INTERNATIONAL CLASSIFICATION OF HEALTH INTERVENTIONS (ICHI)

BROCHURE

Introduction, Guidelines and Comparison with Snomed-CT
A comparison of SNOMED CT and ICHI

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1   INTRODUCTION

The International Classification of Diseases (ICD) has been in use for collection of global health trends and statistics of diseases for over a century. [1, 2] However, there is no equivalent international classification standard for medical and surgical procedures. [3] In 1976, the year after the official release of ICD-9, the World Health Organization (WHO) published the International Classification of Procedures in Medicine (ICPM). [4] ICPM covered procedures for medical diagnosis, prevention, therapy, radiology, drugs, and surgical and laboratory procedures. [5] Work on ICPM stopped in 1989 when the WHO decided not to revise ICPM in conjunction with ICD-10, because "the process of consultation that had to be followed before finalization and publication was inappropriate in such a wide and rapidly advancing field". [6] Almost two decades later, in 2007, work on an international procedure classification recommenced. The WHO decided to broaden the scope to include all health interventions and called this new classification International Classification of Health Interventions (ICHI). [7-11] The WHO defines health intervention as "an act performed for, with or on behalf of a person or a population whose purpose is to assess, improve, maintain, promote or modify health, functioning or health conditions". ICHI covers interventions carried out by a broad range of providers across the full scope of health systems and includes diagnostic, medical, surgical, mental health, primary care, allied health, functioning support, rehabilitation, traditional medicine and public health interventions. After three alpha releases, the first beta version of ICHI was released in 2017. ICD, International Classification of Functioning, Disability and Health (ICF) and ICHI constitute the three reference classifications within the WHO Family of International Classifications (WHO-FIC), which is a set of integrated classifications that provide a common language for health information across the world. Currently, ICHI is in its beta-3 release and is available for browsing online through the unified browser platform for the three WHO-FIC reference

classifications. [12] The medical and surgical interventions in the current version of ICHI are considered to have a stable structure and are ready for implementation.

ICHI provides governments, service providers, managers, and researchers with a common tool for reporting and analysing health interventions for statistical, quality and reimbursement purposes. [13] Internationally, ICHI enables comparison of data between countries, which will support important WHO initiatives such as Universal Health Coverage – the provision of essential health interventions to all people, such as antenatal care, measles vaccination, and hypertension treatment. Nationally, ICHI can be used in several ways. For countries that do not have a procedure classification system, they can use ICHI directly, or develop their national system based on ICHI. For countries that already have a procedure classification system, they can extend their system by incorporating ICHI's broader range of interventions. Moreover, they can map their own system to ICHI to enable comparison with other countries.

The scope of ICHI is quite broad, ranging from surgical procedures to functional support, rehabilitation and public health interventions. A literature search revealed studies that evaluated ICHI in the domains of audiology [14] , nursing, [15] disability [16] and public health interventions [17]. These domains probably attract special attention because there are not covered by any international classifications before ICHI and there are very few competing coding systems. However, in the domain of surgical procedures, ICHI overlaps with existing national and international coding systems. Surgical procedures are an important component of healthcare. It has been estimated that approximately a third of the global disease burden requires surgical and/or anaesthetic care. [18] There are relatively few studies about ICHI involving surgical procedures. There are some studies that compared ICHI to ICD-9-CM procedure codes, but ICD-9-CM is no longer in active use. [10, 11] Another study compared ICHI with SNOMED CT, covering only a small subset of surgical procedures. [19]

2   ICHI SCOPE AND STRUCTURE

ICHI, as a statistical classification, encompasses interventions across all components of health systems, in keeping with the broad conception of health represented jointly by the other two WHO-FIC reference classifications, the International Classification of Functioning, Disability and Health (ICF) and the International Classification of Diseases (ICD). ICHI includes medical, surgical, mental health, primary care, allied health, assistance with functioning, rehabilitation and prevention health interventions, and includes a range of interventions for use in community health and public health.

A health intervention is defined as follows:

> A **health intervention** is an act performed for, with or on behalf of a person or a population whose purpose is to assess, improve, maintain, promote or modify health, functioning or health conditions.

ICHI comprises a comprehensive set of interventions, referred to as **stem codes**. Each stem code in ICHI is described in terms of three axes:

• Target - entity on which the Action is carried out
• Action - deed done by an actor to the Target
• Means - processes and methods by which the Action is carried out.

Each axis consists of a coded list of descriptive categories. Each stem code is represented by a title and a unique seven-character code denoting the axis categories for that intervention: three characters for the Target, two characters for the Action and two characters for the Means. Each ICHI stem code has a unique combination of categories from the three axes. Not every possible combination of the three axes is represented as an ICHI code. Many stem code titles in ICHI are commonly used terms, such as 'Hysterectomy'.

An ICHI stem code includes all necessary elements of the intervention (e.g. laparotomy as an operative approach, suture of abdominal incision after surgery). Separate coding of components is not required.

ICHI does not include information about the provider of an intervention or the setting where the intervention is performed. The reason(s) for an intervention, and its outcome, should be classified using ICD and ICF, and is not included in ICHI.

Additional information about an intervention may be added as needed using **extension codes**, including codes for therapeutic and assistive products, medicaments, essential pathology tests and telehealth, as well as information such as quantification, laterality, and a more detailed description of anatomy. Where applicable, extension codes used in ICHI are the same as those in ICD-11. (Refer to Section 9 Extension codes).

ICF codes may be used as extension codes to provide a more detailed description of functioning Targets. Codes from other classifications (such as LOINC, the International Standard Industrial Classification and the Central Product Classification) may also be used as extension codes, notably for public health interventions.

In fields such as rehabilitation, mental health and public health, packages or programs of treatment are provided which include several specific ICHI interventions. ICHI includes the capacity to link, or cluster, interventions provided as part of a package or program.
ICHI contains more than 8,000 interventions. The number of interventions in ICHI, and consequently the level of detail (granularity) across the classification, has been determined with regard to the use cases for ICHI and the need for stability of the classification over time.

ICHI interventions are grouped into the following four sections, based on the Target of the intervention:
- Interventions on Body Systems and Functions (Chapters 1-12)
- Interventions on Activities and Participation Domains (Chapters 13-21)
- Interventions on the Environment (Chapters 22-27)
- Interventions on Health-related Behaviours (Chapter 28)

3   GUIDELINES FOR CODING INTERVENTIONS ON BODY SYSTEMS

3.1   Introduction

These guidelines are designed to help users select the most appropriate ICHI code/s for a given intervention, and thus support the production of consistently coded data that can be meaningfully

interpreted. ICHI is accessed online through the WHO-FIC ICHI Platform: https://icd.who.int/dev11/l-ichi/en#/

Interventions in ICHI are provider-neutral, that is, the same code should be assigned for a specific intervention regardless of who performs the intervention or where it is performed.

In applying ICHI, users must first decide which stem code or category of the classification is the most appropriate for describing a given intervention. Stem codes are codes in ICHI which can be used alone to describe an intervention. Stem codes are designed to ensure that in use cases that require only one code per case, meaningful information is collected.

Each ICHI stem code is described in terms of three axes:
- **Target** - entity on which the Action is carried out
- **Action** - deed done by an actor to the Target
- **Means** - processes and methods by which the Action is carried out

For example, Cholecystectomy is coded as KCF.JK.AA:
- Target KCF is 'Gall bladder',
- Action JK is 'Excision, total', and
- Means AA is 'Open approach'.

3.2   Selecting ICHI stem codes

Each ICHI stem code has a descriptive title. In some cases the wording of the code title reflects the axis categories for that code (e.g., AAA.FA.AE 'Percutaneous incision of brain'). In other cases the title is a commonly used clinical term (e.g., KCF.JK.AA 'Cholecystectomy').

Where the code title is a commonly used clinical term, the ICHI stem code includes all necessary elements of the intervention (e.g. KCF.JK.AA 'Cholecystectomy' includes laparotomy as an operative approach and suture of abdominal incision after surgery). Do not code the elements separately.

A stem code may be assigned for a given intervention if the axis categories for that code are applicable to the intervention, regardless of the wording in the code title. Index and inclusion terms, relevant to the intervention, help guide the user to a specific ICHI stem code. Before selecting a stem code you should also check that the Target, Action and Means categories for that code are applicable to the intervention you are coding; if in doubt, refer to the definitions provided for the axis categories.

The following information fields are designed to assist users to select the most appropriate stem code.

3.2.1   Definition

The definition provides a description of the intervention.

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3.2.2 Index terms

Index terms are listed as an additional guide to the content of the stem code. They give examples of terms that should be classified to that specific stem code.

Example 1: JBB.LG.AD	Endoscopic dilatation of bronchus
Index Terms	Endoscopic bronchial dilation

The Alphabetical Index provides a list of clinical terms (including synonyms). The index is used to help find the relevant ICHI codes. The mention of a term in the index exclusively serves coding.

3.2.3 Inclusions

Inclusions are used to further define or clarify the scope of a stem code and may refer to intervention components that are an inherent part of the intervention, or as examples of the intervention statements or synonyms to be classified to the stem code. Many of the terms listed relate to important or common terms belonging to the category. The lists of inclusion terms are by no means exhaustive.

Alternative names of intervention entities (synonyms) are included and shown in the electronic coding tool and the Alphabetic Index. It is sometimes necessary to read inclusion terms in conjunction with titles to fully understand why an intervention has been included based on the ICHI axial structure.

Example 2: NME.GA.AD Endometrial ablation Inclusions:
Endometrial ablation by cryoprobe
Endometrial ablation by electrocautery
Endometrial ablation by high intensity focused ultrasound
Endometrial ablation by laser
Endometrial ablation by microwave
Endometrial ablation by radiofrequency
Endometrial ablation by rollerball thermal uterine balloon
Hysteroscopic endometrial ablation

3.2.4 Coding note

3.2.4.1 Code also if performed: This instruction is used to advise the user that an additional code is to be assigned when certain associated interventions are performed. The 'code also' statement marks the categories that must be used in conjunction with the indicated second code(s).

Example 3: JBA.LI.AE	Percutaneous tracheostomy
Inclusions:	

Percutaneous tracheotomy	
Permanent percutaneous dilatational tracheostomy	
Temporary percutaneous dilatational tracheostomy	
Coding note:	Code also, if performed, synchronous bronchoscopy (JBB.AE.AD)

3.2.4.2 Omit code: This instruction applies to certain interventions which, when performed with or as part of other interventions, should not be coded.

Example 4: **PAK.AE.AA**	**Exploratory laparotomy**
Coding note	If performed with any other intra-abdominal procedure – omit code

3.2.5 Exclusions

Certain categories contain lists of conditions preceded by the word 'Exclusions' and list specific interventions that are classified elsewhere in ICHI. In some instances exclusions provide more general guidance on types of interventions for which that code should not be used. Exclusions serve as a cross reference in ICHI and help to delineate the boundaries of an intervention code.

Examples 5: **JAN.JK.AA**	**Complete laryngectomy**
Inclusions	Complete laryngectomy with synchronous tracheostomy
	Complete laryngectomy with thyroidectomy
	Block dissection of larynx
	Laryngopharyngectomy
Exclusions	That with radical neck dissection (JAN.JL.AA)

3.3 Conventions used in ICHI

3.3.1 Abbreviations

NEC Not elsewhere classified Codes with 'not elsewhere classified' in their title are only to be assigned when a more specific code describing the intervention in question is not present in the classification. Codes to which the NEC description is appended should only be used if one of the other options available in the classification is not suitable.

Example 7: **NME.JK.AA**	**Total abdominal hysterectomy, not elsewhere classified**

NOS Not otherwise specified The letters NOS are an abbreviation for 'not otherwise specified', implying that the documentation that is used for classifying the intervention does not provide more detail beyond the term (implying 'unspecified', 'incompletely specified' or 'unqualified').

Example 8: **ABA.JI.AA**	**Local excision of lesion of spinal cord**
Inclusions	Excision of tissue of spinal cord, not otherwise specified

3.3.2 Use of 'And' and 'Or'

The words 'and' and 'or' in ICHI are generally used in their meaning in formal logic. A term that includes a statement of the kind 'A and B' means that both, A and B, have to be present in order to use that category. A term that includes a statement of the kind 'A or B' means that the category may be used if either A or B are present.

Where these terms from ICD-11 or ICF are used in ICHI then the logic of those classifications have been retained

Example 9: **AXA.DB.AC**	**Oral or enteral medication for pain**

This intervention should be understood to mean 'Oral medication for pain, Enteral medication for pain, or both'.

3.3.3 Parentheses

• **( ) Parentheses** are used to enclose supplementary words that indicate elements that may be present or absent in the intervention being classified. They are also used to enclose the ICHI stem code to which an exclusion term refers.
• **[ ] Square brackets** are used for abbreviations which are displayed using upper case letters and followed by the complete title in full. For example, 'CPB – [Cardiopulmonary bypass]'

Example 10: **AS1.PQ.ZZ**	Psychotherapy for mental functions, unspecified
Inclusions	Psychotherapy for simple phobias using exposure to the object
Exclusions	Counselling for mental functions, unspecified (AS1.PP.ZZ)

3.3.4 Singular versus multiple

In ICHI, organs, diseases and anatomical sites are expressed using the singular form to represent both singular and multiple, e.g., 'polyp' can be interpreted as polyp or polyps.

3.3.5 Spelling

Throughout ICHI, British spelling is used.

3.4 Choosing which ICHI Target

For medical and surgical interventions, **anatomy** is the preferred Target:

> • If the target is a Body Function domain, and anatomical structures are not being acted upon, then the Target selected should be the Body Function domain.
> • If the anatomy is altered (surgically) in any way, then anatomy becomes the Target.

Where an intervention concerns several anatomical locations, the Target in the stem code selected should reflect the **deepest location** (within the body or structure) or the **closest to the head**.

For '*Endoscopic excisions of lesions in the oesophagus and duodenum*', assign KBI.JI.AD Endoscopic local excision of lesion of duodenum, as the 'duodenum' is the deepest location.

ICHI Target categories vary in granularity and some groups of Targets are hierarchically related (e.g., HAA 'Left atrium', HAZ 'Atrium, unspecified', and HZZ 'Entire heart or great vessel, unspecified'). In general, a stem code with the most detailed applicable Target category should be used.

If a matching detailed ICHI Target is not available, you should look for a broader Target that encompasses the target of your intervention. For interventions with an anatomical target, residual body system Targets are available, e.g., NZZ 'Urogenital system and functions, unspecified', PZZ 'Unspecified site' or general topographical sites e.g. PNA Lower limb, NOS. These are located at the end of the list of Targets for each body system. ICHI stem codes with these Targets should only be used when there is insufficient documentation or information to select a more specific ICHI Target, or when an applicable code with a more specific Target is not available.

Where other interventions have more than one target, and there is no single target category that encompasses the targets of the intervention, you should select a code with an ICHI target that reflects the main target for the intervention.

Other rules concerning choice of Target for medical and surgical interventions include:

> • **Control of haemorrhage.** Target should specify the organ which requires the 'control of haemorrhage' rather than the bleeding vessel.
> • **Localised pharmacotherapy**. Target should be the specific anatomical site, e.g. for injection of agent into spinal canal, the Target selected is ABG Spinal cavity.
> • **Systemic pharmacotherapy** (not aimed at a specific anatomical site). Target should be the whole body (PZA).
> • **Interventions on the fetus.** Target should be NMR Fetal or embryonic structure, not the specific anatomical structure on the fetus, e.g., NMR.AD.AD Biopsy of fetal structures. If needed, the specific fetal anatomical structure can be identified using an extension code, refer to 9.5 Use of specific 'anatomy and topography' extension codes.

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For medical and surgical interventions, when there is more than one anatomical site involved:

> • the Target in the stem code selected should reflect the main anatomical site of the intervention or the starting point (**from** not to), e.g., ventriculoperitoneal shunt – Target = ventricle e.g., For 'Ventriculoperitoneostomy' assign: AAE.LI.AA Ventricular shunt

Priority rules for selecting the Target for interventions concerning fistulas:

> • If the female genital tract is involved, assign to the specific female genital tract target e.g.: rectovescicovaginal fistula is assigned to the target for 'vagina'.
> • If the urinary tract is involved, the Target is the urinary tract, except when female genital tract is involved.
> • Any other fistulae, the Target is the first mentioned site in the clinical term.

3.5   Choosing which ICHI Action

When selecting an ICHI stem code, choose a code with the most applicable Action. In considering the applicability of a given Action category, users should read the definition for that Action. Index terms help to clarify the scope of the category by giving examples of actions covered; note that lists of index terms are not exhaustive:

Example 18:

Action	FC
Title	Release
Definition	Freeing a body part that is compressed or unable to function without taking out the body part
Inclusions	Adhesiolysis; Carpal tunnel release; Decompression laminectomy; Interrupting or splitting of tissue for release; Lysis of adhesions

Example 19:

Action	SI
Title	Preparation
Definition	Preparing for an upcoming or future intervention
Inclusions	Modelling
	Rehearsal
	Simulation
Exclusions	Planning (TB)

3.5.1 Multiple Actions

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Where an intervention includes more than one action, the user should select an intervention code based on the **main action** or the first one mentioned in the documentation.

Where a medical or surgical intervention has multiple component actions within the same clinical procedure (and the parts of the intervention can also be done separately), assign multiple ICHI stem codes to describe the interventions being performed.

Example 20: For 'Coronary angiogram with intravascular pressure measurement', assign the following stem codes to describe the interventions performed:
• HIA.BA.BB Coronary angiography
• HIA.AB.AF Intravascular pressure measurement of coronary arteries

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Actions undertaken as part of a more comprehensive action should not be separately coded.

Example 21:
• for 'excision/resection with a reconstruction', an ICHI stem code with Action ML 'Reconstruction' should be selected, because 'excision/resection' is inherent in a reconstruction when performed in the one operative episode.

• for 'incision and drainage', an ICHI intervention code with Action JB 'Drainage' would be selected because the incision is the operative route in order to perform the 'drainage'.

3.6   Choosing which ICHI Means

When selecting an ICHI stem code, the Means identifies 'the processes and methods by which the Action is carried out'. The Means axis includes the following groups of Means categories:
- Approach
- Technique
- Method
- Sample
- Unspecified

In considering the applicability of a given Means category, users should read the definition for that Means. Index terms help to clarify the scope of the category by giving examples of means covered; note that lists of index terms are not exhaustive.

3.6.1 Choice of 'Approach' Means categories

'Approach' Means categories are only used for medical and surgical interventions.
• 'Open' (AA) is the default surgical approach, i.e., where type of approach is not specified in the stem code title this indicates 'open approach'.
• For medical/surgical interventions the default is to AA Open approach if not otherwise specified.

Example 22:

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Means	AA
Title	Open approach
Definition	Exposing the actual site of the intervention by incision of the skin or mucous membrane and any other underlying tissue.
Inclusions	Transmastoid
Exclusions	Cutting per orifice (AC)

3.6.2 Choice of 'Imaging Modality' Means categories

Examples 23:

Means	BD
Title	Computerised tomography with contrast medium
Definition	Linear or multi-directional scanning where images are processed and displayed in cross-sections, and contrast medium
Exclusions	Computerised tomography, not otherwise specified (BC)

3.7 Residual Categories – 'Other' and 'Unspecified'

ICHI coding should always be completed to include the highest level of detail possible with the use of one or multiple stem codes. There are, however, circumstances when that is not possible and for that reason ICHI includes stem codes titled 'other' and 'unspecified'.

In some instances, necessary information to select a specific stem code may not be available in the source documentation. When this is the case, the residual stem code for 'unspecified' is selected. Conversely, there are instances where the information in the source documentation is very specific, but ICHI may not include a specific stem code. In this case, users code to the residual category titled 'other'.

Therefore, where an ICHI stem code with the required combination of Target and Action is not available, a code with the appropriate Target and Action ZY 'Other action, not elsewhere classified' should be selected, e.g., KAE.ZY.AC 'Other interventions on teeth, not elsewhere classified'.

Where there is insufficient information about the action performed, a code with the appropriate Target and Action ZZ 'Unspecified action' should be selected, e.g., JZZ.ZZ.ZZ 'Interventions on respiratory system and voice and speech, unspecified'.

3.8 What not to code, and order of code assignment

3.8.1 Intervention Components

Do not code any medical/surgical interventions that are components of another intervention where these components would usually be considered a routine or inherent part of the more significant intervention being performed.

Do not code an intervention that is the operative approach for surgery:

> *Example 24:* laparotomy performed for a cholecystectomy, assign a stem code for the open cholecystectomy only (KCF.JK.AA).

3.8.2 Ordering of Codes

Code in the following sequence
   1. Interventions to treat the main purpose (health condition, body function impairment, activity limitation or participation restriction, environmental factor or health behaviour)
   2. Interventions to treat the additional purpose(s)
   3. Interventions to determine the main purpose
   4. Interventions to determine the additional purposes
   5. Additional code to be recorded in accordance with a 'Code also' instruction

3.9 Extension codes (use when needed)

Additional information about an intervention can be added by the use of extension codes which expand the detail and granularity of ICHI stem codes. Extension codes are not to be used alone but must be added to a stem code.

ICHI extension codes are of the following types:

- Quantifiers o Number of anatomical structures an intervention is performed on
       o Number of interventions performed
       o Number of therapeutic products inserted

- Additional descriptive information for interventions
       o Initiating/maintaining/discontinuing/resuming
       o Relationship to other intervention(s)
       o Standardisation or structure
       o Use of equipment or challenge
       o Recipient
       o Creative therapy
       o Specific skills and techniques
       o Tissue flaps

o Tissue grafts
　　　　• Topology
　　　　　o Measurement
　　• Telehealth
　　　　　o Intervention performed with advice or assistance provided from a distant location
　　　　　o Intervention provided to recipient/s in a distant location
　　　　　o Interventions delivered via technology, without direct involvement of a human provider
　• Essential pathology tests
　• Assistive products
　• Therapeutic products

In addition, the following ICD-11 extension codes may be used as ICHI extension codes:
　　• Topology scale value - Relational
　　• Topology scale value – Laterality
　　• Anatomy and topography
　　• Substances – Medicaments
　　• Substances – Non-medical

A given extension code may be used with any ICHI stem code to which it is applicable.

The ICHI stem code is to be reported first followed by an ampersand '&' followed by the extension code/s. Multiple extension codes are to be separated by '&'.

Syntax: ICHI intervention stem code&extension code&extension code.

Example 25: For '*Unplanned meniscoplasty of knee, right side*', assign: **MMD.ML.AA&XB03.0&XK9K**
Where: Stem code – MMD.ML.AA Meniscoplasty of knee Additional descriptive information extension code – XB03.0 Unplanned intervention Topology extension code for laterality – XK9K Right

3.9.1 Quantifiers

These extension codes are assigned to identify the number of:
　　• anatomical structures an intervention is performed on
　　• the same interventions performed in one episode of care
　　• therapeutic products inserted or implanted during an intervention

3.9.2 Use of specific 'anatomy and topography' extension codes

An 'Anatomy and Topography' extension code may be used to provide further anatomical detail to an existing stem code.

To record further detailed anatomy, an extension code from 'Anatomy and topography' may be assigned:

Example 29

The intervention statement involves more than one anatomical target, e.g.:
For '*Ventriculoperitonostomy'*, assign:
AAE.LI.AA&XA0KZ0
Where:
Stem code – AAE.LI.AA Ventricular shunt
Anatomy extension – XA0KZ0 Peritoneum

Example 30

For '*Coronary artery bypass graft (CABG) from thoracic aorta to coronary artery'*, assign:
HIA.LI.AA&XA8K52&XA3B03
Where:
Stem code – HIA.LI.AA Coronary artery bypass
Anatomy extensions – XA8K52 Aorta of thorax & XA3B03 Coronary artery

Example 31:

For '*Reconstruction of the volar intercarpal ligaments of the hand'*, assign:
MGL.ML.AA&XA47N4
Where:
Stem code – MGL.ML.AA Reconstruction of ligament or fascia of hand or finger
Anatomy extension – XA47N4 Volar intercarpal ligaments

3.9.3 Combining extension codes

Logically combined extensions should be grouped using round brackets ( ), with multiple use of these brackets being used for 'groups' of extension codes.
Syntax: ICHI stem code&(extension code&extension code)&(extension&extension code)

Example 36: For '*Coronary artery bypass graft (CABG) to left diagonal anterior descending coronary artery and right circumflex coronary artery'*, assign:
HIA.LI.AA&(XX8G&XA2DD2)&(XX9K&XA4YJ3)
Where:
Stem code – HIA.LI.AA Coronary artery bypass is combined with:
Topology extension – XK8G Left
Anatomy extension – XA2N78 Diagonal artery
and
Topology extension – XK9K Right
Anatomy extension – XA9FX9 Circumflex artery

3.10 Using Other Code Lists

Other code lists may be used alongside ICHI. These could be:

• ICF codes. ICF Body Functions, Activities and participation and Environmental factors are used as targets in ICHI. Most are at the 3 digit level of the ICF. If more specificity is desired, an ICF 4 or 5 digit code may be used.
• international coding systems to provide more detail (e.g. LOINC, ISO 9999)
• A code list to specify other information about the intervention including International Standard Industrial Classification (ISIC) code to describe industry, and Central Product Classification (CPC) to describe products and services.

Codes from other code lists should be separated from ICHI codes by the hash (#) symbol. The Classification used should be named before the code from that classification.

3.11 Interventions performed together

Where interventions are performed together, the ICHI codes for each intervention should be separated by a forward slash "/". Each intervention should be coded using the relevant stem code and extension codes as needed.
Some medical/surgical interventions performed together are commonly described by a single term.

Example 40

For '*Partial oesophagectomy with gastrostomy*', as per the 'code also' instruction assign: **KBA.JJ.AA/KBF.LI.AA**
Where: KBA.JJ.AA Partial oesophagectomy   KBF.LI.AA Gastric bypass

Example 42

For '*Percutaneous transluminal angioplasty of left lower leg artery and percutaneous transluminal angioplasty of right lower leg artery with insertion of two stents*', assign: **IFA.LG.AF&XCA3/IFA.LH.AF&XCA4&XAC2&XT01.24**
Where: Stem code – IFA.LG.AF Percutaneous transluminal dilatation of artery of lower limb   Topology extension – XK8G Left   Stem code - IFA.LH.AF Percutaneous transluminal dilatation with insertion of device into artery of lower limb   Topology extension – XK9K Right   Quantifier number of products extension – XAC2 Two therapeutic products inserted   Therapeutic product extension – XT01.24 Endovascular stent

Two or more independent interventions provided on the same date, or on different dates, should not be reported as interventions performed together

3.12 Packages of interventions

In some circumstances several interventions may be combined as a package. A rehabilitation program may be constructed for a person to include a selection of interventions, to be provided by a range of providers and disciplines over a time period. A mental health treatment program may be similarly constructed. The interventions within a package should be documented.

Packages of interventions are reported using '+' between interventions. Each intervention is represented by a stem code with or without extension codes.

Packages will vary according to the circumstances of the person being treated or supported, and according to national or sub-national system structures or capacities. Therefore ICHI does not attempt to classify packages of interventions. Where documentation only signifies that a package of interventions has been provided, further information is needed to determine the interventions provided.

3.13 Using ICHI with ICD and/or ICF

As a reference classification of the WHO Family of International Classifications (WHO-FIC), ICHI has been designed to align with, and to be used alongside, the ICD and ICF. ICF categories for Body Functions, Activities and Participation Domains, and Environmental Factors are used as Targets in ICHI (see Section 4.2).

In applying the three WHO-FIC classifications together:

- ICHI can be used to describe investigative intervention(s).
- ICD-11 can be used to record the person's health conditions.
- ICF can be used to describe the person's functioning (body functions, body structures, activities and participation domains and environmental factors).
- ICHI can be used to describe preventive, therapeutic and support intervention(s).

Example 48: Using ICHI with ICD:
Patient admitted for colonoscopy with biopsy to investigate ongoing abdominal pain, results indicated Crohn's Disease of the large intestine and a hemicolectomy of ascending colon was later performed, assign:

ICHI   KBP.AD.AD Endoscopic biopsy of colon
ICD-11 DD70.3 (Crohn disease of large intestine)
ICHI   KBP.JJ.AA&XA3AL5 (Partial excision of colon&Ascending colon)

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4   COMPARISON OF ICHI AND SNOMED-CT

This extract from the article: 'Evaluation of the International Classification of Health Interventions (ICHI) in the coding of common surgical procedures', K.W Fung, J. Xu, F. Ameye, L. Burelle and J. MacNeil, JAMIA, 2021, 1-9, compares ICHI and Snomed in their ability to encode surgical procedures in the electronic health record. This comparison helps to define the role that ICHI can play among surgical procedure coding systems. In addition, the ability of ICHI to support the collection of international statistics on surgical procedures is assessed.

4.1   MATERIALS AND METHODS

4.1.1 Procedure coding systems

The procedure coding systems evaluated here are ICHI and SNOMED CT. Both systems have main codes (also called "precoordinated codes" or "stem codes") that can be used on their own. ICHI and SNOMED CT allow users to optionally add other codes to the main codes to modify or refine their meaning. This is often referred to as "postcoordination". Note that the use of multiple main codes together is not postcoordination, because there is no change in the meaning of the main codes. The following is a brief description of each system (Table 1).

4.1.1.1 ICHI

ICHI is based on three axes, each forming a part of the seven-character code. The axes are:
- target - the entity on which the action is carried out
- action - the deed done by an actor to the target
- means - the processes and methods by which the action is carried out

ICHI allows postcoordination, which means that the main ICHI codes (called "stem codes" when they are used for postcoordination) can be refined by combination with extension codes to add additional detail.

4.1.1.2 SNOMED CT

SNOMED CT is the emerging international clinical terminology standard. [20, 21] SNOMED International has 41 member countries and has issued affiliate licenses to more than 5,000 individuals and organizations. [22] SNOMED CT covers most domain areas relevant to clinical medicine (e.g., diseases, procedures, drugs) and the surgical procedure subhierarchy is the focus of this study. SNOMED CT concepts are defined logically by attributes and values following a concept model. [23] Existing concepts can be refined with postcoordination by adding attributes and values in accordance with the concept model. (see also Table 2 under RESULTS)

Table 1. Characteristics of the procedure coding systems

	ICHI	SNOMED CT
Semantic structure	3 axes – target, action, means	Concepts defined by attributes and values based on the SNOMED CT concept model

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Example	KCF.JK.AB Laparoscopic cholecystectomy KCF=gall bladder (target); JK=excision, total (action); AB=percutaneous endoscopic(means)	45595009 Laparoscopic cholecystectomy defined by: method=excision-action; procedure site-direct=gallbladder structure using access device=laparoscope, device
Number of codes: a. total; b. surgical procedures ** (version)	a. 6,862 stem codes; b. 4,931 stem codes (2020 Beta-3 release)	a. 354,384 codes; b. 20,137 codes (July 2020 release)
Postcoordination	yes	yes
Use in	WHO member countries	SNOMED International member countries and affiliates

** the number of surgical procedure codes is an approximation and can include non-surgical codes. It is estimated as follows:

- ICHI – all codes from Chapter 1: Interventions on Body Systems and Functions
- SNOMED CT: codes under the Surgical procedure subhierarchy

*** counts reflect main codes only, not considering mandatory or optional attributes

4.1.2 Encoding of common surgical procedures in Snomed-CT and ICHI

We utilized the statistics of surgical procedures provided by a large U.S. healthcare provider for a previous project. [28] We identified the top 300 most-performed procedures and encoded each procedure in both coding systems based on their display names in the electronic health record. We ignored some extraneous information in the display names, which was considered out-of-scope for procedure coding systems. Examples of extraneous information included patient age (e.g., Tonsillectomy and adenoidectomy **up to age 12**), indication (e.g., Gastric bypass **for morbid obesity**) and timing (e.g., rotator cuff repair, open, **acute**). If there was no explicit mention of surgical approach (e.g., open, laparoscopic, transluminal), we assumed an open approach. We assumed complete (as opposed to partial) removal of a body part when either was possible. After removing duplicates, 229 unique procedures remained. Encoding was done independently by two terminologists who were experienced with the particular coding system. All discrepancies were discussed until consensus was reached.

For each procedure, we looked for the best matching code, which was either equivalent or broader in meaning than the display name of the procedure. More than one code could be used if the combination of codes matches the meaning of the procedure. If broader codes were used, we would attempt postcoordination. We defined three levels of matching: i) full representation without postcoordination, ii) full representation with postcoordination, and iii) partial representation.

Specifically, the following describes the coding process in each system.

4.1.2.1 ICHI

We used the online browser provided by the University of Udine [29] (the unified WHO browser was not available then) and followed the corresponding coding guidelines and instructions. We considered all relevant information (target, action, means, ICHI descriptor, definition, index terms and

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include notes) when deciding on the ICHI code. To determine the degree of representation, we considered only the information in the ICHI code descriptor and the three axes. For example, the procedure "Capsulotomy, YAG laser" was coded as *BBF.FA.AA Capsulotomy (target=lens, action=incision, means=open approach).* Even though *BBF.FA.AA* had an inclusion "Yttrium-aluminum-garnet [YAG] laser", we still considered this partial representation because "laser" was not mentioned in the descriptor or the axes. Use of multiple stem codes was allowed. For example, the procedure "rhinoplasty with septoplasty" was coded as a combination of *JAA.ML.AA Reconstruction of nose* and *JAB.ML.AC Septoplasty*. ICHI has its own syntax for combination of codes. When multiple procedures are performed together, the stem codes should be separated by "/" (i.e., *JAA.ML.AA/ JAB.ML.AC* in the example above)*.* For procedures that were not fully represented with main ICHI codes, we would attempt postcoordination to achieve full representation. In postcoordination, the stem code is separated from the extension code by "&".

4.1.2.2 SNOMED CT

We used the online browser provided by SNOMED International. [30] We judged the degree of representation based on the fully-specified name, hierarchical position and defining attributes of the SNOMED CT concept. We used multiple precoordinated concepts if necessary. For example, "Hemorrhoidectomy, internal and external, simple" was coded as *22432007 Internal hemorrhoidectomy* and *61498008 Complete external hemorrhoidectomy*. We would attempt postcoordination when precoordinated concepts could not achieve full representation.

4.1.3 Failure analysis

All cases that achieved partial representation were reviewed to determine what kind of information was missing. We categorized the type of missing information according to the three ICHI axes - target, action or means. We further subdivided "means" into three subcategories: method (e.g., laser, cryosurgery), approach (e.g., retropubic) and device (e.g., elbow implant).

4.1.4 Use of ICHI in international statistics

The Organisation for Economic Co-operation and Development (OECD) and European Union (EU) currently report data from member countries on hospital interventions, including a common list of 22 surgical procedure categories (e.g., cataract surgery, tonsillectomy, laparoscopic appendectomy). [34-36] We assessed the adequacy of ICHI codes to support OECD and EU statistical reporting as follows. Among the 229 surgical procedures that were coded in ICHI, we identified those that were encompassed in the OECD/EU list of surgical interventions. We then assessed whether the ICHI encoding of these procedures contained sufficient information for accurate and unambiguous assignment to their corresponding OECD/EU categories.

4.2   RESULTS

4.2.1 Encoding of common surgical procedures in Snomed-CT and ICHI

Coding in each system was done by two terminologists independently. Before coding, the terminologists worked together on some examples to establish coding guidelines. Actual coding

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started when they were satisfied with the guidelines. The inter-coder agreement for the main codes, before discrepancies were discussed, was ICHI 91.7%, SNOMED CT 85.6%.

The results of encoding are summarized in Table 2. Overall, SNOMED CT had the best performance. Without postcoordination, SNOMED CT was able to achieve full representation in 216 (94.3%) procedures. With postcoordination, full representation was achieved in all but one procedure (99,6%). Without postcoordination, ICHI achieved full representation in 52.8%. With postcoordination, ICHI was able to match ICD-10-PCS, achieving full representation in 72%.

Another interesting finding was that, among the procedures that could be fully represented without postcoordination, the proportions of procedures that required multiple codes to represent were 10% in ICHI and 6.6% in SNOMED CT.

Table 2. Encoding common surgical procedures in ICHI and Snomed-CT

	ICHI	SNOMED CT
Full representation without postcoordination	121 (52.8%)	216 (94.3%)
--Single code	--98 (42.8%)	--201 (87.8%)
--Multiple codes	--23 (10%)	-- 15 (6.6%)
Example: Procedure name → Code(s)	Cholecystectomy → KCF.JK.AA Cholecystectomy	Cholecystectomy → 38102005 Cholecystectomy
Full representation with postcoordination	44 (19.2%)	12 (5.2%)
Example: Procedure name → Code(s) + postcoordinated expression	Amputation of toe at metatarsophalangeal joint → PNE.JN.AA Amputation of toe, not elsewhere classified & XA8XU1 Metatarsophalangeal joint	Laparoscopic destruction of intraabdominal endometriomas → 63831004 Destruction of intra-abdominal endometriomas + 425391005 Using access device = 86174004 Laparoscope, device
Partial representation	64 (27.9%)	1 (0.4%)
Example: Procedure name → Code(s)	Capsulotomy, YAG laser → BBF.FA.AA Capsulotomy	Arthroplasty and implant elbow with reconstruction fascia lata ligament → 239471004 Arthroplasty of the elbow (procedure)
Total	229 (100%)	229 (100%)

Table 3. Types of missing information in procedures that are partially represented (the numbers represent the number of procedures with a particular type of missing information, the percentages for each type of missing information are calculated using the number of procedures with missing information for that classification as the denominator, the percentages can add up to over 100% because one procedure can have multiple types of missing information)

Type of missing	ICHI	SNOMED CT

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information		
Target	21 (32.8%)	
Example: a. procedure name b. code found c. missing information	a. Transposition of ulnar nerve at elbow b. ACA.LJ.AA Transposition of peripheral nerve c. ulnar nerve	
Action	None	None
Means - method	41 (64.1%)	1 (100%)
Example: a. procedure name b. code found c. missing information	a. Cryosurgery cervix b. NMF.GA.AC Destruction of lesion or tissue of cervix c. cryosurgery	a. Arthroplasty and implant elbow with reconstruction fascia lata ligament b. 239471004 Arthroplasty of the elbow (procedure) c. reconstruction method
Means - approach	5 (7.8%)	
Example: a. procedure name b. code found c. missing information	a. Radical perineal prostatectomy b. NGA.JL.AA Radical prostatectomy c. perineal approach	
Means - device	3 (4.7%)	
Example: a. procedure name b. code found c. missing information	a. Reduction, primary, open, fracture of femur, open fixation using hip pinning b. MLB.LD.AA & MLB.DN.AA Open reduction of femur & Implantation of device into bone, femur c. hip pin	
Total	64 (100%)	1 (100%)

4.2.2 Failure analysis

The reasons for failure of full representation are summarized in Table 3. The percentages in each type of missing information are based on the number of procedures. The individual percentages can add up to over 100% since one procedure can have more than one type of missing information. For both ICHI, "method" was the most common missing information. The only case of partial representation in SNOMED CT was due to a missing method.

4.2.3 Use of ICHI in international statistics

The alignment of the OECD/EU surgical procedure categories and our list of surgical procedures is shown in Table 4. Altogether, 39 of our procedures were encompassed by 19 of the 22 OECD/EU categories. Three of the OECD/EU categories – laparoscopic hysterectomy, laparoscopic repair of

inguinal hernia and stem cell transplantation were not found among our list of procedures. We reviewed the ICHI codes for the 39 procedures to determine whether they would enable the procedures to be accurately assigned to the OECD/EU categories and here are the results:

1. <u>Procedures fully represented without postcoordination (23 procedures)</u>
   All of them could be assigned correctly to the OECD/EU categories based on the ICHI codes.
2. <u>Procedures fully represented with postcoordination (11 procedures)</u>
   In 10 of the 11 procedures, the information that required postcoordination to capture was not essential in the assignment to the proper OECD/EU categories. For example, in "Mastectomy, **bilateral**"; "Transurethral prostatectomy, **complete**" and **"Total** replacement of hip", the information highlighted in bold required postcoordination to capture. However, even without postcoordination, these procedures could be assigned to the correct OECD/EU categories based on the ICHI codes. The exception was "**Revision** of total hip replacement". Since postcoordination was needed to capture "revision", this procedure would be assigned to the wrong OECD/EU category *Hip replacement* without postcoordination, instead of the correct category *Hip replacement, secondary*.
3. <u>Procedures partially represented (5 procedures)</u>
   All of them could be assigned to the correct category based on their ICHI coding. In all five procedures, the missing information (highlighted in bold) did not affect the OECD/EU category assignment (e.g., "Radical **perineal** prostatectomy", "**Low transverse** cesarean section", "Arthroplasty of knee **using cement**").

Table 4. Procedures encompassed by the OECD/EU surgical procedure categories and their level of representation by ICHI coding

OECD/EU procedure category	Number of procedures in our list and their level of representation in ICHI			
	Total number of procedures in category	Full representation without postcoordination	Full representation with postcoordination	Partial representation
Appendectomy	1	1	0	0
Appendectomy, laparoscopic	1	1	0	0
Cataract surgery	2	1	1	0
Cesarean section	3	1	0	2
Cholecystectomy	2	2	0	0
Cholecystectomy, laparoscopic	2	2	0	0
Coronary artery bypass graft	1	1	0	0
Excision of mammary gland, partial	3	3	0	0
Excision of mammary gland, total	3	2	1	0
Hip replacement	2	0	2	0
Hip replacement, secondary	1	0	1*	0
Hysterectomy	6	4	2	0

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Hysterectomy, laparoscopic	0	0	0	0
Prostatectomy, open	2	0	0	2
Prostatectomy, transurethral	1	0	1	0
Repair of inguinal hernia	1	1	0	0
Repair of inguinal hernia, laparoscopic	0	0	0	0
Stem cell transplantation	0	0	0	0
Tonsillectomy	2	2	0	0
Total knee replacement	4	0	3	1
Transluminal coronary angioplasty	1	1	0	0
Transplantation of kidney	1	1	0	0
Total	39	23	11	5

*needs postcoordination for correct OECD/EU category assignment

As long as a procedure is assigned to the correct category, missing information in the ICHI code would not result in over or under counting, since the count is based on the number of patients receiving a procedure. Even when multiple codes are used for a procedure in a patient, that procedure is only counted once.

4.3 DISCUSSION

4.3.1 Comparison of the ICHI and Snomed-CT procedure coding systems

In this study, we evaluate the ability of both coding systems to encode surgical procedures as they are recorded in the electronic health record. Since the primary function of the electronic health record is to support patient care, we are examining the fitness of the coding systems for the clinical use case. It is not surprising that SNOMED CT has the best performance in our evaluation, with over 99% full representation. SNOMED CT is primarily a clinical terminology. Most terms in SNOMED CT originate from clinical discourse, which would match well with display names used in the electronic health record. In SNOMED CT, most procedures require only a single code. This shows that its granularity is more aligned with clinical documentation compared to ICHI.

ICHI only achieves full representation in about half of the procedures without postcoordination. This can be partly explained by its relatively small number of codes for surgical procedures (Table 1): 6.862 codes vs. 354.384 codes in SNOMED CT. With postcoordination, full representation in ICHI can be increased to 72%.

For the use case of collecting international statistics on surgical procedures, ICHI seems to be generally adequate. Most of the procedures in our study can be assigned to the correct OECD/EU

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category based on their ICHI encoding. One exception is that the procedure "Revision of total hip replacement" would be wrongly classified without postcoordination. Postcoordination is a brand-new feature in the WHO-FIC classification systems (ICD-11 also supports postcoordination), and will have impact on tooling, coder education and coding variability. Since postcoordination may not be universally implemented in all WHO member countries, ICHI should consider adding a new stem code for "revision hip replacement" to ensure that the capture of OECD/EU statistics can still be supported without postcoordination.

4.4 CONCLUSION

For 229 commonly performed surgical procedures, ICHI was able to fully represent 52.8% without postcoordination. A further 19.2% could be fully represented with postcoordination. For the 27.9% that could only achieve partial representation, missing method (58.6%) was the most common reason for failure of full representation, followed by missing target (30%). For the clinical use case, the performance of ICHI is inferior to SNOMED CT. There is room for improvement of coverage in ICHI by enhancing its postcoordination capability. For the statistical use case, ICHI coding is generally adequate and could support correct assignment to the appropriate OECD/EU categories.

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The Guidelines for coding interventions on body systems in this brochure are extracted from the ICHI Reference guide on https://icd.who.int/dev11/l-ichi/en