



HOSPITAL ITALIANO
de Buenos Aires

Facilitating implementations through an interface terminology that maps to SNOMED CT

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#InfomedHIBA

Departamento de Informática
en Salud



HOSPITAL ITALIANO

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Hacete fan

Objectives

To share the experience of the Department of Health Informatics at Hospital Italiano de Buenos Aires in developing and maintaining an interface terminology which supports several institutions in the countries of Argentina, Uruguay and Chile.

Overview

- Background
- Terminologies
- History of HIBA's terminology services
- Structure and functionality of HIBA's terminology server

Background

Non-profit academic medical center
Network of two hospitals with **800 beds**
800 home care patients
24 ambulatory clinics
>2,200,000 outpatient visits (annually)

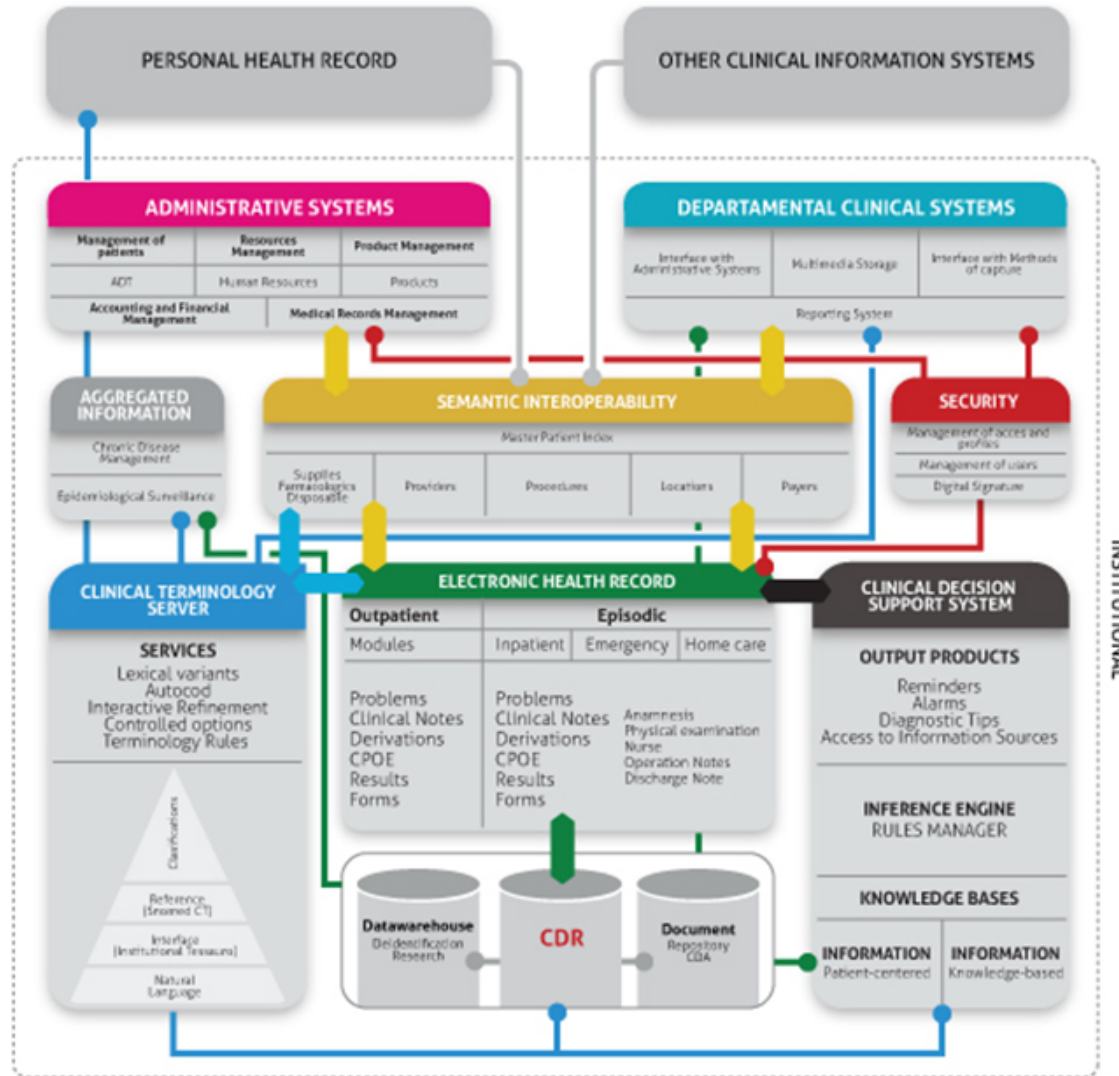
Since 1998 HIS (Italica)

EHR:

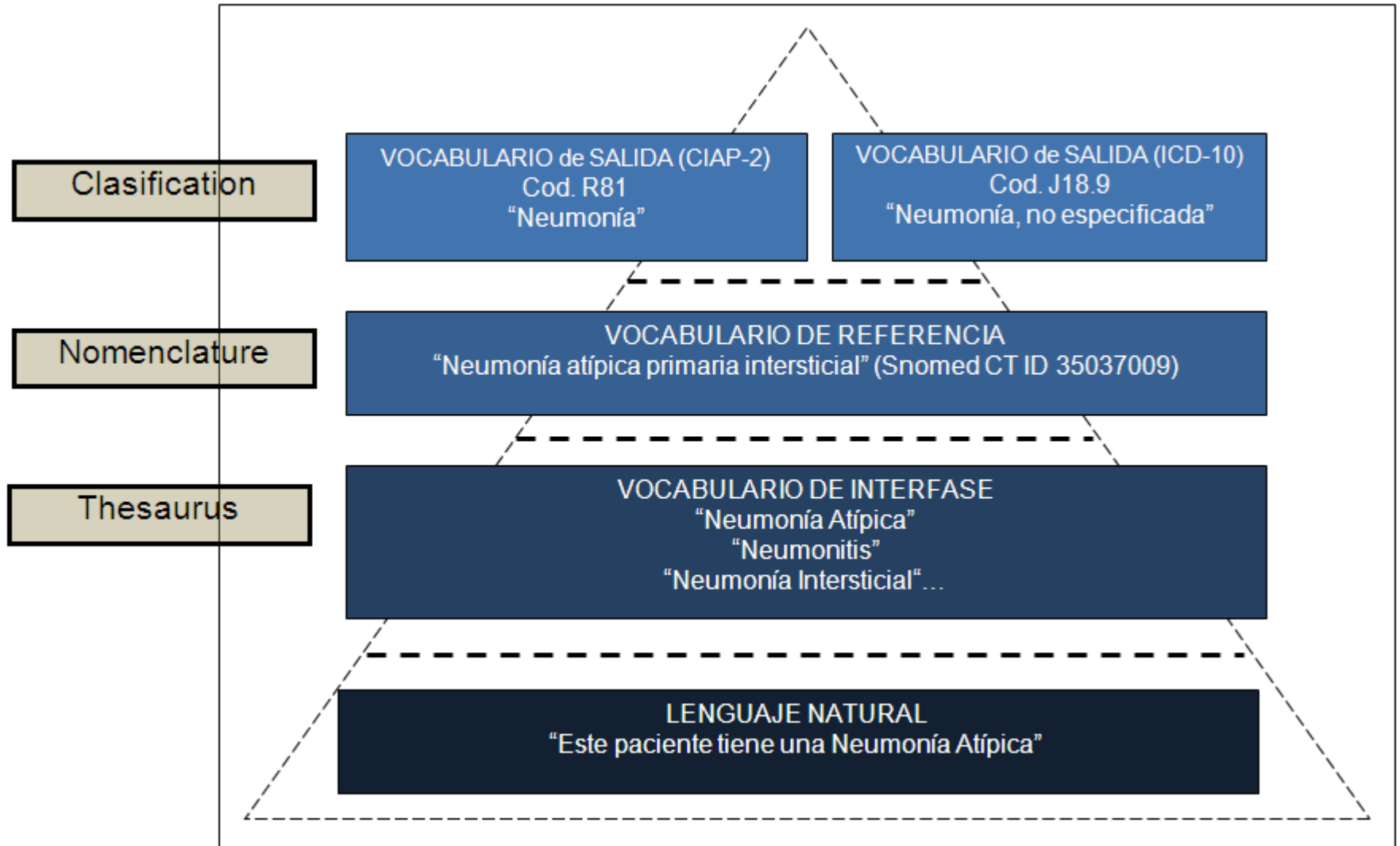
Fully-implemented (paperless)
Web-based
Problem-oriented
Patient-centered



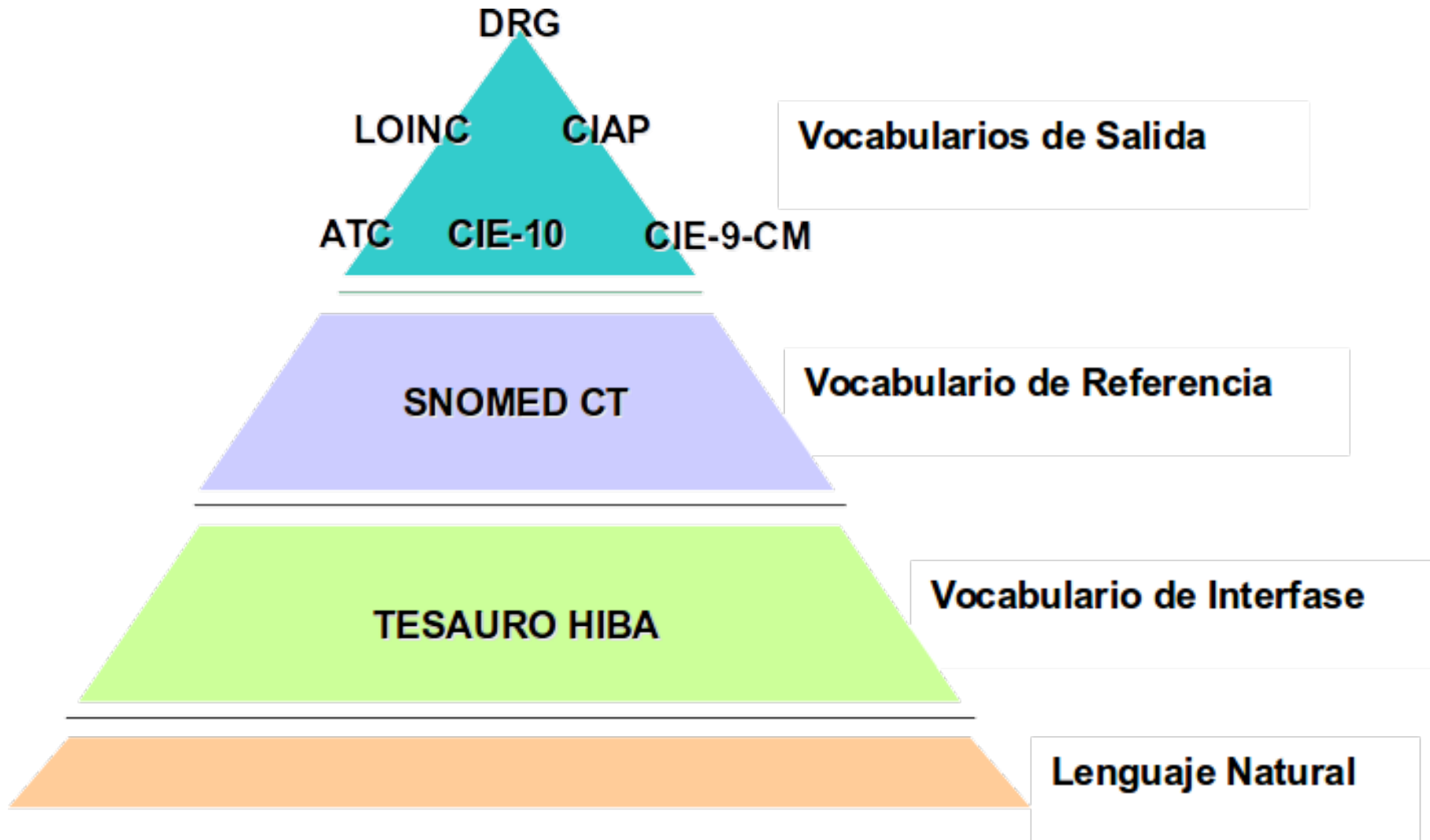
Background



Terminologies



Terminologies



Interface Terminologies

- systematic collection of health care related phrases (terms) that support clinicians' entry of patient-related information into computer programs
- also facilitate display of computer stored patient information to clinician-users as simple human readable text

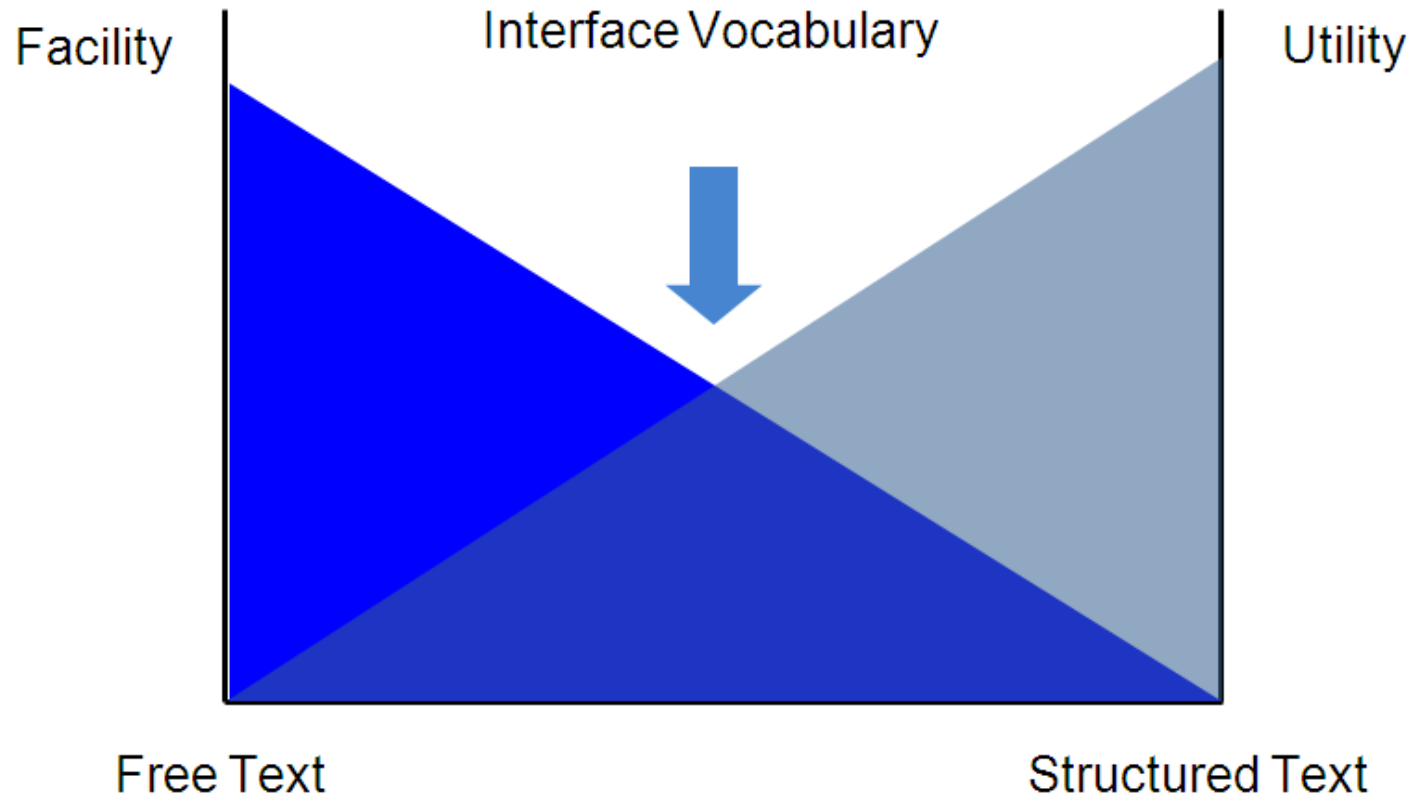
Rosenbloom ST, Miller RA, Johnson KB, Elkin PL, Brown SH. Interface terminologies: facilitating direct entry of clinical data into electronic health record systems. J Am Med Inform Assoc [Internet]. 1992;13(3):277–88. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/1513664>

Interface Terminologies

“Electronic health record systems depend on interface terminologies for successful implementation in clinical settings”

Campbell JR. Semantic features of an enterprise interface terminology for SNOMED RT. Medinfo. 2001;10:82–5.

Interface Terminologies



Rosenbloom ST, Denny JC, Xu H, Lorenzi N, Stead WW, Johnson KB. Data from clinical notes: a perspective on the tension between structure and flexible documentation. *J Am Med Inform Assoc* Mar-Apr; 18(2):181-6.

Middleton B, Renner K, Leavitt M. Ambulatory practice clinical information management: problems and prospects. *Healthc Inf Manage*. 1997 Winter; 11(4):97-112.

Desired qualities of an interface terminology

- Assertional knowledge
- Synonym coverage
- Compositional balance

Assertional Knowledge

- information that provides nuance and context to a concept, but does not define it
- describes each concept's relationships to other concepts and modifiers, such whether concepts are present or absent under certain circumstances
- other forms of assertional knowledge may indicate which modifiers commonly describe a given concept

Rosenbloom ST, Miller RA, Johnson KB, Elkin PL, Brown SH. A model for evaluating interface terminologies. J Am Med Inform Assoc [Internet]. 2008;15(1):65–76. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/17947616> <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC2274877>

Synonym Coverage

- clinical interface terminologies are specifically designed to represent the variety of common colloquial phrases in medical discourse
- rich synonymy should improve the nuance with which users can express themselves when using the terminology

Rosenbloom ST, Miller RA, Johnson KB, Elkin PL, Brown SH. Interface terminologies: facilitating direct entry of clinical data into electronic health record systems. *J Am Med Inform Assoc* [Internet]. 1992;13(3):277–88. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/1513664>

Compositional balance

- facilitates concept selection by minimizing the effort required for users to compose complex concepts from more atomic concepts and to search through long lists of fully defined pre-coordinated concepts

Rosenbloom ST, Miller RA, Johnson KB, Elkin PL, Brown SH. Interface terminologies: facilitating direct entry of clinical data into electronic health record systems. *J Am Med Inform Assoc* [Internet]. 1992;13(3):277–88. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/1513664>

Reference terminologies

- support the storage, retrieval, and classification of clinical data
- their contents correspond to the internal system representation storage formats to which interface terminologies are typically mapped

Rosenbloom ST, Miller RA, Johnson KB, Elkin PL, Brown SH. Interface terminologies: facilitating direct entry of clinical data into electronic health record systems. *J Am Med Inform Assoc* [Internet]. 1992;13(3):277–88. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/1513664>

Developing interface terminologies

- one approach to developing interface terminologies would be to construct them from existing terminologies, such as reference terminologies
- this would permit the underlying formal structure provided by the source reference terminology to remain, while simultaneously presenting clinicians with usable complex terms
- a single standard reference terminology (SNOMED CT) used as the starting point for interface terminology development will permit a uniform back-end representation despite the diverse terms that users require

Rosenbloom ST, Miller RA, Johnson KB, Elkin PL, Brown SH. Interface terminologies: facilitating direct entry of clinical data into electronic health record systems. *J Am Med Inform Assoc* [Internet]. 1992;13(3):277–88. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/1513664>

Potential risks of SNOMED CT extensions

- duplication and confusion due to overlap with the International Edition or other extensions
- risks for administration e.g. underestimation of productivity
- risks for patient care e.g. failing to retrieve critical clinical information
- updates in the international edition must be handled carefully
- duplication of effort if extensions do not feed back to national and international editions when appropriate

HIBA's experience

Subtítulo de la diapositiva

A bit of History

- 1998: HIS development started. Ambulatory record implemented. Free text entry with centralized secondary codification
- 2001: thesaurus started, secondary coding with ICPC-2 and ICD-10
- 2002/3: SNOMED CT evaluation, SNOMED CT added to thesaurus
- 2004: institutional extension, interactive coding (with non valid terms). Cross maps to ICD-9 for DRG

A bit of History

- 2005: terminology server implementation across HIBA
- 2007: terminology services offered to other institutions
- 2013: drug composition service based on dm+d
- 2015: CDSS based on drugs and allergies knowledge database and SNOMED CT

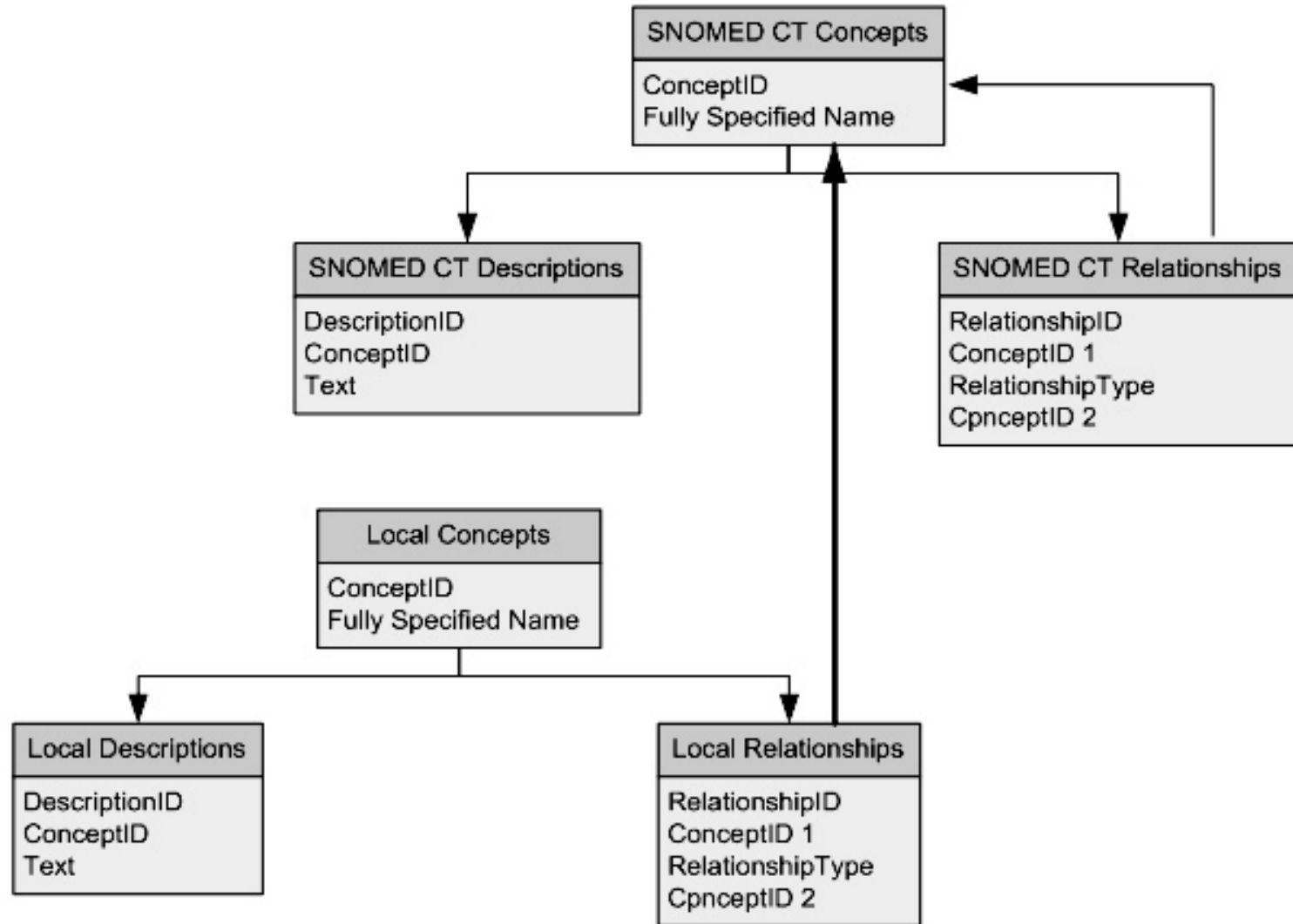
Initial construction of the thesaurus

- all problem list entries and discharge notes were processed to extract all different textual descriptions
- more than 2 million free text inputs since 1998
- manual depuration process, assisted by string normalization functions
- problems list subset created with 24800 different concepts and 110000 descriptions in total

Mapping to SNOMED CT

- 85% of the original texts received a concept code of the new entry terminology
- 10% of them were recognized as invalid entries
- 75% were finally mapped to SNOMED CT

Structure: an extension of SNOMED CT



Why SNOMED CT?

- SNOMED CT is a powerful modern clinical terminology
- comprehensive scope and support for detailed information
- code system providing standard representation of clinical meanings
- global reference terminology with multilingual term support
- polyhierarchy with ontological features that enable inference

HIBA's Interface Terminology Functions

- an institutional vocabulary for all user interfaces, so our professionals interact with familiar terms, including local jargon and preferences.
- concept lookup functions, with loose lexical matches and options, to be used during the data entry process of new items in a problems list or similar user interfaces.
- short pick-lists definitions for more structured data entry in specific use templates, with a short list of valid entries, like occupation, level of consciousness, etc.

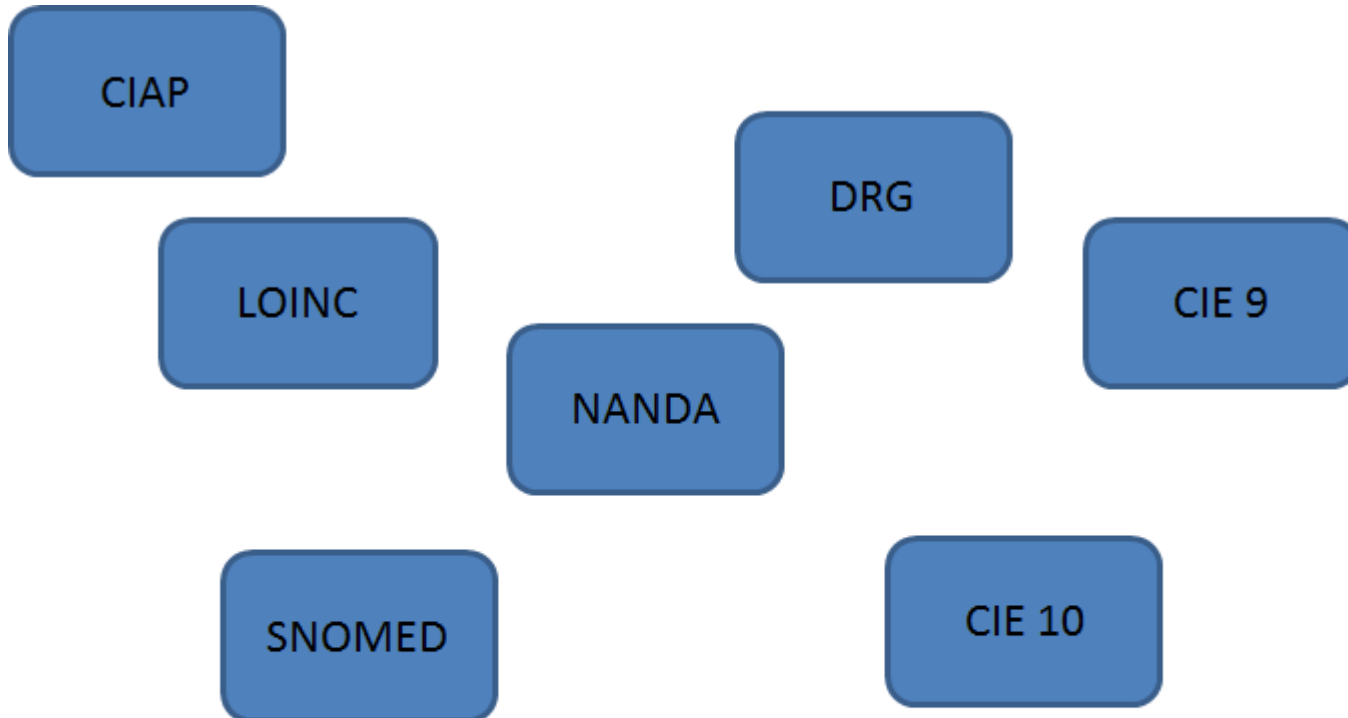
HIBA's Interface Terminology Functions

- navigational tree interfaces for structured data entry in more complex templates, like cause of liver failure, etc.
- different preferred terms for the same concept in different settings.
- ability to accept new terms from the user, in case a concept or description is not represented.
- detection of inappropriate terms for being too general or not valid in a subset, as in the case of problem lists entries Emergency Consultation or Cardiology, etc.

Cross Maps

- official SNOMED CT cross maps model was implemented
- a multi-classification interface was created as part of the Terminology Maintenance Software to visualize, test and modify mappings from Snomed to different classifications

Cross Maps



HIBA's Terminology Maintenance Application

- a terminology maintenance software application was also developed to administrate the institutional terminology, its relationship with Snomed and the mappings

HIBA's Terminology Maintenance Application

- entry terminology administration: creation of new concepts, description assignment and modeling of each concept with Snomed CT
- drug composition services administration: creation and maintenance of drug products
- subsets administration: creation of new subsets, addition and removal of concepts from the subsets, defining hierarchies for tree interface

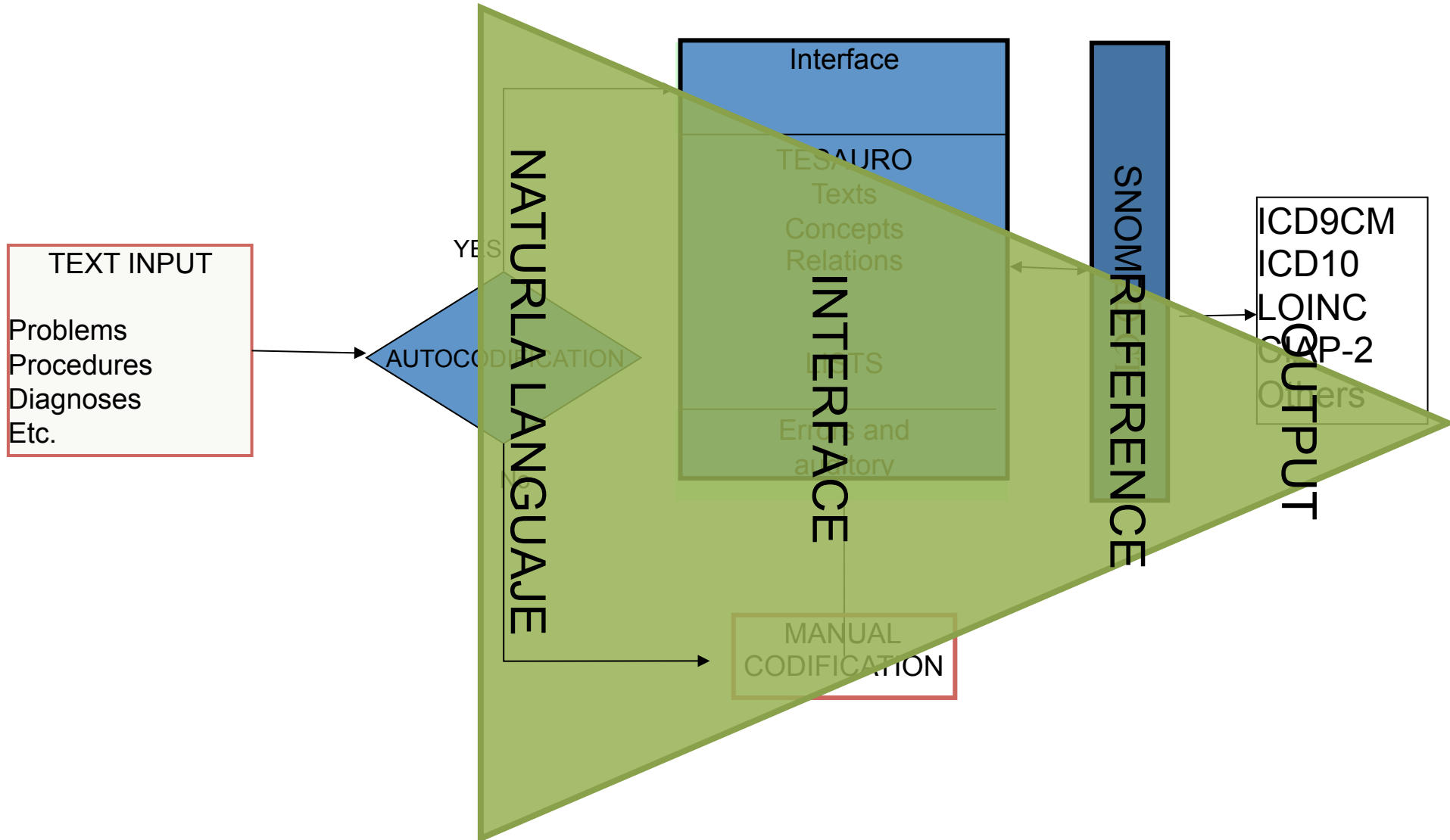
HIBA's Terminology Maintenance Application

- pending concepts or descriptions: all proposed new concepts or descriptions are stored in a list, waiting to be evaluated and modeled, ordered by the number of proposals
- cross maps administration: existing cross maps can be visualized, edited and tested using this module
- dashboard: data for managing coders, clients and pending terms

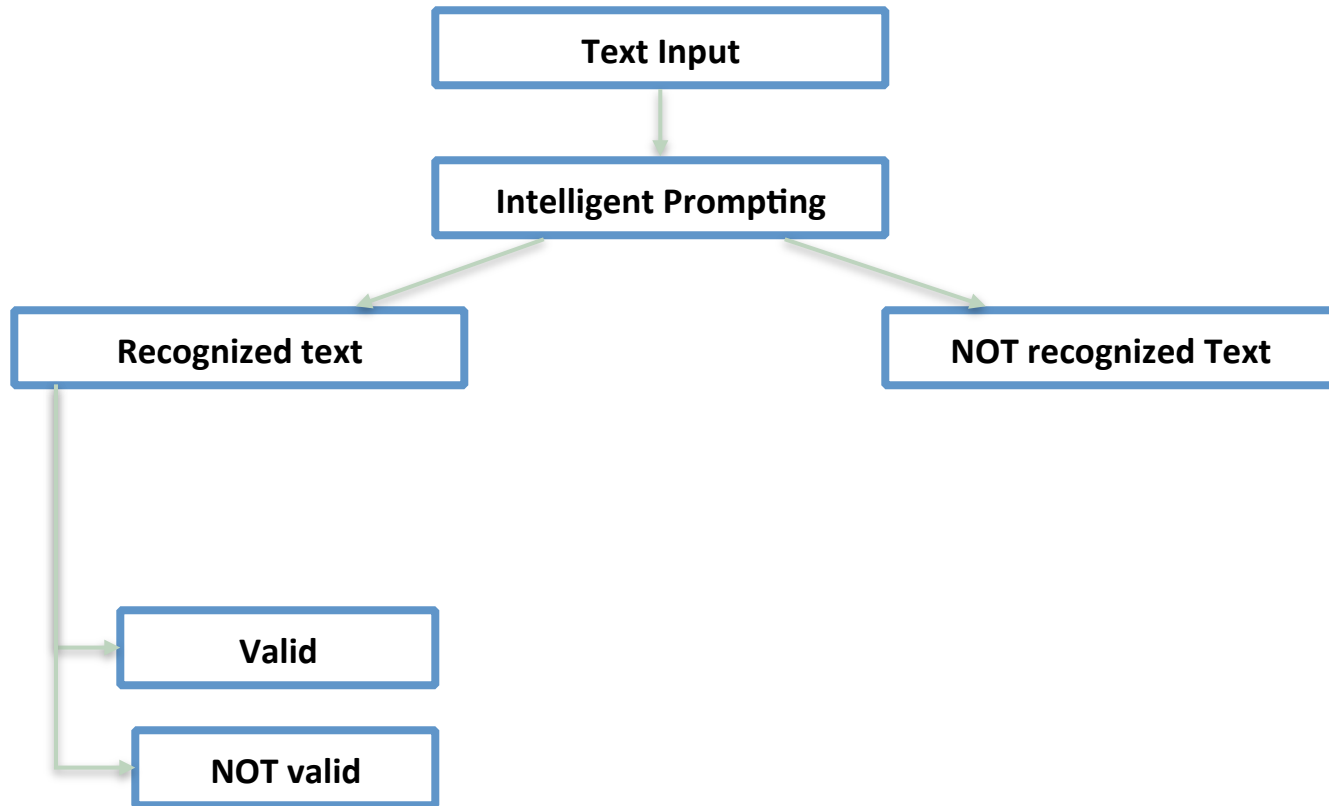
HIBA's Terminology Server

- all desired functions run on a centralized software and data structure
- the Terminology Server provides these functions to all existing applications in the Health Information System in the form of Web Services
- also to external applications from institutions in Argentina, Chile, and Uruguay

HIBA's Terminology Server




HIBA's Terminology Server



Intelligent Prompting

Buscar terminos

BUSCAR TERMINO

CEFALEA EN RACIMO 

CEFALEA EN RACIMO IZQUIERDA

No existen elementos a mostrar

NOT Recognized Text

TIA 29/09/2011 LOPEZ GASTON AREA DE INFORMATICA MEDICA

COLECISTECTOMIA LAPARO 02/02/2011

Buscar terminos

BUSCAR TERMINO

Término no reconocido 🚩

No existen elementos a mostrar

Mantener el texto original
[HTA POR ESTRESS](#)

Recognized Valid Text with Optional Refinement

TIA 29/09/2011 LOPEZ GASTON AREA DE INFORMATICA MEDICA COLECISTECTOMIA LAPAROS

HELL

SECUR

ION P

RONIC

ION A

MELL

Buscar terminos

BUSCAR TERMINO

El texto ingresado es válido (puede confirmarlo o elija una opción detallada)
APENDICITIS
Existen otras opciones de refinamiento para el texto ingresado 📌

- APENDICITIS AGUDA
- APENDICITIS FLEGMONOSA
- APENDICITIS RETROCECAL
- APENDICITIS AGUDA CONGESTIVA RETROCECAL
- SINDROME APENDICULAR MINIMO
- APENDICITIS AGUDA CONGESTIVA
- APENDICITIS AGUDA NO OBSTRUCTIVA SIN PERFORACION
- APENDICITIS AGUDA NO PERFORADA
- APENDICITIS PELVIANA
- APENDICITIS AGUDA FLEGMONOSA CON PERITONITIS LOCALIZADA
- APENDICITIS AGUDA NO OBSTRUCTIVA

Mantener el texto original
APENDICITIS

[Si lo desea puede realizar una sugerencia.](#)

Recognized Valid Text with Necessary Refinement

29/09/2011 LOPEZ GASTON AREA DE INFORMATICA MEDICA

COLECISTECTOMIA LAPAROS

Buscar terminos

BUSCAR TERMINO

Debe seleccionar una de estas opciones 📌

- FORUNCULO DEL MIEMBRO INFERIOR IZQUIERDO
- FORUNCULO DEL CUELLO
- FORUNCULO DEL MIEMBRO INFERIOR DERERCHO
- FORUNCULO VAGINAL
- FORUNCULOSIS DE PIEL RECURRENTE
- FORUNCULO EN LA REGION OCCIPITAL
- FORUNCULO DE LA CARA
- FORUNCULO EN EL MIEMBRO SUPERIOR DERECHO
- FORUNCULO DE MIEMBRO SUPERIOR
- FORUNCULO EN EL MENTON
- FORUNCULO EN EL MAXILAR INFERIOR
- FORNUNCULO EN LA CARA

[Si lo desea puede realizar una sugerencia..](#)

Recognized Invalid Text - invalid abbreviation

ENSIÓN ARTERIAL 29/09/2011 LOPEZ GASTON AREA DE INFORMATICA MEDICA

COLECISTECTOMIA LAPAROSCOPICA

ME HELLI

ES SECUN

ENSIÓN P

A

ENSIÓN A

A CRONIC

ES MELLI

EA

Buscar terminos

BUSCAR TERMINO lag Buscar

No válido: No es una abreviatura válida 🚩

No existen elementos a mostrar

Agregar un problema

Recognized Invalid Text - nonspecific

The screenshot shows a web application interface for searching medical terms. At the top, there is a header with user information: "29/09/2011", "LOPEZ GASTON", and "AREA DE INFORMATICA MEDICA". Below this is a search bar with the text "Buscar terminos" and a search button labeled "Buscar". The search input field contains the text "primera toma hta". Below the search bar, a message states "No válido: Texto poco específico" with a warning icon. A list of search results is displayed below the message, including "REGISTRO AISLADO DE TENSION ARTERIAL ELEVADA", "CRISIS HIPERTENSIVA CON DIAGNOSTICO DE HIPERTENSION ARTERIAL", and "CRISIS HIPERTENSIVA SIN DIAGNOSTICO DE HIPERTENSION ARTERIAL". At the bottom of the search results, there is a link that says "Si lo desea puede realizar una sugerencia.". Below the search results, there is a button labeled "Agregar un problema".

29/09/2011 LOPEZ GASTON AREA DE INFORMATICA MEDICA

Buscar terminos

BUSCAR TERMINO primera toma hta Buscar

No válido: Texto poco específico

REGISTRO AISLADO DE TENSION ARTERIAL ELEVADA

CRISIS HIPERTENSIVA CON DIAGNOSTICO DE HIPERTENSION ARTERIAL

CRISIS HIPERTENSIVA SIN DIAGNOSTICO DE HIPERTENSION ARTERIAL

[Si lo desea puede realizar una sugerencia.](#)

Agregar un problema

Recognized Invalid Text - NOT a problem

The screenshot shows a medical software interface with a search modal. At the top, the header includes patient information: "ON ARTERIAL", "29/09/2011", "LOPEZ GASTON", and "AREA DE INFORMATICA MEDICA". A search bar at the top of the modal is labeled "Buscar terminos". Below it, the search input field contains "BUSCAR TERMINO" followed by "ausente" and a green "Buscar" button. The search results area displays an error message: "No válido: No es un problema" with a yellow warning icon, followed by "No existen elementos a mostrar". At the bottom of the modal, there are two empty input fields and a button labeled "Agregar un problema".

Recognized Invalid Text - ambiguous

ION ARTERIAL 29/09/2011 LOPEZ GASTON MEDICA COLECISTECTOMIA LAPAROSCOPICA 02/02/2011

HELLI

SECUM

ION PI

ION A

ONIC

MELLI

Buscar terminos

BUSCAR TERMINO

Ambiguo 🚩

HIPERTENSION PORTAL

HIPERTENSION PULMONAR

[Si lo desea puede realizar una sugerencia.](#)

Recognized Invalid Text - more than one term

The screenshot shows a medical software interface with a search modal. At the top, there is a header with patient information: "29/09/2011", "LOPEZ GASTON", and "AREA DE INFORMATICA MEDICA". The search modal has a title "Buscar terminos" and a search input field containing "fiebre astenia". A green "Buscar" button is next to the input. Below the input, a message states: "El texto ingresado contiene más de un concepto médico, deben ser ingresados por separado. Si hay opciones puede seleccionarlas para ingresarlo automáticamente 🗨️". Below this message, a list of search results is shown: "FIEBRE" and "ASTENIA", with "ASTENIA" highlighted in green. At the bottom of the modal, there is a text box with the link "Si lo desea puede realizar una sugerencia.". Below the modal, there is a button labeled "Agregar un problema".

29/09/2011 LOPEZ GASTON AREA DE INFORMATICA MEDICA

Buscar terminos

BUSCAR TERMINO fiebre astenia Buscar

El texto ingresado contiene más de un concepto médico, deben ser ingresados por separado. Si hay opciones puede seleccionarlas para ingresarlo automáticamente 🗨️

FIEBRE
ASTENIA

Si lo desea puede realizar una sugerencia.

Agregar un problema

Recognized Invalid Text - need to indicate location

The screenshot shows a medical software interface with a search modal. The search input contains the text "absceso". A green "Buscar" button is to the right of the input. Below the input, a message states "No válido: Indique localizacion problema o procedimiento" with a warning icon. A list of suggestions is shown below the message:

- ABSCESO ANAL
- ABSCESO DE LA PIERNA
- ABSCESO VULVAR
- ABSCESO INGUINAL

At the bottom of the modal, there is a text input field and a link that says "Si lo desea puede realizar una sugerencia.". Below the modal, a button labeled "Agregar un problema" is visible.

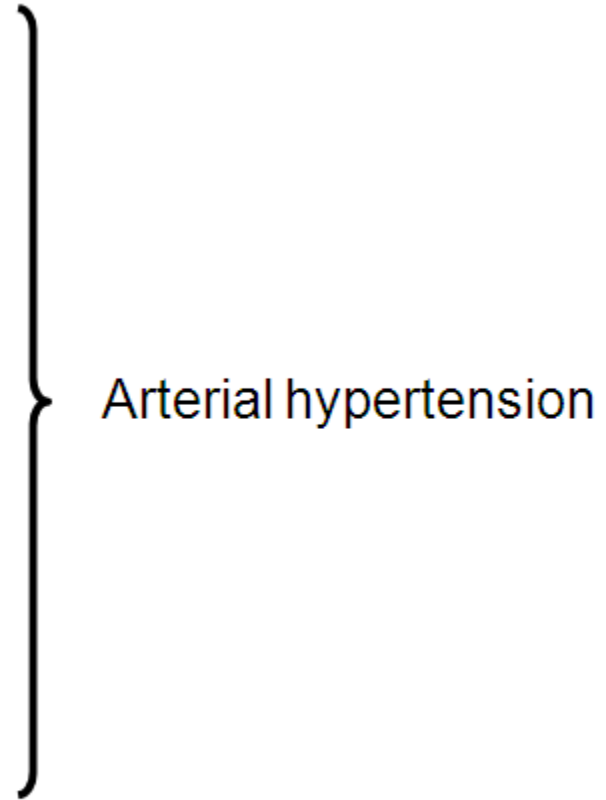
Synonyms

VALID

- HTA
- Hipertension arterial

NOT VALID

- HTA,,,,,
- Htn aerterrial
- Hipertencion arterial



- ✓ List of valid and invalid terms, synonyms, abbreviations and acronyms with validated by each institution to be used by its members
- ✓ Thesaurus comprised of different description ID related to a concept ID

HIBA's Terminology Server

- More than 3 million processed terms
- Nearly 600.000 valid terms
- Synonyms and acronyms recognition (more than 140 different ways to enter “HIPERTENSION ARTERIAL” in the problems domain)
- More than 8000 spanish terms not present in RAE (only in the problems domain)

HIBA's Terminology Server

- Each institution starts with HIBA's thesaurus
- Autocodifies between 70-85% of an institution historical terms
- After this process, an institutional thesaurus with customized preferred terms and subsets is created

Finishing remarks

- the desired level of freedom of user expression we wanted to support included describing laterality in findings and procedures
- this lead to a combinatorial “explosion” of thousands of new concepts to model outside SNOMED CT and an important increase in manual work by the terminology team
- this is the cause of high levels of post-coordination, which puts us on the need of a very strict quality assurance process

Finishing remarks

- the main drawback of creating a local IfT is the additional work required for its development and maintenance
- in our case, conforming to usability demands from our user base was a key point in our implementation, so the extra effort in creating and maintaining an IfT was deemed not only acceptable but necessary

Thank you very much!



<http://www.hospitalitaliano.org.ar/infomed/index.php?contenido=term.php>



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