Number Format

The UPI/CR automatically assigns a nine digit unique identification "shadow" number to each individual registered; however, this number is not used as a UHI. The registry system uses this number for the purposes of indexing the records it holds and is not visible to users of the system⁽²⁵⁾. Individuals will continue to use their MCP number as a UHI province wide, unless there is a demonstrated need to use the "shadow" number. Individuals are also registered with local identification numbers in healthcare facilities using Meditech, the information system used in hospitals, and Client Referral Management System (CRMS), used in primary care. These systems all communicate with the UPI/CR system which facilitates the linking and cross-referencing of various identifiers for an individual⁽²⁵⁾.

3.3 UPI Client Registry Number Validation Method

As the unique identification number is generated in the background and used as a shadow identifier by the UPI/CR system, there is currently no validation method for the number itself. The demographic information collected at registration points throughout the health system is stored on local registration systems and shared with the UPI/Client Registry. The UPI/Client Registry is designed to work seamlessly with the Meditech Registration modules used in hospitals and long-term care facilities and with the demographic information in the Client and Referral Management System (CRMS) used by health and community services. The users of the Meditech Registration Module and CRMS are responsible for the accuracy and integrity of their clients' demographic information⁽²⁸⁾.

3.4 Dataset Associated with the Registry

The following UPI record data elements in the UPI/Client Registry are accessed, and in some cases updated, by the various participating stakeholder organisations:⁽²⁷⁾

- MCP number
- chart number
- UPI number
- full name (Last, Given, Middle, Maiden/Other, Aliases)
- date of birth
- gender
- address
- phone numbers (home, other)
- mother's first name
- MCP eligibility status
- alternate health care insurance (number, description)
- date of death
- date of birth registered
- date of death registered

3.5 UPI / Client Registry Architecture

When a client presents to receive health services, registration staff use one of a number of information systems to access and/or update the client's demographic and administrative information. These systems are:

- Meditech
- Client Referral Management System (CRMS)
- Medical Care Plan (MCP)

This means information for a client receiving health services can exist in more than one location. To ensure a client's record is up-to-date and consistent across each of the information systems, the UPI/CR interacts with the various information systems to assist in identifying duplicate records and communicating updates. The UPI/CR integrates the information systems and helps tie the various sources of client information together. The UPI/CR and information systems interact by exchanging client information as shown in figure 2 below ⁽²⁹⁾.

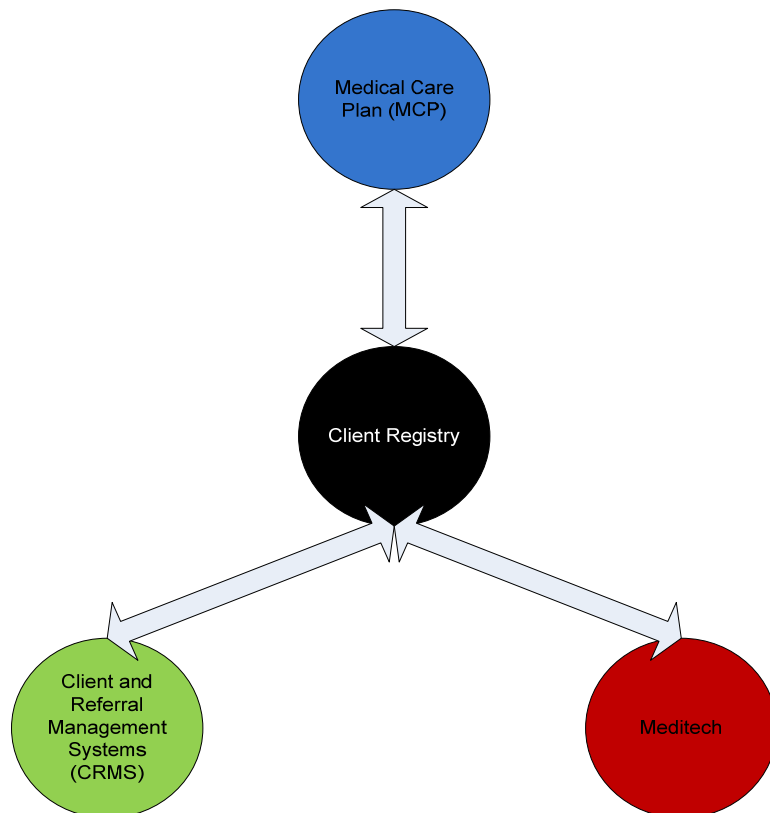


Figure 2: Newfoundland and Labrador Centre for Health Information, UPI/Client Registry Source System Structure⁽²⁹⁾

3.6 UPI / Client Registry Governance

As the lead organisation in the development of the UPI/Client Registry, the NLCHI is responsible for ensuring the personal information that is collected, used, disclosed, stored, or disposed of as part of the developing EHR is subject to the highest level of confidentiality and security available through best practices in the health system and through the protection of legislation. Within the NLCHI, the Registry Integrity Unit (RIU) is responsible for the file maintenance of the UPI/Client Registry⁽²⁵⁾. In order to promote transparency and enhance accountability the NLCHI has carried out a privacy impact assessment (PIA) of the UPI/CR to ensure that the registry does not allow breaches of individual privacy⁽²⁸⁾.

The UPI/CR is a provincial information system of demographic registration information collected by the Regional Integrated Health Authorities and the Department of Health and Community Services, Medical Care Plan (MCP). Each public body is the custodian for the personal information they hold. The NLCHI is the custodian of the provincial database of demographic information, the UPI/CR⁽²⁵⁾.

The UPI/CR was approved by the Minister of Health and Community Services under the authority of the *Hospitals Act*, the *Health and Community Services Act*, and the *Medical Care Insurance Act*. Approval was given following the submission of the UPI/Client Registry Project Scope to the Minister. This document identified to the Minister the purposes of the UPI/CR for which it can be used⁽²⁷⁾.

These uses are:

- To provide a central database of clients of the health system in order to facilitate the development of the EHR
- To identify accurately the individual during an encounter with the health system
- To confirm the individual's eligibility for MCP coverage
- To maintain the accuracy of patient, client and resident indexes in the users' systems
- To identify newborns for metabolic screening
- To generate reports for the maintenance of the accuracy and integrity of the UPI/CR⁽²⁷⁾.

Any individual, whether resident in Newfoundland and Labrador or a visitor to the province, will be registered on a system that is linked with the UPI/CR. The UPI/CR will then assign a shadow unique identifier to the individual. There is no option to opt out of registration and individuals accessing both public and private health facilities are registered. The collection, use and disclosure of health information is governed by the Access to Information and Protection of Privacy Act (ATIPPA) of Newfoundland and Labrador and more specifically by a forthcoming Health Information Act, due to be enacted in 2010⁽³⁰⁾

3.7 Features of the UPI / Client Registry

The unique identification number created by the UPI/Client registry system is assigned automatically when an individual is registered at any healthcare facility using a local system. This usually occurs at the point of registration of a new birth on a hospital system, but any individual who has never accessed health services in Newfoundland and Labrador can be registered at the point of care. This includes visitors who may not be resident in the province. At the point of registration, the local system queries the UPI/Client registry with the basic demographic details of the individual. The UPI/Client Registry then returns the individual's full demographic details if the individual has been previously registered on any other system. If the individual's details are not found, the authorised user then registers the individual locally and assigns a local identification number. This information is communicated to the UPI/Client Registry where a new record is created automatically⁽²⁵⁾.

Access to the UPI/Client Registry will be granted to authorised registration and medical record personnel by their Regional Health Board. Authorisation and access management (e.g., user ID/password assignment) will be coordinated between NLCHI and a designate registration/medical record manager or IT security-coordinating contact at Regional Health Board level. The UPI/CR front-end database access tool will be accessible by authorised users through the Meditech log-on process, and as such, users will not be required to undergo a separate log-on process⁽²⁷⁾.

The UPI/CR satisfies most of the fundamental criteria established by the Authority for selection of a UHI (see appendix 4).

3.8 Privacy Concerns and Consent Process

All initiatives that collect, use, store or disclose personal information run some risk of a breach of the privacy of personal information. The NLCHI have made efforts to design an information system, develop policies and procedures, and establish ongoing processes that will protect the UPI/Client Registry data.

The UPI/Client Registry was not designed as a privacy enhancing technology for the health system; however, some of the features of the information system support the protection of personal information. By using an index of identifiers, rather than a single identifier for the full provincial health system, a record can be identified by a number or alphanumeric code and still easily retrieved for the correct client. Re-identification is still possible but requires several steps including authorised access to a registration database. The role of the Registry Integrity Unit ensures accuracy and integrity of demographic information that was not previously possible in a health system with disparate registration systems. Additionally, the design of the database limits the collection of personal information only to standardised data fields.

Before every encounter with the health system, a person is registered on a system that is linked to the UPI/CR therefore there is no option to opt out. Consent is considered implied for the primary purposes of registration. As the UPI/CR is not directly accessed by users, role based access levels are approved locally for users to access the system they connect to the UPI/CR with. The users who collect the registration information do not seek consent from the individual for its use or disclosure. The individual will be unable to receive care or services without providing demographic information to the stakeholder, which is why an individual accessing the health service is considered to have given (implied) consent.

Demographic information for people receiving emergency care may be collected after the care according to each hospital's policies and procedures. Detailed access management procedural documentation, including UPI/Client Registry access application forms are held by the authorising managers at Regional Health Board level. Application access to the UPI/Client Registry system contains entities and attributes to implement security, audit requirements, and to establish functions per user. Users are assigned user ID's, passwords, and a set of functions that they are eligible to execute based on their organisation's requirements e.g. some users will only be able to perform client searches (read access) while others will have access to update Client Registry data via the source system they use⁽²⁷⁾.

3.9 Lessons Learned

The following are lessons learned and associated recommendations made by Canada Health Infoway following a full post implementation assessment and evaluation of the Best of Breed UPI/Client Registry⁽²⁶⁾:

- regular audits of business processes are required. There was a time delay of approximately 18 months between the scoping exercise and the implementation of the UPI/CR. During this period, the business processes around registration in the institutional health boards changed significantly. As regular audits of the business processes were not conducted and implementation of the CR did not proceed as smoothly as anticipated. Post-implementation adaptation of the technology was required to accommodate the new business processes. In addition some sites did not recruit a registration subject matter expert to assist with project design and implementation which delayed implementation.
- communication and stakeholder engagement is essential. The problem with communication was most pronounced in the first site to go live. This was due to a lack of a communication plan with health records personnel and IT directors. Secondly key stakeholders such as registration personnel in each facility, did not have pre existing communication vehicles, and did not have extensive knowledge or experience in dealing with the project team. When problems arose with the

implementation of UPI/CR in the first site, the front line registration staff, and staff who registered patients for various procedures throughout the hospital were impacted by the confusion. As time-consuming and costly as a full communications plan can be, the absence of one can have a significant detrimental impact on stakeholder acceptance of a new intervention and their willingness to support future initiatives.

- it is necessary to anticipate additional resource requirements. The CR went live in one facility during the summer months, fewer personnel were available to perform regular work routines, or trouble shoot or develop communication plans to deal with newly identified problems. In addition the project team did not deploy personnel on site to monitor implementation. As a result there were time delays in responding to users concerns.
- Education and training of staff is essential. Incomplete education of all front-line workers had an impact on implementation. Education should take place prior to implementation, and this training should involve the business and technical team at both the project management site and the host site.

4 Australia

The health service in Australia is governed centrally by the Department of Health and Ageing. The department has responsibility for providing leadership in policy making, public health, research and national health information management. Each state and territory has individual responsibility for the management and delivery of public health services and the regulation of healthcare practitioners within their state or territory boundary. Public health services are delivered by Medicare Australia, an organisation which is funded by revenue from taxation. All Australian citizens are entitled to receive healthcare with Medicare Australia. Private healthcare is also an option for those who wish to avail of private health insurance and the Australian government subsidise the cost of this by providing for 30 percent of the cost. It is not clear whether private health providers will be required to use any proposed UHI in Australia, but it is implied⁽³¹⁾.

Australia has yet to introduce a UHI; however, the implementation project is in its final stages and much work has been done to develop structures and governance to support the proposed UHI. The National E-Health Transition Authority Limited (NEHTA) was established by the Australian state and territorial governments to develop better ways of electronically collecting and securely exchanging health information⁽³²⁾. Part of their strategy to achieve this is to develop a Healthcare Identifiers (HI) service. The design and build of the HI Service is expected to be completed by NEHTA and Medicare Australia by mid 2010⁽³³⁾.

4.1 Purpose of the Identifier

The unique health identifier for individuals in Australia is referred to as the Individual Healthcare Identifier (IHI). The intended primary purpose of the IHI is the accurate identification of individuals across all healthcare settings.

According to NEHTA, accurate individual identification ensures that as part of a healthcare interaction:

- the correct health information is associated with the correct corresponding healthcare individual
- electronic and non-electronic communications (for example, discharge summaries and referrals) between providers about a healthcare individual relate to the correct person⁽³⁴⁾.

4.2 IHI Number Format

The IHI is a unique, content-free 16 digit identifier that will be assigned to all Australian residents and others accessing healthcare in Australia. Each number will apply to only one person and will be used in health information records alongside the person's name and date of birth⁽³⁵⁾. There are three component parts of the number⁽³⁶⁾:

- the first five digits correspond to the issuer and will be the same for all IHIs issued. This number is 80036 and is assigned by ISO to describe that the number is used for health and that it has been issued in Australia. The sixth digit denotes whether the number identifies an individual, a healthcare practitioner or a healthcare organisation
- the next nine digits identify the individual and corresponds to ISO standard ISO-7811-3
- the sixteenth and final digit is a check digit for verification that the IHI is valid

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

4.3 IHI Validation Method

The method of validation of the IHI number will be by use of a 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 IHI in this way does not verify the identity of the individual possessing the number.

4.4 Dataset Associated with the IHI

The IHI will consist of the number itself and an associated record comprising three sub-categories of record that are used for different purposes⁽³⁷⁾. These are (in order):

- a summary record whose purpose is to facilitate searching for and locating the right identifier for the individual. It contains the minimum set of personal attributes that are required for healthcare professionals to confirm they have located the right individual's IHI. This summary record could be viewed during the process of retrieving the individual's record for an appointment with their healthcare provider. The likely set of information is name, sex, and DOB only.
- an identification record which contains a list of attributes (acquired information) which describes an individual; for example, address and traits (inherent features) of the individual which normally do not change for example, gender and date of birth (DOB) that are used for identification. In addition to the minimum set of the

summary record, the identification record may also include date of death (DOD), country of birth, identification characteristics, etc.

- a demographic record, which contains additional information about the individual, that is not mandatory for identification but is essential for healthcare and healthcare related communication. This may include home phone number, mobile phone number, email or other electronic address detail⁽³⁷⁾.

The minimum dataset required to uniquely assign an IHI is: name, date of birth, date of birth accuracy indicator, sex⁽³⁶⁾. Date of birth accuracy indicator is a code used by healthcare practitioners in Australia to show whether a date of birth is partially or fully estimated.

4.5 IHI Architecture

The conceptual operating model outlined in figure 3 is the basic blueprint for what the Unique Healthcare Identification Services will provide and how it will be accessed⁽³⁷⁾.

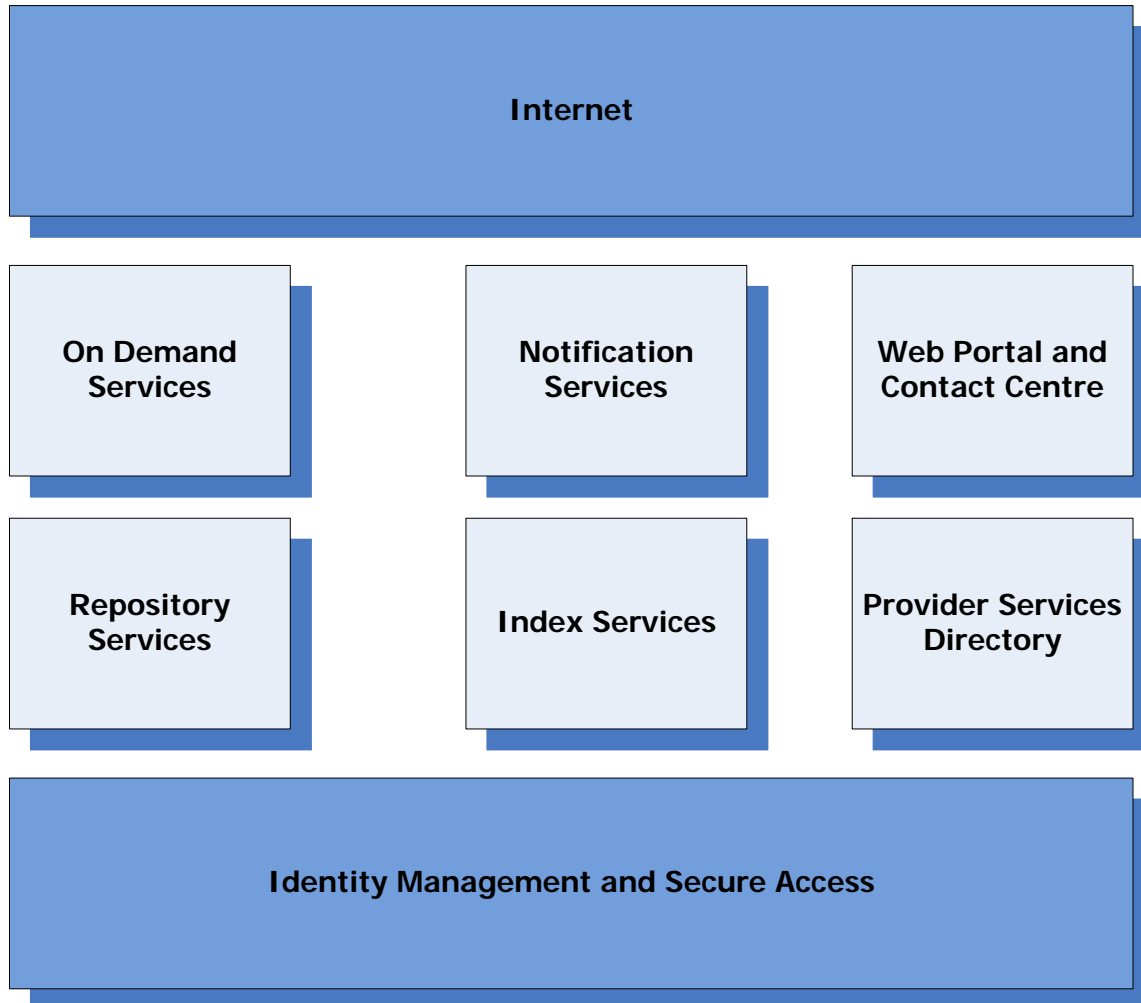


Figure 3: NEHTA, Health Identifier Service Conceptual Operating Model⁽³⁷⁾

The Healthcare Identification Services conceptual model is underpinned by appropriate identity, security and access methods, and is intended to be accessible using the Internet. For non-internet users alternate access channels to the HI Service will be provided, for example, contact centres will be available to allow authorised users to access information held on the system. The data held and the ability to access that data will be primarily private in nature. This means the right to access that information must be established through verifying credentials prior to gaining access. The services are intended to be accessible over the internet via the Web Portal after appropriate identification and security measures have been applied. Not having access to the internet will not prevent access to services by any individual. Healthcare providers will

be expected to access these services online via the internet unless there is a service outage or physical remoteness consideration⁽³⁷⁾.

4.6 IHI Governance

The use of the IHI and its information record is limited to the health sector as defined by the Governance Authority, currently part of NEHTA. It is proposed that overall strategic responsibility for the Healthcare Identifiers (HI) service will rest with a Ministerial Council of Health Ministers. Key responsibilities will be to determine national policies and strategic direction of the HI Service, including its scope and authorised participants, the required regulatory and institutional arrangements and monitoring of those arrangements to ensure they continue to be suitable⁽³³⁾. HI service management and operation responsibility will lie with Medicare Australia and an independent regulator will oversee the HI Service to ensure compliance with privacy regulations⁽³⁸⁾.

The full set of data items to be contained in the IHI record will be subject to legal and privacy assessment. A look-up capability will allow the IHI to be linked to existing local, private, and public health identifiers so that health information can be associated across healthcare sites. The UHI services privacy framework will define suitable role based access levels to the information stored in the repository. Specific Commonwealth legislation is being drafted to detail the governance, privacy and approved uses for the Individual Healthcare Identifiers. As well as this, access to the IHI and the limited information it contains, is protected by state and national privacy laws. Penalties apply if any of these laws are breached⁽³⁵⁾.

4.7 Features of the IHI

Medicare Australia has responsibility for provision and administration of health related programmes. They are to be the initial operator of the healthcare identifiers service. As a dedicated provider of health related services, Medicare has the national infrastructure, processes and industry and community relationships needed to securely deliver and maintain the Healthcare Identifiers.

The healthcare identifier service will be a separate and new Medicare business, not linked to its funding or claims for payment functions. As a statutory agency Medicare Australia is governed by national legislation that prescribes the scope of the functions it will perform and the privacy and security it must maintain⁽³⁵⁾.

The IHI service will be seeded by demographic data held within Medicare Australia's Consumer Directory Maintenance System (CDMS). The CDMS currently holds demographic information about approximately 98 per cent of Australia's healthcare consumers, which allows for the majority of IHI numbers and records to be created without having to re-collect this demographic information, or collect additional information, from individuals⁽³⁵⁾. The Department of Veteran Affairs database will also

be used as a trusted data source (TDS) to seed the initial HI service database⁽³⁶⁾. There will be no IHI card or number carrying document issued to individuals in Australia as the major trusted data sources which will seed the IHI database cover the vast majority of the population and registrants are issued with identifying numbers for these trusted data sources already. These numbers although not required, in addition to personal demographic information can aid healthcare practitioners to ascertain each individual's IHI securely online.

In privacy terms this involves the use of existing information by Medicare Australia in its role as the initial HI service operator, rather than a collection of new information. Collection of personal information to assign an IHI to an individual will only need to occur in limited circumstances. Where an individual's personal demographic details are not available from the Medicare Australia CDMS or the Department of Veteran Affairs database (e.g. because the individual is not enrolled), only information required for the identification of healthcare individuals will be collected by the HI service^(33;36).

The IHI and the IHI record will be available via a single source. Access to the system will be controlled, and constantly audited and monitored. Those wishing to access the system must be appropriately authenticated and authorised. Authenticated healthcare providers and healthcare administrators will be able to search for or view the IHI record of individuals for whom they provide healthcare. An identifier for healthcare providers (HPI - I) and organisations will be implemented at the same time as the IHI and all healthcare providers, including healthcare administrators will be assigned a HPI-I following authentication.

Individuals will have the right to access their IHI record and the record of those for whom they act in an authorised representative capacity. Detailed legal policy analysis will be required to develop appropriate policies dealing with agency issues for individual access. This will include information on who has accessed their IHI record and when. The system is expected to allow individuals to access their IHI record using a number of different options; for example, over the counter, over the phone or through a web portal⁽³⁷⁾.

The IHI satisfies most of the fundamental criteria for selection of a UHI identified by the Authority (see appendix 5).

4.8 UHI Privacy Concerns and Consent Process

The Australian Health Ministers' Advisory Council published a consultation document about privacy and proposed legislative support required to protect the privacy of individuals in July 2009⁽³³⁾. Submissions were invited from stakeholders; however, details of submissions and a draft privacy framework have yet to be published as of 23 November, 2009. It is proposed in this document that assignment of the IHI will be authorised by legislation, therefore, consent need not be sought from individuals⁽³³⁾.

4.9 Lessons Learned

The following are some lessons learned from the Australian experience thus far:

- full governance controls should be in place prior to implementation to ensure the identifier is used for its intended purpose only following implementation
- wide consultation with stakeholders around privacy concerns should be undertaken at an early stage of the project
- public awareness campaigns should be undertaken in advance of implementation to highlight the benefits of the IHI to individuals and encourage public support and buy in
- privacy impact assessment (PIA) of the UHI Service proposed should be undertaken at the planning stage and after any legislative or strategic change that results in the programme changing direction.

5 New Zealand

The Minister of Health in New Zealand has overall responsibility for the health and disability system. The health service is funded and delivered by 21 district health boards (DHBs) who report directly to the Minister of Health⁽³⁹⁾. Approximately 30 percent of the New Zealand population have opted for private health insurance; however, the provision of private healthcare is still governed by the DHB. The New Zealand Health Information Service (NZHIS), reporting to the Minister of Health, was established in the early 1990's to develop the National Health Index (NHI) and prevent fragmentation of health information in New Zealand⁽⁴⁰⁾.

New Zealand has a reputation for leadership in national health information systems due to fact that the country has had some form of national unique identifier for health since the late 1970s and a fully specified NHI system since 1992. The NHI is a database of information associated with a unique identifying number (NHI number) that is assigned to each person using health and disability services in New Zealand. An upgrade of the NHI is currently approaching completion following a review of efficiency and effectiveness in 2001. This review recommended a programme to remove duplicate record entries and upgrade the technology used by the NHI in order to increase efficiency⁽⁴⁰⁾.

The NHI number was first conceived of in the 1970s and implemented for use in public hospitals only. The public hospitals were linked to a centralised mainframe based computer system at that time⁽⁴⁰⁾. The NHI number much as it is known now was implemented in 1992 when the NZHIS were established. Although the NHI number has been in existence for over 30 years, it is only in more recent years that its implementation and use have spread nationally across the various health sectors to the population of just under four million people⁽⁴⁰⁾.

5.1 Purpose of the Identifier

As the benefits of using a unique identifier became apparent over time and following a comprehensive review, the NHI system was upgraded and is currently being rolled out to primary care⁽⁴⁰⁾. 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⁽⁴⁰⁾

5.2 NHI Number Format

The NHI number 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⁽⁴¹⁾. The number is generated randomly, 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 a UHI as defined by the ASTM, in that it is atomic, unambiguous, can be made public and is supported by a secure network (see appendix 6)⁽⁴⁰⁾.

5.3 NHI Validation Method

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 by the NHS number in England and Wales, (appendix 1). 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⁽⁴⁰⁾.

5.4 Dataset Associated with the NHI

The NHI does not record information about an individual's health. Individual demographic details on record are:

- NHI number
- name
- address
- date of birth
- sex
- New Zealand resident status
- date of death
- ethnicity
- domicile code⁽⁴²⁾.

New information to be collected following the NHI upgrade which is at present, approaching completion:

- place of birth

- address history
- ethnicity history
- geo-spatial fields⁽⁴³⁾

All the information associated with the NHI number is designed to accurately identify individuals receiving treatment and link them with their medical records. The NHI number and its associated demographics are held centrally on the NHI Online Access for Health (NOAH) system⁽⁴²⁾.

5.5 NHI Architecture

There is no visual representation of the technical structure of the NHI available at the time of writing this report. The core of the NHI is a database containing basic demographic information on individuals. Most of these data are held in a single table indexed according to a unique healthcare user identification number, more commonly referred to as the NHI number. External access to the database is controlled by software components known as application programming interfaces (APIs) which execute the allowed transactions within the NHI, such as reading from the index, creating a new entry to the index and changing existing entries. The APIs allow interaction with the NHI system by external systems that are certified by the NZHIS, which is responsible for the operations of the NHI⁽⁴⁰⁾.

5.6 NHI Governance

The NZHIS, a division of the Ministry of Health, act as the central trusted authority for the NHI number and the NOAH system. The NZHIS hold responsibility for ensuring that all users who access the NHI number system and its dataset are fully authorised and that the NHI number is only used in compliance with the Privacy Act 1993 and the Health Information Privacy Code 1994⁽⁴³⁾. Authorised health practitioners are authenticated by the Health Practitioner Index Common Person Number (HPI-CPN), a unique identifier for healthcare practitioners. All users who have access to the NHI have signed an access agreement prior, binding them to the Health Information Privacy Code⁽⁴³⁾.

The NZHIS has issued a statement of use for the NHI Number⁽⁴⁴⁾. This statement defines the allowed uses for the NHI number in accordance with the Health Information Privacy Code 1994. They include that the NHI Number can be used for identification of an individual for referrals, hospital visits, clinical tests and patient related correspondence, to facilitate the linkage of health information across different specialties and various authorised health providers, for communication with patients, to report patient events to national data collections and for screening programmes. An encrypted form of the NHI number can be used in statistical databases to help protect the privacy of individuals while enabling data from different places to be linked and the NHI number

may also be used as an anonymous reference to the patient in research undertaken by a hospital⁽⁴⁴⁾.

5.7 Features of the NHI Number

Most NHI numbers are now issued at birth and it is estimated that 95% of the population of New Zealand now have an NHI number. Anyone without an NHI number who presents at a healthcare organisation is assigned a number following a search of the index. New numbers can be assigned electronically via a request directly to the NZHIS or to the relevant DHB in close to real time. It is now seen as a requirement to allow real time assignment at the point of care, therefore, as part of the current NHI upgrade programme, it will become possible for some providers to assign the NHI number directly in real time⁽⁴³⁾. Individuals are not provided with NHI number cards, however, an individual can find out their NHI number through their general practitioner if they wish.

The NHI was initially designed for use solely in public hospitals. It was accessed via the NOAH system, which was made available in all public hospitals in the 1990's. NOAH is a web-based solution allowing access to the NHI from an authorised provider's computer. As part of the current upgrade of the NHI, the NOAH system is being implemented at primary care level with the majority of users gaining read only access initially. Following sufficient training, write access will be rolled out incrementally in the primary care setting⁽⁴³⁾.

5.8 NHI Privacy Concerns and Consent Process

The Health Information Privacy Code 1994 allows for the assignment of the NHI number without the express consent of the individual as it is deemed necessary to facilitate the provision of safe and secure care⁽⁴⁵⁾.

Prior to the current upgrade of the NHI, which is nearing completion, there were concerns about the accuracy of data held on the NHI due to large numbers of duplicate records; however, a dedicated team within the NZHIS are actively working to remove duplicates and improve the data integrity of the index. This initiative, together with intensive training for users is helping to significantly address the issue of duplicates in the index.

Another initiative implemented as part of the NHI upgrade programme in order to protect the privacy of the individual is the NHI audit. Auditing is a useful means of ensuring that authorised users do not abuse the trust that has been placed with them. The audit project was implemented as a pro-active and ongoing process to audit all of the users of the NHI and verify that the NHI is only accessed for legitimate reasons⁽⁴³⁾.

5.9 Lessons Learned

Lessons learned were highlighted in a review of the NHI undertaken in 2006, *Fourteen Years Young - A Review of the National Health Index in New Zealand*⁽⁴⁰⁾. They are:

- the use of the unique identifier must span all levels of health and social care, particularly primary care, in order to be truly effective in accurately identifying and tracking the care of individuals⁽⁴⁰⁾
- privacy concerns around the accuracy of data held on individuals should be addressed and prevented if possible by avoiding manual transcription of the identifier and minimising duplicate numbers and records in the central repository⁽⁴⁰⁾
- real time assignability of the UHI. (This is currently being addressed as part of the current upgrade of the NHI)
- the ability for authorised users to update individual demographics on the UHI system in real time.

6 Germany

The German health system is decentralised in nature and is based on statutory social insurance provided by over 300 insurers. The Ministry of Health and Social Security propose all health acts which provide a legislative framework in which the insurance companies must operate⁽⁴⁶⁾.

The Modernisation 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)) on the 1st January 2006. The eGK replaces the previous health insurance card (krankenversichertenkarte). Part and parcel of the modernisation bill is the creation of a new universal health identifier, the Krankenversichertennummer⁽⁴⁷⁾. The format of this number will be used by all public health insurance companies to ensure that the number associated with an individual does not change, should the individual change insurance providers⁽⁴⁸⁾.

The roadmap for implementing the applications, functions and services of the electronic health card and UHI in Germany is the following:

- pilot tests operating at regional level (modellregionen and testregionen) are to be adapted in line with the electronic health card concepts under development
- smaller pilot tests, if successful, will be rolled out at the regional level facilitating incremental implementation.

Pilot site tests have so far been successful; however in 2009, the full implementation of the German UHI is at least two years behind schedule^(49:50)

6.1 Purpose of the Identifier

The implementation of a unique identifier is part of the strategy towards modernising the health service in Germany. The purposes for modernising according to the German ehealth strategy 2005 are to:

- establish more citizen-oriented services
- support patient-centred care
- improve quality and services
- reduce costs
- provide better data for health systems management⁽⁴⁹⁾.

6.2 Krankenversichertennummer Number Format

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

Case identifiers and family member identifiers can be attached to the Krankenversicherungsnummer in order to identify specific episodes of care; however, the initial 10 digit Krankenversicherungsnummer will not change and is assigned for the lifetime of the insured⁽⁵¹⁾. This number will be based on the German social security number equivalent and will be generated by running a one-way algorithm⁽⁵⁰⁾.

6.3 Krankenversicherungsnummer Validation Method

The German UHI will be validated by use of a check digit. This check digit will be in the twentieth position of the sequence when it has been suffixed with the 9 digit health insurance Kassennummer⁽⁵¹⁾.

6.4 Dataset Associated with the Krankenversicherungsnummer

Basic demographic information will be associated with the German UHI; however, the smartcard that will contain the number can also hold some clinical information useful in emergency situations if the individual gives consent⁽⁵⁰⁾. The exact demographic and clinical content is unknown.

6.5 Krankenversicherungsnummer Architecture

The architecture has yet to be fully defined; however, the specialist company, Gematik has been contracted to define the first infrastructure set-up and the technical framework and security concepts⁽⁴⁹⁾.

6.6 Krankenversicherungsnummer Governance

The union of public health insurers (GKV) agreed that ITSEG - Informationstechnische Servicestelle der gesetzlichen Krankenversicherung GmbH - be in charge of the creation of the Vertrauensstelle Krankenversicherungsnummer (VST), an organisation responsible for issuing the new health care number. The VST is supervised by the Department of Health and Social Security and cooperates with the "Bundesamt" for information technology security (BSI). The union of private health insurance (PKV) has also agreed that its approximately 8 million insured should avail of a health care number issued by the VST^(52;53).

Initially, the German UHI was to be issued to all German citizens regardless whether they are publicly or privately insured; however, the private insurance companies have recently decided to opt out of the initiative citing rising costs as the reason. This is not deemed as a major problem as 90 percent of the population are publicly insured⁽⁵⁴⁾.

The mandatory applications for which consent will not be required are:

- provision of administrative data (data identifying the citizen and his or her insurance status, address etc.)
- provision of information about share of private co-payments
- transmission of electronic prescriptions
- provision of data required by European regulations for having access to medical treatment in the Member States of the EU (in Germany the data will not only be visible but also stored on the chip, thereby creating an “Electronic European Health Insurance Card” - e-EHIC)⁽⁵⁰⁾

6.7 Assignment of the Krankenversicherturnummer - Registration

The process of assignment has yet to be defined or is unavailable.

6.8 Access to Krankenversicherturnummer System

Access to the system will be via healthcare practitioner smartcard access verification using the same technology as the individual health card; however, information about who can access the system has not been defined as yet or is unavailable⁽⁵⁰⁾.

6.9 Features of the Krankenversicherturnummer

As the exact format of the number, its supporting systems and the full governance arrangements are yet to be clearly defined, the Krankenversicherturnummer cannot yet be measured against the criteria for selection of a UHI. However, it is known that the number on its own when separated from the social security number, will be content free, healthcare focused and designed to be accessible and assignable at all times⁽⁵⁵⁾.

6.10 Krankenversicherturnummer Privacy Concerns and Consent Process

Consent will not be sought for the mandatory applications of the ehealth card with the German UHI. There are many voluntary applications of the card to follow including the option to store clinical information on the card itself. Although consent will be required for these voluntary applications, strong governance controls to ensure the card only holds the information the individual requests are necessary.

6.11 Lessons Learned

There are a number of lessons that can be learned from the German experience so far:

- incremental introduction of the UHI by use of pilot sites is beneficial
- clear definitions of the full proposed dataset to be associated with the UHI should be published prior to introduction
- clear definition of mandatory and voluntary functions of the UHI should be defined

- better communication and agreement between public and private sectors must be maintained throughout the project.

7 Conclusions

The aim of this paper was to explore the international experience of implementing a UHI to inform best practice for implementation in Ireland. Structures, formats, governance and current status in a number of countries were documented.

Of the information that was sourced in the course of this research the following are the key points:

- privacy and the protection of individual confidentiality is recognised as overarching the success of a UHI. Strong governance controls must be in place with clear lines of accountability prior to any implementation of a UHI
- a central trusted authority is necessary in driving the project forward and ensuring consistency across providers
- broad ranging stakeholder engagement is required early on in the project to ensure representation from all parties involved
- change management processes must be developed prior to implementation in order to minimise the impact on front line staff and consequently the delivery of care to the individual
- **it is vital that any UHI satisfies the fundamental Criteria for Selection of a UHI in Ireland**

At the time of writing of this report a number of developments are ongoing – most notably in Australia and Germany, with an upgrade of the UHI system currently underway in New Zealand. As such the information presented in this document may change accordingly over the coming weeks and months.

8 Appendices

8.1 Appendix 1 - Modulus 11 Calculation

Below are the steps involved in modulus 11 calculations. This allows the validity of a number to be electronically checked.

1. Multiply each of the first nine digits by a weighting factor as follows:
2. Add the results of each multiplication together.
3. Divide the total by 11 and establish the remainder.
4. Subtract the remainder from 11 to give the check digit. If the result is 11 then a check digit of 0 is used. If the result is 10 then the NHS Number is invalid and not used.
5. Check the remainder matches the check digit. If it does not, the NHS Number is invalid.

Digit Position	Factor
1	10
2	9
3	8
4	7
5	6
6	5
7	4
8	3
9	2

Modulus 11 Calculation:

8.2 Appendix 2 – Dataset Associated with the NHS Number

FIELD	DESCRIPTION
NHS Number	The unique patient identifier
Patient Name	Including any previous names, aliases and preferred name, e.g. Chris rather than Christopher
Date of birth	The patient's date of birth.
Place of Birth	The patient's place of birth
Additional birth information	The delivery time and birth order for multiple births
Date of death	The patient's date of death
Death notification status	Indicates a formal death certificate has been issued for the patient and the death has been registered
Gender	Administrative gender
Address	Includes main, temporary and correspondence addresses
Alternative contacts	The patient's legal guardian, proxy, family/close contact
Telecommunication contact details	Contact details such as telephone number, fax number and email address
Preferred contact times	Patient's preferred contact times
Preferred contact method	The patient's preferred contact method, e.g. telephone contact by proxy, no telephone contact, sign language required in face to face contact or minicom
Preferred written communication format	Specialised patient contact requirements, e.g. large print, Braille, audio tape
Preferred language	Information on patient's preferred language of communication
Interpreter required	Indicates that the patient requires an interpreter
NHS Care Record consent to share status	Indicates that the patient has agreed to share their health record
Nominated dispensing contractor*	The patient's nominated dispensing contractor that could include a community pharmacy, dispensing appliance contractor and a dispensing doctor.
Reason for Removal	Indicates that the patient is not registered with a GP
Previous NHS contact indicator	Indicates that the patient confirms they have had previous NHS treatment. This allows the PDS National Back Office to check for a duplicate of a record
Patient call-back consent status	Indicates that the patient is willing to be called back from a Choose & Book call-centre
Shared secret	An encrypted password used to validate a patient's identity when contacted from a Choose & Book call-centre
Sensitive record indicator	Indicates that either the record is not accessible to PDS users or that the content of the record is being reviewed to ensure the data is correct

Primary Care	The GP Practice with whom the patient is registered
Date of Registration	The date the patient registered with the GP Practice
Back office location	The back office location associated with the GP Practice where the patient is registered, used for the administration of primary care
Serial change number	The mechanism for synchronising local and national records
HealthSpace status	Indicates that the patient is registered to use HealthSpace
NHAIS Information	The PDS holds certain information to allow it to interact with the NHAIS system that administers primary care. This information is not routinely accessible by the NHS

8.3 Appendix 3 – NHS Number and the Criteria for Selection of a UHI

Criteria	Definition	NHS Number
Accessible – <i>fundamental</i>	The UHI System should be available whenever and wherever they are required for registration/positive identification purposes. Any UHI should be available in an efficient and timely manner 24 hours a day.	The NHS Number is accessible in real time through the PDS at points of care 24 hours a day
Assignable – <i>fundamental</i>	It should be possible to assign a UHI to an individual whenever it is needed. Assignment will be performed by a UHI trusted authority after receiving a properly authenticated request for a new UHI.	The NHS Number can be assigned at the point of care in real time by authorised healthcare professionals
Identifiable – <i>fundamental</i>	It shall be possible to identify the person associated with a valid UHI. Identifying information may include such standard items as name, birthplace, sex, address, mother's maiden name. This information is not incorporated in the UHI itself, but is associated with it by linkage and where necessary this information can be updated or corrected.	There is a standard dataset of demographic information associated with the NHS Number.
Mergeable - <i>fundamental</i>	In the (theoretically infrequent) case that duplicate UHIs are issued to a single individual, it shall be possible to merge the two UHIs to indicate that they both apply to the same individual. In such cases, the invalid UHI must remain linked to the valid UHI.	The NHS number is mergeable with another NHS number without the loss of linked information
Splittable – <i>fundamental</i>	In the (theoretically never occurring) event that the same UHI is assigned to two individuals, there must be a mechanism to retire the UHI and assign a new UHI to both of these individuals	In the unlikely event of this occurring, the NHS number could be split to allow the introduction of new numbers without the loss of any information
Verifiable – <i>fundamental</i>	A user should be able to determine that a candidate identifier is or is not a valid UHI without requiring additional information. This should support the ability to detect	The last character of the NHS number is a check digit to support verification of the number

	accidental information, such as typographical errors. It is not meant to be able to preclude intentional misinformation or misuse of an identifier.	
--	---	--

Linkage of Lifelong Health Record

Criteria	Definition	Testing against criteria
Linkable – <i>fundamental</i>	It shall be possible to use the UHI to link various health records together in both automated and manual systems	Use of the NHS number is widespread nationally facilitating the linkage of health records across various locations
Mappable – <i>differentiating</i>	During the incremental implementation of a UHI, it shall be possible to create bidirectional linkages between a UHI and existing identifiers used currently by a variety of health care institutions	Many organisations maintain a local identification number that is mappable to the NHS Number

Patient Confidentiality and Access Security

Criteria	Definition	Testing against criteria
Content-free – <i>fundamental</i>	The structure and elements of the UHI number itself should not contain any information about the individual.	The NHS Number is content free
Controllable - <i>fundamental</i>	It must be possible to ensure the confidentiality of personal information held in association with the UHI. Only trusted authorities have access to algorithms and methods used to link and disidentify individuals with the UHI.	There is a central trusted authority and secure technical infrastructure in place to ensure the NHS number is controllable
Healthcare Focused – <i>fundamental</i>	Was the number created for healthcare purposes? The UHI should not be used to identify an individual for any purpose other than for the provision of health and social care in Ireland.	The NHS Number is used solely for the provision of health and social care services
Public –	The individual a UHI identifies	The NHS number on its

<i>fundamental</i>	should be able to reveal it.	own does not allow access to personal information associated with that number
Secure – <i>fundamental</i>	It should be possible to encrypt and decrypt a UHI as required to ensure that individual privacy is protected.	Unknown
Legislation - <i>fundamental</i>	Legislation should allow that the UHI can be used for health and social care purposes while stipulating severe penalties for misuse of the UHI.	Use of the NHS number for health and social care purposes is legislated for and this includes penalties for misuse of the number
Dis-identifiable – <i>differentiating</i>	It should be possible to create an arbitrary number of specialised UHIs that can be used to link health information concerning specific individuals but that cannot be used to identify the associated individual.	Unknown

Compatibility with Standards and Technology

Criteria	Definition	Testing against criteria
Deployable – <i>fundamental</i>	The UHI should be implementable using a variety of technologies, including magnetic cards, bar code readers, optical cards, smart cards, audio, voice, computer data files, and paper.	The NHS Number employs barcode scanning and smartcard technology
Standard // Based on Industry Standards – <i>fundamental</i>	The identifier scheme should be based on international best practice and take guidance from CEN and ISO standards.	Unknown
Usable – <i>fundamental</i>	A UHI should be processable by both manual and automated means. While manual methods for such functions as verifying the validity of a UHI may require considerably more time, there should be no technical or policy inhibitions to manual operation	The NHS number can be used and is processable by both manual and automated means

Design Characteristics

Criteria	Definition	Testing against criteria
Atomic – <i>fundamental</i>	A UHI should be a single data item. It should not contain sub elements that have meaning outside the context of the entire UHI. Nor should the UHI consist of multiple items that must be taken together to constitute an identifier. The UHI must have no elements that can be analysed into any type of coherent structure.	The NHS number is a single data item
Governed Centrally – <i>fundamental</i>	A management organisation shall exist that is responsible for overseeing the UHI system. This agency will determine the policies that govern the UHI system, manage the trusted authority, and take such actions to ensure that the UHI can be used properly and effectively to support health care.	There is a central trusted authority which has produced policies and procedures that govern the use of the NHS number
Networked - <i>fundamental</i>	The UHI should be supported by a secure network that makes UHI services universally available where needed.	There is a secure network in place that can support the issue and use of the NHS number
Permanent – <i>fundamental</i>	Once assigned, a UHI should remain with the individual. It should never be reassigned to another person, even after the individual's death.	The NHS number is never re-used for another individual
Repository-based - <i>fundamental</i>	A secure, permanent repository shall exist in support of the UHI system. The repository should contain the UHI and other relevant information to support the function of the UHI system.	There is a permanent, secure repository that supports the NHS number
Retroactive – <i>fundamental</i>	It should be possible to assign a UHI to all currently existing individuals at the time that the UHI system is implemented	There is a process in place to facilitate the issue of the NHS number to the existing general population
Unambiguous – <i>fundamental</i>	Whether represented in automated or handwritten form, a UHI should minimise the risk of misinterpretation (for example confusing o with a zero)	The NHS number includes safeguards to minimise misinterpretation

Unique – <i>fundamental</i>	A valid UHI should identify one and only one individual	The NHS number identifies one and only one individual
Universal – <i>fundamental</i>	A UHI should be able to support every living person for the foreseeable future. This may include the future expansion of the UHI system to include individuals from outside of Ireland.	Unknown
Incremental – <i>differentiating</i>	The UHI system should be capable of being implemented in a phased-in-manner. This may include incremental implementation for a specific institution for the information on a specific patient, and for a geographical area.	N/A The NHS number is already in use by all NHS services
Longevity – <i>differentiating</i>	The UHI system should be designed to function for the foreseeable future. It should not contain known limitations that will force the system to be restricted or revised radically.	Unknown
Concise – <i>differentiating</i>	The UHI should be as short as possible to minimise errors, the time required for use, and the storage needed.	The NHS number is 10 digits in length
Deactivation – <i>differentiating</i>	The UHI numbering system should allow for the deactivation of a UHI.	The NHS Number dataset includes a date of death field, however, the number still remains associated with the individual

Reduction of Cost and Enhanced Health Status

Criteria	Definition	Testing against criteria
Cost effective – <i>differentiating</i>	The UHI system chosen should achieve maximum functionality while minimizing the investment required to create and maintain it.	Unknown

8.4 Appendix 4 – Newfoundland and Labrador UPI/ Client Registry and the Criteria for Selection of a UHI

Criteria	Definition	UPI/Client Register
Accessible – <i>fundamental</i>	The UHI System should be available whenever and wherever they are required for registration/positive identification purposes. Any UHI should be available in an efficient and timely manner 24 hours a day.	The UPI/Client Registry is accessible in real time through local information systems at points of care 24 hours a day
Assignable – <i>fundamental</i>	It should be possible to assign a UHI to an individual whenever it is needed. Assignment will be performed by a UHI trusted authority after receiving a properly authenticated request for a new UHI.	The UPI/Client Registry Number can be assigned at the point of care in real time by authorised healthcare professionals
Identifiable – <i>fundamental</i>	It shall be possible to identify the person associated with a valid UHI. Identifying information may include such standard items as name, birthplace, sex, address, mother's maiden name. This information is not incorporated in the UHI itself, but is associated with it by linkage and where necessary this information can be updated or corrected.	There is a standard dataset of demographic information associated with the UPI/Client Registry
Mergeable - <i>fundamental</i>	In the (theoretically infrequent) case that duplicate UHIs are issued to a single individual, it shall be possible to merge the two UHIs to indicate that they both apply to the same individual. In such cases, the invalid UHI must remain linked to the valid UHI.	The Registration Integrity Unit (RIU) undertakes merging of duplicate records without any loss of information.
Splittable – <i>fundamental</i>	In the (theoretically never occurring) event that the same UHI is assigned to two individuals, there must be a mechanism to retire the UHI and assign a new UHI to both of these individuals	Unknown
Verifiable – <i>fundamental</i>	A user should be able to determine that a candidate identifier is or is not a valid UHI without requiring additional information. This should support the ability to detect accidental information, such as typo	Unknown (Shadow UPI)

	graphical errors. It is not meant to be able to preclude intentional misinformation or misuse of an identifier.	
--	---	--

Linkage of Lifelong Health Record

Criteria	Definition	Testing against criteria
Linkable – <i>fundamental</i>	It shall be possible to use the UHI to link various health records together in both automated and manual systems	The UPI can be used to link various health records using both manual and automated systems
Mappable – <i>differentiating</i>	During the incremental implementation of a UHI, it shall be possible to create bidirectional linkages between a UHI and existing identifiers used currently by a variety of health care institutions	Many organisations maintain a local identification number that is mappable to the UPI/Client Registry

Patient Confidentiality and Access Security

Criteria	Definition	Testing against criteria
Content-free – <i>fundamental</i>	The structure and elements of the UHI number itself should not contain any information about the individual.	Unknown
Controllable - <i>fundamental</i>	It must be possible to ensure the confidentiality of personal information held in association with the UHI. Only trusted authorities have access to algorithms and methods used to link and disidentify individuals with the UHI.	There is a central trusted authority that maintains control of the UPI/CR
Healthcare Focused – <i>fundamental</i>	Was the number created for healthcare purposes? The UHI should not be used to identify an individual for any purpose other than for the provision of health and social care in Ireland.	The UPI/Client Registry Number is used solely for the provision of health and social care services

Public – <i>fundamental</i>	The individual a UHI identifies should be able to reveal it.	The UPI could be made public without revealing any personal information
Secure – <i>fundamental</i>	It should be possible to encrypt and decrypt a UHI as required to ensure that individual privacy is protected.	It is possible to securely encrypt and decrypt the number
Legislation - <i>fundamental</i>	Legislation should allow that the UHI can be used for health and social care purposes while stipulating severe penalties for misuse of the UHI.	The use of the UPI/CR for health and social care purposes is legislated for
Dis-identifiable – <i>differentiating</i>	It should be possible to create an arbitrary number of specialised UHIs that can be used to link health information concerning specific individuals but that cannot be used to identify the associated individual.	The UPI/CR record is disidentifiable for the purposes of linking anonymised data

Compatibility with Standards and Technology

Criteria	Definition	Testing against criteria
Deployable – <i>fundamental</i>	The UHI should be implementable using a variety of technologies, including magnetic cards, bar code readers, optical cards, smart cards, audio, voice, computer data files, and paper.	The UPI/Client Registry can employ smartcard technology
Standard // Based on Industry Standards – <i>fundamental</i>	The identifier scheme should be based on international best practice and take guidance from CEN and ISO standards.	Unknown
Usable – <i>fundamental</i>	A UHI should be processable by both manual and automated means. While manual methods for such functions as verifying the validity of a UHI may require considerably more time, there should be no technical or policy inhibitions to manual operation	Local identifiers can still be used in the case of the UPI/Client Registry not operating

Design Characteristics

Criteria	Definition	Testing against criteria
Atomic –	A UHI should be a single data item.	The UPI/CR identifier is a

<i>fundamental</i>	It should not contain sub elements that have meaning outside the context of the entire UHI. Nor should the UHI consist of multiple items that must be taken together to constitute an identifier. The UHI must have no elements that can be analysed into any type of coherent structure.	single data item
Governed Centrally – <i>fundamental</i>	A management organisation shall exist that is responsible for overseeing the UHI system. This agency will determine the policies that govern the UHI system, manage the trusted authority, and take such actions to ensure that the UHI can be used properly and effectively to support health care.	There is a central trusted authority in place to govern the use of the UPI/CR
Networked - <i>fundamental</i>	The UHI should be supported by a secure network that makes UHI services universally available where needed.	There is a secure network in place that can support the issue and use of the UPI/CR
Permanent – <i>fundamental</i>	Once assigned, a UHI should remain with the individual. It should never be reassigned to another person, even after the individual's death.	The number is never re-used for another individual
Repository-based - <i>fundamental</i>	A secure, permanent repository shall exist in support of the UHI system. The repository should contain the UHI and other relevant information to support the function of the UHI system.	There is a secure permanent repository in support of the UPI/CR
Retroactive – <i>fundamental</i>	It should be possible to assign a UHI to all currently existing individuals at the time that the UHI system is implemented	There is a process in place for assigning the UPI/CR identifier
Unambiguous – <i>fundamental</i>	Whether represented in automated or handwritten form, a UHI should minimise the risk of misinterpretation (for example confusing o with a zero)	Unknown
Unique – <i>fundamental</i>	A valid UHI should identify one and only one individual	Each UPI/CR record identifies one and only one individual

Universal – <i>fundamental</i>	A UHI should be able to support every living person for the foreseeable future. This may include the future expansion of the UHI system to include individuals from outside of Ireland.	Unknown
Incremental – <i>differentiating</i>	The UHI system should be capable of being implemented in a phased-in-manner. This may include incremental implementation for a specific institution for the information on a specific patient, and for a geographical area.	N/A The UPI/Client Registry is already in use province wide
Longevity – <i>differentiating</i>	The UHI system should be designed to function for the foreseeable future. It should not contain known limitations that will force the system to be restricted or revised radically.	Unknown
Concise – <i>differentiating</i>	The UHI should be as short as possible to minimise errors, the time required for use, and the storage needed.	The number is 9 digits in length
Deactivation – <i>differentiating</i>	The UHI numbering system should allow for the deactivation of a UHI.	The UPI/Client Registry dataset includes a date of death field; however, the number still remains associated with the individual

Reduction of Cost and Enhanced Health Status

Criteria	Definition	Testing against criteria
Cost effective – <i>differentiating</i>	The UHI system chosen should achieve maximum functionality while minimizing the investment required to create and maintain it.	Unknown

8.5 Appendix 5 – IHI Australia and the Criteria for Selection of a UHI

Criteria	Definition	IHI Number
Accessible – <i>fundamental</i>	The UHI System should be available whenever and wherever they are required for registration/positive identification purposes. Any UHI should be available in an efficient and timely manner 24 hours a day.	The HI Service will be accessible in real time through local information systems at points of care 24 hours a day
Assignable – <i>fundamental</i>	It should be possible to assign a UHI to an individual whenever it is needed. Assignment will be performed by a UHI trusted authority after receiving a properly authenticated request for a new UHI.	The IHI Number can be assigned at the point of care in real time by authorised HI Service operatives
Identifiable – <i>fundamental</i>	It shall be possible to identify the person associated with a valid UHI. Identifying information may include such standard items as name, birthplace, sex, address, mother's maiden name. This information is not incorporated in the UHI itself, but is associated with it by linkage and where necessary this information can be updated or corrected.	There will be a standard dataset of demographic information associated with the IHI
Mergeable - <i>fundamental</i>	In the (theoretically infrequent) case that duplicate UHIs are issued to a single individual, it shall be possible to merge the two UHIs to indicate that they both apply to the same individual. In such cases, the invalid UHI must remain linked to the valid UHI.	The IHI will be mergeable with other IHI's without the loss of information
Splittable – <i>fundamental</i>	In the (theoretically never occurring) event that the same UHI is assigned to two individuals, there must be a mechanism to retire the UHI and assign a new UHI to both of these individuals	Unknown
Verifiable – <i>fundamental</i>	A user should be able to determine that a candidate identifier is or is not a valid UHI without requiring additional information. This should support the ability to detect accidental information, such as typo	Unknown

	graphical errors. It is not meant to be able to preclude intentional misinformation or misuse of an identifier.	
--	---	--

Linkage of Lifelong Health Record

Criteria	Definition	Testing against criteria
Linkable – <i>fundamental</i>	It shall be possible to use the UHI to link various health records together in both automated and manual systems	The IHI has yet to be introduced; however, it will support the linkage of health records
Mappable – <i>differentiating</i>	During the incremental implementation of a UHI, it shall be possible to create bidirectional linkages between a UHI and existing identifiers used currently by a variety of health care institutions	The IHI will be capable of linkage to other identifiers used, subject to privacy legislation.

Patient Confidentiality and Access Security

Criteria	Definition	Testing against criteria
Content-free – <i>fundamental</i>	The structure and elements of the UHI number itself should not contain any information about the individual.	The IHI will be content-free
Controllable - <i>fundamental</i>	It must be possible to ensure the confidentiality of personal information held in association with the UHI. Only trusted authorities have access to algorithms and methods used to link and disidentify individuals with the UHI.	The IHI will be controlled by secure technical infrastructures and a central trusted authority
Healthcare Focused – <i>fundamental</i>	Was the number created for healthcare purposes? The UHI should not be used to identify an individual for any purpose other than for the provision of health and social care in Ireland.	The IHI Number will be used solely for the provision of health and social care services
Public – <i>fundamental</i>	The individual a UHI identifies should be able to reveal it.	Possession of the number by any individual will not allow access to personal

		information associated with that number without authentication
Secure – <i>fundamental</i>	It should be possible to encrypt and decrypt a UHI as required to ensure that individual privacy is protected.	The IHI will support encryption and decryption processes
Legislation - <i>fundamental</i>	Legislation should allow that the UHI can be used for health and social care purposes while stipulating severe penalties for misuse of the UHI.	This legislation is currently under development
Dis-identifiable – <i>differentiating</i>	It should be possible to create an arbitrary number of specialised UHIs that can be used to link health information concerning specific individuals but that cannot be used to identify the associated individual.	It will be possible to generate arbitrary numbers to de-identify individuals

Compatibility with Standards and Technology

Criteria	Definition	Testing against criteria
Deployable – <i>fundamental</i>	The UHI should be implementable using a variety of technologies, including magnetic cards, bar code readers, optical cards, smart cards, audio, voice, computer data files, and paper.	The IHI and its supporting system will be designed with the utilization of technology in mind.
Standard // Based on Industry Standards – <i>fundamental</i>	The identifier scheme should be based on international best practice and take guidance from CEN and ISO standards.	The IHI numbering system is in line with international best practice
Usable – <i>fundamental</i>	A UHI should be processable by both manual and automated means. While manual methods for such functions as verifying the validity of a UHI may require considerably more time, there should be no technical or policy inhibitions to manual operation	The IHI will be processable using both manual and automated means

Design Characteristics

Criteria	Definition	Testing against criteria
Atomic – <i>fundamental</i>	A UHI should be a single data item. It should not contain sub elements that have meaning outside the context of the entire UHI. Nor should the UHI consist of multiple items that must be taken together to constitute an identifier. The UHI must have no elements that can be analysed into any type of coherent structure.	The IHI is a single data item
Governed Centrally – <i>fundamental</i>	A management organisation shall exist that is responsible for overseeing the UHI system. This agency will determine the policies that govern the UHI system, manage the trusted authority, and take such actions to ensure that the UHI can be used properly and effectively to support health care.	There is a central trusted authority in place and policies and procedures are currently under development
Networked - <i>fundamental</i>	The UHI should be supported by a secure network that makes UHI services universally available where needed.	The IHI will be supported by a secure network
Permanent – <i>fundamental</i>	Once assigned, a UHI should remain with the individual. It should never be reassigned to another person, even after the individual's death.	The number will never be re-used for another individual
Repository-based - <i>fundamental</i>	A secure, permanent repository shall exist in support of the UHI system. The repository should contain the UHI and other relevant information to support the function of the UHI system.	There will be a secure central repository in support of the HI system
Retroactive – <i>fundamental</i>	It should be possible to assign a UHI to all currently existing individuals at the time that the UHI system is implemented	There is a current plan for assignment of the number to the existing population
Unambiguous – <i>fundamental</i>	Whether represented in automated or handwritten form, a UHI should minimise the risk of misinterpretation (for example confusing o with a zero)	Unknown

Unique – <i>fundamental</i>	A valid UHI should identify one and only one individual	The IHI will identify one and only one individual
Universal – <i>fundamental</i>	A UHI should be able to support every living person for the foreseeable future. This may include the future expansion of the UHI system to include individuals from outside of Ireland.	The IHI is being designed to support every Australian for the foreseeable future and in line with international standards
Incremental – <i>differentiating</i>	The UHI system should be capable of being implemented in a phased-in-manner. This may include incremental implementation for a specific institution for the information on a specific patient, and for a geographical area.	It is planned to introduce the IHI incrementally
Longevity – <i>differentiating</i>	The UHI system should be designed to function for the foreseeable future. It should not contain known limitations that will force the system to be restricted or revised radically.	The IHI will be designed according to international standards of best practice, therefore will function for the foreseeable future
Concise – <i>differentiating</i>	The UHI should be as short as possible to minimise errors, the time required for use, and the storage needed.	The IHI is 16 digits in length
Deactivation – <i>differentiating</i>	The UHI numbering system should allow for the deactivation of a UHI.	The IHI dataset includes a date of death field and can be deactivated; however, the number still remains associated with the individual after deactivated

Reduction of Cost and Enhanced Health Status

Criteria	Definition	Testing against criteria
Cost effective – <i>differentiating</i>	The UHI system chosen should achieve maximum functionality while minimizing the investment required to create and maintain it.	Unknown

8.6 Appendix 6 – NHI New Zealand and the Criteria for Selection of a UHI

Criteria	Definition	NHI
Accessible – <i>fundamental</i>	The UHI System should be available whenever and wherever they are required for registration/positive identification purposes. Any UHI should be available in an efficient and timely manner 24 hours a day.	The NHI has been available to all public hospitals in New Zealand since 1992. Development since the Wave report has increased availability to primary care.
Assignable – <i>fundamental</i>	It should be possible to assign a UHI to an individual whenever it is needed. Assignment will be performed by a UHI trusted authority after receiving a properly authenticated request for a new UHI.	The NHI is specifically designed to meet this criteria; however, assignment is not currently undertaken in real time across the entire healthcare service
Identifiable – <i>fundamental</i>	It shall be possible to identify the person associated with a valid UHI. Identifying information may include such standard items as name, birthplace, sex, address, mother's maiden name. This information is not incorporated in the UHI itself, but is associated with it by linkage and where necessary this information can be updated or corrected.	There is a standard dataset of demographic information associated with the NHI Number. These demographics are contained in the NHI database.
Mergeable - <i>fundamental</i>	In the (theoretically infrequent) case that duplicate UHIs are issued to a single individual, it shall be possible to merge the two UHIs to indicate that they both apply to the same individual. In such cases, the invalid UHI must remain linked to the valid UHI.	The NHI has always had this functionality since its inception, and it has recently been improved.
Splittable – <i>fundamental</i>	In the (theoretically never occurring) event that the same UHI is assigned to two individuals, there must be a mechanism to retire the UHI and assign a new UHI to both of these individuals	These facilities have recently been improved in the NHI.
Verifiable – <i>fundamental</i>	A user should be able to determine that a candidate identifier is or is not a valid UHI without requiring additional information. This should support the ability to detect accidental information, such as typographical errors. It is not meant to	The NHI incorporates a check-digit to assist with validation of the number

	be able to preclude intentional misinformation or misuse of an identifier.	
--	--	--

Linkage of Lifelong Health Record

Criteria	Definition	Testing against criteria
Linkable – <i>fundamental</i>	It shall be possible to use the UHI to link various health records together in both automated and manual systems	The NHI is embedded in national collections of health data and facilitates linkage where required
Mappable – <i>differentiating</i>	During the incremental implementation of a UHI, it shall be possible to create bidirectional linkages between a UHI and existing identifiers used currently by a variety of health care institutions	NHI numbers can be linked one to another to eliminate duplicates, but there is no specific mapping facility

Patient Confidentiality and Access Security

Criteria	Definition	Testing against criteria
Content-free – <i>fundamental</i>	The structure and elements of the UHI number itself should not contain any information about the individual.	The NHI number is routinely used in isolation from the main index and does not contain any information about the individual
Controllable - <i>fundamental</i>	It must be possible to ensure the confidentiality of personal information held in association with the UHI. Only trusted authorities have access to algorithms and methods used to link and disidentify individuals with the UHI.	One-way encryption algorithms have been developed; however it is possible that this encryption could be cracked using the power of modern computers, therefore this is under review currently
Healthcare Focused – <i>fundamental</i>	Was the number created for healthcare purposes? The UHI should not be used to identify an individual for any purpose other than for the provision of health and social care in Ireland.	The NHI is specifically reserved for health care purposes only, and this is regulated by the Health Information Privacy Code 1994
Public – <i>fundamental</i>	The individual a UHI identifies should be able to reveal it.	Unencrypted NHI numbers are routinely used on hospital medical records, lab test requests,

		prescription forms, etc. without compromising privacy
Secure – <i>fundamental</i>	It should be possible to encrypt and decrypt a UHI as required to ensure that individual privacy is protected.	Encryption facilities exist. These facilities are currently under review
Legislation - <i>fundamental</i>	Legislation should allow that the UHI can be used for health and social care purposes while stipulating severe penalties for misuse of the UHI.	The NHI is regulated by the Health Information Privacy Code 1994 and cannot be used outside of health and social care
Dis-identifiable – <i>differentiating</i>	It should be possible to create an arbitrary number of specialised UHIs that can be used to link health information concerning specific individuals but that cannot be used to identify the associated individual.	One-way encryption algorithms have been developed for the NHI to allow an individual to be de-identified

Compatibility with Standards and Technology

Criteria	Definition	Testing against criteria
Deployable – <i>fundamental</i>	The UHI should be implementable using a variety of technologies, including magnetic cards, bar code readers, optical cards, smart cards, audio, voice, computer data files, and paper.	A wide range of different systems are currently using the NHI
Standard // Based on Industry Standards – <i>fundamental</i>	The identifier scheme should be based on international best practice and take guidance from CEN and ISO standards.	Unknown
Usable – <i>fundamental</i>	A UHI should be processable by both manual and automated means. While manual methods for such functions as verifying the validity of a UHI may require considerably more time, there should be no technical or policy inhibitions to manual operation.	The NHI is routinely used by both manual and automated means in different systems throughout the NZ health sector

Design Characteristics

Criteria	Definition	Testing against criteria
Atomic –	A UHI should be a single data item.	The NHI number is an

<i>fundamental</i>	It should not contain sub elements that have meaning outside the context of the entire UHI. Nor should the UHI consist of multiple items that must be taken together to constitute an identifier. The UHI must have no elements that can be analysed into any type of coherent structure.	essentially random series of letters and numbers and does not contain any sub elements that have meaning
Governed Centrally – <i>fundamental</i>	A management organisation shall exist that is responsible for overseeing the UHI system. This agency will determine the policies that govern the UHI system, manage the trusted authority, and take such actions to ensure that the UHI can be used properly and effectively to support health care.	The NHI has been governed by NZHIS, a department of the Ministry of Health since its inception
Networked - <i>fundamental</i>	The UHI should be supported by a secure network that makes UHI services universally available where needed.	The NHI network currently covers all public hospitals and is available to primary care via a number of secure different paths
Permanent – <i>fundamental</i>	Once assigned, a UHI should remain with the individual. It should never be reassigned to another person, even after the individual's death.	NHI numbers are never reassigned
Repository-based - <i>fundamental</i>	A secure, permanent repository shall exist in support of the UHI system. The repository should contain the UHI and other relevant information to support the function of the UHI system.	This repository exists and is operated by NZHIS
Retroactive – <i>fundamental</i>	It should be possible to assign a UHI to all currently existing individuals at the time that the UHI system is implemented	NHI numbers are estimated to have been issued for 95% of the New Zealand population
Unambiguous – <i>fundamental</i>	Whether represented in automated or handwritten form, a UHI should minimise the risk of misinterpretation (for example confusing o with a zero)	The rules for issuing an NHI number are designed to mitigate this problem by not using certain ambiguous letters and combinations
Unique –	A valid UHI should identify one and	Although one person can

<i>fundamental</i>	only one individual	have more than one identifier, each identifier can only be for one individual
Universal – <i>fundamental</i>	A UHI should be able to support every living person for the foreseeable future. This may include the future expansion of the UHI system to include individuals from outside of Ireland.	The number of NHI identifiers that can be generated is finite. There are sufficient unused numbers to serve the needs of the New Zealand population for at least another decade or two
Incremental – <i>differentiating</i>	The UHI system should be capable of being implemented in a phased-in-manner. This may include incremental implementation for a specific institution for the information on a specific patient, and for a geographical area.	The NHI has been phased in, starting with public hospitals, although it is now ubiquitous throughout the health sector in New Zealand
Longevity – <i>differentiating</i>	The UHI system should be designed to function for the foreseeable future. It should not contain known limitations that will force the system to be restricted or revised radically.	The NHI system has functioned in its current form without major changes since 1992; however, there are a finite number of NHI Numbers that can be generated. NZHIS are currently working to increase longevity
Concise – <i>differentiating</i>	The UHI should be as short as possible to minimise errors, the time required for use, and the storage needed.	The NHI number is seven characters in length, three alpha and three numeric characters plus a check-digit
Deactivation – <i>differentiating</i>	The UHI numbering system should allow for the deactivation of a UHI.	Unknown

Reduction of Cost and Enhanced Health Status

Criteria	Definition	Testing against criteria
Cost effective – <i>differentiating</i>	The UHI system chosen should achieve maximum functionality while minimizing the investment required to create and maintain it.	The cost of operating the NHI has become progressively lower over time.

Reference List

- (1) The Department of Health and Children. *Health Information - A National Strategy*. <http://www.dohc.ie/publications/pdf/nhis.pdf?direct=1>; 2004.
- (2) The Department of Health and Children. *The National Health Information Strategy*. 2004.
- (3) The Commission on Patient Safety and Quality Assurance. *Building a Culture of Patient Safety - Report of the Commission on Patient Safety and Quality Assurance*. http://www.dohc.ie/publications/pdf/en_patientsafety.pdf?direct=1; 2008.
- (4) The Department of Health and Children. *Discussion Document on the Proposed Health Information Bill - June 2008 Version*. <http://www.dohc.ie/>; Jun 2008.
- (5) Health Information and Quality Authority. *Recommendations for a Unique Health Identifier for Individuals in Ireland*. 2009.
- (6) NHS Choices. *NHS Choices, Your Health, Your Choices: About the NHS*. 2009. Available from: URL: <http://www.nhs.uk/NHSEngland/aboutnhs/Pages/About.aspx>. Accessed: 21 Oct 2009
- (7) Department of Health. *The NHS in England: The Operating Framework for 2008/9*. 2007.
- (8) NHS Connecting for Health. *NHS Number Programme Implementation Guidance*. 2008.
- (9) NHS Connecting for Health. *Personal Demographics Service - Access and Security*. 2009. Available from: URL: <http://www.connectingforhealth.nhs.uk/systemsandservices/demographics/pds/ig>. Accessed: 21 Oct 2009
- (10) National Patient Safety Agency. *NHS Number, Risk to Patient Safety of Not Using the NHS Number as the National Identifier for All Patients*. 2008.
- (11) Department of Health. *The NHS Plan, a plan for investment, a plan for reform*. 2000.
- (12) The American Society for Testing and Materials. *ASTM International: Standard Guide for Properties of a Universal Healthcare Identifier (UHID)*. 1995.

- (13) NHS Connecting for Health. *NHS Number Programme Interim Guidance 5*. 18 Sep 2008.
- (14) NHS Connecting for Health. *SNOMED CT in the NHS Care Records Service*. 2005.
- (15) National Information Governance Board for Health and Social Care. *Better information being shared and used better to support better care*. 2009. Available from: URL: <http://www.nigb.nhs.uk/>. Accessed: 28 Jul 2009
- (16) Information Commissioners Office. *Data protection Act*. United Kingdom: Office of Public Sector Information; 1998.
- (17) Department of Health. *Records management: NHS code of practice*. 2006.
- (18) NHS Connecting for Health. *Information Governance*. 2009. Available from: URL: <http://www.connectingforhealth.nhs.uk/systemsandservices/infogov>. Accessed: 21 Oct 2009
- (19) Health Information and Quality Authority. *Criteria for Selection of a Unique Health Identifier for Ireland*. 2008.
- (20) NHS Connecting for Health. *NHS Number: Information for NHS Staff*. 2009. Available from: URL: <http://www.connectingforhealth.nhs.uk/systemsandservices/nhsnumber/staff>. Accessed: 22 Oct 2009
- (21) NHS Connecting for Health. *NHS Number Communications Toolkit*. 2009. Available from: URL: <http://www.connectingforhealth.nhs.uk/systemsandservices/nhsnumber/staff/toolkit>. Accessed: 22 Oct 2009
- (22) Hayes G. *Independent Review of NHS and Social Care IT*. 2009.
- (23) Government of Newfoundland and Labrador. *Medical Care Plan*. 2009. Available from: URL: <http://www.health.gov.nl.ca/mcp/html/mcp.htm>. Accessed: 24 Sep 2009
- (24) Government of Newfoundland and Labrador. *Health and Community Services, Departmental Profile*. 2009.
- (25) Newfoundland and Labrador Centre for Health Information. *UPI/Client Registry Project Scope*. Feb 2000.
- (26) Neville,D.ScD,Gates,K.MSc,MacDonald,D.MSc. *An Evaluation of the Newfoundland and Labrador Client Registry*. Jun 2005.

- (27) Newfoundland and Labrador Centre for Health Information. *UPI/Client Registry PIA Appendices*. 2005.
- (28) Newfoundland and Labrador Centre for Health Information. *The Newfoundland and Labrador Unique personal Identifier/Client Registry Privacy Impact Assessment*. 2005.
- (29) Newfoundland and Labrador Centre for Health Information. *Registration and the Client Registry Fact Sheet*. 2008. Available from: URL: http://www.nlchi.nf.ca/pdf/Fast%20Facts_CR_4_Pager2.pdf. Accessed: 12 Aug 2009
- (30) Newfoundland and Labrador Centre for Health Information. *Annual Business Report 2006-2007*. 2007.
- (31) Commonwealth Department of Health and Aged Care. *The Australian Healthcare System, An Outline*. 2000. Accessed: 27 Aug 2009
- (32) National E Health Transition Authority. *The National E-Health Transition Authority Strategic Plan (2009-2012)*. 2009.
- (33) National E Health Transition Authority. *Healthcare Identifiers and Privacy: Discussion Paper on Proposals for Legislative Support*. 2009.
- (34) National E Health Transition Authority. *Fact Sheet, Identifying Individuals for Healthcare Purposes*. 2007.
- (35) National E Health Transition Authority. *Q&A for Healthcare Identifiers*. 2009. Available from: URL: <http://www.nehta.gov.au>. Accessed: 15 Sep 2009
- (36) National E Health Transition Authority. *HI Service, Concept of Operations*. 2009.
- (37) National E Health Transition Authority. *Unique Healthcare Identification, Concept of Operations*. 2007.
- (38) National E Health Transition Authority. *Individual Healthcare Identifiers, Business Requirements*. 2009.
- (39) New Zealand Ministry of Health. *New Zealand's Health and Disability System*. 2009. Available from: URL: <http://www.moh.govt.nz/healthsystem>. Accessed: 5 Oct 2009
- (40) Ray Delany. *Fourteen Years Young - A Review of the National Health Index in New Zealand*. 1 Jun 2006.
- (41) Health Information Strategy Steering Committee. *Health Information Strategy*. 2005.

- (42) Office of the Auditor General. *Progress with Priorities for Health Information Management and Information Technology*. 2006.
- (43) New Zealand Health Information Service. *National Health Index Upgrade Programme*. 2009.
- (44) New Zealand Health Information Service. *NHI Statement of Use*. 2009. Available from: URL: <http://www.nzhis.govt.nz/moh.nsf/pagesns/269?Open>. Accessed: 5 Oct 2009
- (45) Privacy Commissioner New Zealand. *Health Information Privacy Code*. 1994.
- (46) World Health Organisation. *Highlights on Health in Germany*. 2004.
- (47) Kassenärztliche Bundesvereinigung. *Gesetz zur Modernisierung der Gesetzlichen Krankenversicherung GKV - Modernisierungsgesetz - GMG, Informationen für den Vertragsarzt*. 2003. Accessed: 16 Aug 2009
- (48) Vertrauensstelle Krankenversichertennummer. *Auf dem Weg zur Elektronischen Gesundheitskarte*. 2009. Available from: URL: [https://kvnummer.gkvnet.de/\(S\(ytyukv5544qs3ras5t1gpn55\)\)/pubpages/ziel.aspx](https://kvnummer.gkvnet.de/(S(ytyukv5544qs3ras5t1gpn55))/pubpages/ziel.aspx). Accessed: 16 Sep 2009
- (49) Bundesministerium für Gesundheit und Soziale Sicherung. *The German E-Health Strategy*. 2005.
- (50) Stroetmann K, Lilischkis S, Empirica, E-Health Era. *E-Health Strategy and Implementation Activities in Germany - Report in the Framework of the eHealth ERA Project*. 2007.
- (51) Vertrauensstelle Krankenversichertennummer. *Transparent, Sicher, Einheitlich: Die Neue Krankenversichertennummer*. 2009. Available from: URL: [https://kvnummer.gkvnet.de/\(S\(ijt0rp55qmcmoz5543gr30mo\)\)/pubPages/krankenversichertennummer.aspx](https://kvnummer.gkvnet.de/(S(ijt0rp55qmcmoz5543gr30mo))/pubPages/krankenversichertennummer.aspx). Accessed: 16 Sep 2009
- (52) Vertrauensstelle Krankenversichertennummer. *Die Vertrauensstelle - Herzstück des Verfahrens*. 2009. Available from: URL: [https://kvnummer.gkvnet.de/\(S\(ytyukv5544qs3ras5t1gpn55\)\)/pubpages/vertrauensstelle.aspx](https://kvnummer.gkvnet.de/(S(ytyukv5544qs3ras5t1gpn55))/pubpages/vertrauensstelle.aspx). Accessed: 16 Sep 2009
- (53) Informationstechnische Servicestelle der Gesetzlichen Krankenversicherung GmbH. *Ein etabliertes Vergabeverfahren: Private Krankenversicherung will nun auch die VST nutzen*. 2007. Accessed: 16 Aug 2009
- (54) Aerzteblatt. *Projekt Gesundheitskarte: Private Krankenversicherung Steigt Aus*. 2009. Available from: URL: www.aerzteblatt.de. Accessed: 16 Sep 2009

- (55) Vertrauensstelle Krankenversicherer. *Grundsätze zum Datenschutz*. 2009. Available from: URL: [https://kvnummer.gkvnet.de/\(S\(30v5yv55rxooeea54iqggx45\)\)/pubpages/datensicherheit.aspx](https://kvnummer.gkvnet.de/(S(30v5yv55rxooeea54iqggx45))/pubpages/datensicherheit.aspx). Accessed: 16 Sep 2009