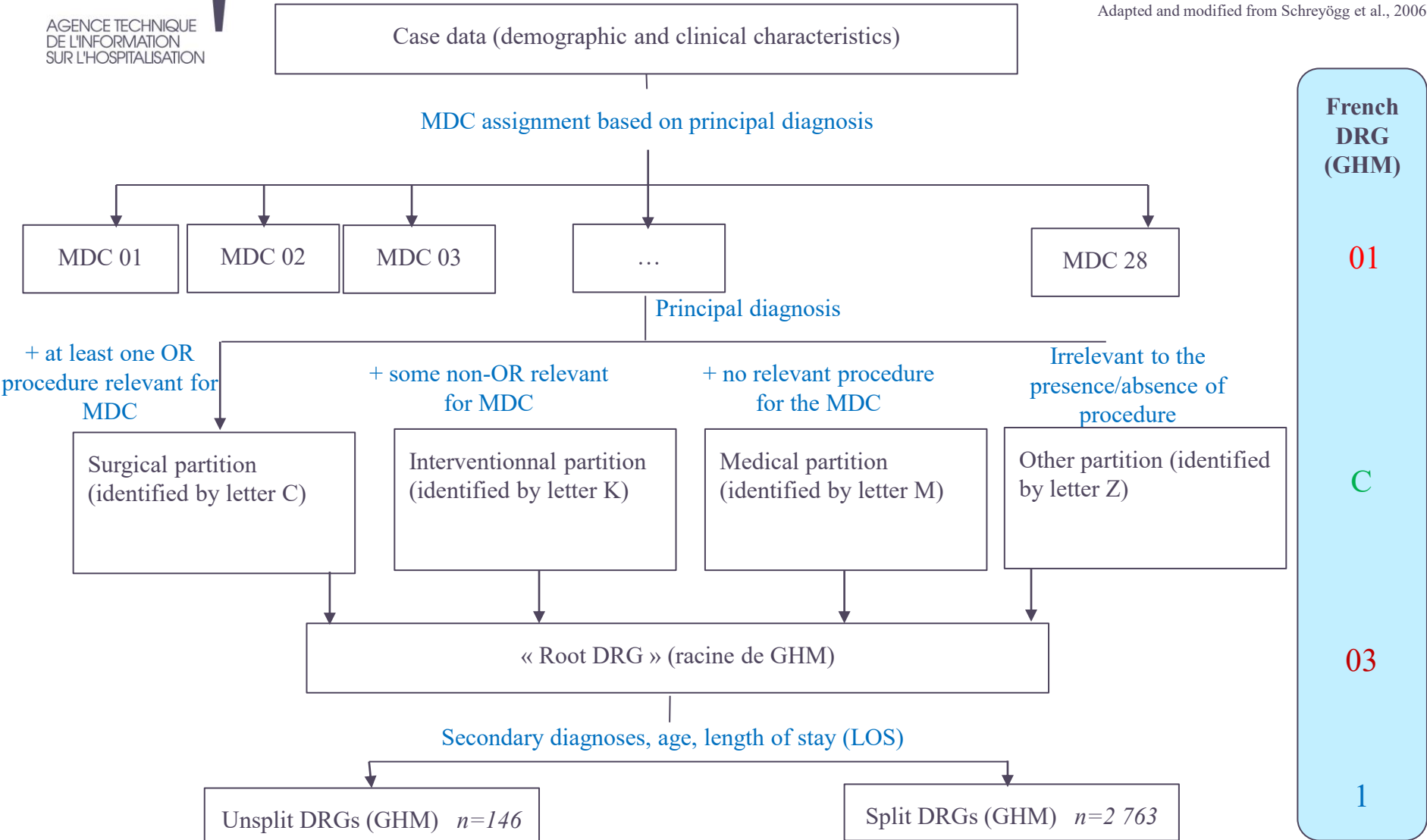# Optimising severity determination in the French DRGs with the exclusions mechanisms

Raphaël Simon
Alexandra Delannoy
Nicolas Dapzol
Vincent Pisetta
Raphaël Schwob

117, bd Marius Vivier Merle
69329 Lyon cedex 03
Téléphone : 04 37 91 33 10
Fax : 04 37 91 33 67
www.atih.sante.fr

Overview of the French DRGs in acute care

Adapted and modified from Schreyögg et al., 2006

Case data (demographic and clinical characteristics)

MDC assignment based on principal diagnosis

| MDC 01 | MDC 02 | MDC 03 | … | MDC 28 |

Principal diagnosis

+ at least one OR procedure relevant for MDC

+ some non-OR relevant for MDC

+ no relevant procedure for the MDC

Irrelevant to the presence/absence of procedure

Surgical partition (identified by letter C)

Interventionnal partition (identified by letter K)

Medical partition (identified by letter M)

Other partition (identified by letter Z)

« Root DRG » (racine de GHM)

Secondary diagnoses, age, length of stay (LOS)

Unsplit DRGs (GHM) *n=146*

Split DRGs (GHM) *n=2 763*

French DRG (GHM)

01

C

03

1

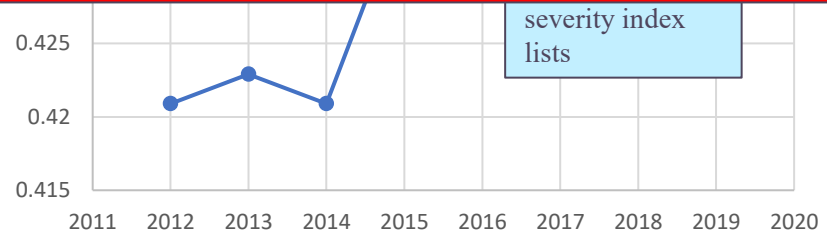# Severity index: Importance and evolution

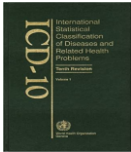| R²(GHM,LOS) in 2019 | Evolution of R²(LOS,GHM) over last years |

01   C   03   1

MOTIVATION FOR UPDATING THE WAY SEVERITY IS COMPUTED
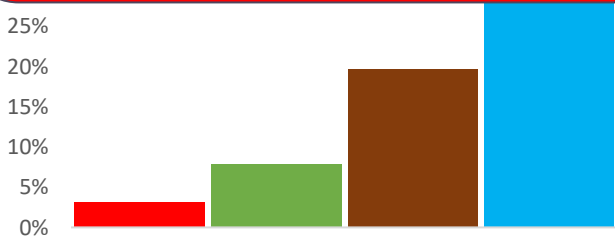
Severity index is essential in the quality of French DRG

severity index lists

Explicative power of severity index seems to reach a plateau

Determination of the Severity index in French DRGs

atih

AGENCE TECHNIQUE
DE L'INFORMATION
SUR L'HOSPITALISATION

ICD-10

STEP 1. Remove the secondary diagnoses (SD) that are related to the principal diagnosis (PD) (*exclusion mechanism*)

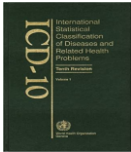**STEP 2.** The severity index of the stay is the max level of its SD

STEP 3. The severity index of the stay is potentially increased by 1 depending on the root-DRG and the age of the patient

STEP 4. The severity index of the stay is potentially decreased if the LOS is lower than a specified threshold:
3 days min. for lvl 2
4 days min. for lvl 3
5 days min. for lvl 4

	STEP 1	STEP 2	STEP 3	
PD	N39.0	N39.0	N39.0	
Root DRG	11M04	11M04	11M04	
Age	82	82	82	
LOS	4	4	4	
Secondary diagnoses (SD)	B96.2 C78.0 Z29.0 U82.2 A41.5	B96.2 / C78.0 1 / Z29.0 3 / U82.2 3 / A41.5 4	B96.2 / C78.0 1 / Z29.0 3 / U82.2 3 / A41.5 4	Level 3

Determination of the Severity index in French DRGs

atih

AGENCE TECHNIQUE
DE L'INFORMATION
SUR L'HOSPITALISATION

ICD-10

	STEP 1. Remove the secondary diagnoses (SD) that are related to the principal diagnosis (PD) (*exclusion mechanism*)	STEP 2. The severity index of the stay is the max level of its SD	STEP 3. The severity index of the stay is potentially increased by 1 depending on the root-DRG and the age of the patient	STEP 4. The severity index of the stay is potentially decreased if the LOS is lower than a specified threshold: 3 days min. for lvl 2 4 days min. for lvl 3 5 days min. for lvl 4
PD	N39.0	N39.0	N39.0	
Root DRG	11M04	11M04	11M04	
Age	82	82	82	
LOS	4	4	4	
Secondary diagnoses (SD)	~~B96.2~~ C78.0 Z29.0 U82.2 A41.5	~~B96.2~~ C78.0 1 Z29.0 3 U82.2 3 A41.5 4	~~B96.2~~ C78.0 1 Z29.0 3 U82.2 3 A41.5 4	Level 3

Context

- Exclusion : A SD is *excluded* if it is not considered for severity level attribution because of the PD

- Why redesigning exclusions ?
  - Stacked over time
    - In 2000 => 400,000 code-pairs
    - In 2022 => 28,000,000 code-pairs
    - The cause of a particular exclusion is usually hard to retrieve

  - A significant part of exclusions is *statistical*
    - A excludes B because R^2 is better if so
    - May not be robust over time and to a change of model
    - Some of them are medically hard to justify and thus are very often questionned by hospitals representatives

> We want to have a set of « medical exclusions », exclusions that are valid both over time and over any possible severity model

Exclusions

Foundational

AUTOMATIC

Each code excludes all codes sharing the same first 3 characters (same ICD-10 category) except for Z-codes

Method
The different causes of exclusion

Exclusions

Foundational

Literal redudancy

AUTOMATIC

Each code excludes all codes sharing the same first 3 characters (same ICD-10 category) except for Z-codes

IDENTITY

Same pathology at different places in ICD-10

Examples :
PD : P54.2 : Neonatal rectal haemorrhage
SD : K62.5 : Haemorrhage of anus and rectum

PD : O74.0 : Aspiration pneumonitis due to anaesthesia during labour and delivery
SD : J69.0 : Pneumonitis due to food and vomit

Method
The different causes of exclusion

Examples:

PD: A04.0 Enteropathogenic Escherichia coli infection
SD: B96.2 Escherichia coli [E. coli] as the cause of diseases classified to other chapters

PD : E10.2 Type 1 diabetes mellitus, with renal complications
SD : N08.3 Glomerular disorders in diabetes mellitus (E10-E14 with common fourth character .2†)

Method
The different causes of exclusion

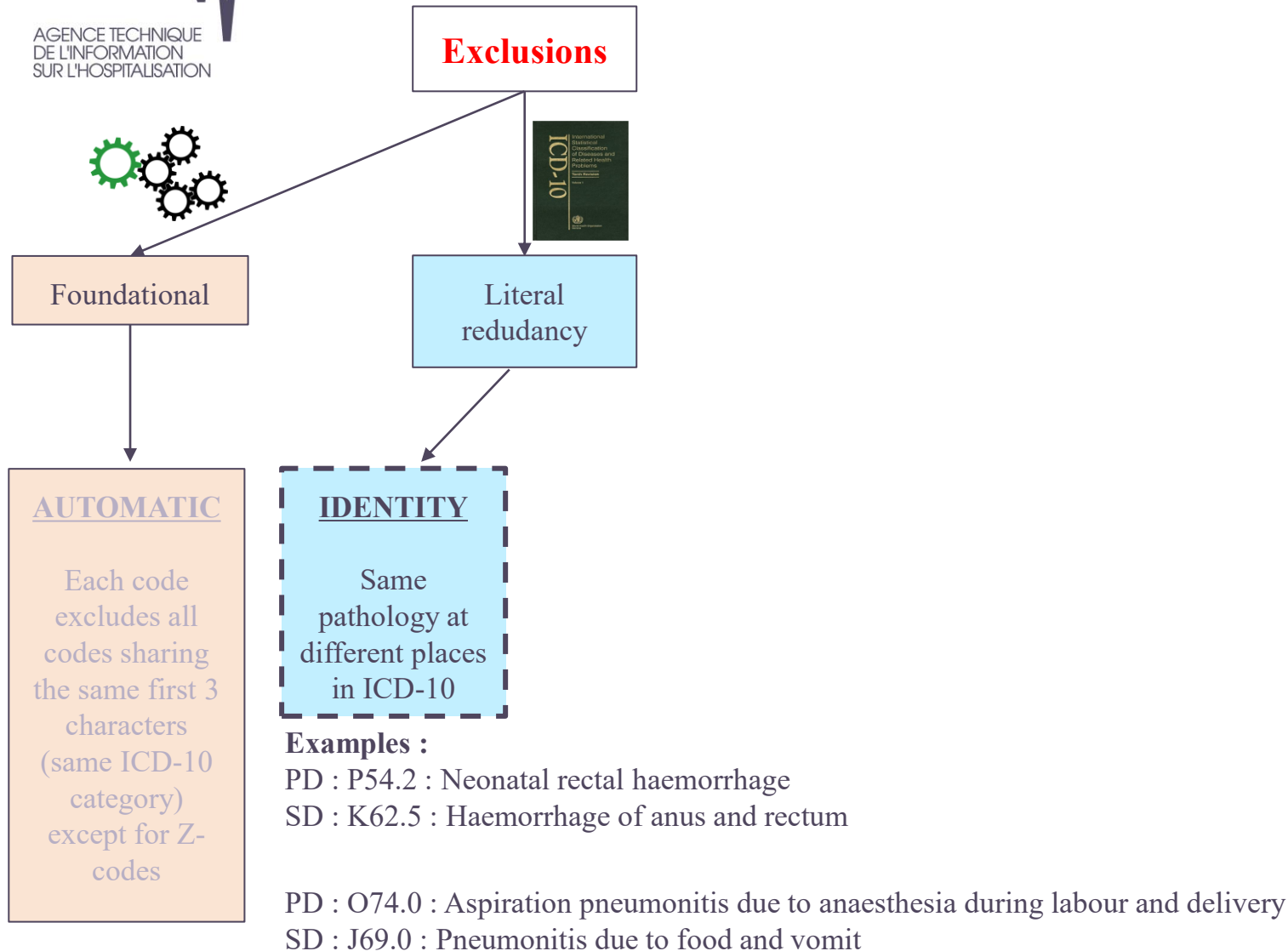
Exclusions

Foundational

Literal redudancy

Medical redudancy

AUTOMATIC

Each code excludes all codes sharing the same first 3 characters (same ICD-10 category) except for Z-codes

IDENTITY
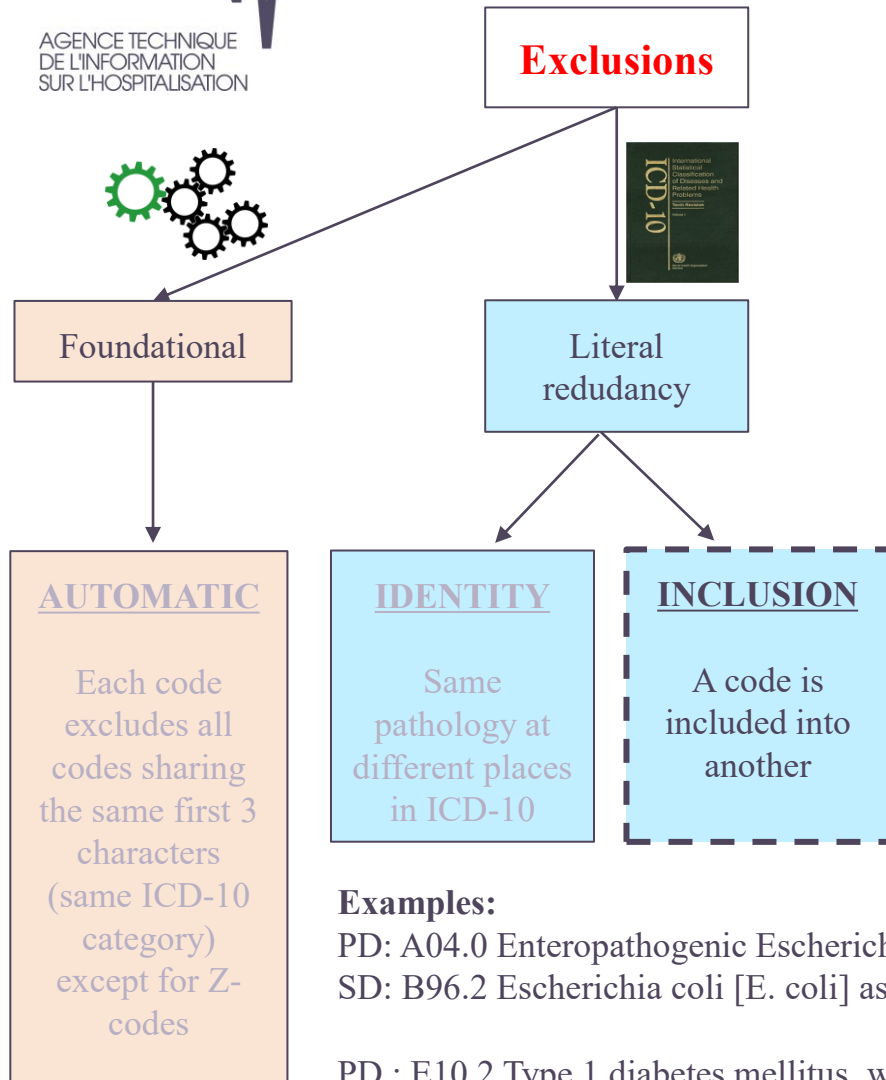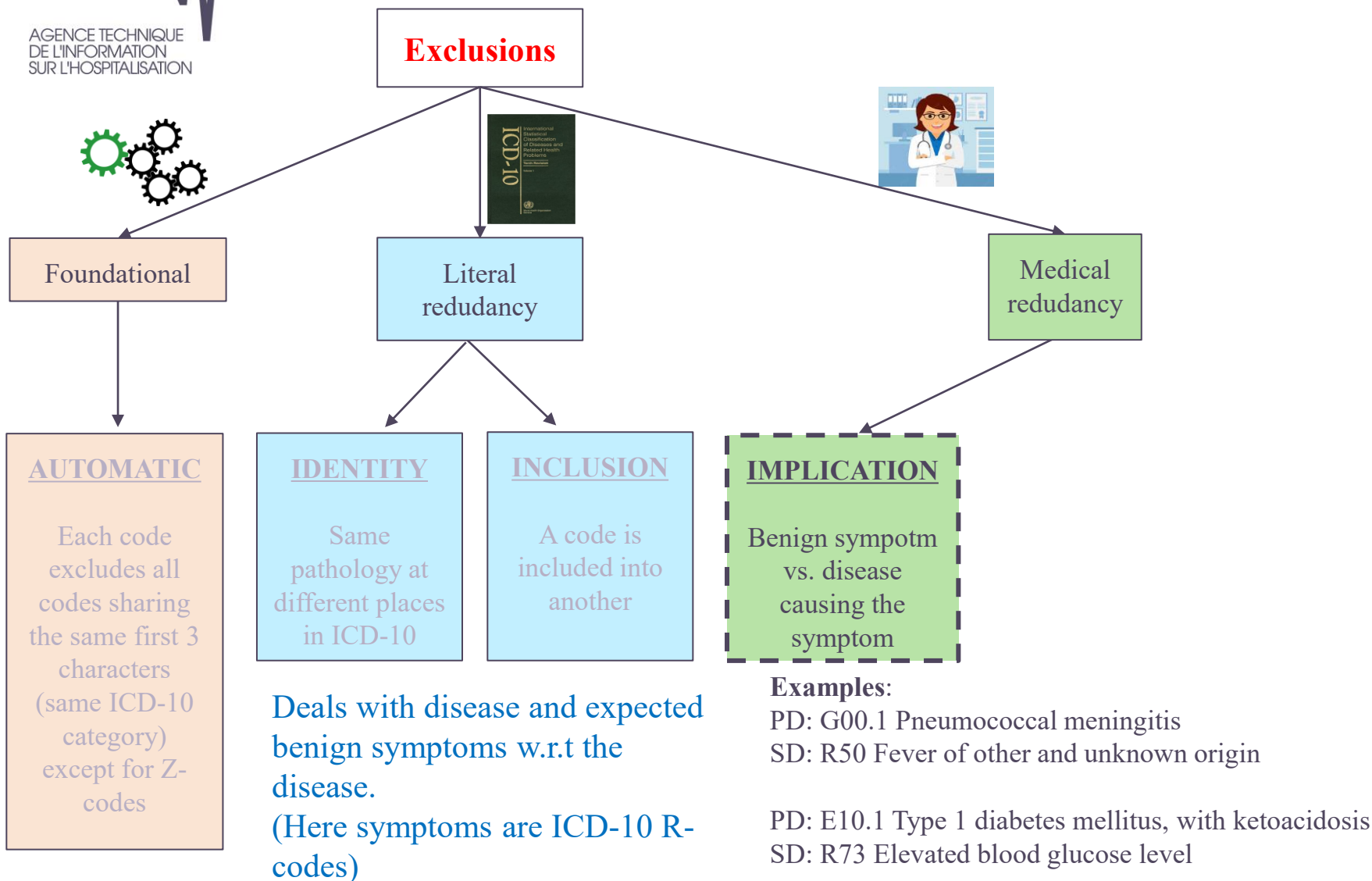
Same pathology at different places in ICD-10

INCLUSION

A code is included into another

Deals with disease and expected benign symptoms w.r.t the disease.
(Here symptoms are ICD-10 R-codes)

IMPLICATION

Benign sympotm vs. disease causing the symptom

Examples:
PD: G00.1 Pneumococcal meningitis
SD: R50 Fever of other and unknown origin

PD: E10.1 Type 1 diabetes mellitus, with ketoacidosis
SD: R73 Elevated blood glucose level

Method
The different causes of exclusion

Exclusions

Foundational

Literal redudancy

Medical redudancy

AUTOMATIC

Each code excludes all codes sharing the same first 3 characters (same ICD-10 category) except for Z-codes

IDENTITY

Same pathology at different places in ICD-10

INCLUSION

A code is included into another

IMPLICATION

Benign sympotm and disease causing the symptom

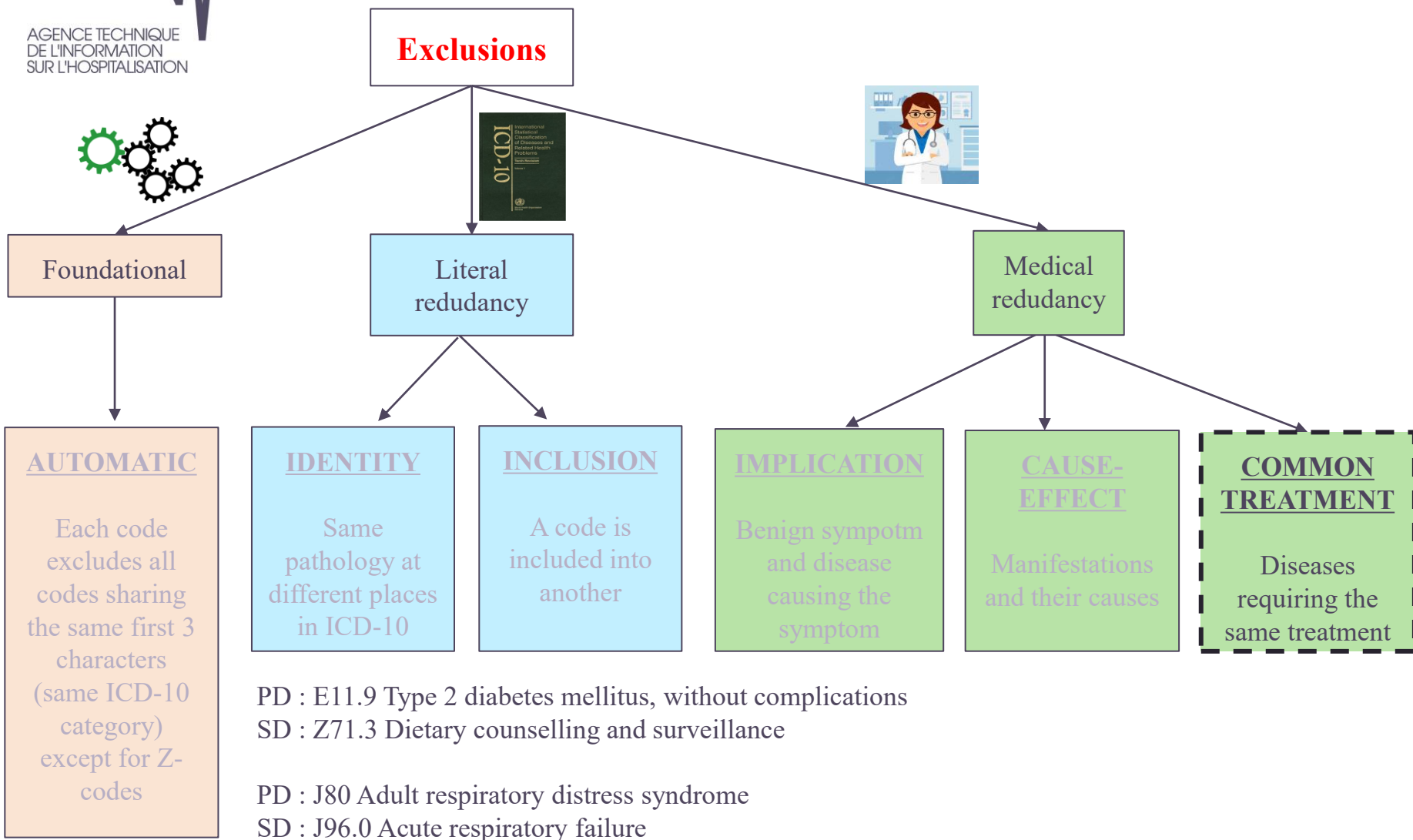**CAUSE-EFFECT**

Manifestations and their causes

Very close to IMPLICATION but not restricted to R-codes

PD: F00 Dementia in Alzheimer disease with early onset (G30.0†)
SD : G30 Alzheimer disease

PD : K29.0 Acute haemorrhagic gastritis
SD : K92.0 Haematemesis

Method
The different causes of exclusion

Exclusions

Foundational	Literal redudancy		Medical redudancy		

| **AUTOMATIC**

Each code excludes all codes sharing the same first 3 characters (same ICD-10 category) except for Z-codes | **IDENTITY**

Same pathology at different places in ICD-10 | **INCLUSION**

A code is included into another | **IMPLICATION**

Benign sympotm and disease causing the symptom | **CAUSE-EFFECT**

Manifestations and their causes | **COMMON TREATMENT**

Diseases requiring the same treatment |

PD : E11.9 Type 2 diabetes mellitus, without complications
SD : Z71.3 Dietary counselling and surveillance

PD : J80 Adult respiratory distress syndrome
SD : J96.0 Acute respiratory failure

Method

- Expected size of code-pairs was huge (millions)
- Necessity to design an algorithm to parse higher level instructions and build the custom-made lists accordingly
  - Instructions have the form **« Set of codes X » excludes « set of codes Y »**
  - **« Set of codes »** may be
    - an ICD-10 category
    - a group of ICD-10 categories
    - a manually defined list of codes in order to capture a specific medical concept (e.g. haemorraghe, spreaded in ICD-10)
    - a single code
    - a mixture of the previous points

Method
Illustration of a set of instructions

Instruction ID

Set of codes in Principal Diagnosis position

Label of the set of codes in PD position (handcrafted)

Set of codes in Secondary Diagnosis (SD) position

Label of the set of codes in SD position

Cause of exclusion

Les lots générant des couples DP/DAS (aucun sélectionné)

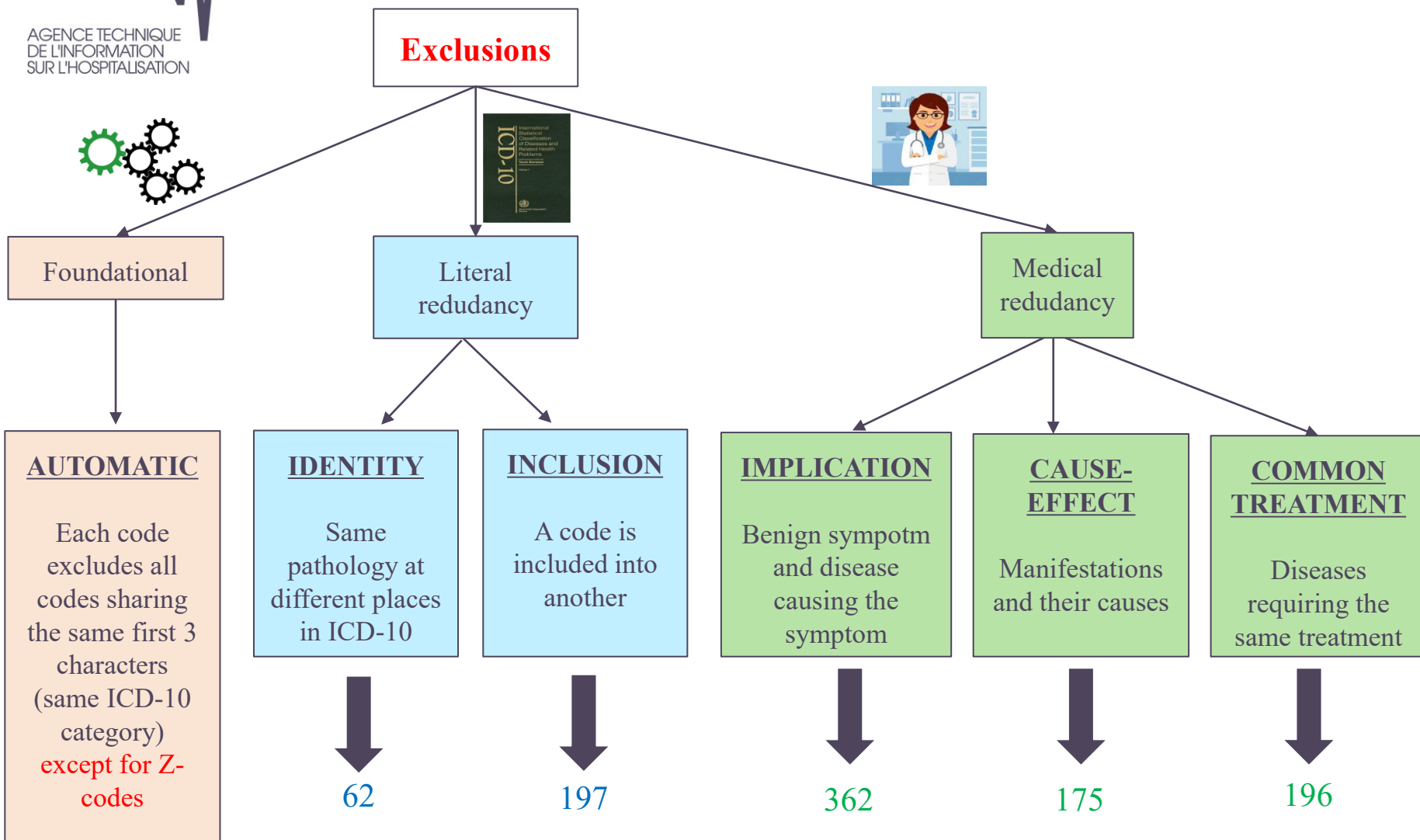| Lot	ID	DP	Lib DP	DAS	Lib DAS	Effet	Cause	Motif
1	1.1	A040|A041|A042|A043|A044|J155|P234|P364|P3640|P3649	Infections à E Coli	B962	Escherichia coli, cause de maladies classées dans d'autres chapitres	exclus	CIM	COMPREND
1	1.2	A048|A058|A288|A488|A498|M008|M0139|P3689|P3690|P3699|Z223	Infections à d'Autres agents bactériens précisés	B968	Autres agents bactériens précisés, cause de maladies classées dans d'autres chapitres	exclus	CIM	COMPREND
1	1.3	A400|A38|A46	Sepsis, scarlatine & érisypèle à streptocoques, groupe A	B950	Streptocoques, groupe A, cause de maladies classées dans d'autres chapitres	exclus	CIM	COMPREND
1	1.4	A401|J153|P233|P360|P3600|P3609	Infections à Strep de gp B	B951	Streptocoques, groupe B, cause de maladies classées dans d'autres chapitres	exclus	CIM	COMPREND

Method
Number of instructions per type of exclusion

Exclusions

Foundational

Literal redudancy

Medical redudancy

AUTOMATIC

Each code excludes all codes sharing the same first 3 characters (same ICD-10 category) except for Z-codes

IDENTITY

Same pathology at different places in ICD-10

INCLUSION

A code is included into another

IMPLICATION

Benign sympotm and disease causing the symptom

CAUSE-EFFECT

Manifestations and their causes

COMMON TREATMENT

Diseases requiring the same treatment

62

197

362

175

196

Method
Extension to imprecise codes

- A set of imprecise lists have been manually designed such that
  - All ICD-10 codes are associated to a list (one list per code) containing their potentially imprecise equivalent codes

- Example : Imprecise codes of *I05.0 Rheumatic mitral stenosis*
  - I08.9 Rheumatic multiple valve disease
  - I09.9 Rheumatic heart disease, unspecified
  - I51.8 Other ill-defined heart diseases
  - I51.9 Heart disease, unspecified
  - I05.8 Other rheumatic mitral valve disease
  - I05.9 Rheumatic mitral valve disease, unspecified

- Then any exclusion of the form ***A excludes B*** is extended automatically to ***« any imprecise code of A » excludes « any imprecise code of B »***

Results
Comparison with existing exclusions

<p align="center">New exclusions (on-going work)</p>

	#Code-pairs excluded	#Code-pairs not excluded	Total
Official exclusions #Code-pairs excluded	5 287 999	23 225 619	28 513 618
#Code-pairs not excluded	278 273	-	
Total	5 566 272		

- Around 20% of existing code-pairs are kept as exclusions in the updated version
- Those results were expected because our goal was to have a set of medical exclusions only, designed to operate as a basis for future models

Conclusion and future work

- A new set of medical exclusions robust and valid for any type of statistical model
  - Progressively integrated into new learning schemes for severity
  - Very huge medical work
  - Only possible with knowledge of both medicine and ICD-10

- This set of medical exclusions will now be enriched with dedicated statistical exclusions by measuring the effect of each combination PD-SD in databases

- An R-shiny app has been designed
  - to be shared with hospitals
    - Their feedback is important to ensure quality and acceptability of the set of instructions
  - to maintain more easily future updates of the set of instructions

Thanks for your attention

**Agence technique de l'information
sur l'hospitalisation**

117, bd Marius Vivier Merle 69329 Lyon cedex 03
Téléphone : 04 37 91 33 10
Fax : 04 37 91 33 67

www.atih.sante.fr

Appendix

- O Link to app