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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

E-health multimedia services and applications – Multimedia e-health data exchange services

Multimedia e-health data exchange services: Data schema and supporting services

Recommendation ITU-T H.860

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Recommendation ITU-T H.860

Multimedia e-health data exchange services: Data schema and supporting services

Summary

Recommendation ITU-T H.860 specifies a common health schema applicable to a wide range of health systems – e.g., clinical and wellness – and describes the supporting services and systems architecture for a health data exchange that allows an exchange of multimedia health data between a health provider, a controlling function and a patient. The services this Recommendation describes include both point-of-care and personal healthcare services.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
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Keywords

Architecture, data dictionary, e-health, schema.

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FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

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Multimedia e-health data exchange services: Data schema and supporting services

1 Scope

This Recommendation defines the following for health data exchange:

– A common health data schema to form a common language, for all participants in the health system, to exchange health information.

– Formats and mechanisms for exchanging health information.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ISO 3166-1] ISO 3166-1 (2013), *Codes for the representation of names of countries and their subdivisions – Part 1: Country codes*.

[ISO 4217] ISO 4217 (2008), *Codes for the representation of currencies and funds*.

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 e-claim: A digital representation of a medical bill generated by a health provider for submission using telecommunications to a controlling function.

3.2.2 prior request: A process initiated by a health provider to obtain permission from a controlling function prior to providing service to a patient.

3.2.3 prior authorization: An approval provided by a controlling function to a health provider to provide service to a patient.

3.2.4 remittance advice: An explanation of payment provided by the controlling function, which provides details about the health provider's e-claim payment. A denied e-claim would contain the required explanations for denial.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

API	Application Programming Interface
APR-DRG	All Patient Refined Diagnosis Related Group
AR-DRG	Australian Refined Diagnosis Related Group
ASN.1	Abstract Syntax Notation One
CCAM	Common Classification of Medical Procedures
CCI	Cardiovascular Credentialing International
CEN/TC 251	Comité Européen de Normalisation – Technical Committee 251
CHDS	Common Health Data Schema
CMS	Care Management System
CPT-4	Current Procedural Terminology (4th Edition)
CPT-5	Current Procedural Terminology (5th Edition)
DICOM	Digital Imaging and Communications in Medicine
DRG	Diagnosis Related Group
EHR	Electronic Health Record
ESB	Enterprise Service Bus
e-Health	Electronic Health
e-Prescription	Electronic Prescription
GOÄ	Gebührenordnung für Ärzte (fees for doctors (medical fee schedule))
HCPCS	Healthcare Common Procedure Coding System
HIE	Health Information Exchange
HIPPA	Health Insurance Portability and Accountability Act
HIS	Hospital Information System
HL7	Health Level Seven International
HTTPS	Hypertext Transfer Protocol Secure
ICD	International Classification of Diseases
ICD-9	International Classification of Diseases, 9th Edition
ICD-9-CM	International Classification of Diseases, 9th Edition, Clinical Modification
ICD-10	International Classification of Diseases, 10th Edition
ICD-10-PCS	International Classification of Diseases, 10th Edition Procedure Coding System
ICD-11	International Classification of Diseases, 11th Edition
ICPC-2	International Classification of Primary Care, Second edition
ID	Identifier
IEEE	Institute of Electrical and Electronics Engineers

IHE	Integrating the Healthcare Enterprise
IR-DRG	International-Refined Diagnostic Related Group
ISO	International Organization for Standardization
ISO/TC 215	ISO/Technical Committee 215 – Health informatics
LOINC	Logical Observation Identifiers Names and Codes
m-Health	mobile Health
MS-DRG	Medicare Severity Diagnosis Related Group
NCD	Non Communicable Disease
NGO	Non-Governmental Organization
NHS	National Health Service
NOMESCO	Nordic Medico- Statistical Committee
OPS-301	Operationen – und Prozedurenschlüssel § 301 SGB V
OPCS-4.6	Office of Population Censuses and Surveys – Classification of Interventions and Procedures
RIM	Reference Information Model
SMS	Short Message Services
SSL	Secure Socket Layer
Swiss-DRG	Swiss Diagnosis Related Group
TARMED	Tarif Médical (medical fee)
WHO	World Health Organization
XML	Extensible Markup Language

5 Conventions

In this Recommendation:

– The expression "is required to" indicates a requirement which must be strictly followed and from which no deviation is permitted if conformance to this Recommendation is to be claimed.

– The expression "is recommended to" indicates a requirement which is recommended but which is not absolutely required. Thus this requirement need not be present to claim conformance.

– The expression "can optionally" indicates an optional requirement which is permissible, without implying any sense of being recommended.

6 Overview of the current data standard challenges in healthcare

Worldwide, healthcare outputs are flattening while costs continue to increase. It is widely accepted that electronic health (e-health) systems hold great promise, in a broad range of health systems worldwide, for improving global access to healthcare services, improving health system performance and improving health outcomes. And yet, technological obstacles continue to hinder the promise of e-health systems; these include the lack of global interoperability standards for e-health and technical

infrastructure barriers [b-ITU-T TWR-EH-2011]. In the interests of addressing these technological obstacles, this Recommendation proposes an additional global interoperability standard for e-health.

There is already a rich ecosystem of standards for e-health, including telecommunications and messaging standards (e.g., short message service (SMS) and extensible markup language (XML) [b-W3C XML 1.0]), specific health code sets (e.g., for diagnosis, clinical treatment and clinical observations), and e-health standards including digital imaging and communications in medicine (DICOM), Comité Européen de Normalisation – Technical Committee 251 (CEN/TC 251), Health Level Seven International (HL7), Integrating the Healthcare Enterprise (IHE), ISO/Technical Committee 215 – Health informatics (ISO/TC 215), ISO/IEEE 11073 [b-ISO/IEEE 11073] and ITU-T technology watch report [b-ITU-T TWR-EH-2012].

One prominent and widely adopted set of standards are those developed by HL7 [b-HL7-RIM]. "Open integration" models (such as those developed by HL7) allow for a broad range of data to be transmitted (e.g., messages, documents, services) under the definition of the standard. However, there remains scope for differences in data definitions between functionally similar data senders (for example, different clinics within a market may adopt HL7 compliant messaging that uses different data elements). Such diversity may create difficulty among data receivers that receive data from a range of data senders.

In this context, and based on e-health implementations in a range of health markets, a data exchange model has been developed based on a defined set of stakeholders (e.g., patient, clinician, insurer, and regulator) and a defined set of data interactions among these stakeholders. These data exchange interactions are termed "health data transactions". A "transaction-first" approach adds additional standardization to "open integration" standards by defining the transactions and the data elements through a collaborative development framework, where all participants in a health systems agree on which health problems need to be solved and then determining which transactions and data elements are required to solve these health problems. This achieves a functional level of interoperability.

The use of standardized content for health data transactions enables health markets to deploy health data systems more rapidly, at lower cost, with access to mobile and personal health devices, and with an ability to progressively increase functionality as stakeholder requirements evolve. Standardization between health markets creates the potential for shareable practice and applications. Stakeholder benefits include:

– patient: ability to access personal health data compiled from multiple sources through simple portals;
– clinician: ability to exchange structured data with other clinicians and access patient data from a range of sources (subject to patient consent where applicable);
– public health officer: ability to access anonymized patient data from across the population to rapidly assess disease burden and the effectiveness of interventions;
– health regulator: ability to access patient-level data to assess the safety and effectiveness of healthcare providers;
– health insurer or commissioner: ability to access patient data across their covered lifespan to enable risk assessment.

This Recommendation comprises four components:

1) an initial set of health data transactions required by a defined health system;
2) an initial common health data schema capable of supporting the health data transactions required by a defined health system;
3) the key elements of service architecture to provide health data transactions;

4) a health system level governance model called the "collaborative development process".

Additional details on these four components are as follows.

6.1 Health data transactions

Health data transactions are built upon existing industry standard code sets for health data, for example:

– diagnoses and presenting complaints may be codified using the World Health Organization (WHO) international classification of diseases (ICD);

– clinical activities (e.g., clinical examination, laboratory tests, surgery, treatment) may be codified using the American Medical Association's (AMA) current procedural terminology (CPT) codes;

– logical observation identifiers names and codes (LOINC) for clinical observation data.

Each health data transaction uses the minimum possible dataset within the scope of the defined health data transaction. This data parsimony carries two important benefits:

1) health data transactions are compact (typically 15-20 kilobytes) and are thus suitable for systems with limited bandwidth (including mobile);

2) data exchange based on the minimum required data helps ensure data security and compliance with data protection laws, and the principles set out in key health data regulations such as the US Health Insurance Portability And Accountability Act (HIPAA) law [bUS HIPAA] and the UK Caldicott principles [b-UK CP].

Health data transactions specify which data fields are mandatory and which are optional, the syntax of data within each field and validation ranges for data within certain fields (where applicable). This definition enables the administrative validation of the exchanged data as a key component of data quality assurance.

For each data element in a health data transaction the specific version of the data set used is defined separately from the data itself, meaning that any version of these code sets may be used (e.g., ICD 9th edition (ICD-9) or ICD 10th edition (ICD-10); CPT 4th edition (CPT-4) or CPT 5th edition (CPT-5)). Where necessary, compatibility with existing legacy IT systems is delivered by middleware applications based on read-across tables (for example, Translating International Classification Of Primary Care, second edition (ICPC-2) to ICD-10). Whilst such read-across is not perfect (data can be lost through one-to-many asymmetry in certain code sets), a functional level of interoperability can be achieved using this method.

6.2 Common health data schema

For each health system deploying this standard, a common health data schema (CHDS) is built by combining the data elements required for each of the health data transactions within a defined health system. Each health data transaction is made up of a subset of the CHDS. To ensure the full exchange of data to fulfil each health data transaction, mandatory fields are included. Data within the CHDS beyond the mandatory fields may be included as optional fields.

The CHDS contains substantial clinical data (e.g., diagnosis, clinical activity such as assessment and treatment, drugs and devices used and clinical outcomes). Such data is included for primary purposes (typically, clinical and administrative) but selected data (whether patient identifiable, anonymized or aggregated) may also be provided to stakeholders for a range of secondary uses (e.g., research or regulation) according to role-based access. The CHDS is flexible for a wide range of use cases, and the structured nature of data also significantly simplifies both storage and analytics. A shared overall

structure of CHDSs and common data elements help to ensure functional data exchange interoperability between health systems with divergent CHDSs.

Health data is transmitted in XML [b-W3C XML 1.0] enabling data collection, transmission, storage and analysis by a wide array of devices, including personal computers, basic 2G mobile phones, modern smartphones and personal health devices. Routine health data transmissions are very compact (typically less than 20 kilobytes) avoiding the need for costly architecture and enabling the use of mobile applications. This Recommendation supports defined role-based access and is, therefore, adaptable for compliance with data protection and confidentiality laws and regulations in a range of markets.

6.3 Service architecture

Health data systems using this Recommendation are simple and modular; they can be built from simple, standard and low-cost Internet components. The modular nature of the architecture enables implementation within existing health data systems where these exist (or full system implementation where such systems do not exist).

The health data standards in this Recommendation aim to provide simple and interoperable exchange for core health data transactions, creating data for a range of clinical and non-clinical uses based on a collaborative development framework (see Appendix I). This Recommendation does not aim to provide an exchange for all the data that may be required for clinical care (for example, detailed clinical and nursing notes and images such as x-rays or scan results). However, data from this Recommendation may be used as a log of clinical activities, thus supporting the peer-to-peer exchange of additional data where this is required.

6.4 Collaborative development process

The deployment of a health data system compliant with this Recommendation requires an iterative development process. To ensure inclusiveness, balance and the acceptance of the development recommendations made, this process requires the active participation of the key health system stakeholders and users of health data. Typically this includes physicians, other clinical staff, the management of healthcare providers/facilities, health insurers (where applicable), health regulators, patients and caretakers, and voluntary/non-governmental organizations (NGOs). Further details are provided in Appendix I.

Strong governance of this process is important to ensure a balance of future flexibility (for additional functionality) and ongoing simplicity, structure and parsimony of the data model and service architecture. The Chair of the collaborative development process must have a strong understanding of health data IT systems (particularly as set out in this Recommendation) and detailed knowledge of the structure of the health system, including the key operational details related to the exchange of data between health system stakeholders.

In light of its importance, the collaborative development process is a key component of this Recommendation.

The process may be set out in seven stages:

1) review of health data exchange requirements of health system stakeholders
2) mapping of additional health data exchange requirements into specifications for the development of existing health data transactions (for extended functionality) and/or new health data transactions
3) refinement of the common health data schema (to support all health data transactions)
4) refinement of the service architecture (where required)

5) piloting and beta testing

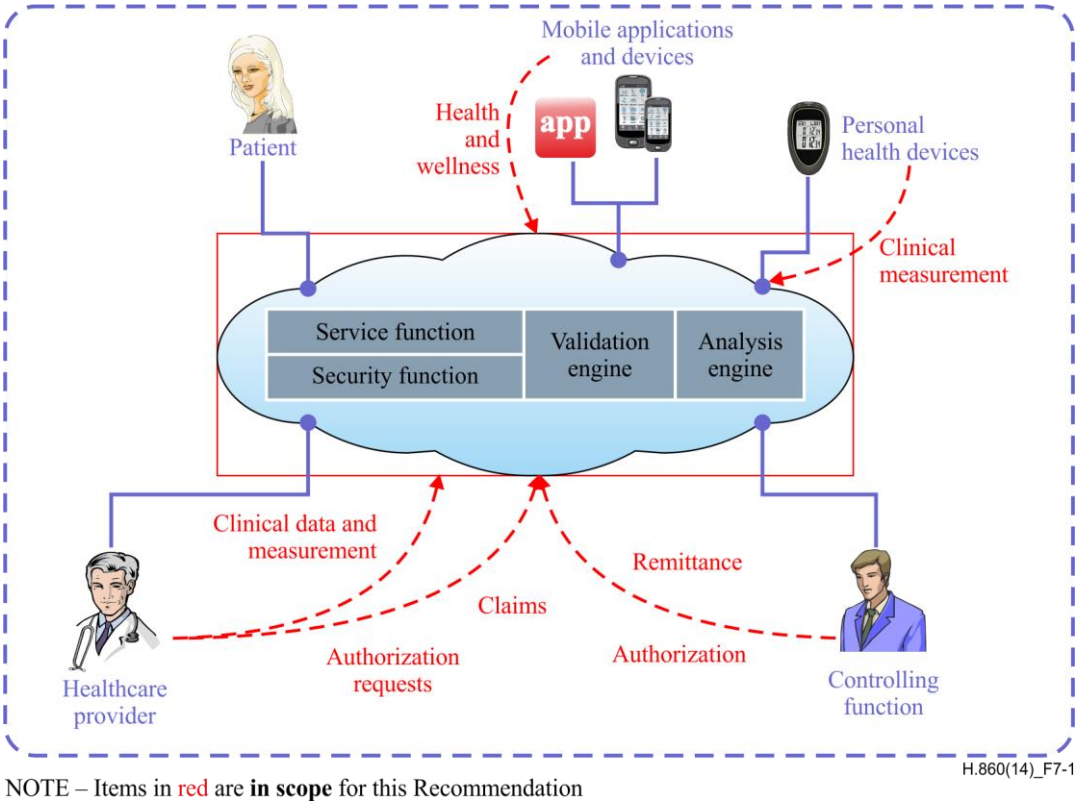
6) hardening

7) scalable deployment.

Through the collaborative development process, the standards for data exchange in a health system will evolve over time (typically with additional functionality as the health system progresses through a health data maturity model).

7 Systems overview

The objective of this clause is to describe the high-level architecture of a health data exchange. Figure 7-1 illustrates the components of the architecture.



NOTE – Items in red are **in scope** for this Recommendation

Figure 7-1 – Health data exchange

7.1 Participants

The participants in a health system include:

– **patient**: the recipient of health services;

– **healthcare provider**: an individual or an institution that provides preventive, curative, promotional, or rehabilitative healthcare services in a systematic way to individuals, families or communities;

– **controlling function**: an entity other than the patient that finances or reimburses the cost of health services. In most cases, this term refers to insurance carriers, other third-party payers, or health plan sponsors (employers or unions), although the term may also be applied to controlling functions within a health provider, for example, in monitoring operations that are funded by block budget;

– **mobile applications and devices**: a consumer mobile device and/or mobile application that captures health and wellness information;
– **personal health devices**: a consumer wearable device that captures a person's health data (e.g., fitness monitor, jogging monitor, sleep monitor, oximeter, heart rate monitor).

7.2 Transaction types

The participant will submit transactions through the system. The transaction can include a:
– **prior request** submitted from health provider to the controlling function;
– **prior authorization** submitted by the controlling function to the health provider;
– **claim** submitted by the health provider to the controlling function;
– **remittance advice** submitted by the controlling function to the health provider;
– **person register** submitted by the health provider to the controlling function;
– **data submission** transaction to submit a patient's health and wellness readings from a health device and/or mobile application to a health provider.

7.3 Transmission

The transactions are encoded based on a CHDS (see clause 8).

The transactions are formatted in XML and transmitted via secure connection (e.g., hypertext transfer protocol secure (HTTPS)).

7.4 Validation and storage

The health data exchange receives the transaction and performs the following functions:
– authenticates the transaction based on credentials supplied (e.g., username and password based, certificate-based, card-based, biometrics);
– validates that the transaction is from a licensed entity (validates the controlling function or health provider licence ID);
– validates the contents and eligibility of the transaction based on established business and validation rules;
– encrypts and stores the transaction in local storage.

7.5 Analysis

The XML [b-W3C XML 1.0] transaction files from the health data exchange are stored in the data repository for further processing. A parser translates the XML documents into a relational data structure.

A multidimensional model is applied and the data is made available via data cubes for analysis.

7.6 Statistics and insights

The aggregation of the transactions in a multidimensional model allows an analysis of population wide health information. The outputs of the analysis may include:
– health statistics and/or
– quality indicators addressing individual patient and population health, as well as health provider and clinician performance.

7.7 Governance

Establishing one or more governance bodies helps to ensure the adoption of a common data standard as well as ensuring ongoing exchange of information with improving quality. There are typically at least three governance roles that need to be performed (whether by one or more than one governance bodies):

1) **Oversee data standards**: reviews and recommends changes and additions to health data exchange standards, such as transactions, codes and business rules. The data standards panel can include representatives of health providers, accountability authority, regulators and government officials. To ensure transparency all proposed changes and panel decisions should be publically available.

2) **Manage data access**: subject to patient and commercial confidentiality and the implementation of appropriate security measures, data received through the health data exchange should be made available, in order to ensure transparency, improve healthcare and build trust. Data access requests may be submitted to an authorized panel (which may be called the 'data control panel') by any organization – whether submitting data or not. An end-user licence agreement governs access to the data and codifies the applicable laws and regulations. Application access to data may be purpose-based (that is based on the intended use of the data) or role-based (that is, based on the role of the entity requesting the data). Where role-based functional roles may be used to determine the functionality available to a user, and access roles may be used to determine which data a user is permitted to access. Role-based access and end-user licence agreements are defined and refined on an ongoing basis by the data control panel, which may be made up of representatives of health providers, relevant accountability authorities, regulators and government officials. To ensure transparency all requests and panel decisions should be publically available.

3) **Maintain technical standards**: all changes to the transaction file XML format, the architecture definition, security and encryption protocol used to transmit the transaction file to the health data exchange are reviewed and recommended by a technical standard panel. This panel can include IT representatives of health providers and controlling functions. To ensure transparency all proposed changes and panel decisions should be made publically available.

8 Common health data schema

The objective of this clause is to describe the CHDS, which forms the foundation for the health data exchange. The CHDS forms the common language that allows all participants in a health system to exchange relevant health information. The following high-level use case describes the interactions between the entities in the healthcare system.

*Healthcare systems help individual **persons** obtain better health. A person can be a patient who has an **encounter** with a **health provider**. The health provider then claims some or all of the charges from the controlling function. The **controlling function** in turn collects insurance premiums (**financing**) from its members, who are individual persons.*

*When a patient has an **encounter** with a health provider, the health provider needs to know what was done with the patient (e.g., **activity** such as a lab test) to be able to charge for it. Activities may or may not lead to an **observation**, such as the result of a lab test. (See Appendix IV for an illustrative use case of a patient, health provider and controlling function interaction.)*

Figure 8-1 describes the common health data schema data types.

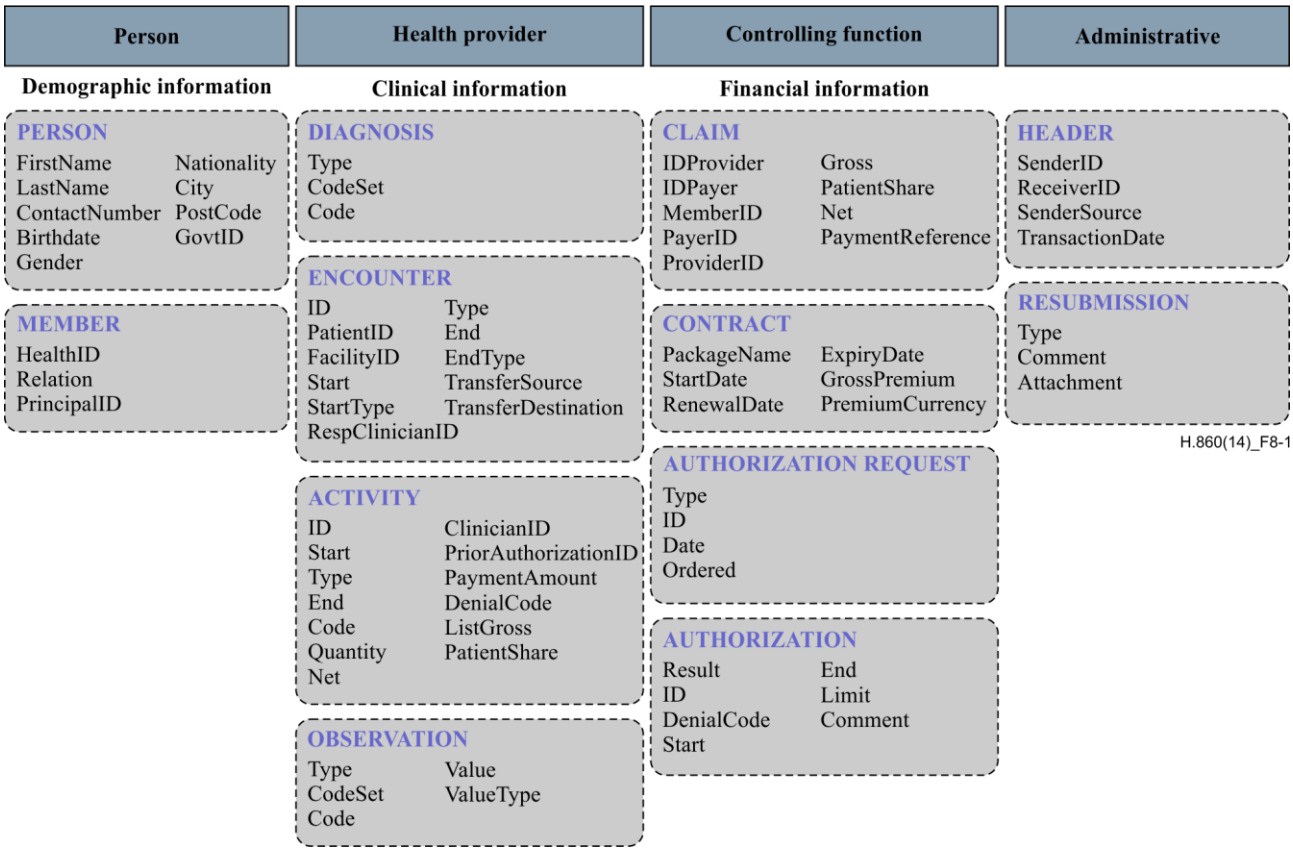


Figure 8-1 – Common health data schema

– **encounter** – starts when a patient is first brought under the care of a responsible healthcare professional and ends when the patient stops being under the care of a responsible healthcare professional at the healthcare provider.

– **claim** – an original request for payment for health services provided to a single patient. Claims are generally linked to patients who are covered by health insurance. For the purposes of this guidance, any invoices made out to non-insured patients should also be considered as claims.

– **activity** – any claim item or encounter item. Generally a claim item corresponds to an encounter item, so every claim item/activity item is considered an activity. This could be the case, for example, for a first outpatient consultation or a prescription, two separate activities. Some encounter items however do not correspond with claim items.

– **observation** – the result of an encounter activity such as a diagnostic test, lab work, etc. An activity may have multiple observations, but an observation can only be the result of one activity. In the simplest form, for example, a blood pressure test (the activity) results in a blood pressure reading (the observation).

The common health data schema incorporates industry standards for health coding and includes:

– **clinical procedures** – any standard code sets such as CPT-4, ICD-10 procedure coding system (ICD-10-PCS), cardiovascular credentialing international (CCI), operationen – und prozedurenschlüssel (OPS-301), office of population censuses and surveys – classification of interventions and procedures (OPCS-4.6), common classification of medical procedures (CCAM), Nordic medico-statistical committee (NOMESCO), Gebührenordnung für Ärzte (GOÄ), Nomenclature des prestations de santé, tarif médical (TARMED), Classificatie van virrichtingen).

– **clinical diagnosis** – any ICD derivatives ICD-9-(WHO, clinical modification (CM)), ICD-10-(WHO, German modification (GM), Australian consortium (AM), CM), ICD-11-WHO.

– **observations** – LOINC.

– **diagnosis related groups (DRGs)** – any of the current DRG systems, such as all patient refined (APR)-DRGs), Medicare severity (MS)-DRGs, Australian refined (AR)-DRG, German(G)-DRG, Nord-DRG, international-refined (IR)-DRG, Swiss-DRG, amongst others.

See Annex A for full common health data schema details.

9 Health transactions

The objective of this clause is to describe the health transactions, which adhere to the common health data schema described in clause 8 and forms the bases of the exchange between the various health entities. Following is an example list of typical health data transactions in a health system with one or more health payers and multiple healthcare providers:

– **PriorRequest**: submitted by the health provider to the controlling function, this is a request for permission prior to providing service to a patient; it can be used as an electronic prescription (e-prescription).

– **PriorAuthorization**: submitted by the controlling function, this is the response to the health provider providing authorization to provide service to the patient.

– **PersonRegister**: submitted by the health provider, the person registered at the time of the visit is submitted to the accountability authority.

– **ClaimSubmission**: submitted by a health provider to send a medical bill to the controlling function in order to be reimbursed for the service provided.

– **RemittanceAdvice**: submitted by a controlling function explaining the details of the payment made to the health provider based on the claim submitted. In the event that the claim is denied, an explanation of denial is submitted.

– **DataSubmission**: submitted by the patient via a health device or a mobile application. This transaction submits health and wellness measurement data to a health provider.

All the above transaction types follow a standard XML [b-W3C XML 1.0] format.

See Appendix II for health transaction XML [b-W3C XML 1.0] samples.

10 Health transactions transmission

The transactions described in clause 9 are transmitted using a secure and encrypted channel (e.g., web service call over HTTPS [b-IETF RFC 2616], [b-IETF RFC 2818]). The available transaction transmissions are as follows:

– **uploadTransaction**: used to upload the above-mentioned transaction files to the health data exchange. This transmission mechanism should be agnostic of the transaction file being submitted.

– **downloadTransactionFile**: used to download transaction files from the health data exchange.

– **getNewTransactions**: used to determine whether a transaction file is available for download.

– **setTransactionDownloaded**: used to flag a transaction file as 'downloaded' in order to prevent submitting multiple copies of the same transaction.

– **checkNewPriorAuthorizationTransactions**: used by providers to determine whether there are prior authorization transactions available for download.

– **getNewPriorAuthorizationTransactions**: used by health providers to download prior authorizations sent by the accountability authority.

– **getPrescriptions**: used by pharmacists to download prescription transactions from the health data exchange.

– **searchTransactions**: used by the controlling functions and providers to search the health data exchange for their relevant transactions.

See Appendix IV for an illustrative example of transactions. Figure 10-1 illustrates the interactions of the system.

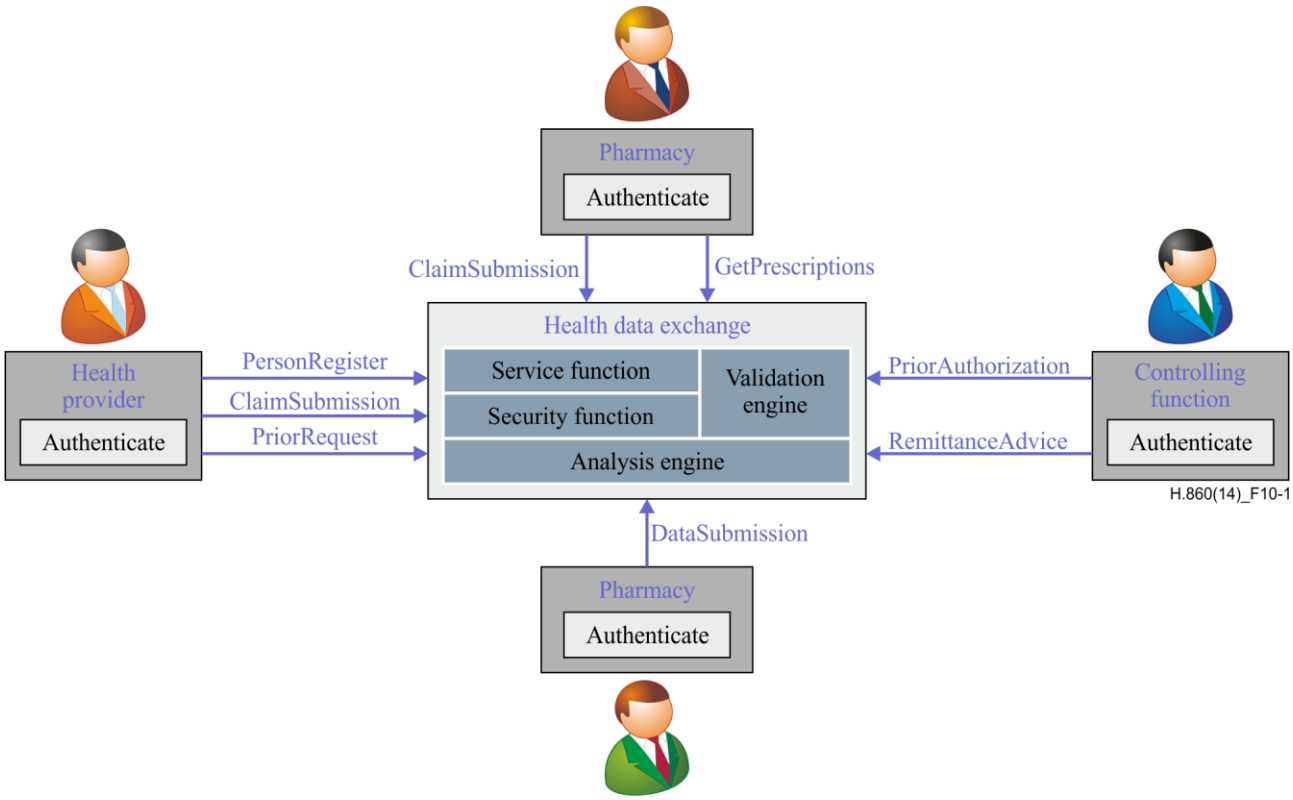


Figure 10-1 – Interaction diagram

See Appendix IV for an illustrative use case of transactions between key participants in a healthcare system

11 Validation

The validation engine in the health data exchange parses through each transaction and validates the permission, contents and eligibility. Based on the transaction type it determines the appropriate validation rule to apply.

See Annex C for validation rule details.

Annex A

Common health data schema

(This annex forms an integral part of this Recommendation.)

Table A.1 contains details of each element of the common health data schema defined in this Recommendation.

Table A.1 – Details of elements of the common health data schema

Data object	Data field	Description	Data type	Example
Person				
	Person.FirstName	First name of person receiving activity	string	jane
	Person.LastName	Last name of person receiving activity	string	doe
	Person.ContactNumber	Contact number of person receiving activity	string	07555 121212
	Person.BirthDate	Date of birth of person receiving activity	date and time	28/10/2012 09:30
	Person.Gender	0 = Female 1 = Male 9 = Unknown	integer	0
	Person.Nationality	Nationality of person receiving activity, using [ISO 3166-1] two-letter code	string	uk
	Person.City	City of residence of person receiving activity	string	london
	Person.PostCode	Residential post code of person receiving activity	string	TW2 2SW
	Person.GovtID	Government-issued ID (e.g., passport number, social security number, national ID card number) of person receiving activity	string	12345678
Member				
	Member.HealthID	Patient's health system number (e.g., health insurance member number)	string	23456789
	Member.Relation	Information about family relationships: Principal, Spouse, Child, Parent, Other with reference to principal's family member	string	principal

Table A.1 – Details of elements of the common health data schema

Data object	Data field	Description	Data type	Example
	Member.PrincipalID	MemberID of the principal member of the family	string	34567890
Encounter				
	Encounter.ID	Unique number (for that provider) assigned by the healthcare provider to identify an encounter	string	abc12345
	Encounter.Type	1 = No Bed + No emergency room 2 = No Bed + Emergency room 3 = Inpatient Bed + No emergency room 4 = Inpatient Bed + Emergency room 5 = Daycase Bed + No emergency room 6 = Daycase Bed + Emergency room 7 = Home 8 = Assisted living facility 9 = Mobile unit 10 = Ambulance	integer	1
	Encounter.PatientID	Unique number (for that provider) that a specific healthcare provider assigns to a patient (e.g., medical record number)	string	ab123456
	Encounter.FacilityID	Unique ID of facility responsible for encounter (e.g., government issued facility licence number)	string	abcd1234
	Encounter.RespClinicianID	Unique ID of responsible clinician using unique number for that clinician (e.g., government licence number)	string	def4567
	Encounter.Start	Date and time the patient comes under the care of the responsible clinician	date and time	28/10/2012 09:30

Table A.1 – Details of elements of the common health data schema

Data object	Data field	Description	Data type	Example
	Encounter.StartType	1 = Elective, i.e., encounter was scheduled in advance 2 = Emergency 3 = Transfer from another healthcare provider 4 = Live birth 5 = Stillbirth 6 = Dead on arrival 7 = Continuing encounter 8 = Transfer admission from non-acute care	integer	1
	Encounter.End	Date and time the patient ceases to be under the direct care of the responsible clinician	date and time	28/10/2012 11:30
	Encounter.EndType	1 = Discharged with approval 2 = Discharged against advice 3 = Discharged absent without leave 4 = Discharge and transfer to another healthcare provider 5 = Discharge and transfer to a non-healthcare provider 6 = Not discharged 7 = Dead	integer	1
	Encounter.TransferSource	Healthcare facility from which a hospital transfer originated (used only when Encounter.StartType = 3)	string	abcde123
	Encounter.TransferDestination	Healthcare facility to which a hospital transfer is made (at the end of an Encounter.EndType = 3)	string	abcdef12
Diagnosis				
	Diagnosis.Type	Type of Diagnosis being recorded (i.e., principal, secondary, tertiary or admitting)	string	principal
	Diagnosis.CodeSet	Codeset used for diagnosis (e.g., ICD-9-CM, ICD-10)	string	icd-10
	Diagnosis.Code	Diagnosis code value in type specified by Diagnosis.CodeSet	string	c23.2

Table A.1 – Details of elements of the common health data schema

Data object	Data field	Description	Data type	Example
Activity				
	Activity.ID	Unique identifier that a specific healthcare provider assigns to an activity	string	cdefghi
	Activity.Start	Date and time at which activity started	date and time	28/10/2012 09:45
	Activity.Type	Type of activity, e.g., Procedures, Drugs or Services 1 = CPT 2 = HCPC 3 = Drug 4 = Generic drug 5 = Service code 6 = DRG 7 = Dental	integer	8
	Activity.End	Date and time at which activity ended	date and time	28/10/2012 09:45
	Activity.Code	Code, specified by the Activity.Type, for the activity performed	string	10
	Activity.Quantity	Number of units (quantity) for a specific activity	integer	1
	Activity.Net	Net charges billed by the provider to the payer for this activity	integer	75
	Activity.ClinicianID	Clinician providing the activity for the patient (typically government licence number)	string	abcdefg1
	Activity.PriorAuthorization ID	Authorization ID provided by the payer	string	abcdefgh
	Activity.PaymentAmount	For RemittanceAdvice: Amount paid by the payer towards the provider's claim For PriorAuthorization: Amount of guaranteed payment for the activity	string	500
	Activity.DenialCode	Code that indicates the reason for denial or adjustment of authorization/payment by the payer	integer	den12345
	Activity.List	List price before any adjustments of discounts	string	5000

Table A.1 – Details of elements of the common health data schema

Data object	Data field	Description	Data type	Example
	Activity.Gross	Total monetary amount of the charges included on the activity	string	4000
	Activity.PatientShare	Any fee that the payer is expecting the provider to collect from the patient	string	1000
Observation				
	Observation.Type	Type of observation being recorded	integer	plain film AP chest x-ray
	Observation.CodeSet	Codeset used to record observation (e.g., LOINC)	string	loinc
	Observation.Code	Code describing the observation value	string	clinical
	Observation.Value	Observed value of the activity	string	450
	Observation.ValueType	Unit of measure for the observation value	string	milligrams
Claim				
	Claim.IDProvider	Unique number assigned by the health provider to identify the claim	string	xyz789
	Claim.IDPayer	Unique number assigned by a payer to identify the claim	string	bcd234
	Claim.MemberID	Patient's insurance member number	string	cde345
	Claim.PayerID	Unique ID for the payer (insurance provider) e.g., a government licence number	string	insurer5678
	Claim.ProviderID	Unique ID for the healthcare provider (e.g., a government licence number)	string	hospital3456
	Claim.Currency	Currency of claim amount, using [ISO 4217] currency code	string	gbp
	Claim.Gross	Total amount of the charges included on the claim (includes any amount to be paid by the patient)	integer	2000
	Claim.PatientShare	Amount to be paid by a patient to a provider according to the terms of their insurance plan	integer	200

Table A.1 – Details of elements of the common health data schema

Data object	Data field	Description	Data type	Example
	Claim.Net	Net charges included on the claim (amount the provider is expected to be paid by the payer)	integer	1800
	Claim.PaymentReference	Unique ID for the payment transaction (e.g., cheque number, electronic funds transfer number) generated by the payer	string	xyza1234
Contract				
	Contract.PackageName	Name of health insurance product, generated by the payer	string	gold plus
	Contract.StartDate	Start date of health insurance coverage, generated by the payer	date and time	10/28/12
	Contract.ExpiryDate	End date of health insurance coverage, generated by the payer	date and time	27/10/2013
	Contract.RenewalDate	Renewal date of health insurance coverage, generated by the payer	date and time	9/26/13
	Contract.Premium Currency	Currency of health insurance premium, using [ISO 4217] currency code	string	gbp
	Contract.GrossPremium	Premium payable for defined health insurance coverage	integer	1000
Authorization request				
	AuthorizationRequest.ID	Unique ID for PriorRequest transaction	string	pr1234
	AuthorizationRequest.Type	Type of PriorRequest	string	authorization
	AuthorizationRequest.Date Ordered	Submit date of PriorRequest	date	28/10/2012
Authorization				
	Authorization.ID	Unique ID for PriorAuthorization	string	pa5678
	Authorization.Result	Indication of whether PriorAuthorization is approved or denied	string	yes
	Authorization.DenialCode	Reason code for PriorAuthorization denial	string	DC9876
	Authorization.Start	Valid start date for PriorAuthorization	date	15/2/2013

Table A.1 – Details of elements of the common health data schema

Data object	Data field	Description	Data type	Example
	Authorization.End	Valid end date for PriorAuthorization	date	15/3/2013
	Authorization.Limit	Monetary limit for the authorized charge amount	integer	1000
	Authorization.Comment	PriorAuthorization comments	string	
Header				
	Header.SenderID	Unique ID of the entity sending the transaction	string	xxx3456
	Header.ReceiverID	Unique ID of the entity receiving the transaction	string	yyy7654
	Header.SenderSource	Source of the transaction (used to indicate whether transaction is from clinic or medical/fitness device)	string	fitbit
	Header.TransactionDate	Date and time stamp of the transaction	date and time	2011-06-16T00:00:00.000
Resubmission				
	Resubmission.Type	The type of resubmission	string	claim
	Resubmission.Comment	Comments providing additional information for resubmission	string	
	Resubmission.Attachment	Supporting documentation for resubmission		

Annex B

Health transactions

(This annex forms an integral part of this Recommendation.)

Table B.1 contains the list of the health transactions and the common health data schemas that are required as part of the transaction. In the table "R" designates required elements and "O" designates optional ones.

Table B.1 – Matrix of required and option data elements and transactions

	Claim submission	Remittance advice	Person register	Prior request	Prior authorization	Data submit
Header						
SenderID	R	R	R	R	R	R
ReceiverID	R	R	R	R	R	R
TransactionDate	R	R	R	R	R	R
RecordCount	R	R	R	R	R	R
Person						
Person.FirstName			O			
Person.LastName			O			
Person.ContactNumber			O			
Person.BirthDate			R			
Person.Gender			R			
Person.Nationality			R			
Person.City			R			
Person.GovtID			R	R		
Member						
Member.HealthID			R			
Member.Relation			R			
Member.PrincipalID			O			
Encounter						
Encounter.ID	R	O		O		
Encounter.Type	R			O		
Encounter.PatientID	R					
Encounter.FacilityID	R	O		R		
Encounter.RespClinicianID	R					
Encounter.Start	R					
Encounter.StartType	O					
Encounter.End	O					
Encounter.EndType	O					

Table B.1 – Matrix of required and option data elements and transactions

	Claim submission	Remittance advice	Person register	Prior request	Prior authorization	Data submit
Encounter.TransferSource	O					
Encounter.TransferDestination	O					
Diagnosis						
Diagnosis.Type	R			R	R	
Diagnosis.CodeSet	R			R	R	
Diagnosis.Code	R			R	R	
Activity						
Activity.ID	O	O		R	R	
Activity.Start	R	R		O		R
Activity.Type	R	R		R	R	R
Activity.End	R	R		O	O	
Activity.Code	R	R		R	R	
Activity.Quantity	R	R		O	O	
Activity.Net	R	R		R	R	
Activity.ClinicianID	R	R		O		
Activity.PriorAuthorizationID	O	O				
Activity.PaymentAmount		R			R	
Activity.DenialCode		O				
Activity.List		O			O	
Activity.Gross		O			O	
Activity.PatientShare		O				
Observation						
Observation.Type	R			R	R	R
Observation.CodeSet	R			R	R	R
Observation.Code	R			R	R	R
Observation.Value	R			R	R	R
Observation.ValueType	R			R	R	R
Claim						
Claim.IDProvider	R	R		R	R	
Claim.IDPayer	O	R		O	O	
Claim.MemberID	O			R		
Claim.PayerID	R			R		
Claim.ProviderID	R	O		R		
Claim.Currency	R					
Claim.Gross	R					
Claim.PatientShare	R					

Table B.1 – Matrix of required and option data elements and transactions

	Claim submission	Remittance advice	Person register	Prior request	Prior authorization	Data submit
Claim.Net	R					
Claim.PaymentReference		R				
Contract						
Contract.PackageName	O		R			
Contract.StartDate			R			
Contract.ExpiryDate			R			
Contract.RenewalDate			R			
Contract.PremiumCurrency			R			
Contract.GrossPremium			R			
Authorization request						
AuthorizationRequest.ID				R		
AuthorizationRequest.Type				R		
AuthorizationRequest.DateOrdered				O		
AUTHORIZATION						
Authorization.ID				R	R	
Authorization.Result					O	
Authorization.DenialCode					O	
Authorization.Start					R	
Authorization.End					R	
Authorization.Limit					O	
Authorization.Comment					O	
RESUBMISSION						
Resubmission.Type	R			R		
Resubmission.Comment	R			R		
Resubmission.Attachment	O			O		

Annex C

Validation rules definition

(This annex forms an integral part of this Recommendation.)

Annex C describes the validation rules as outlined in clause 10. The rules in Tables C.1 and C.2 are used to validate the transaction submitted through the health data exchange

Table C.1 – Details of validation rules for schema elements

#	Data object	Data element	Rule	Claim submission	Remittance advice	Person register	Prior request	Prior authorization	Data submit
1	Global	N/A	zip file uploaded must contain only one XML file	•					•
2	Global	N/A	names of files uploaded may not contain reserved XML symbols		•				
3	Global	Date	cannot be less than 01/01/1900			•			
4	Global	Date and time	cannot be less than 01/01/1900 00:00					•	
5	Header	Header.SenderID	must be a valid payer government/commercial licence	•			•	•	
6	Header	Header.SenderID	must be a valid payer registered data provider						•
7	Header	Header.ReceiverID	must be a valid payer government/commercial licence				•	•	•

Table C.1 – Details of validation rules for schema elements

#	Data object	Data element	Rule	Claim submission	Remittance advice	Person register	Prior request	Prior authorization	Data submit
8	Header	Header.RecordCount	must be equal to the number of records in the e-claim file	•					
9	Header	Header.TransactionDate	must be equal to the current date					•	
10	Person	Person.BirthDate	<= Header.TransactionDate	•	•				
11	Person	Person.Nationality	must have a correct value from the list of nationalities				•		
12	Person	Person.GovtID	must have a correct value				•		
13	Member	Member.ID	must be unique within a file					•	
14	Member	Member.RelationTo	must be equal to Member.ID if Member.Relation = 'Principal'				•	•	
15	Member	Member.RelationTo	must have a value if Member.Relation is not 'Principal'					•	
16	Member	Member.RelationTo	must be equal to a MemberID, where Member.Relation = Principal					•	
17	Encounter	Encounter.Type	must have a value		•				
18	Encounter	Encounter.FacilityID	must be a valid payer government/commercial licence	•					
19	Encounter	Encounter.FacilityID	must have a value		•				
20	Encounter	Encounter.FacilityID	must be a valid payer government/commercial licence		•				
21	Encounter	Encounter.FacilityID	must be a valid payer government/commercial licence	•	•		•		

Table C.1 – Details of validation rules for schema elements

#	Data object	Data element	Rule	Claim submission	Remittance advice	Person register	Prior request	Prior authorization	Data submit
22	Encounter	Encounter.Start	must have a value		•				
23	Encounter	Encounter.Start	must be before Header.TransactionDate		•				
24	Encounter	Encounter.End	must have a value for inpatient			•			
25	Encounter	Encounter.End	must be greater that Encounter.Start	•			•		
26	Encounter	Encounter.EndType	must have a value for inpatient	•					
27	Encounter	Encounter.Start, End, Activity.Start	start and end dates of all encounters must not overlap, Encounter.End for outpatients is defined by maximum activity start	•					
28	Encounter	Encounter.TransferSource	must be a valid payer government/commercial licence	•					
29	Encounter	Encounter.Transfer Destination	must be a valid payer government/commercial licence	•					
30	Diagnosis	Diagnosis.Type	must be Principal, Secondary or Admitting		•				
31	Diagnosis	Diagnosis.Code	must be a valid ICD code		•				
32	Diagnosis	Diagnosis.Code	must be unique within a claim	•	•	•	•	•	
33	Diagnosis	Diagnosis.Code	must be unique within an authorization	•	•	•	•	•	
34	Activity	Activity.ID	must be unique within a claim	•					•

Table C.1 – Details of validation rules for schema elements

#	Data object	Data element	Rule	Claim submission	Remittance advice	Person register	Prior request	Prior authorization	Data submit
35	Activity	Activity.ID	must be present in all or none of the activities within a particular claim	•					
36	Activity	Activity.ID	must be unique within an authorization	•			•		
37	Activity	Activity.Start	must have a value	•	•				•
38	Activity	Activity.Start	>= Encounter.Start and <= Encounter.End	•					
39	Activity	Activity.Start	must be within 24 hours from Encounter.Start if Encounter.Type = Outpatient	•			•		
40	Activity	Activity.Start	<= Header.TransactionDate			•			•
41	Activity	Activity.Start	= Encounter.Start if Activity.Type = 9 (IR-DRG)	•			•		
42	Activity	Activity.Type	must be 3 = CPT, 4 = HCPCS, 5 = Drug, 6 = Dental, 8 = Service code or 9 = IR-DRG	•			•		
43	Activity	Activity.Type	= 9 (IR-DRG) is only allowed for in-patient claims	•			•		
45	Activity	Activity.Code	must have a value	•	•	•	•	•	•
47	Activity	Activity.Code	must be a valid ICD code	•					
48	Activity	Activity.Code	must be a valid CPT code	•			•		
49	Activity	Activity.Code	must be a valid HCPCS code	•					
50	Activity	Activity.Code	must be a valid Drug code	•	•				

Table C.1 – Details of validation rules for schema elements

#	Data object	Data element	Rule	Claim submission	Remittance advice	Person register	Prior request	Prior authorization	Data submit
51	Activity	Activity.Code	must be a valid Dental code			•			
52	Activity	Activity.Code	must be a valid Service code	•					
53	Activity	Activity.Code	must be a valid DRG code	•					
54	Activity	Activity.Code	must have LOINC observations	•	•				
55	Activity	Activity.Code	must have at least one Common Dental observation if Activity.Type = 6 and dental code has 'Tooth Number Required'='Yes'	•					
56	Activity	Activity.Code	must have no modifier if Activity.Type = 3 (CPT)	•					
57	Activity	Activity.Quantity	must be greater than zero	•					
58	Activity	Activity.Net	must have a value	•					
59	Activity	Activity.Net	sum of all Activity.Net must be equal to Claim.Net of the latest Claim.Submission transaction with same combination of ClaimID/ProviderID	•					
60	Activity	Activity.Net	>= 0	•			•		
61	Activity	Activity.Clinician	must have a value	•					
62	Activity	Activity.Clinician	must be a valid payer government/commercial licence	•					
63	Activity	Activity.Clinician	must not be a Pharmacist	•					
64	Activity	Activity.PaymentAmount	must have a value	•					

Table C.1 – Details of validation rules for schema elements

#	Data object	Data element	Rule	Claim submission	Remittance advice	Person register	Prior request	Prior authorization	Data submit
65	Activity	Activity.PaymentAmount	must be equal to Activity.Net for all activities in a claim if the sum of Activity.Net = sum of Activity.PaymentAmount	•					
66	Activity	Activity.DenialCode	must be a valid denial code	•					
67	Activity	Activity.DenialCode	must have a value if Activity.Net <> Activity.PaymentAmount	•	•				
68	Activity	Activity.DenialCode	must be empty if Activity.Net = Activity.PaymentAmount	•					
69	Activity	Activity.DenialCode	must be empty if Activity.Net = 0	•					
70	Activity	Activity.List	> 0	•					
71	Activity	Activity.PatientShare	>= 0	•					
72	Observation	Observation.Type	must have a value				•		•
73	Observation	Observation.Code	must be a valid LOINC code if Observation.Type = LOINC				•		•
74	Observation	Observation.Code	must have a valid value					•	•
75	Observation	Observation.Code	must be a valid Common Tooth Numbering code if Observation.Type = Common Dental				•	•	
76	Observation	Observation.Value	must have a value					•	•
77	Observation	Observation.Value	must be numeric if Observation.Type = LOINC				•	•	•

Table C.1 – Details of validation rules for schema elements

#	Data object	Data element	Rule	Claim submission	Remittance advice	Person register	Prior request	Prior authorization	Data submit
78	Observation	Observation.ValueType	must be valid (list of LOINC codes with their allowed value types is published on data dictionary web site)				•		•
79	Observation	Observation.ValueType	must have a value					•	•
80	Claim	Claim.N/A	must have one principal diagnosis only	•	•				
81	Claim	Claim.ID	must have a value	•	•				
82	Claim	Claim.ID	must be unique within a claim transaction			•			
83	Claim	Claim.ID	RemittanceAdvice cannot be resubmitted before receiving claim resubmission		•				
84	Claim	Claim.ID	Claim cannot be resubmitted before receiving corresponding Remittance.Advice transaction	•	•				
85	Claim	Claim.IDPayer	can exist only in combination with one Claim.ID		•				
86	Claim	Claim.IDPayer	must have value if Header.SenderID = Payer			•			
87	Claim	Claim.MemberID	must be present in at least one Person.Register transaction	•	•	•	•	•	
88	Claim	Claim.PayerID	must have a value	•	•				
89	Claim	Claim.PayerID	must be a valid payer government/commercial licence	•	•		•		

Table C.1 – Details of validation rules for schema elements

#	Data object	Data element	Rule	Claim submission	Remittance advice	Person register	Prior request	Prior authorization	Data submit
90	Claim	Claim.ProviderID	must have a value	•					
91	Claim	Claim.ProviderID	must be a valid payer government/commercial licence	•			•	•	
92	Claim	Claim.ProviderID	must be a valid payer government/commercial licence			•			
93	Claim	Claim.ProviderID	must be unique within a claim transaction	•	•	•	•		
94	Claim	Claim.ProviderID	must be a valid payer government/commercial licence	•	•	•	•	•	
95	Claim	Claim.ProviderID	RemittanceAdvice cannot be resubmitted before receiving claim resubmission		•				
96	Claim	Claim.ProviderID	claim cannot be resubmitted before receiving corresponding Remittance.Advice transaction	•	•	•	•	•	
97	Claim	Claim.GovermentID	must have a correct value			•			
98	Claim	Claim.Gross	must have a value	•			•		
99	Claim	Claim.Gross	must be greater than or equal to PatientShare + Net	•			•		
100	Claim	Claim.PatientShare	must have a value	•	•				
101	Claim	Claim.PatientShare	>= 0	•					
102	Claim	Claim.Net	must have a value	•			•	•	
103	Claim	Claim.Net	must be equal to the sum of all its Activity.Net values	•	•				

Table C.1 – Details of validation rules for schema elements

#	Data object	Data element	Rule	Claim submission	Remittance advice	Person register	Prior request	Prior authorization	Data submit
104	Claim	Claim.Net	>= 0		•				
105	Claim	Claim.DateSettlement	must have a value		•				
106	Claim	Claim.DateSettlement	must be after the latest Activtiy.Start in the claim			•			
107	Claim	Claim.PaymentReference	must have value if sum of Activity.PaymentAmount <> 0	•					
108	Contract	Contract.ExpiryDate	>= Contract.StartDate	•					
109	Contract	Contract.ExpiryDate	>= Contract.RenewalDate			•			
110	Contract	Contract.RenewalDate	>= Contract.StartDate	•					

Table C.2 – Details of validation rules for Authorization ata element

#	Transaction type	Object	Element	Rule	Claim submission	Remittance advice	Person register	Prior request	Prior authorization	Data submit
1	Authorization	Claim	PayerID	must have a value	•	•	•	•	•	
2	Authorization	Claim	PayerID	= Header.ReceiverID		•				
3	Authorization	Claim	PayerID	= Header.SenderID	•	•	•	•	•	
4	Authorization	Claim	IDPayer	must have a value	•	•		•	•	
5	Authorization	Person	ID	must have a value	•	•		•	•	
6	Authorization	Person	ID	must be unique within a file	•	•		•	•	
7	Authorization	Claim	PayerID	must be a valid payer licence	•	•		•	•	
8	Authorization	Claim	Denial Code	must be a valid denial code	•	•		•	•	
9	Authorization	Activity	Start	must have a value	•	•		•	•	
10	Authorization	Activity	End	must have a value	•	•		•	•	
11	Authorization	Activity	End	>= Authorization.Start	•	•		•	•	
12	Authorization	Member	HealthID	must be present in at least one Person.Register transaction	•	•	•	•	•	
14	Authorization	Activity	Start	>= Activity.Start of the correspondent Prior.Request transaction	•	•				
15	Authorization	Activity	Start	<= Header.TransactionDate	•	•		•	•	
16	Authorization	Diagnosis	Code	must have one principal diagnosis only	•	•		•		
17	Authorization	Claim	IDPayer	<= Header.TransactionDate		•				
18	Authorization	Claim	Denial Code	must not be present if Authorization.Type = "Prescription"		•			•	

Appendix I

Illustrative governance model

(This appendix does not form an integral part of this Recommendation.)

I.1 Collaborative development framework

This Recommendation was developed with substantial involvement of health stakeholders in a range of health markets. Through the collaborative development process determined by the data standards panel (Figure I.1), the real-world use cases for health data exchange between defined health system stakeholders have been codified into an initial set of health data transactions, which are all based on a single CHDS. Thus the CHDS has been, and continues to be, modified through the governance process to deliver additional health data transactions, whilst maintaining its basic structure and compact file size.

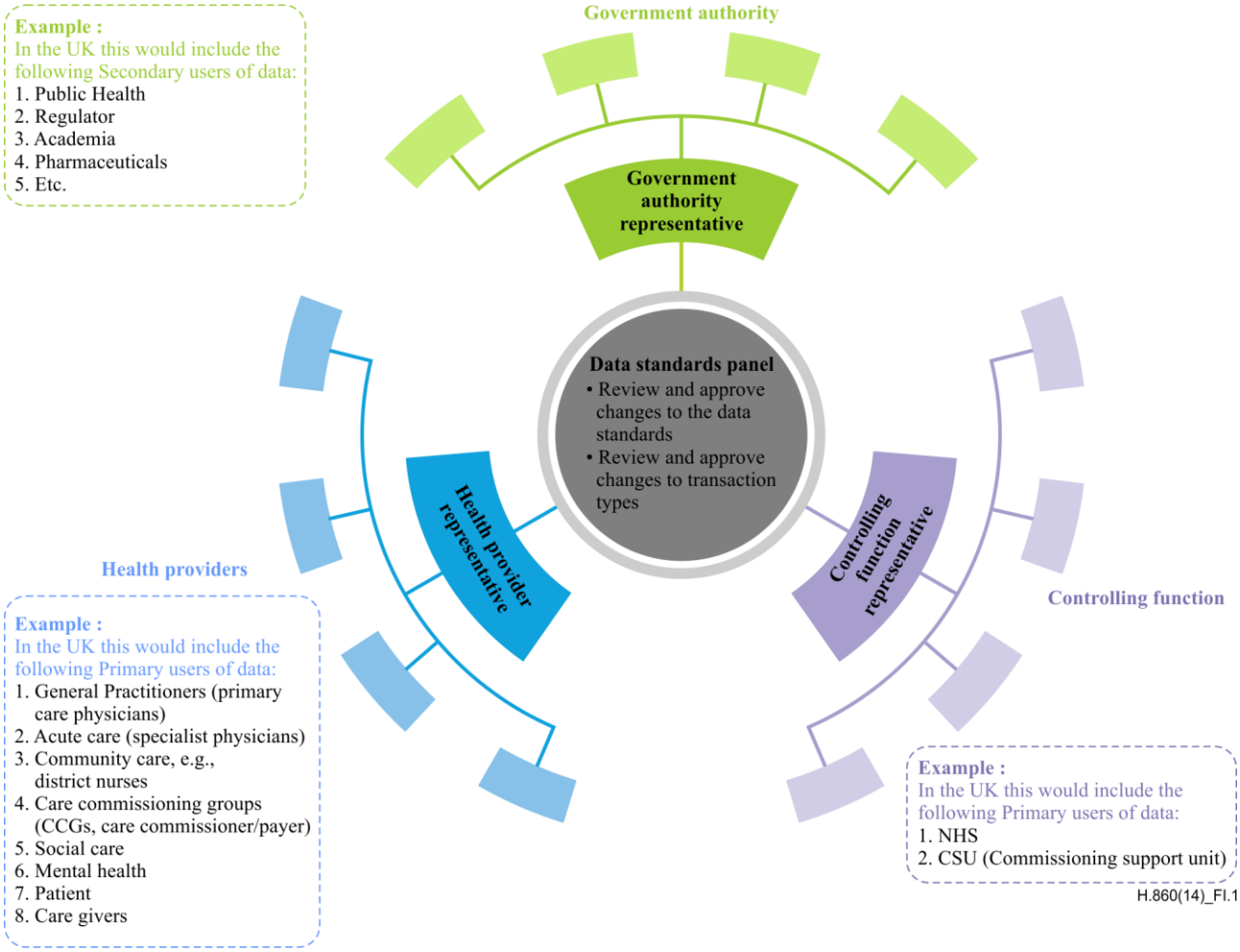


Figure I.1 – Data standards panel

The deployment of this Recommendation depends on the iterative matching (through the collaborative development process) of health system requirements with defined health data transactions and the underlying CHDS. Health systems differ in their structure (e.g., those with a single (e.g., government) healthcare payer or those with plural private healthcare payers) and the requirements of health sector stakeholders for health data (e.g., in response to a health data maturity model). In response, the deployment of systems based on this recommended standard may be adapted to meet the specific requirements of an individual health system. However, all health systems operating the data standards in this Recommendation will have a technical capability to combine and share data; this will be subject to data protection and confidentiality laws and regulations.

Appendix II

Health transactions XML

(This appendix does not form an integral part of this Recommendation.)

Appendix II describes the XML sample for the health transactions.

NOTE – An abstract syntax notation one (ASN.1) [ITU-T X.680] schema equivalent to the XML sample can be used in order to provide a compact encoding.

II.1 ClaimSubmission

```
<!-- Mammogram in Claim -->
<Claim>
     <ProviderID>xyz789</ProviderID>
     <HealthID>23456789</HealthID>
     <PayerID>insurer</PayerID>
     <ProviderID>hospital1234</ProviderID>
     <GovtID>111-1111-1111111-1</GovtID>
     <Gross>800</Gross>
     <PatientShare>174</PatientShare>
     <Net>626</Net>
          <!-- Encounter information -->
                    <Encounter>
                    <FacilityID>MF2057</FacilityID>
                    <Type>1</Type>
                    <PatientID>1245</PatientID>
                    <Start>01/01/2009 12:00</Start>
                    <End>01/01/2010 15:00</End
               <StartType>3</StartType>
               <EndType>2</EndType>
               </Encounter>
               <Diagnosis>
                    <Type>Principal</Type>
                    <Code>012.13</Code>
               </Diagnosis>
                    <Activity>
                         <Start>01/01/2009 13:00</Start>
                         <Type>3</Type>
                         <Code>77057</Code>
                         <Quantity>1</Quantity>
                         <Net>313</Net>
                         <ClinicianID>clinician3456</ClinicianID>
                         <!-- Observation information: observation - Date of
        Initial Encounter -->
                              <Observation>
                                   <Type>CPT</Type>
                                   <Code>77057</Code>
                                   <Value>3342F</Value>
                                   <ValueType>CPT</ValueType>
                              </Observation>
                    </Activity>
                    <Activity>
                         <Start>01/01/2009 13:00</Start>
                         <Type>3</Type>
                         <Code>77052</Code>
                         <Quantity>1</Quantity>
                         <Net>313</Net>
                         <ClinicianID>clinician3456</ClinicianID>
                    </Activity>
</Claim>
```

II.2 Remittance.Advice

```
<!-- Header: Submission identification information -->
<Header>
     <SenderID>insurance1234</SenderID>
     <ReceiverID>hospital5678</ReceiverID>
     <TransactionDate>06/01/2009 15:00</TransactionDate>
     <RecordCount>1</RecordCount>
</Header>
<Claim>
     <IDProvider>hospital1234</IDProvider>
     <IDPayer>insurer4567</IDPayer>
         <Activity>
          <Start>08/01/2013 13:00</Start>
          <Type>3</Type>
          <Code>0031T</Code>
          <Quantity>1</Quantity>
          <Net>6000</Net>
          <ClinicianID>clinician1234</ClinicianID>
          <PriorAuthorizationID>1235</PriorAuthorizationID>
          <Gross>6000</Gross>
          <PatientShare>500</PatientShare>
          <PaymentAmount>5500</PaymentAmount>
         </Activity>
</Claim>
```

II.3 DataSubmission

The health data exchange calls the HumanAPI (www.humanapi.co) web service (http://humanapi.co/v1/human/heart_rate) to retrieve heart rate information and translates it to the ITU-T H.860 format.

```
<!-- HumanAPI Example of a HEART RATE
reading -->
<HeartRate>
      <ID>1</ID>
      <userID>2</userID>
      <timestamp>2013-06-
21T02:19:14.596Z</timestamp>
      <value>62</value>
      <unit>bpm</unit>
</HeartRate>
```

```
<!-- HumanAPI HEART RATE reading mapped to the ITU-T H.860
format. -->

<Activity>
      <ID>1</ID>
      <start>2013-06-21T02:19:14.596Z</start>
      <type>2</type>    <!-- CPT -->
      <code>HHHHHH</code>  <!-- CPT Code for HR
Measurement -->
      <end>2013-06-21T02:19:14.596Z</end>
      <Observation>
            <type>LOINC</type>
            <code>NNNNN-M</code> <!-- LOINC Code for Heart
Rate -->
            <valueType>bpm</value>
            <value>62</value>
      </Observation>
</Activity>
```

The health data exchange calls the HumanAPI (www.humanapi.co) web service (http://humanapi.co/v1/human/blood_pressure) to retrieve heart rate information and translates it to the ITU-T H.860 format.

```
<!-- HumanAPI Example of a BLOOD
PRESSURE Reading -->
<BloodPressure>
      <ID>1</ID>
      <userID>2</userID>
      <timestamp>2013-06-
21T02:19:14.596Z</timestamp>
      <value>
            <systolic>122</systolic>
            <diastolic>77</diastolic>
      </value>
      <unit>mmHg</unit>
</BloodPressure>
```

```
<!-- HumanAPI BLOOD PRESSURE reading mapped to the ITU-T
H.860 format. -->
<Activity>
      <ID>3</ID>
      <start>2013-06-21T02:19:14.596Z</start>
      <type>2</type>      <!-- CPT -->
      <code>BBBBBB</code> <!-- CPT Code for Blood Pressure
Measurement -->
      <end>2013-06-21T02:19:14.596Z</end>
      <Observation>
            <type>LOINC</type> <!-- LOINC Code for
BloodPressure Systolic -->
            <code>NNNNN-A</code>
            <valueType>mmHg</value>
            <value>122</value>
      </Observation>
      <Observation>
            <type>LOINC</type> <!-- LOINC Code for
BloodPressure Diastolic -->
            <code>NNNNN-B</code>
            <valueType>mmHg</value>
            <value>77</value>
      </Observation>
</Activity>
```

The health data exchange calls a jogging monitoring device web service (developer.nike.com) web service (GET https://api.nike.com/me/sport/activities/104019031?access_token={access_token}) to retrieve activity information and translates it to the ITU-T H.860 format.

```
<!-- Example of RUN activity -->
<activityId>42505310606</activityId>
<activityType>RUN</activityType>
<startTime>2013-08-
25T14:13:03Z</startTime>
<activityTimeZone>Asia/Baku</activityTim
eZone>
<status>COMPLETE</status>
<deviceType>SPORTWATCH</deviceType>
<metricSummary>
      <calories>423</calories>
      <fuel>1334</fuel>
      <distance>6.051599979400635</dista
nce>
      <duration>0:32:23.000</duration>
</metricSummary>
```

```
<!-- RUN activity mapped to the ITU-T H.860 format. -->
<Activity>
      <ID>42505310606</ID>
      <start>2013-08-25T14:13:03Z</start>
      <type>2</type>       <!-- CPT -->
      <code>RRRRRR</code>  <!-- CPT Code for Run Activity
Measurement -->
      <end>2013-08-25T14:13:03Z</end>
      <Observation>
            <type>LOINC</type>
            <code>CCCCC-A</code>  <!-- LOINC Code for
Calories -->
                  <valueType>joule</value>
                  <value>423</value>
      </Observation>
      <Observation>
            <type>LOINC</type>
            <code>FFFFF-B</code>    <!-- LOINC Code for
Nike fuel -->
            <valueType>NikeFuel</value>
            <value>1334</value>
      </Observation>
      <Observation>
            <type>LOINC</type>
            <code>DDDDD-A</code>      <!-- LOINC Code for
Distance -->
            <valueType>km</value>
            <value>6.051599979400635</value>
      </Observation>
      <Observation>
            <type>LOINC</type>
            <code>TTTTT-B</code>      <!-- LOINC Code for
Duration -->
            <valueType>millisecond</value>
            <value>1933800</value>   <!-- duration
converted to milliseconds-->
      </Observation>
</Activity>
```

The health data exchange calls a fitness monitoring web service (dev.fitbit.com) (GET /1/user/-/activities/date/2010-03-27.xml) to retrieve step information and translates it to the ITU-T H.860 format.

```
<!-- Example of STEP activity -->
<activityLog>
<activityId>51007</activityId>
<activityParentID>90019</activityParentID>
      <calories>230</calories>
      <description>7mph</description>
      <distance>2.04</distance>
      <duration>1097053</duration>
      <hasStartTime>false</hasStartTime>
      <isFavorite>true</isFavorite>
      <logId>1154701</logId>
      <name>Treadmill, 0% Incline</name>
      <startTime>00:00</startTime>
      <steps>3783</steps>
</activityLog>
```

```
    <!-- STEP activity mapped to the ITU-T H.860 format. -->
 <Activity>
      <ID>51007</ID>
      <start>2013-08-25T14:13:03Z</start>
           <type>2</type>       <!-- CPT -->
   <code>SSSSSS</code>   <!-- CPT Code for Step Activity Measurement -->
   <end>2013-08-25T14:13:03Z</end>
      <Observation>
            <type>LOINC</type>
           <code>CCCCC-A</code>     <!-- LOINC Code for Calories -->
            <valueType>joule</value>
            <value>230</value>
      </Observation>
      <Observation>
            <type>LOINC</type>
            <code>SSSSS-B</code>    <!-- LOINC Code for Steps -->
            <valueType>steps</value>
            <value>3783</value>
      </Observation>
      <Observation>
            <type>LOINC</type>
           <code>DDDDD-A</code>     <!-- LOINC Code for Distance -->
            <valueType>km</value>
           <value>3.28306</value>   <!-- distance converted to km-->
      </Observation>
      <Observation>
            <type>LOINC</type>
           <code>TTTTT-B</code>     <!-- LOINC Code for Duration -->
            <valueType>millisecond</value>
           <value>1097053</value>   <!-- duration converted to ms-->
      </Observation>
 </Activity>
```

The health data exchange calls a sleep activity monitoring web service (dev.fitbit.com) (GET /1/user/-/sleep/date/2010-03-27.xml) to retrieve sleep information and translates it to the ITU-T H.860 format.

```
<!-- Example of SLEEP activity -->
<sleepLog>
      <isMainSleep>true</isMainSleep>
      <logId>29744</logId>
      <efficiency>98</efficiency>
      <startTime>2011-06-6T00:00:00.000</startTime>
      <duration>28800000</duration>
      <minutesToFallAsleep>0</minutesToFallAsleep>
      <minutesAsleep>480</minutesAsleep>
      <minutesAwake>0</minutesAwake>
      <minutesAfterWakeup>0</minutesAfterWakeup>
      <awakeningsCount>0</awakeningsCount>
      <timeInBed>480</timeInBed>
</sleepLog>
```

```
<!-- SLEEP activity mapped to the ITU-T H.860 format. -->
<Activity>
      <ID>29744</ID>
      <start>2011-06-16T00:00:00.000</start>
      <type>2</type>     <!-- CPT -->
      <code>SLSLSL</code>      <!-- CPT Code for Sleep Activity Measurement -->
      <end>2013-08-25T14:13:03Z</end>
      <Observation>
            <type>LOINC</type>
            <code>EEEEE-A</code>    <!-- LOINC Code for Sleep Efficiency -->
            <valueType>%</value>
            <value>98</value>
      </Observation>
      <Observation>
            <type>LOINC</type>
            <code>MINFA-A</code> <!-- LOINC Code for Min. to Fall Asleep -->
            <valueType>min</value>
            <value>0</value>
      </Observation>
      <Observation>
            <type>LOINC</type>
            <code>MINASL-A</code> <!-- LOINC Code for Min. Asleep -->
            <valueType>min</value>
            <value>480</value>
      </Observation>
      <Observation>
```

	<type>LOINC</type> <code>MINAW-B</code> <!-- LOINC Code for Min. Awake --> <valueType>min</value> <value>0</value> </Observation> <Observation> <type>LOINC</type> <code>MINAA-B</code> <!-- LOINC Code for Min. After Awake --> <valueType>min</value> <value>0</value> </Observation> <Observation> <type>LOINC</type> <code>AWCNT-B</code> <!-- LOINC Code for Awakenings Count --> <valueType>min</value> <value>0</value> </Observation> <Observation> <type>LOINC</type> <code>TIBED-B</code> <!-- LOINC Code for Time in Bed --> <valueType>min</value> <value>480</value> </Observation> </Activity>

Appendix III

Web services definition

(This appendix does not form an integral part of this Recommendation.)

Appendix III describes the web services for the transaction transmission as outlined in clause 10.

III.1 UploadTransaction

This web service is used to upload new transactions to the health data exchange.

```
int UploadTransaction(string login,
           string pwd,
           byte[] fileContent,
           string fileName,
           out string errorMessage)
```

login	User login name to connect to the health data exchange
pwd	User password to connect to the health data exchange
fileContent	Content of the file to upload
fileName	Uploaded file name; this file name will be used later to show users the available files for download
errorMessage	Error message value returned

III.2 GetNewTransactions

This web service is used to get a list of new transactions available on the health data exchange.
The service returns back a list of transactions that have not yet been downloaded.

```
int GetNewTransactions(string login,
            string pwd,
            out string transactionResults,
            out string errorMessage)
```

login	User login name to connect to the health data exchange
pwd	User password to connect to the health data exchange
fileContent	Content of the file to upload
transactionResults	Output parameter that contains xml with description of the new transaction files
errorMessage	Error message value returned

III.3 DownloadTransaction

The web service returns a transaction file.

```
int DownloadTransaction(string login, string pwd,
            string fileID,
            out byte[] file,
            out string errorMessage)
```

Login	User login name to connect to the health data exchange
Pwd	User password to connect to the health data exchange
fileID	ID of the file to receive the downloading link for; this ID is received from the XML file returned by GetNewTransactions web services
File	File content as byte array returned by the web server to the caller
errorMessage	Error message value returned

III.4 SetTransactionDownloaded

The web service is used to flag the downloaded file as downloaded.

```
int SetTransactionDownloaded(string login, string pwd,
                string fileID,
                out string errorMessage)
```

Login	User login name to connect to the health data exchange
Pwd	User password to connect to the health data exchange
fileID	ID of the file to set as 'downloaded'
errorMessage	Error message value returned

III.5 CheckNewPriorAuthorizationTransactions

This web service is used to check if new Prior.Request or Prior.Authorization transactions are available on the health data exchange. The service returns back a reply if at least one such transaction exists.

```
int CheckNewPriorAuthorizationTransactions
              (string login, string pwd,
               out string errorMessage)
```

Login	User login name to connect to the health data exchange
Pwd	User password to connect to the health data exchange
errorMessage	Error message value returned

III.6 GetNewPriorAuthorizationTransactions

This web service is used to get a list of new Prior.Request or Prior.Authorization transactions available on the health data exchange. The service returns back a list of transactions that have not yet been downloaded.

```
int GetNewPriorAuthorizationTransactions
               (string login, string pwd,
               string transactionResults,
               out string errorMessage)
```

Login	User login name to connect to the health data exchange
Pwd	User password to connect to the health data exchange
transactionResults	Output parameter that contains XML with description of the new e-claim files with Prior.Request and Prior.Authorization transactions
errorMessage	Error message value returned

III.7 GetPrescriptions

This web service is used to check prescription transaction that contains a list of approved trade drugs available for dispensing.

```
int GetPrescriptions(string login,
           string pwd,
           string payerID,
           string memberID,
           out byte[] prescription,
           out string errorMessage)
```

Login	User login name to connect to the health data exchange
Pwd	User password to connect to the health data exchange
payerID	Content of the file to upload
memberID	Output parameter that contains xml with description of the new transaction files
prescription	Output parameter that contains prescription transaction that contains approved drugs
errorMessage	Error message value returned

III.8 SearchTransactions

The web service performs advanced search for sent and received transactions.

```
int SearchTransactions(string login,
            string pwd,
            int direction,
            string callerLicense,
            string ePartner,
            int transactionID,
            string transactionFileName,
            string transactionFromDate,
            string transactionToDate,
            out string transactionResults,
            out string errorMessage)
```

Login	User login name to connect to the health data exchange
Pwd	User password to connect to the health data exchange
Direction	flag indicating if function will search for sent or received transactions; sent=1; received=2
ePartner	Licence ID of the ePartner – if direction = 1 then ePartner licence ID is used to find transactions sent to the ePartner – if direction = 2 then ePartner licence is used to find transactions received from the ePartner;
transactionID	ID of transactions to search for. The following values can be used: 1 – ALL transactions 2 – Claim.Submission transactions 3 – Person.Register transactions 4 – Remittance.Advice 5 – Prior.Request transaction 6 – Prior.Authorization transaction
transactionFileName	Partial or complete transaction file name to search for; e.g., string 'Oct' will return all transactions with the word 'Oct' in the filename e.g., 'ClaimSubmissionOct2013.xml'
transactionFromDate	'From Date' to search for transactions. Date format = 'dd/MM/yyyy hh:mm:ss'

transactionToDate	'To Date' to search for transactions. Date format = 'dd/MM/yyyy hh:mm:ss'
transactionResults	Output parameter that contains XML with description of the found transaction files
errorMessage	Error message value returned

III.9 Web services returned values

All of the above web services have a standard return value as part of the **errorMessage** value. The supported returned values are shown in Table III.1.

Table III.1 – Values for errorMessage

0	Operation is successful
1	Transaction validation succeeded with warnings
2	No new prior authorization transactions are available for download
3	Prescription transaction is not returned – member has no approved trade drugs
−1	Login failed for the user
−2	Transaction validation failed with errors
−3	Required input parameter is empty, or null, or contains invalid value
−4	Unexpected error occurred
−5	The specified file is not found
−6	Transaction is not supported

III.10 XML format

For 'GetNewTransactions', 'GetNewPriorAuthorizationTransactions' and 'SearchTransactions' the **transactionResults** parameter will return XML in the following format:

```
<Files>
<File FileID='31830' FileName='TransactionFile1.xml' SenderID='ABCD1234'
ReceiverID='INSURER5678' TransactionDate='11/15/2012 8:36:03'
IsDownloaded='True' />

<File FileID='31824' FileName=' TransactionFile2.xml' SenderID='HJKL9876'
ReceiverID='INSURER5678' TransactionDate='12/22/2012 20:19:10'
IsDownloaded='False' />

<File FileID='31821' FileName=' TransactionFile3.xml' SenderID='TUVW6789'
ReceiverID='INSURER5678' TransactionDate='31/03/2013 11:44:31'
IsDownloaded='True' />
</Files>
```

FileID	Unique file ID
FileName	Original file name uploaded by the sender
SenderID	Transaction file sender
ReceiverID	Transaction file receiver
TransactionDate	Value from the transaction file's TransactionDate value
IsDownloaded	True = file has been downloaded False = file has not been downloaded

Appendix IV
Illustrative use case

(This appendix does not form an integral part of this Recommendation.)

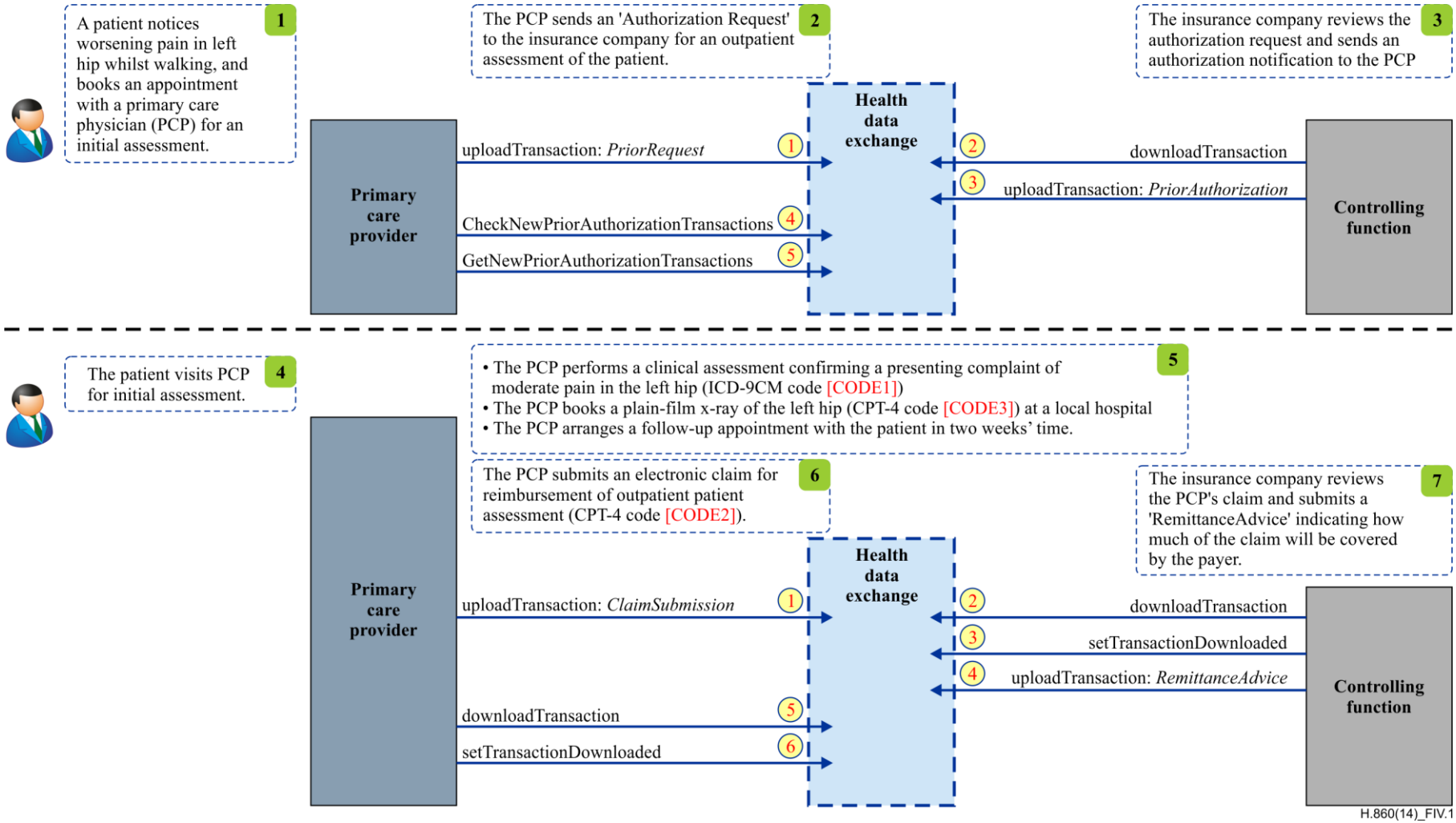


Figure IV.1 – Illustrative use case, part 1

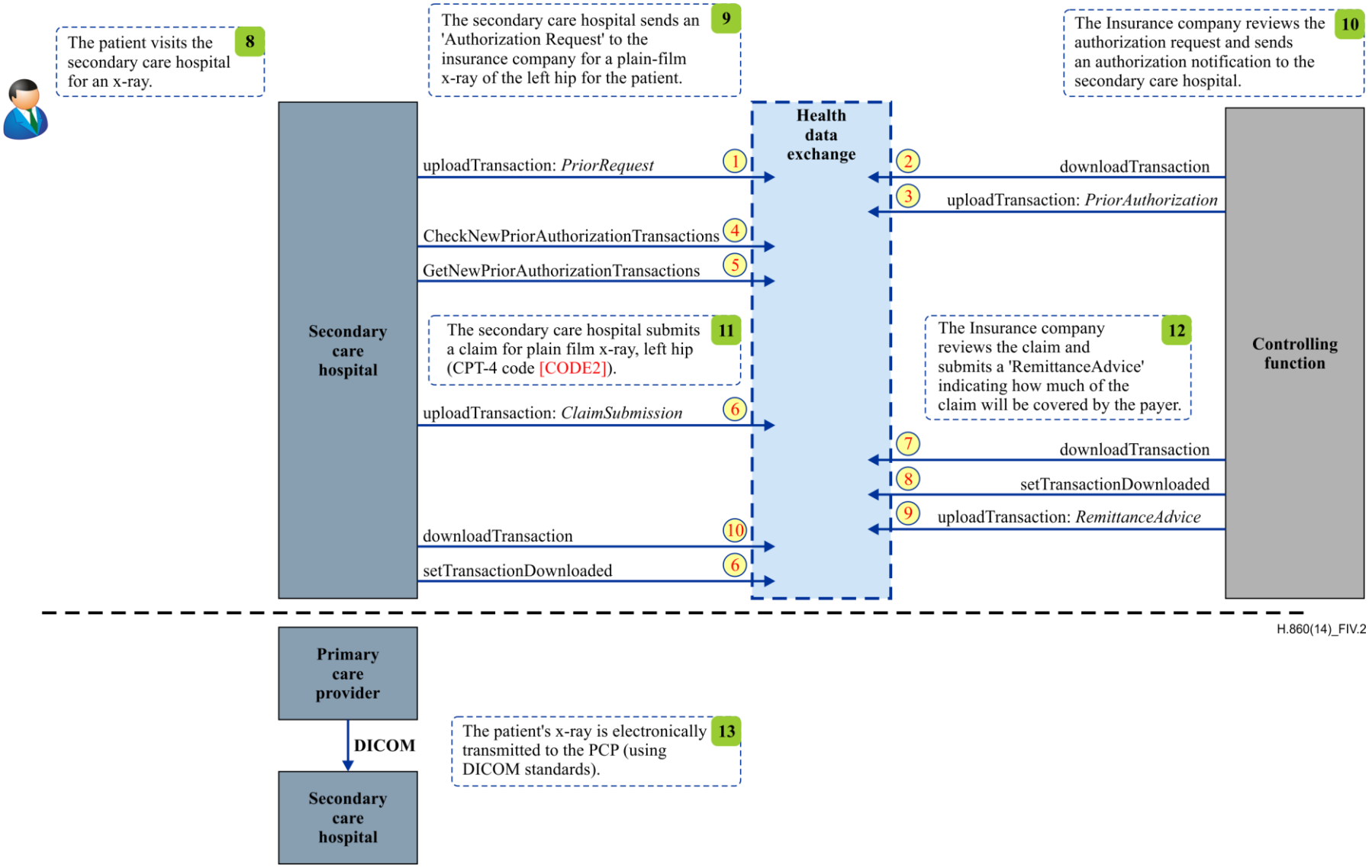


Figure IV.2 – Illustrative use case, part 2

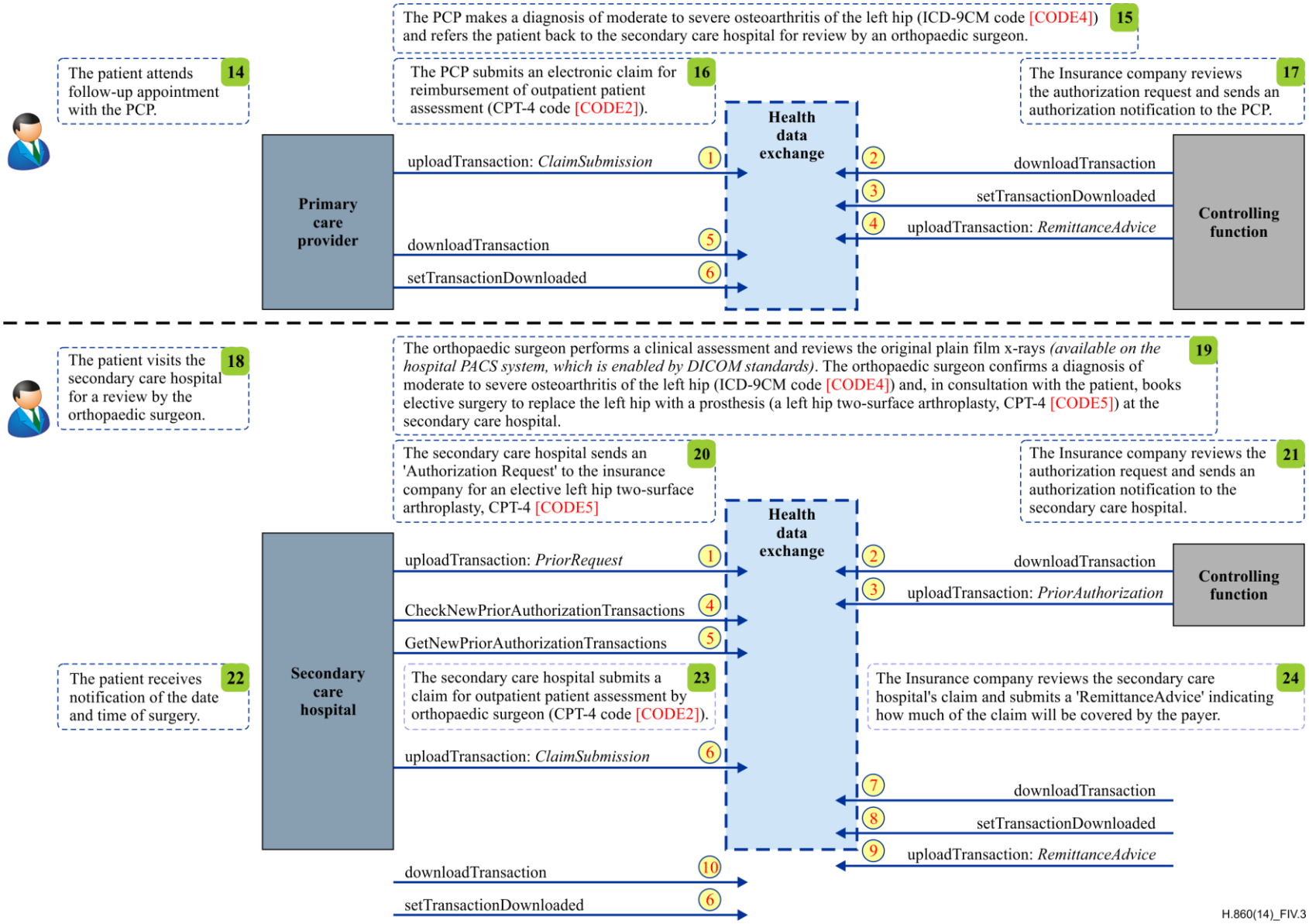


Figure IV.3 – Illustrative use case, part 3

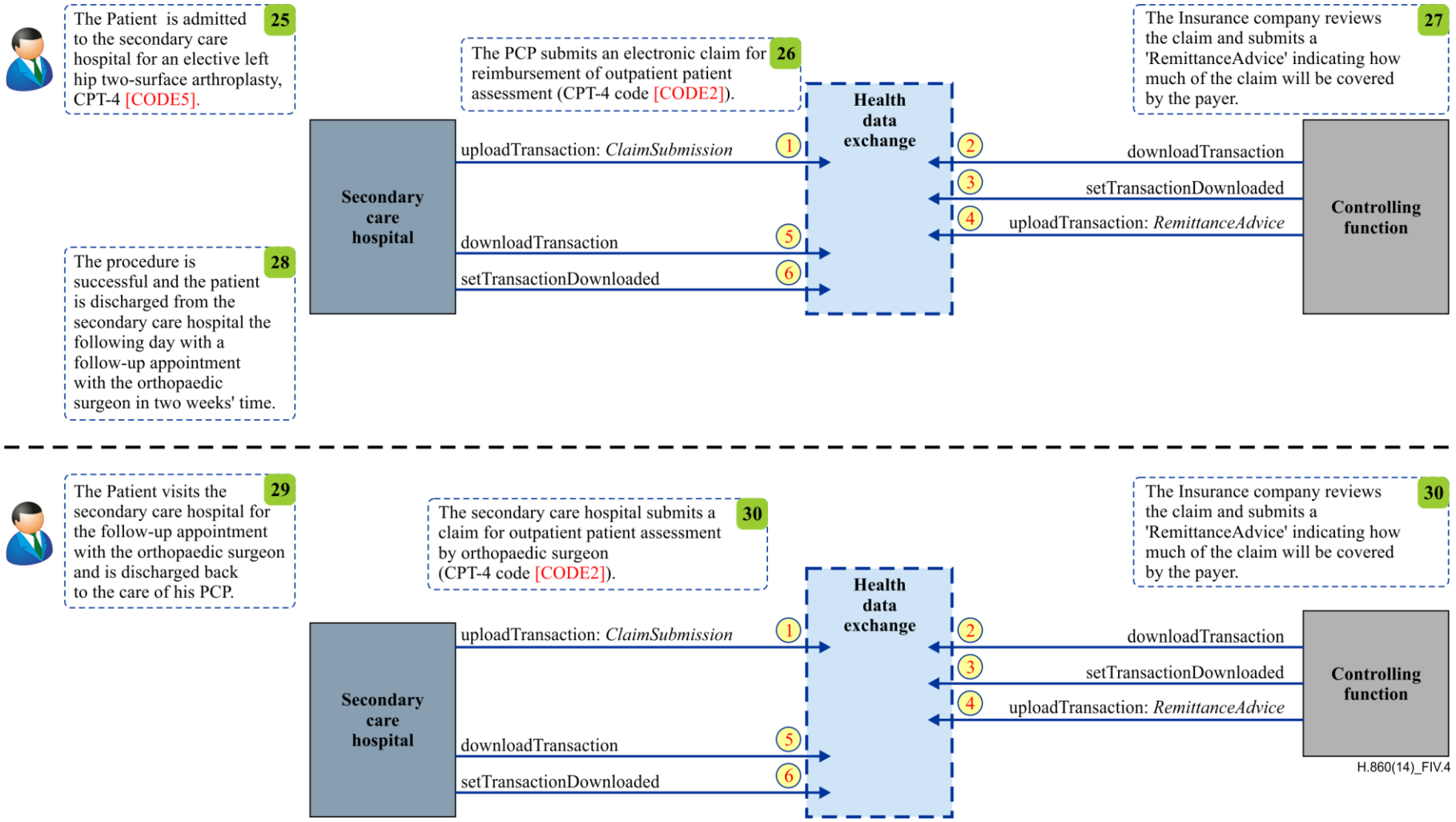


Figure IV.4 – Illustrative use case, part 4

Appendix V

Illustrative implementation architecture

(This appendix does not form an integral part of this Recommendation.)

This Recommendation can use various architectures to exchange standardized health information. Two examples are listed below.

V.1 Centralized health exchange

This model uses a centralized architecture to exchange health information between all participating entities. The centralized entity typically uses an enterprise service bus (ESB) to exchange the data and will have a centralized validation engine and analytics engine. This model is typically seen in a large health system with multiple health providers and controlling function. See Figure V.1.

A single entity, either government (e.g., Health Authority or Ministry of Health) or a commercial entity governs and operates the centralized health exchange with inputs from all participating entities.

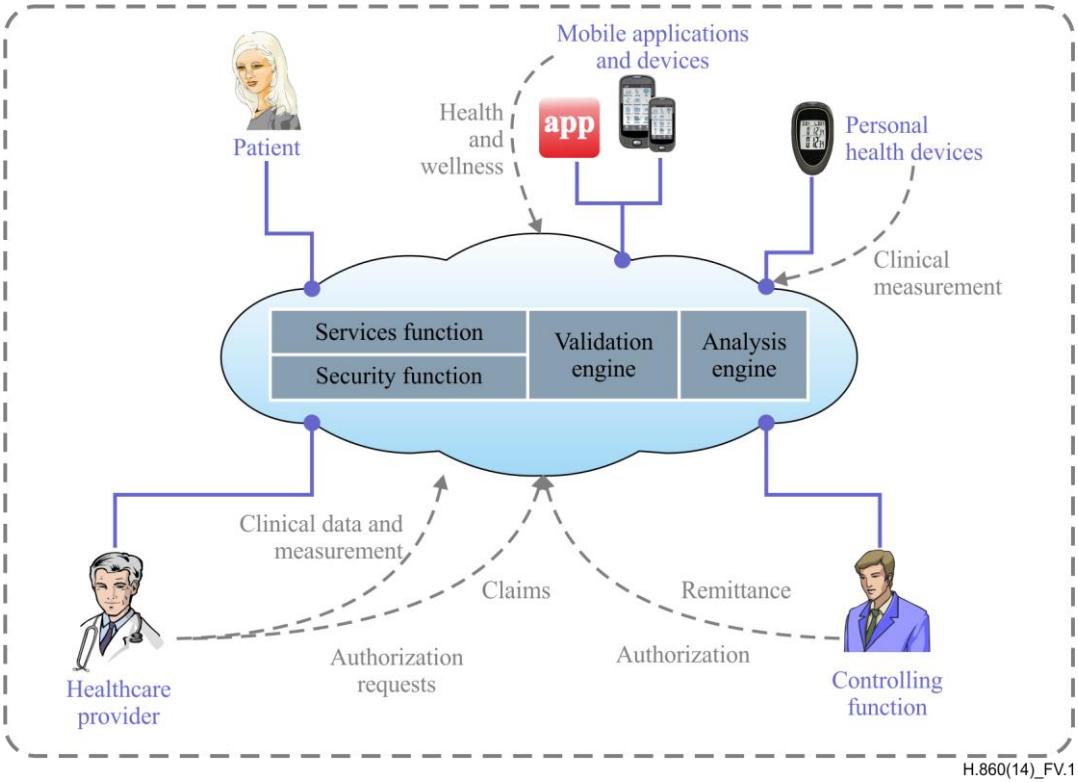


Figure V.1 – Centralized health data exchange

V.2 Peer-to-peer health exchange

This model is a decentralized architecture. Each participating entity ensures that the data exchanged conforms to ITU-T H.860. They also ensure that the data is validated prior to submitting the data to the other entity. The connections are peer-to-peer between participating entities. This type of model is typically seen where there are few entities to connect and/or in a low resource scenario where the cost of building, operating and governing a centralized exchange architecture is cost prohibitive. The peer-to-peer health exchange can often be used as the first step in implementing ITU-T H.860. The exchange can move to a centralized model when the number of participants reaches a point where

peer-to-peer management of the exchange becomes administratively prohibitive or when implementing a centralized exchange becomes cost permissible. See Figure V.2.

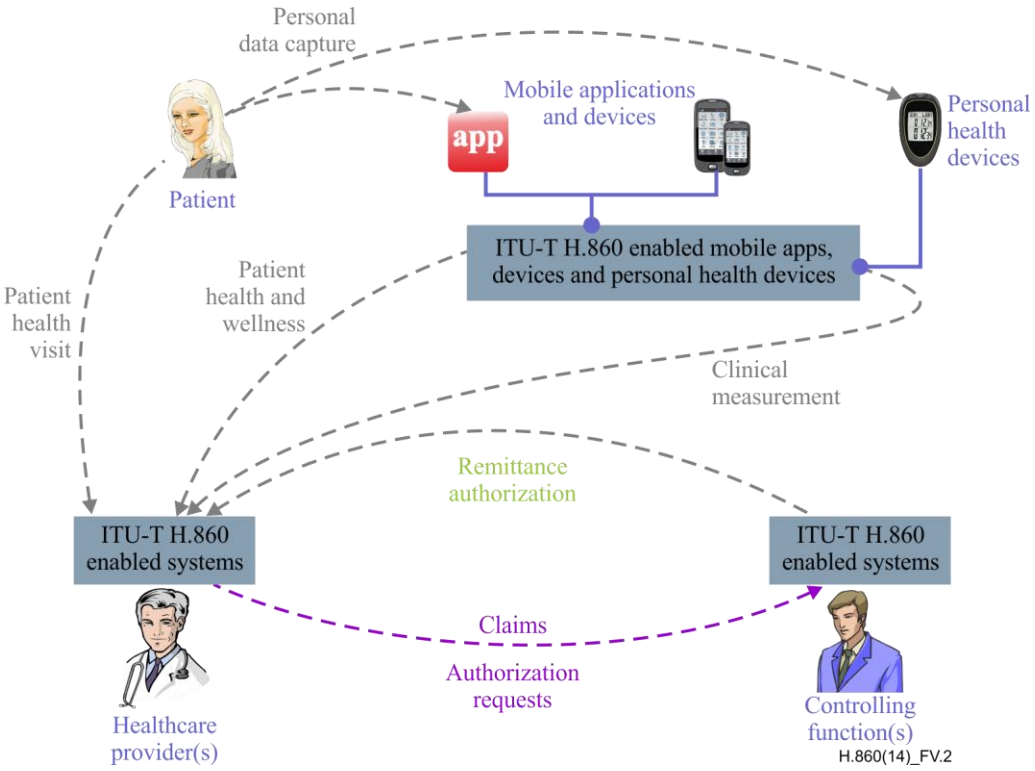


Figure V.2 – Peer-to-peer health data exchange

Appendix VI

Data standards for national workflow and low resource settings

(This appendix does not form an integral part of this Recommendation.)

The data standard set out in this Recommendation establishes an iterative process for delivering the interoperability of health data by establishing a collaborative development framework. Within the collaborative development framework, the stakeholders that use health data within a defined health market jointly define the specific health data exchange problems that need to be solved, and define health data transactions that meet these challenges. The definitions of health data transactions include the data elements contained within those transactions, the approved format or syntax for these data elements, and which data elements are mandatory and which are optional. The sum of all data elements across the health data transactions within a health market defines the common health data schema for that market.

The data standards set out in this Recommendation are, therefore, adopted within the context of a health market, and are able to adapt to the health data exchange problems that need to be solved. This collaborative development framework thus applies to any health system (whether it is a multi-payer or single payer, multi-provider or single provider). The components of the collaborative development framework are as follows:

– **define health problem** – determine the desired health outcomes (e.g., mortality, morbidity/disease burden, life expectancy) or disease-specific outcomes (e.g., obesity, cardiovascular disease). Desired outcomes can also be operational (e.g., regulation, patient education, telehealth, mobile health (m-health), integration with non-healthcare sector).

– **define health system stakeholders** – identify health system stakeholders that need to be involved to solve the health problem (e.g., health providers, health payers, health authority, patients). Establish a governance body that includes all the key health systems stakeholders.

– **define health transactions** – identify the transactions that need to be implemented to exchange the required data to solve the health problem (e.g., claims submission, e-prescription, screening data transmission).

– **define common health data schema** – identify the data standard data element required for each transaction to exchange the required information between the health system participants (e.g., patient information, screening data).

– **define systems architecture** – based on current e-health system assessment and technology capabilities, determine the systems architecture required to enable the transaction and data exchange.

– **assess e-health readiness** – assess e-health capabilities within the health system. Determine which standard technologies have been adoption (e.g., electronic health record (EHR), HIS, care management system (CMS)) and what health standards are in use (e.g., ICD, CPT LOINC, HL7).

– **manage changes to data standards & architecture** – establish a governance process with key health systems stakeholders to review request for changes to the transaction, data standards and systems architecture.

Figure VI.1 Illustrates the collaborative development framework.

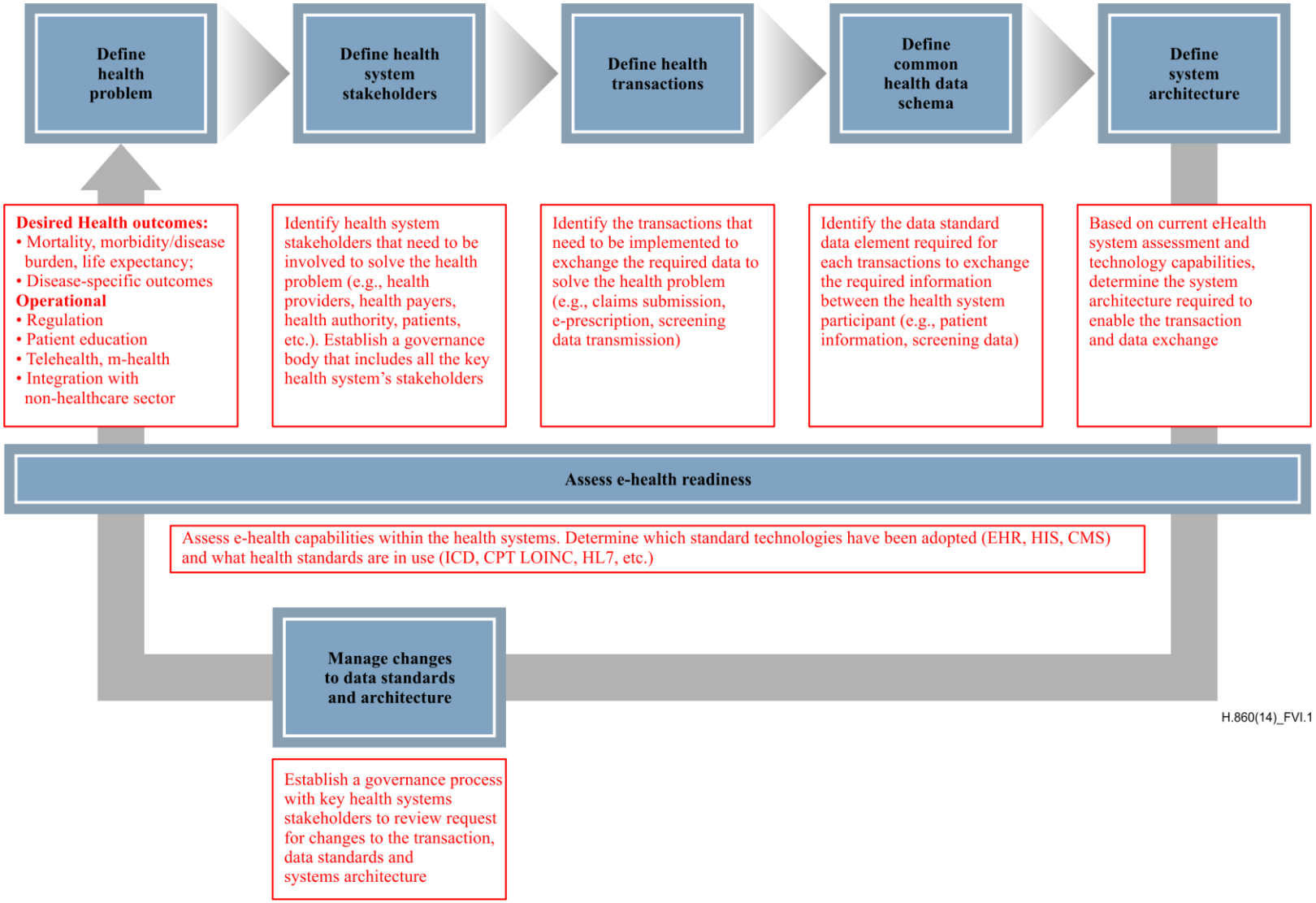


Figure VI.1 – Collaborative development framework

Below are two illustrative examples of health markets, including the characteristics of the market and the unmet need(s) addressed by the data standard set out in this Recommendation.

VI.1 National workflow in a high resource setting

VI.1.1 Characteristics of a high resource setting

1) Well-established healthcare system
2) Health system structure may feature:
   a) Health insurance (with one or more payers and one or more providers)
   b) A form of internal provider-payer/commissioner market (e.g., national health service (NHS) England)
   c) No payer-provider split
3) Likely to feature legacy health IT systems and well-established e-health components (e.g., EHR, telehealth) and established health standards (e.g., CPT, ICD, LOINC, HL7).

VI.1.2 Health problems to be solved in a high resource setting

1) Functional integration of existing health IT systems to deliver:
   a) Greater transparency on health outcomes and their determinants (e.g., quality metrics)
   b) Ultimately, better health outcomes
2) Achievement of health system efficiency gains through better coordination of clinical care across institutional boundaries
3) Creation of population health approaches based on the integration of health data from multiple sources
4) Creation of "asset based" community health approaches that are integrated with healthcare system approaches.

VI.2 National workflow in a low resource setting

VI.2.1 Characteristics of a low resource setting

1) Relative lack of an established healthcare system (for example, insufficient suppliers of healthcare to meet population demand)
2) Health system structure may feature:
   a) Health insurance (with one or more payers and one or more providers)
   b) Form of internal provider-payer/commissioner market (e.g., NHS England), or
   c) No payer-provider split.
3) Limited and fragmented implementation of health IT systems (e.g., e-health, EHR, HIS, CMS).

VI.2.2 Health problems to be solved in a low resource setting

1) Support for creation of basic health IT functionality (e.g., EHR, disease and treatment registries, electronic claims processing (where there is health insurance), e-prescription)
2) Implementation of basic health IT systems (e.g., clinic management software (CMS) and hospital information systems (HIS), electronic claims processing, health information exchange (HIE))
3) Ensure strong functionality and foundation for additional functional development whilst ensuring compatibility with low bandwidth environments (including basic mobile)

4) Ensure system is capable of managing information governance as it continues to evolve, including dynamic consent.

VI.2.3 Illustrative scenario – enable health screening in rural areas

In this scenario, rural areas have low access to healthcare. Residents often have to travel hours to get to a healthcare facility. The cost to get to a healthcare facility (both direct and lost opportunity costs) often far exceeds the cost of treatment. To overcome this, an NGO has been established to send social workers to the rural areas and provide basic health screening and basic medical care.

While technology is used to screen patients and capture basic clinical data, it is often a manual and time-consuming process to aggregate and analyse the data. The NGO will also need to share data with healthcare providers to establish an EHR. They will need to submit the clinical data to health payers to get reimbursed for their services and finally they will benefit from sending the data to the health regulator for them to build population health data statistics.

The collaborative development framework will be used to solve this health problem:

– **define health problem** – enable transmission of rural screening data to participants of the national health system,

– **define health systems stakeholders** – identify which health entity will be exchanging the data (i.e., NGO, health provider, patient, health insurance, health regulator),

– **define health transaction** – data submit to health provider, claims submission to health insurance, data submit to health regulator,

– **define common health data schema** – identify which of the data standards data elements are required for each transaction identified (e.g., patient, activity, observation, diagnosis, claim),

– **define system architecture** – determine what cost effective technology can be used to capture and transmit rural health screening information (mobile table, web based technologies, [b-ITU-T H.810] certified devices).

Appendix VII

Continua Design Guidelines – Illustrative use case

(This appendix does not form an integral part of this Recommendation.)

The Continua Design Guidelines in [b-ITU-T H.810] contain specifications to ensure the interoperability of devices used for applications monitoring personal health. It enables the end-to-end, plug-and-play connectivity of devices and services for personal health management and healthcare delivery.

ITU-T H.810 certified devices are one of many source systems that feed into the ITU-T H.860 system. They provide personal health data (e.g., temperature, heart rate and blood glucose) transmitted using existing industry standards [b-HL7 CDA R2].

Systems using ITU-T H.860 consume the data output from ITU-T H.810 devices and transform the data packets to the ITU-T H.860 format. See Figure VII.1.

In Figure VII.2, ITU-T H.860 systems receive the HL7 CDA R2 formatted message from the ITU-T H.810 device. The ITU-T H.860 system will parse the message and extract and transform the necessary data.

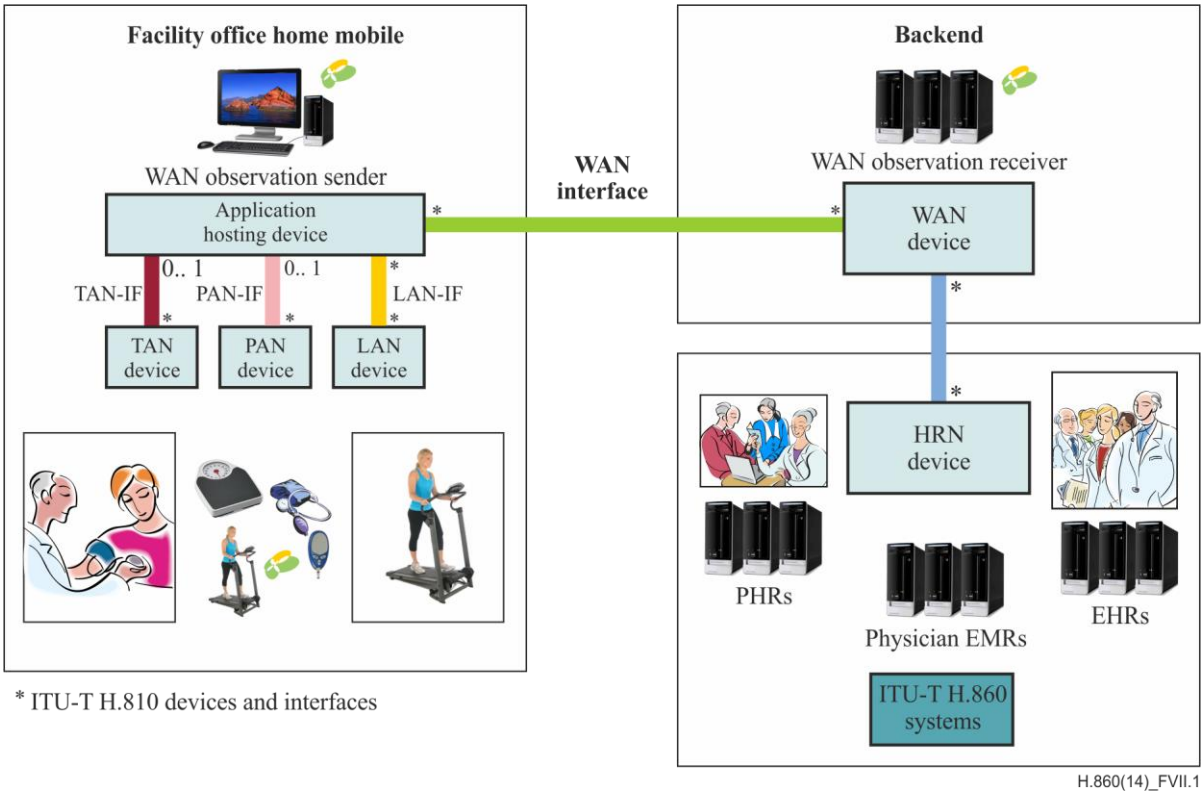


Figure VII.1 – ITU-T H.810 and ITU-T H.860 architecture

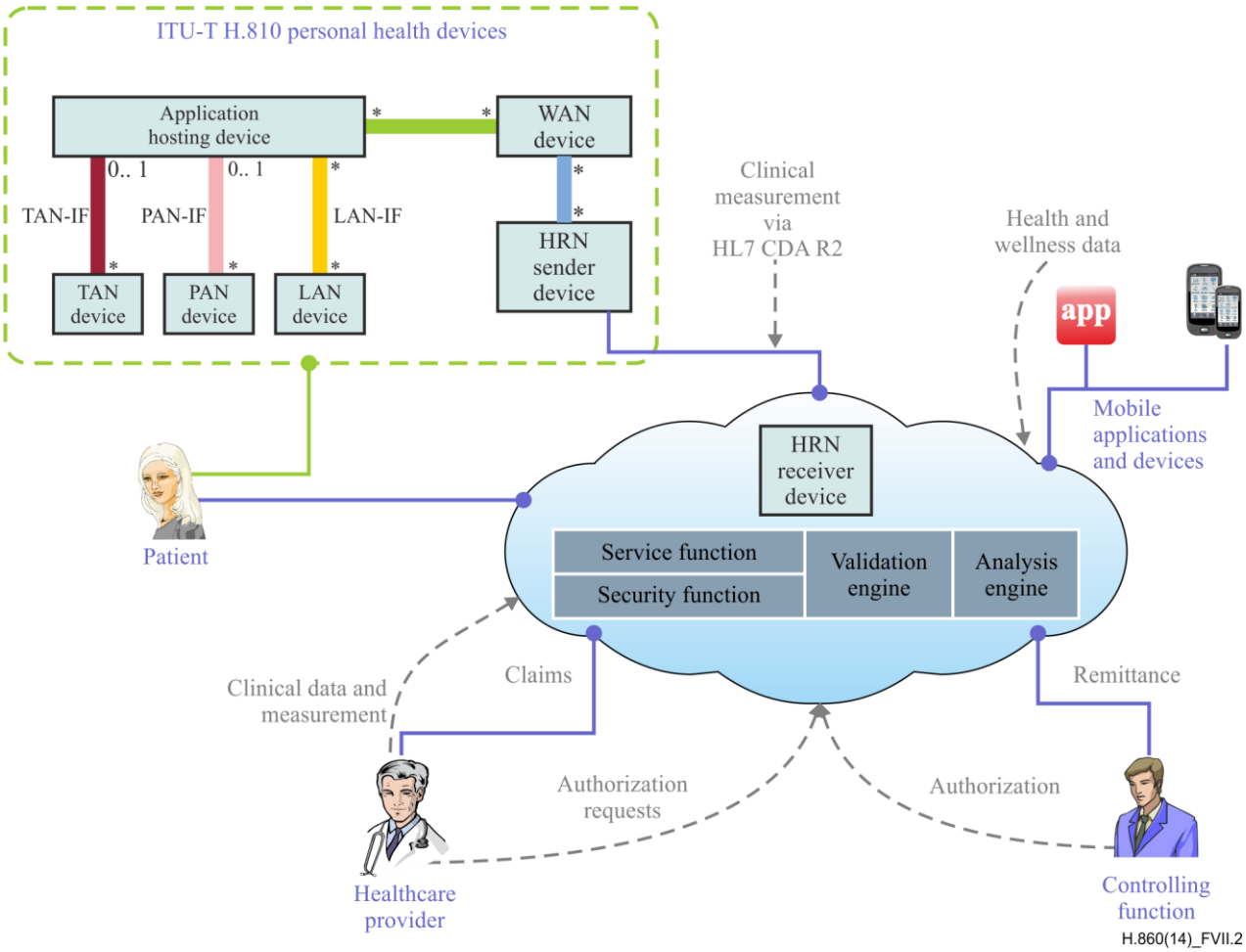


Figure VII.2 – ITU-T H.810 and ITU-T H.860 conceptual architecture

The following examples illustrate the outputs from ITU-T H.810 devices (in HL7 CDA R2 format) and the conversion of the relevant elements of the ITU-T H.810 continua data to the ITU-T H.860 format.

The example below illustrates extracts from:

1) pulse oximeter

2) thermometer.

In the examples below, the ITU-T H.860 system will extract the following information:

– **activity**: Activity.Start, Activity.ID, Activity.End,

– **observation**: Observation.Type, Observation.Code, Observation.ValueType, Observation.Value.

VII.1 Continua pulse oximeter reading

Figure VII.3 displays the output of an [b-ITU-T H.810] compliant pulse oximeter. The output is in HL7 CDA R2 format.

```
<!-- ITU-T H.810 CERTIFIED PULSE OXIMETER DATA OUTPUT IN HL7 R2 MESSAGE FORMAT
-->

<ClinicalDocument xmlns="urn:hl7-org:v3"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
<typeId root="2.16.840.1.113883.1.3" extension="18369527497003753199"/>
<templateId root="2.16.840.1.113883.10.20.9"/>
```

```
<id root="2.25.999.99.99.99.99.9"/>
<code code="53576-5" codeSystem="2.16.840.1.113883.6.1"
displayName="Summarization of episode note"/><!-- LOINC code 53576-5 "Personal
Health Monitoring Report Document" -->
<title>Continua CESL 1.5 PHMR Document</title>
<effectiveTime value="20131218062706+0000"/><!-- 2013/12/18 06:27:06 -->
<confidentialityCode code="N" codeSystem="2.16.840.1.113883.5.25"/><!-- //HL7
Confidentiality Code "N" = Normal -->
<languageCode code="en-US"/>
<recordTarget>
     <patientRole>
          <id root="2.25" extension="18369527497003753199"/>
          <addr>
     <streetAddressLine></streetAddressLine>
               <city></city>
               <state></state>
               <postalCode></postalCode>
               <country></country>
          </addr>
          <telecom value="tel:999-999-9999" use="DIR"/>
          <patient>
               <name>
                    <prefix></prefix>
                    <given>John</given>
                    <family>Smith</family>
                    <suffix></suffix>
               </name>
               <administrativeGenderCode code="M"/>
               <birthTime value="19700101"/><!-- 1971/01/01 -->
          </patient>
     </patientRole>
</recordTarget>
<author>
     <time value="20131218062711+0000"/><!-- 2013/12/18 06:27:11 -->
     <assignedAuthor>
          <id root="2.25" extension="18369527497003753198"/>
          <addr>
               <streetAddressLine>58 Dover Rd.</streetAddressLine>
               <city>Durham</city>
               <state>NH</state>
               <postalCode>03857</postalCode>
               <country>USA</country>
          </addr>
     <telecom value="tel:603-868-8411" use="DIR"/>
     <assignedPerson>
          <name>
               <prefix></prefix>
               <given>GUI Manager</given>
               <family>CESL</family>
               <suffix></suffix>
          </name>
     </assignedPerson>
          <representedOrganization>
               <name>Heart of Gold Hospital</name>
               <telecom value="tel:999-999-9999"/>
               <addr>
                    <streetAddressLine>42 End O' The Universe
Lane</streetAddressLine>
                    <city>Magrathea</city>
                    <state>Confusion</state>
                    <postalCode>12345</postalCode>
                    <country>The Universe</country>
               </addr>
          </representedOrganization>
```

```
     </assignedAuthor>
</author>
<custodian>
     <assignedCustodian>
          <representedCustodianOrganization>
               <id root="2.25" extension="183695274970037531 98"/>
                    <name>Good Health Clinic</name>
               <telecom value="tel:603-868-8411" use="DIR"/>
               <addr>
                    <streetAddressLine>58 Dover Rd.</streetAddressLine>
                    <city>Durham</city>
                    <state>NH</state>
                    <postalCode>03857</postalCode>
                    <country>USA</country>
               </addr>
          </representedCustodianOrganization>
     </assignedCustodian>
</custodian>
<informationRecipient>
     <intendedRecipient>
          <id extension="4" root="2.16.840.1.113883.19"/>
          <addr>
               <streetAddressLine>42 End O' The Universe
Lane</streetAddressLine>
               <city>Magrathea</city>
               <state>Confusion</state>
               <postalCode>12345</postalCode>
               <country>The Universe</country>
          </addr>
          <telecom value="tel:999-999-9999" use="DIR"/>
     <informationRecipient>
          <name>
               <prefix>Dr.</prefix>
               <given>Zaphod</given>
               <family>Beeblebrox</family>
          </name>
     </informationRecipient>
     <receivedOrganization>
          <name>Heart of Gold Hospital</name>
          <telecom value="tel:999-999-9999"/>
               <addr>
                    <streetAddressLine>42 End O' The Universe
Lane</streetAddressLine>
                    <city>Magrathea</city>
                    <state>Confusion</state>
                    <postalCode>12345</postalCode>
                    <country>The Universe</country>
               </addr>
     </receivedOrganization>
     </intendedRecipient>
</informationRecipient>
<legalAuthenticator>
     <time value="20131218062706+0000"/><!-- 2013/12/18 06:27:06 -->
     <signatureCode code="S"/>
     <assignedEntity>
          <id root="2.25" extension="183695274970037531 99"/>
          <addr>
               <streetAddressLine>58 Dover Rd.</streetAddressLine>
               <city>Durham</city>
               <state>NH</state>
               <postalCode>03857</postalCode>
               <country>USA</country>
          </addr>
          <telecom value="tel:603-868-8411" use="DIR"/>
```

```
          <assignedPerson>
               <name>
                    <prefix></prefix>
                    <given>GUI Manager</given>
                    <family>CESL</family>
                    <suffix></suffix>
               </name>
          </assignedPerson>
     </assignedEntity>
</legalAuthenticator>
<documentationOf>
     <serviceEvent classCode="MPROT">
          <effectiveTime>
               <low value="20131218062706+0000"/><!-- 2013/12/18 06:27:06 -->
               <high value="20131218062706+0000"/><!-- 2013/12/18 06:27:06 -->
          </effectiveTime>
     </serviceEvent>
</documentationOf>
<component>
     <structuredBody>
          <component>
               <section>
               <templateId root="2.16.840.1.113883.10.20.1.16"/>
               <templateId root="2.16.840.1.113883.10.20.9.2"/>
               <code code="8716-3" codeSystem="2.16.840.1.113883.6.1" /><!--
LOINC Code 8716-3 "Vital Signs" -->
               <title>Vital Signs</title>
               <text></text>
                    <entry typeCode="DRIV">
                         <organizer classCode="CLUSTER" moodCode="EVN">
                              <templateId root="2.16.840.1.113883.10.20.1.35"/>
                              <id nullFlavor="NI"/>
                              <code codeSystem="2.16.840.1.113883.6.96"
code="46680005" displayName="Vital Signs"/><!-- SNOMED Code 46680005 "Vital
Signs" -->
                              <statusCode code="completed"/>
                                   <component>
                                        <observation classCode="OBS"
moodCode="EVN">
                                             <templateId
root="2.16.840.1.113883.10.20.1.31"/><id/>
                                             <code code="431314004"
codeSystem="2.16.840.1.113883.6.96" displayName="Peripheral oxygen
saturation"><!-- SNOMED Code 431314004 "Peripheral Oxygen Saturation" -->
                                                  <translation
code="MDC_PULS_OXIM_SAT_O2" codeSystem="2.16.840.1.113883.6.24"
displayName="Peripheral oxygen saturation" /><!-- ISO/IEEE 11073
MDC_PULS_OXIM_SAT_02 "Peripheral Oxygen Saturation" -->
                                             </code>
                                             <statusCode code="completed"/>
                                             <effectiveTime
value="20131218062707+0000"/><!-- 2013/12/18 06:27:07 -->
                                             <value xsi:type="PQ" value="97.5"
unit="%"/><!-- 97.5% -->
                                             <participant typeCode="DEV">
                                                  <participantRole>
                                                   <id
root="1.2.840.10004.1.1.1.0.0.1.0.0.1.2680" assigningAuthorityName="EUI64"
extension="1311768464868844083"/>
                                                  </participantRole>
                                             </participant>
                                        </observation>
                              </component>
                              <component>
```

```
                                        <observation classCode="OBS"
moodCode="EVN">
                                            <templateId
root="2.16.840.1.113883.10.20.1.31"/><id/>
                                            <code code="78564009"
codeSystem="2.16.840.1.113883.6.96" displayName="Pulse rate"><!-- SNONMED
78564009 "Pulse Rate" -->
                                                <translation
code="MDC_PULS_OXIM_PULS_RATE" codeSystem="2.16.840.1.113883.6.24"
displayName="Pulse rate" /><!-- ISO/IEEE 11073 MDC_PULS_OXIM_PULS_RATE "Pulse
rate" -->
                                            </code>
                                            <statusCode code="completed"/>
                                            <effectiveTime
value="20131218062707+0000"/><!-- 2013/12/18 06:27:07 -->
                                            <value xsi:type="PQ" value="80"
unit="{beat }/min"/><!-- 80 beat/min -->
                                            <participant typeCode="DEV">
                                                <participantRole>
                                                 <id
root="1.2.840.10004.1.1.1.0.0.1.0.0.1.2680" assigningAuthorityName="EUI64"
extension="1311768464868844083"/>
                                                </participantRole>
                                            </participant>
                                        </observation>
                                    </component>
                                    <component>
                                        <observation classCode="OBS" moodCode="EVN">
                                            <templateId
root="2.16.840.1.113883.10.20.1.31"/><id/>
                                            <code code="431314004"
codeSystem="2.16.840.1.113883.6.96" displayName="Peripheral oxygen
saturation"><!-- SNOMED 4131314004 "Peripheral oxygen saturation" -->
                                                <translation
code="MDC_PULS_OXIM_SAT_O2" codeSystem="2.16.840.1.113883.6.24"
displayName="Peripheral oxygen saturation" /><!-- ISO/IEEE 11073
MDC_PULS_OXIM_SAT_02 "Peripheral Oxygen Saturation" -->
                                            </code>
                                            <statusCode code="completed"/>
                                            <effectiveTime
value="20131218062710+0000"/><!-- 2013/12/18 06:27:10 -->
                                            <value xsi:type="PQ" value="99"
unit="%"/><!-- 99 % -->
                                            <participant typeCode="DEV">
                                                <participantRole>
                                                    <id
root="1.2.840.10004.1.1.1.0.0.1.0.0.1.2680" assigningAuthorityName="EUI64"
extension="1311768464868844083"/>
                                                </participantRole>
                                            </participant>
                                        </observation>
                                    </component>
                                    <component>
                                        <observation classCode="OBS" moodCode="EVN">
                                            <templateId
root="2.16.840.1.113883.10.20.1.31"/><id/>
                                            <code code="78564009"
codeSystem="2.16.840.1.113883.6.96" displayName="Pulse rate"><!-- SNOMED
78564009 "Pulse Rate" -->
                                                <translation
code="MDC_PULS_OXIM_PULS_RATE" codeSystem="2.16.840.1.113883.6.24"
displayName="Pulse rate" /><!-- ISO/IEEE 11073 MDC_PULS_OXIM_PULS_RATE "Pulse
rate" -->
                                            </code>
```

```
                                        <statusCode code="completed"/>
                                        <effectiveTime
value="20131218062710+0000"/><!-- 2013/12/18 06:27:10 -->
                                        <value xsi:type="PQ" value="86.8"
unit="{beat }/min"/><!-- 86.8 beat/min -->
                                        <participant typeCode="DEV">
                                             <participantRole>
                                                  <id
root="1.2.840.10004.1.1.1.0.0.1.0.0.1.2680" assigningAuthorityName="EUI64"
extension="13117684648688440 83"/>
                                             </participantRole>
                                        </participant>
                                   </observation>
                              </component>
                         </organizer>
                    </entry>
               </section>
          </component>
<component>
     <section>
          <templateId root="2.16.840.1.113883.10.20.9.1"/>
          <templateId root="2.16.840.1.113883.10.20.1.7"/>
          <code code="46264-8" codeSystem="2.16.840.1.113883.6.1"/><!-- LOINC
code 46264-8 "Medical Equipment" -->
          <title>Medical Equipment</title>
          <text></text>
     </section>
</component>
<component>
     <section>
          <templateId root="2.16.840.1.113883.10.20.1.14"/>
          <templateId root="2.16.840.1.113883.10.20.9.14"/>
          <code code="30954-2" codeSystem="2.16.840.1.113883.6.1"/><!-- LOINC
code 30954-2 "Relevant Diagnostic Tests/Laboratory Data Narrative" = No
Results -->
               <title>Results</title>
               <text>No Results.</text>
     </section>
</component>
</structuredBody>
</component>
</ClinicalDocument>
```

Figure VII.3 – Output of an ITU-T H.810 compliant pulse oximeter

Figure VII.4 displays the transformation of the [b-ITU-T H.810] compliant pulse oximeter HL7 message into the ITU-T H.860 format.

```
<!-- ITU-T H.810 VITAL SIGNS RESULTS MAPPED TO THE ITU-T H.860 FORMAT. -->
<Activity>
     <ID>2.16.840.1.113883.1.3</ID>
     <start>2013-12-18T06:27:06Z</start>
     <type>2</type>    <!-- CPT -->
     <code> 2010F</code>  <!-- CPT Code for Vital Signs Measurement -->
     <end>2013-12-18T06:27:06Z </end>
     <Observation>
          <type>SNOMED</type>
          <code>431314004</code> <!-- SNOMED Code for Peripheral Oxygen
Saturation -->
          <valueType>%</value>
          <value>97.5</value>     <!-- Oxygen Saturation in percentage -->
     </Observation>
    <Observation>
          <type>SNOMED</type>
          <code>78564009</code>     <!-- SNOMED Code for Pulse Rate -->
          <valueType>bpm</value>
          <value>80.0</value>      <!— Pulse Rate in beats per minute -->
     </Observation>
     <Observation>
          <type>SNOMED</type>
          <code>431314004</code> <!-- SNOMED Code for Peripheral Oxygen
Saturation -->
          <valueType>%</value>
          <value>99</value>       <!-- Oxygen Saturation in percentage -->
     </Observation>
     <Observation>
          <type>SNOMED</type>
          <code>78564009</code>     <!-- SNOMED Code for Pulse Rate -->
          <valueType>bpm</value>
          <value>86.8</value>      <!— Pulse Rate in beats per minute -->
     </Observation>
</Activity>
```

Figure VII.4 – Pulse oximeter HL7 message converted into the ITU-T H.860 format

VII.2 Continua thermometer reading

Figure VII.5 displays the output of an [b-ITU-T H.810] compliant thermometer. The output is in [b-HL7 CDA R2] format.

```
<!-- ITU-T H.810 CERTIFIED THERMOMETER DATA OUTPUT IN HL7 R2 MESSAGE FORMAT --
>

<section>
 <templateId root="2.16.840.1.113883.10.20.1.7"/>
 <templateId root="2.16.840.1.113883.10.20.9.1"/>
 <code code="46264-8" codeSystem="2.16.840.1.113883.6.1"/><!—LOINC code 46264-
8 “Medical Equipment” -->
 <title>Medical Equipment</title>
 <text>
     <!-- Device information -->
     <table border="1" width="100%">
          <tbody>
               <tr>
                    <th>System Type</th>
                    <th>System Model</th>
                    <th>System Manufacturer</th>
```

```
                    <th>System ID</th>
                    <th>Production Spec</th>
                    <th>Regulated</th>
               </tr>
               <tr>
                    <td>Blood Pressure Monitor</td>
                    <td>Pulse Master 2000</td>
                    <td>Acme</td>
                    <td>1F-3E-46-78-9A-BC-DE-F1</td>
                    <td>
                         Unspecified:
                              Serial Number: 584216<br/>
                              Part Number: 69854<br/>
                              Hardware Revision: 2.1<br/>
                              Software Revision: 1.1<br/>
                              Protocol Revision: 1.0<br/>
                              Prod Spec GMDN:
                    </td>
                    <td>Regulated</td>
               </tr>
          </tbody>
     </table>
 </text>
 <entry typeCode="COMP">
     <organizer classCode="CLUSTER" moodCode="EVN">
          <templateId root="2.16.840.1.113883.10.20.9.4"/>
          <statusCode code="completed"/>
          <effectiveTime value="20080801104033-0600"/><!—2008/08/01 10:40:33 -
->
          <participant typeCode="SBJ">
               <participantRole classCode="MANU">
                    <templateId root="2.16.840.1.113883.10.20.1.52"/>
                    <templateId root="2.16.840.1.113883.10.20.9.9"/>
                    <id root="1.2.840.10004.1.1.1.0.0.1.0.0.1.2680"
assigningAuthorityName="EUI-64" extension="1A-34-46-78-9A-BC-DE-F3"/><!—Unique
Identifier (IMEI) -->
                    <code nullFlavor="OTH">
                         <originalText>Regulated Device</originalText>
                    </code>
                    <playingDevice>
                         <code code="MDC_DEV_SPEC_PROFILE_BPM"
codeSystem="2.16.840.1.113883.6.24" codeSystemName="MDC" displayName="Blood
Pressure Monitor"><!-- ISO/IEEE 11073 MDC_DEV_SPEC_PROFILE_BPM "Blood Pressure
Monitor" -->
                              <translation code="32033000"
codeSystem="2.16.840.1.113883.6.96" codeSystemName="SNOMED CT"
displayName="Arterial pressure monitor"/><!—SNOMED code 32033000 “Arterial
Pressure Monitor -->
                              <translation code="???" codeSystem="GMDN-OID">
                                   <!--move Production spec GMDN here from the
manufacturerModelName-->
                              </translation>
                         </code>
<code code="MDC_DEV_SPEC_PROFILE_BPM" codeSystem="2.16.840.1.113883.6.24"
codeSystemName="MDC" displayName="Blood Pressure Monitor"><!-- ISO/IEEE 11073
MDC_DEV_SPEC_PROFILE_BPM "Blood Pressure Monitor" -->
                              <translation code="32033000"
codeSystem="2.16.840.1.113883.6.96" codeSystemName="SNOMED CT"
displayName="Arterial pressure monitor"/><!—SNOMED code 32033000 “Arterial
Pressure Monitor -->
                              </translation>
                         </code>
                         <manufacturerModelName>
```

```
                              <!-- these will be unstructured, the text below is
an example (no shalls for the labels used below)-->
                              Model: Pulse Master 2000
                              Serial number:584216
                              Part number: 69854
                              Hardware revision: 2.1
                              Software revision: 1.1
                              Protocol revision: 1.0
                              Unspecified (free text comment):
                         </manufacturerModelName>
                    </playingDevice>
                    <scopingEntity>
                         <desc>Acme</desc>
                    </scopingEntity>
               </participantRole>
          </participant>
          <component>
               <observation classCode="OBS" moodCode="EVN">
                    <!--... all our device observations go here -->
                    <code/>
               </observation>
          </component>
     </organizer>
 </entry>
</section>
<!-- Observation information -->
<section>
 <templateId root="2.16.840.1.113883.10.20.1.16"/>
 <templateId root="2.16.840.1.113883.10.20.9.2"/>
 <code code="8716-3" codeSystem="2.16.840.1.113883.6.1"/><!—LOINC code 8716-3
“Vital Signs” -->
 <title>Vital Signs</title>
 <text>
     <paragraph>Thermometer Results</paragraph>
     <table border="1" width="100%">
          <tBody>
               <tr>
                    <th>Date/Time</th>
                    <th>Body Temp</th>
                    <th>Finger Temp</th>
                    <th>Oral Temp</th>
               </tr>
               <tr>
                    <td>20080501104033</td>
                    <td>99.9 deg F</td>
                    <td>88.8 deg F</td>
                    <td>37.5 deg C</td>
               </tr>
          </tBody>
     </table>
 </text>
 <entry typeCode="DRIV">
     <organizer classCode="CLUSTER" moodCode="EVN">
          <!-- Vital sign data/ Test Groups -->
          <!-- A VITAL SIGNS ORGANIZER IS USED TO GROUP RELATED -->
          <templateId root="2.16.840.1.113883.10.20.1.35"/>
          <id root="b606a959-baab-4836-84a8-97c4e9857533"/>
          <code code="46680005" codeSystem="2.16.840.1.113883.6.96"
displayName="Vital signs"/><!—SNOMED code 46680005 “Vital Signs” -->
          <statusCode code="completed"/>
          <component>
               <observation classCode="OBS" moodCode="EVN">
                    <templateId root="2.16.840.1.113883.10.20.1.31"/>
                    <id root="975c2f3b-2bd4-4e45-aed1-84af9ff51b10"/>
```

```
                    <code code="386725007" codeSystem="2.16.840.1.113883.6.96"
codeSystemName="SNOMED CT" displayName="Body Temperature"><!—SNOMED code
386725007 “Body Temperature” -->
                         <translation code="MDC_TEMP_BODY"
codeSystem="2.16.840.1.113883.6.24" codeSystemName="MDC" displayName="Body
Temperature"/><!-- ISO/IEEE 11073 MDC_TEMP_BODY "Body Temperature" -->
                    </code>
                    <statusCode code="completed"/>
                    <effectiveTime value="20080501104033-0600"/><!—2008/05/01
10:40:33 -->
                    <value xsi:type="PQ" value="99.9" unit="[degF]"/><!—99.9 F
-->
                    <participant typeCode="DEV">
                         <participantRole>
                    <id root="1.2.840.10004.1.1.1.0.0.1.0.0.1.2680"
assigningAuthorityName="EUI-64" extension="1A-34-46-78-9A-BC-DE-F3"/>
                         </participantRole>
                    </participant>
               </observation>
          </component>
          <component>
               <observation classCode="OBS" moodCode="EVN">
                    <templateId root="2.16.840.1.113883.10.20.1.31"/>
                    <templateId root="2.16.840.1.113883.10.20.9.8"/>
                    <id root="975c2f3b-2bd4-4e45-aed1-84af9ff51b10"/>
                    <code code="433588001" codeSystem="2.16.840.1.113883.6.96"
codeSystemName="SNOMED CT" displayName="Temperature of digit of hand"><!—
SNOMED code 433588001 “Temperature of digit of hand” -->
                         <translation code="MDC_TEMP_FINGER"
codeSystem="2.16.840.1.113883.6.24" codeSystemName="MDC" displayName="Finger
Temperature"/> "/><!-- ISO/IEEE 11073 MDC_TEMP_FINGER "Finger Temperature" -->
                    </code>
                    <statusCode code="completed"/>
                    <effectiveTime value="20080501104033-0600"/><!—2008/05/01
10:40:33 -->
                    <value xsi:type="PQ" value="88.8" unit="[degF]"/><!—88.8 F
-->
                    <participant typeCode="DEV">
                         <participantRole>
                    <id root="1.2.840.10004.1.1.1.0.0.1.0.0.1.2680"
assigningAuthorityName="EUI-64" extension="1A-34-46-78-9A-BC-DE-F3"/>
                         </participantRole>
                    </participant>
               </observation>
               </component>
          <component>
               <observation classCode="OBS" moodCode="EVN">
                    <templateId root="2.16.840.1.113883.10.20.1.31"/>
                    <templateId root="2.16.840.1.113883.10.20.9.8"/>
                    <id root="975c2f3b-2bd4-4e45-aed1-84af9ff51b10"/>
                         <code code="415945006"
codeSystem="2.16.840.1.113883.6.96" codeSystemName="SNOMED CT"
displayName="Oral Temperature"><!—SNOMED code 415945006 “Oral Temperature” -->
                              <translation code="MDC_TEMP_ORAL"
codeSystem="2.16.840.1.113883.6.24" codeSystemName="MDC" displayName="Oral
Temperature"/><!-- ISO/IEEE 11073 MDC_TEMP_ORAL "Oral Temperature" -->
                         </code>
                    <statusCode code="completed"/>
                    <effectiveTime value="20080501104033-0600"/><!—2008/05/01
10:40:33 -->
                    <value xsi:type="PQ" value="37.5" unit="Cel"/><!—37.5 C -->
                    <participant typeCode="DEV">
                         <participantRole>
```

```
                    <id root="1.2.840.10004.1.1.1.0.0.1.0.0.1.2680"
assigningAuthorityName="EUI-64" extension="1A-34-46-78-9A-BC-DE-F3"/>
                         </participantRole>
                    </participant>
               </observation>
          </component>
     </organizer>
 </entry>
</section>
```

Figure VII.5 – Output of an ITU-T H.810 compliant thermometer

Figure VII.6 displays the transformation of the [b-ITU-T H.810] certified thermometer reading HL7 message into the ITU-T H.860 format.

```
<!-- ITU-T H.810 THERMOMETER RESULTS MAPPED TO THE ITU-T H.860 FORMAT. -->
<Activity>
     <ID>42505310606</ID>
     <start>2008-05-11T10:40:33Z</start>
     <type>2</type>    <!-- CPT -->
     <code>CCCCCC</code>  <!-- CPT Code for Vital Signs Measurement -->
     <end>2008-05-11T10:40:33Z</end>
     <Observation>
          <type>SNOMED</type>
          <code>386725007</code>  <!-- SNOMED Code for Body Temperature -->
          <valueType>degF</value>
          <value>99.9</value>
     </Observation>
     <Observation>
          <type>SNOMED</type>
          <code>433588001</code> <!-- SNOMED Code for Temperature of digit of
hand -->
          <valueType>degF</value>
          <value>88.8</value>
     </Observation>
     <Observation>
          <type>SNOMED</type>
          <code>415945006</code>    <!-- SNOMED Code for Oral Temperature -->
          <valueType>Cel</value>
          <value>37.5</value>      <!—Temperature in celsius -->
     </Observation>
</Activity>
```

Figure VII.6 – Thermometer HL7 message converted into the ITU-T H.860 format

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