Fit for SNOMED CT?

Kidney Biopsy Codes for Pathologists

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SNOMED CT Business Meeting 22nd April 2021

Who are we?

Kidney Biopsy Codes

KBC

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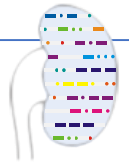
Ghent/Antwerp, Belgium
FCGG

Sabine Leh
Bergen, Norway
NNR

Essentials about non-neoplastic kidney diseases

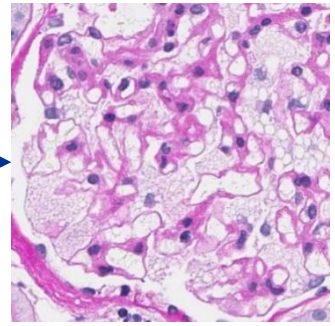
Significance for health care systems, pathologist subspecialisation, pathology reports



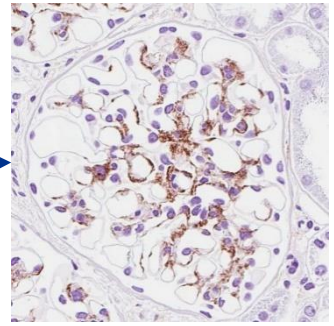
Non-neoplastic kidney biopsy

Complex work-up applying various methods

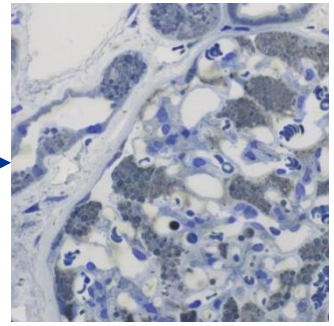
Conventional histology



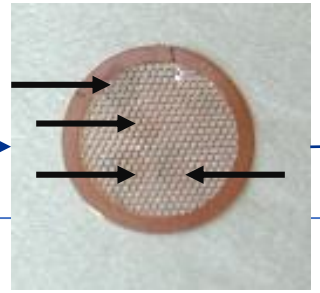
Immunohistochemistry

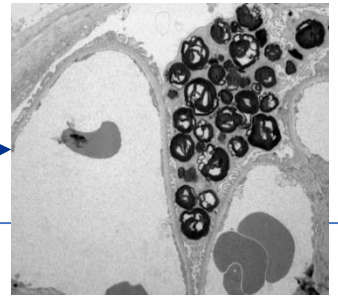


Semithin section



Electron microscopy





Renal biopsy laboratorium, Department of Pathology, Haukeland University Hospital, Bergen

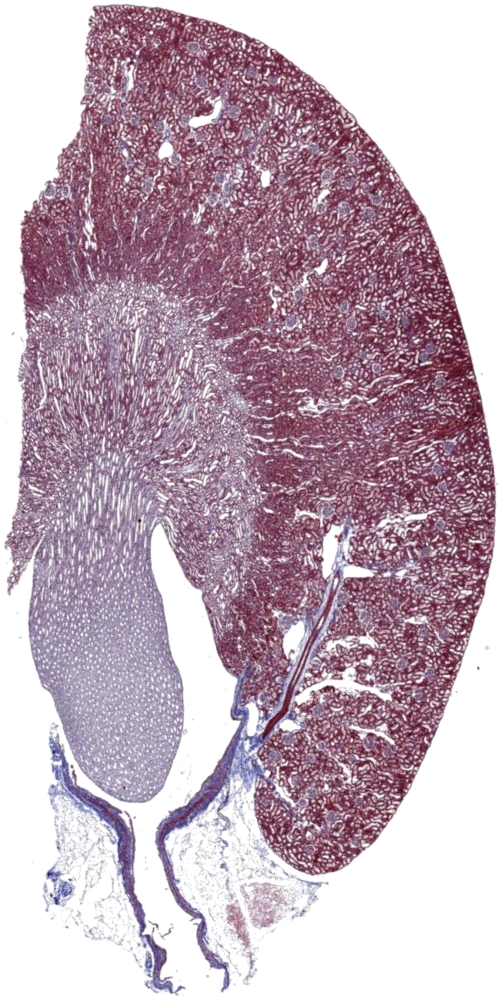
Non-neoplastic kidney biopsy: Some facts

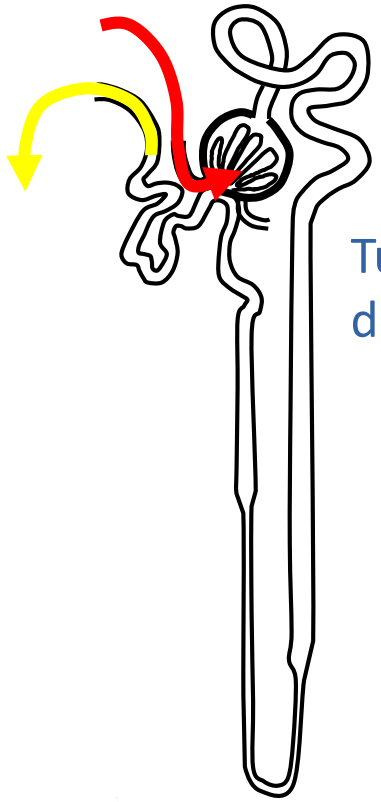
-1 nephropathologist per 2 million people
-2-4 hours of work per biopsy
-Often complex, rare diseases
-Unclear etiology
-Changing classifications
-30-50% of 'clinical' diagnoses change after biopsy
-Treatment schemes more based on experience than RCT

-> NICHE SPECIALTY IN MEDICINE

Fiorentino et al. Am J Nephrol 2015

The kidney

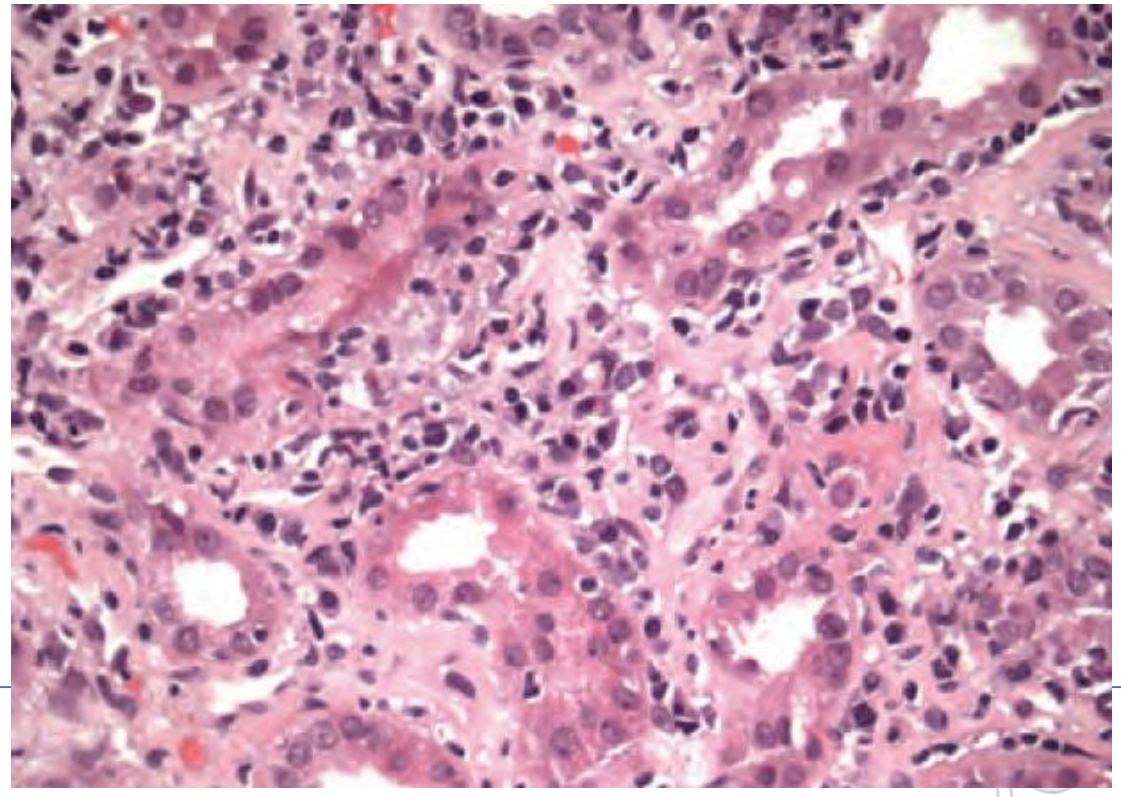




Glomerulonephritis

Tubulointerstitial diseases

Pattern: Inflammation
Disease: Medication-induced allergic nephritis



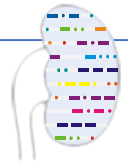
The kidney biopsy report

Acute renal failure with proteinuria (1.8g/day). On NSAID. No hematuria.

Macroscopic description: 2 cilinders of fresh tissue, 15 and 16 mm

Light microscopic description:

It is a fragment of cortical renal parenchyma on which there are 7 glomeruli, 1 of which is sclerous. The glomeruli show a preserved morphology. The mesangial stems are thin, without hypercellularity. There are no circulating cells in the glomerular capillaries. The capillary walls glomerulars are thin and flexible, with no irregularities on their outer side and a double-sided appearance. Interstitium is the site of a diffuse interstitial inflammatory infiltrate composed mainly of cells lymphoplasmocytic inflammatory diseases. However, there are households rich in eosinophils. Some neutrophils are also observed. This infiltration is accompanied by tubulitis lesions characterized by the infiltration of tubular epithelia by lymphocytic cells. We note also acute tubular necrosis lesions characterized by bites, thinning and epithelial detachments. Some foci of tubular rupture are noted, one of which is accompanied by a histiocytic reaction. Interstitial edema beaches are present. Interstitium is also the site of fibrosis whose extent is difficult to determine on this highly inflammatory biopsy specimen but which appears at least moderate with proportional tubular atrophy. The arterial sections show a discrete intimal fibrous thickening. Arteriolar sections sometimes show endothelial turgidity, with no other significant lesions.



The kidney biopsy report

Immunohistological description:

The technique was performed on two fragments of renal parenchyma on which has 6 glomeruli, 3 of which are sclerous. IgG: Enhancement of the membrane network. IgA: Negative. IgM: Negative. C3 : Vascular deposits. C1Q: Rare mesangial grains. Fibrine: Not specific. Albumin: Enhancement of the membrane network. Kappa: Negative. Lambda: Negative.

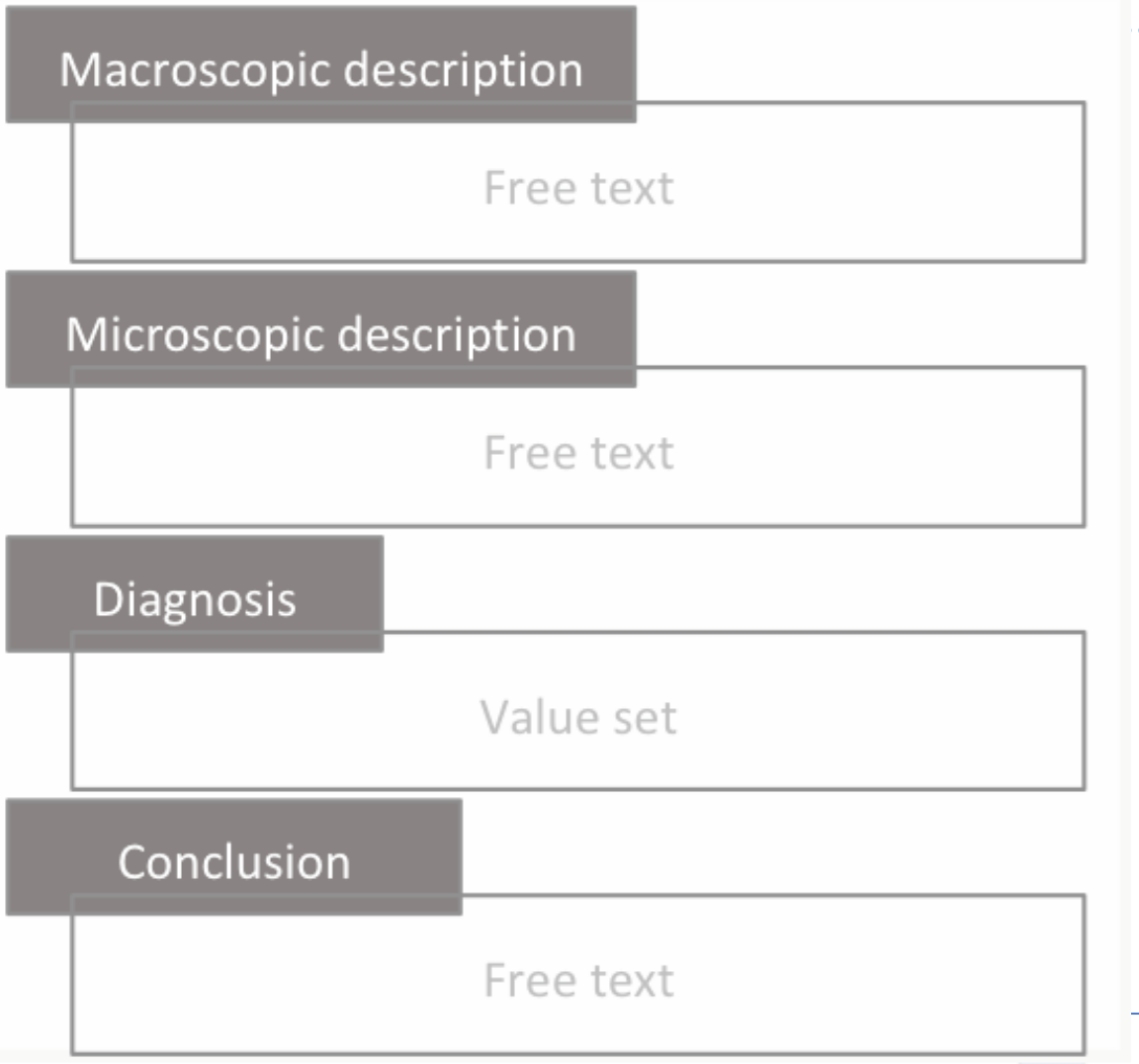
Electron microscopy

Three blocks have been prepared. There were no glomeruli in the specimen. No immune-looking deposits and deposits have been seen along the tubular basement membranes.

Conclusion/Diagnosis:

In summary, microscopy examination revealed the presence of interstitial inflammatory foci rich in eosinophils suggesting first of all an immuno-allergic etiology. This observation remains to be correlated with clinical data.

Structure of the report



Coding practice in kidney biopsy registries

Overview about kidney biopsy registries, coding practice

How do kidney biopsy registries code?

British Columbia Glomerulonephritis Network
Uruguayan Registry of Glomerular Diseases
Scottish Renal Biopsy Registry
Norwegian Renal Registry
Swedish Renal Registry
National Pathology Database Denmark (PATOBANK)
Limburg Renal Registry
Flemish Collaborative GN Group Registry
Spanish Renal Registry
Italian Registry of Renal Biopsies
Czech Registry of Renal Biopsies
Polish Registry of Kidney Biopsies
Japanese Renal Biopsy Registry (J-RBR)
National Renal Biopsy Registry Taiwan
Malaysian Registry of Renal Biopsy
Philippine Renal Disease Registry

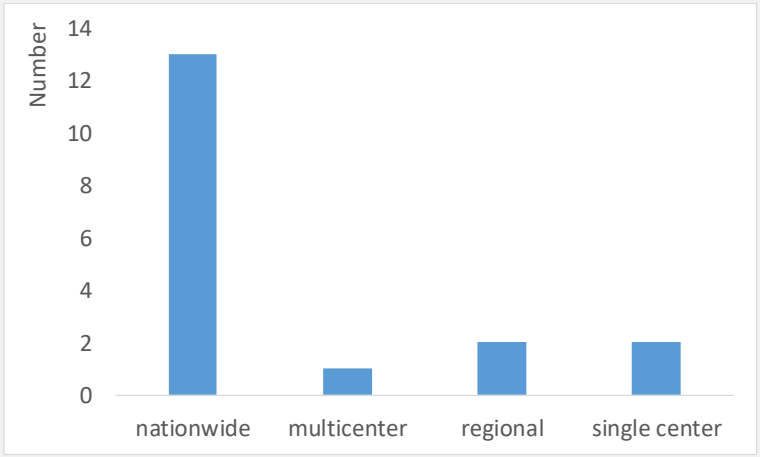
Dendooven A. et al: Coding practice in national and regional kidney biopsy registries, accepted for publication by BMC Nephrology

How do kidney biopsy registries code?

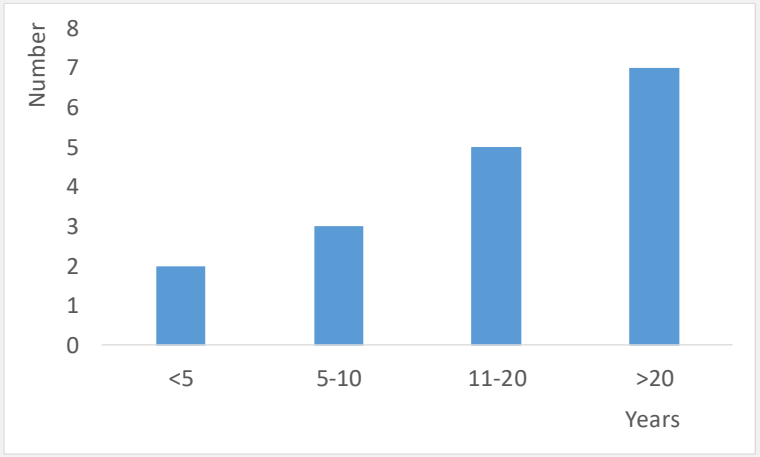
Online survey:

18 participants

Type of registry



Duration of registry



IgA nephropathy, mesangioproliferative GN glomerulonephritis. 15 glomeruli, 1 cellular crescent, 2 segmental sclerosis, 4 global glomerulosclerosis. Tubular atrophy in around 20% of the cortical area. Moderate arteriolosclerosis and arteriosclerosis. IH: Dominant IgA positivity EM: Mesangial electron dense deposits
Oxford classification: M1 E0 S1 T0 C1

PHILIPPINE RENAL DISEASE REGISTRY

Mesangioproliferative GN
IgA nephropathy

NORWEGIAN RENAL REGISTRY (NNR)

ERA-EDTA PRD	1128	IgA nephropathy-histologically proven
NNR 2013	300	IgA nefropati
NNR 2011	3	IgA nefropati

JAPAN RENAL BIOPSY REGISTRY (J-RBR)

IgA nephropathy (histological diagnosis by pathogenesis)
Mesangial proliferative glomerulonephritis (histological diagnosis by histopathology)

SWEDISH RENAL REGISTRY

ERA-EDTA PRD	1128	IgA nephropathy-histologically proven
M46860		mesangial proliferative GN
M53300		glomerulosclerosis
M52200		arteriolosclerosis
M52220		arteriolosclerosis without fibrinoid necrosis

MALAYSIAN REGISTRY OF RENAL DISEASE

IgA nephropathy

SCOTTISH RENAL BIOPSY REGISRTY

ERA-EDTA PRD 1128 IgA nephropathy – histologically proven

PATOBANK (DENMARK)

T 71000	kidney
M46862	diffuse mesangial proliferative GN
S67300	IgA nephritis
M53300	glomerulosclerosis
M58000	tubular atrophy

LIMBURG RENAL REGISRTY

Mesangioproliferative glomerulonephritis
IgA nephropathy
Interstitial fibrosis
Arteriosclerosis

BRITISH COLUMBIA GLOMERULONEPHRITIS NETWORK

G23.1	IgA nephropathy primary
V3	Hypertensive/benign/ischemic nephrosclerosis

FLEMISH COLLABORATIVE GLOMERULONEPHRITIS GROUP (FCGG-NBVN)

FCGG-NBVN	3/3a	IgA nephropathy / IgA nephropathy, primary
ERA-EDTA PRD	1128	IgA nephropathy –histologically proven

URUGUAYAN REGISTRY OF GLOMERULAR DISEASES

1151 IgA nephropathy

SPANISH REGISTRY OF GLOMERULONEPHRITIS

? IgA nephropathy

POLISH REGISTRY OF RENAL BIOPSIES (PRRB)

124 Class IV (diffuse proliferative) lesions in IgA nephropathy

ITALIAN REGISTRY OF RENAL BIOPSIES (IRRB)

ERA-EDTA PRD 1128 IgA nephropathy – histologically proven

CZECH REGISTRY OF RENAL BIOPSIES (CRRB)

1730 IgA nephropathy with crescents

CROATIA

IgA nephropathy

ROMANIA "Dr. Carol Davila"

IgA nephropathy

KBC

Published international coding systems

Homemade coding systems mapped to international published coding systems

How do kidney biopsy registries code?

Microscopy:
15 glomeruli, 1 cellular crescent, 2 segmental glomerulosclerosis, 4 global glomerulosclerosis.
Tubular atrophy in around 20% of the cortical area.
Moderate arteriolosclerosis and arteriosclerosis.
IH: *Dominant IgA positivity.*
EM: *Mesangial electron dense deposits.*

Diagnosis:
Mesangioproliferative glomerulonephritis
IgA nephropathy

Oxford classification: M1 E0 S1 T0 C1

IgA nephropathy-primary (1)	proprietary
IgA nephropathy with crescents (1)	proprietary
IgA nephropathy, primary (1)	proprietary
IgA nephropathy-histologically proven (5)	ERA-EDTA PRD
IgA nephropathy (histological diagnosis by pathogenesis) (1)	proprietary
IgA nephropathy (5)	proprietary
IgA nephritis (1)	SNOMED old
IgA nefropati (1)	proprietary
Class IV (diffuse proliferative) lesions according to Haas classification in IgA Nephropathy (1)	proprietary

There is a need for

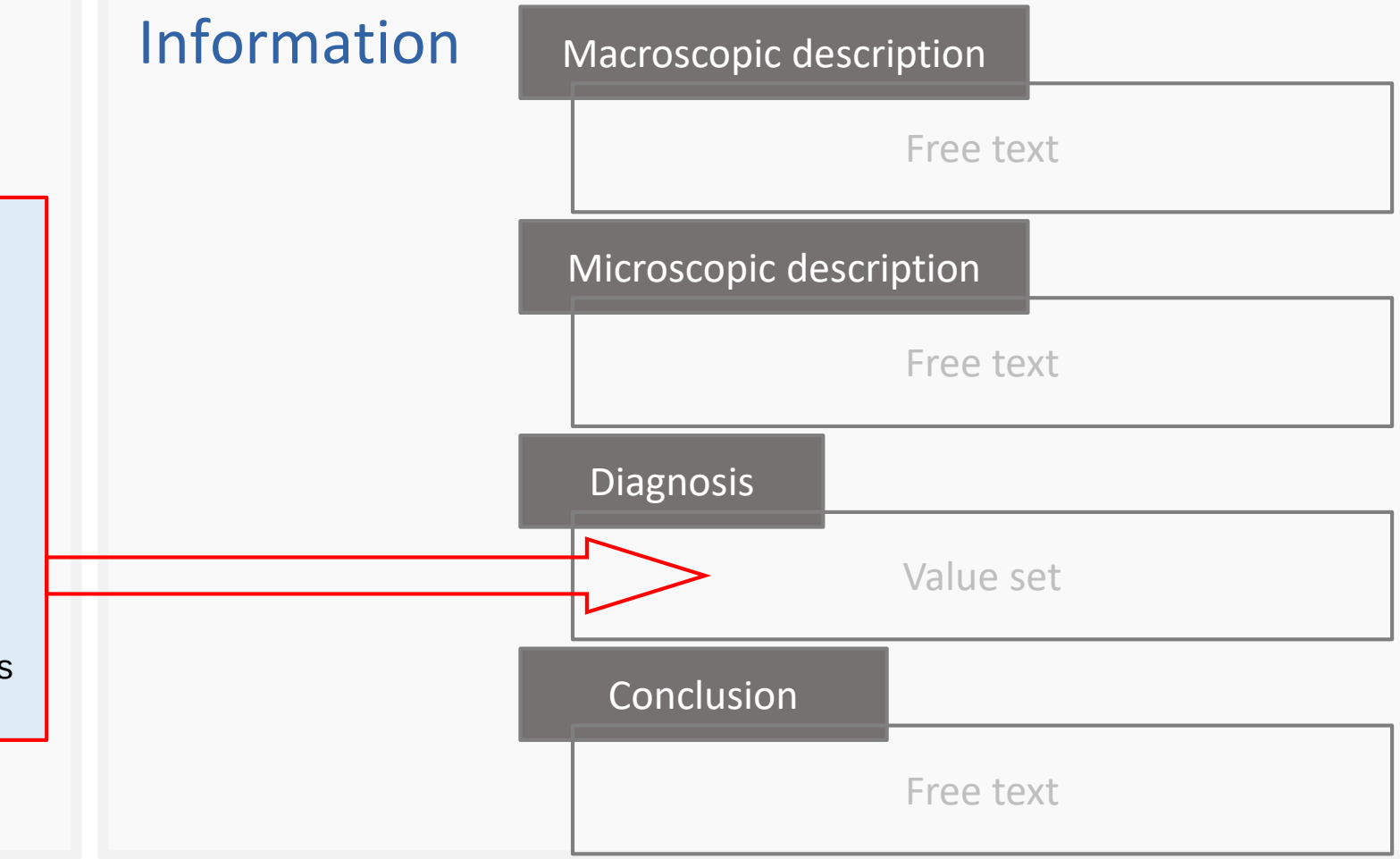
an international coding system that meets the needs of kidney biopsy registries in order to utilize the potential of these registries

Registries are coding based on pathology reports

Terminology

IgA nephropathy/HSP
Infection-related GN
Lupus nephritis
Membranous nephropathy
Pauci-immune glomerulonephritis
Anti-GBM glomerulonephritis
Podocytopathy
Podocytopathy, primary
Podocytopathy, secondary
Podocytopathy, not primary, not genetic
C3 glomerulopathy
Glomerular disease with monoclonal Ig deposits
Cryoglobulinemic glomerulonephritis

Information



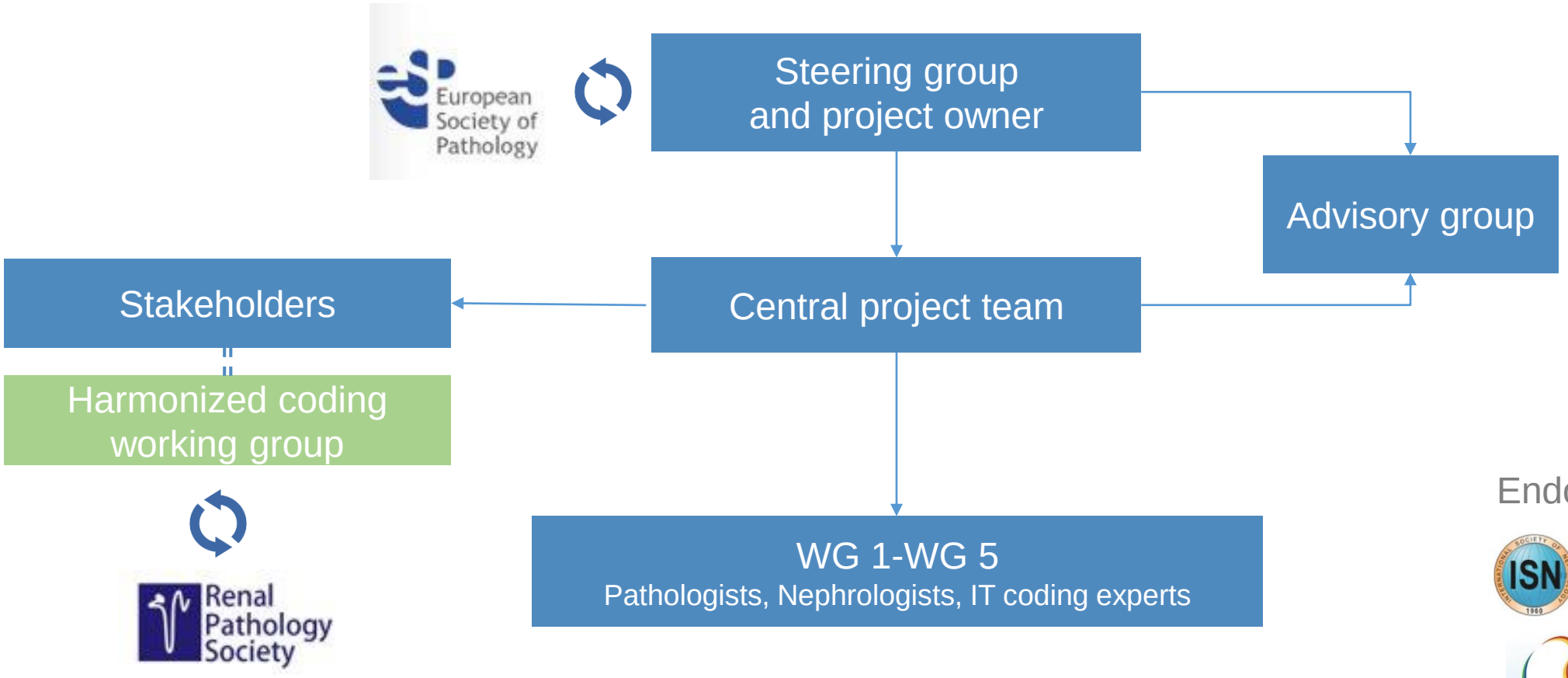
Why are we conducting this project?

We want to develop a terminology with corresponding codes (or “code values”) applicable to every non-neoplastic kidney biopsy for use by nephropathologists, nephropathology units or kidney biopsy registries.

Kidney Biopsy Codes KBC

Project organisation, work packages, project status

Kidney Biopsy Codes project organization



Endorsement

International Society of Nephrology
Advancing kidney health worldwide. Together.

era edta
LEADING EUROPEAN NEPHROLOGY

Steering group
and project owner

Kerstin Amann
Ronald Cornet
Loreto Gesualdo
Helmut Hopfer

Central project team

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Germany

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Basel
Switzerland

Ronald Cornet
Amsterdam
Netherlands

Loreto Gesualdo
Bari
Italy

Principles

How we want to build our coding system for non-neoplastic kidney biopsies?

Workshop WP 2 principles Maastricht 21.06.2018

First row (left to right): Tri Nguyen (Netherlands), Evelyne Lerut (Belgium)
Second row: Han Peetermans (Belgium), Thorsten Wiech (Germany), Candice Roufousse (UK), Myrurgia Abdul Hamid M.A. (Netherlands), Amélie Dendooven (Belgium), Joris Roelofs (Netherlands), Sabine Leh (Norway)

WP2: Principles

1. Coding of more than one morphological pattern is possible
2. KBC allows coding along several axes
3. Coding multiple diagnoses is possible with KBC
4. KBC provides for unambiguous coding
5. Governance is established
6. KBC reflects state-of-the-art knowledge
7. KBC is simple and quick to use
8. KBC is freely accessible
9. Use of KBC is flexible according to the user´s needs
10. Mapping of KBC to existing coding systems is possible
11. KBC provides synonyms for concepts
12. The workload in production, maintenance and governance is minimised
13. KBC allows for various operating modalities such as coding on paper, but also coding in digital systems and databases

KBC: design and content (WP3)

Basic technical design, existing terminologies matching this design?, choose a reference terminology, generate the definitive coding system, provide a mapping example

Is there a terminology around we can use?

SNOMED CT
The global language of healthcare

orphanet

Orphanet Rare Disease ontology (ORDO)

World Health Organization

ICD-11

human phenotype ontology

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Primary renal disease (PRD) codes

How to build a terminology?

"Domain knowledge and experience"

"Domain specific documents"

Proprietary registry coding systems

Pathology reports

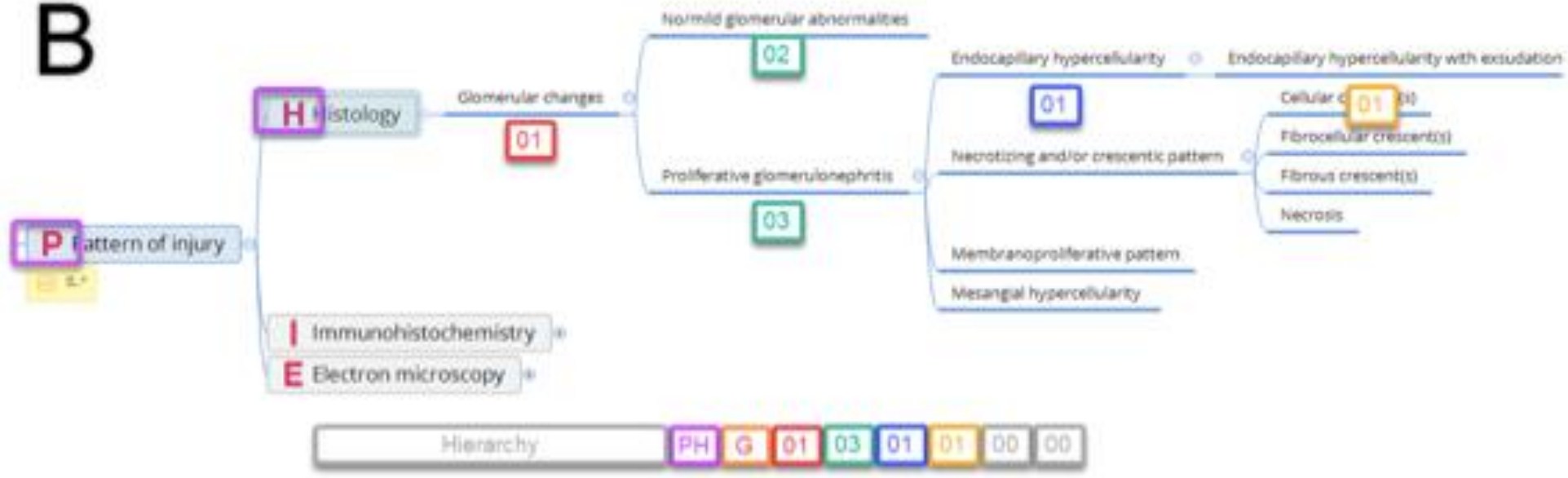
Prieto-Díaz, R. (2003). A faceted approach to building ontologies. Proceedings Fifth IEEE Workshop on Mobile Computing Systems and Applications, IEEE.

Tools: excel

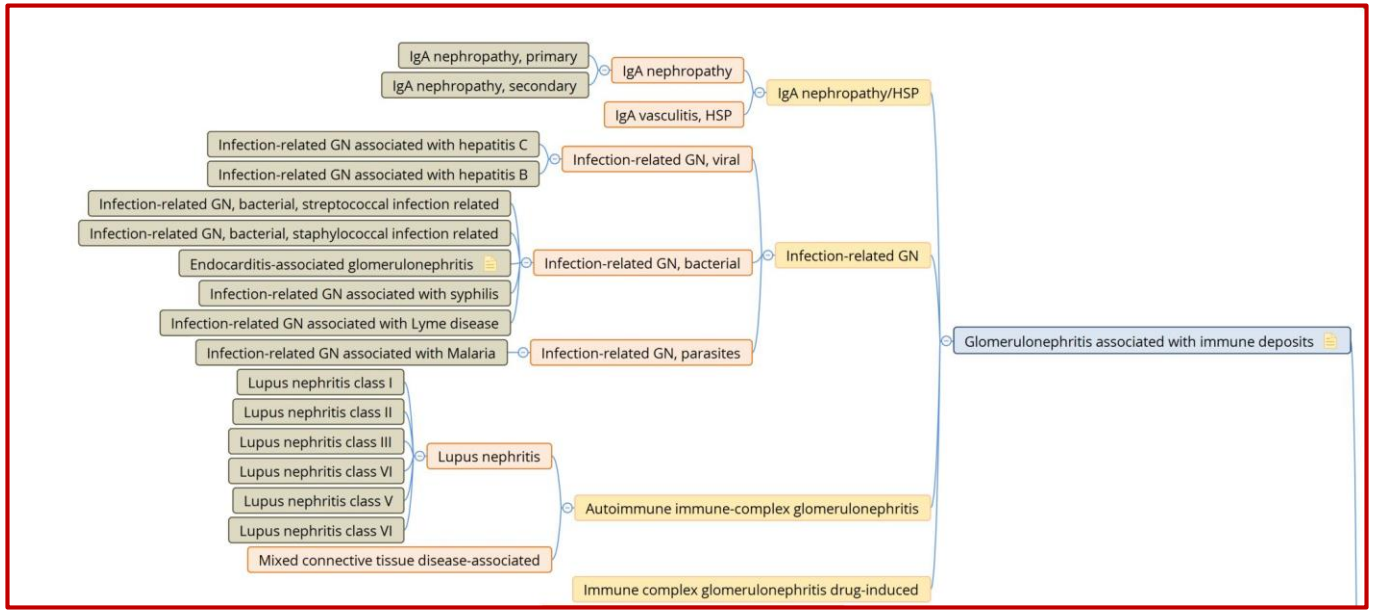
A

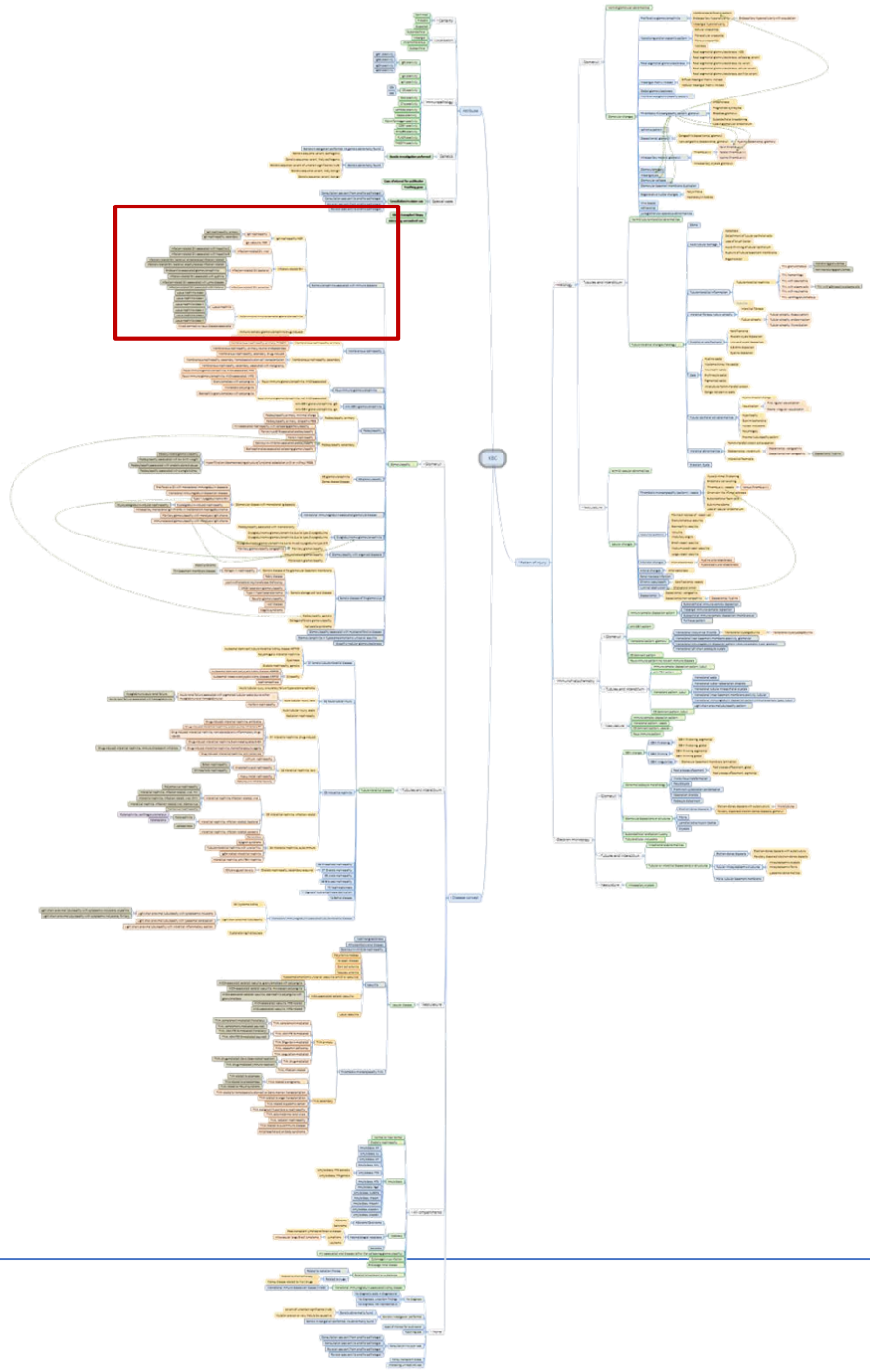
1	2	3	4	5	Do not change this co	Item (preferred term)
PH G 01	00	00	00	00	PH_G_01_00_00_00_00	**Glomerular changes**
PH G 01	02	00	00	00	PH_G_01_02_00_00_00	**No/mild glomerular abnormalities**
PH G 01	03	00	00	00	PH_G_01_03_00_00_00	**Proliferative glomerulonephritis**
PH G 01	03	01	00	00	PH_G_01_03_01_00_00	**Endocapillary hypercellularity**
PH G 01	03	01	01	00	PH_G_01_03_01_01_00	Endocapillary hypercellularity with exsudation
PH G 01	03	02	00	00	PH_G_01_03_02_00_00	**Necrotizing and/or crescentic pattern**
PH G 01	03	02	01	00	PH_G_01_03_02_01_00	Cellular crescent(s)
PH G 01	03	02	02	00	PH_G_01_03_02_02_00	Fibrocellular crescent(s)
PH G 01	03	02	03	00	PH_G_01_03_02_03_00	Fibrous crescent(s)
PH G 01	03	02	04	00	PH_G_01_03_02_04_00	Necrosis

B

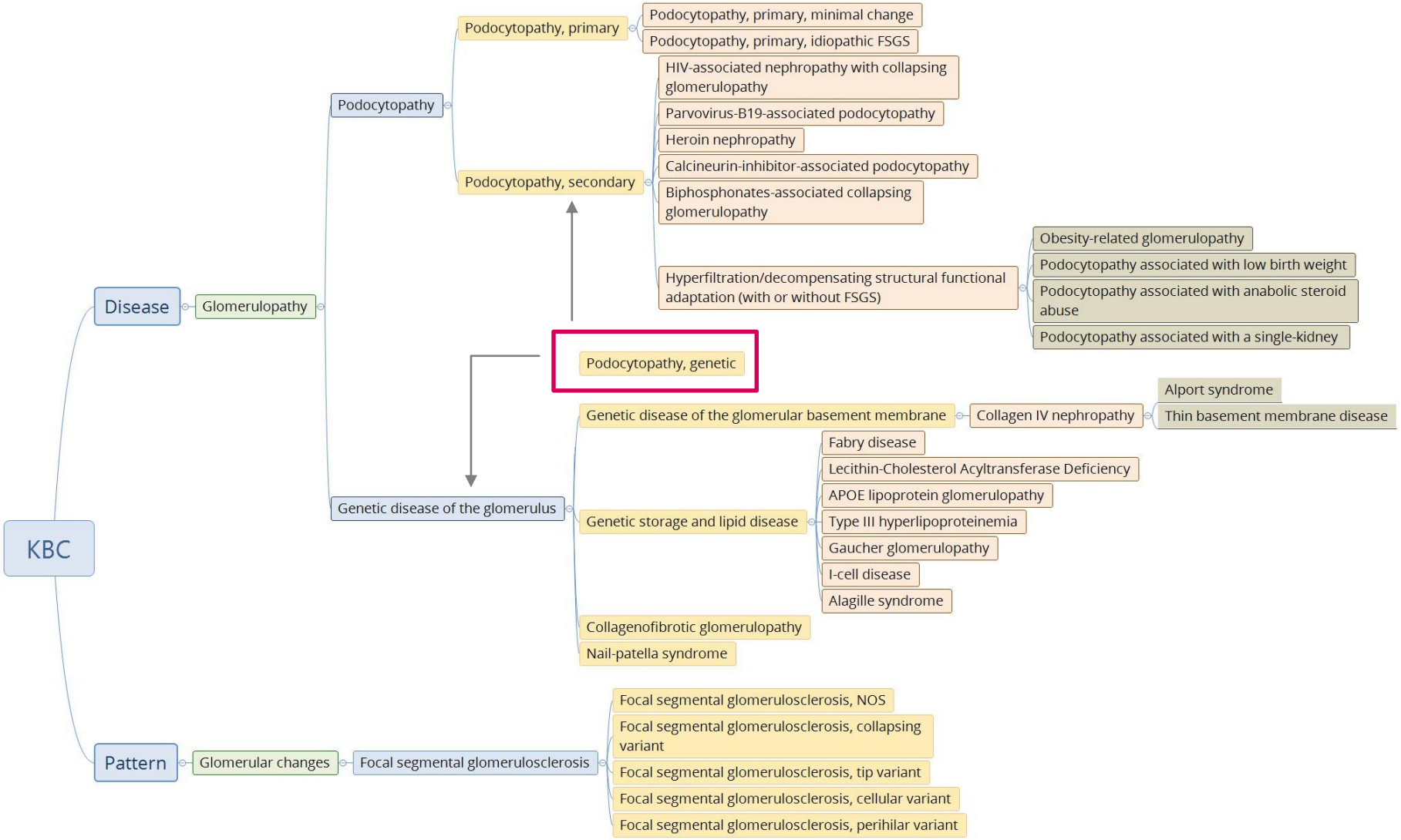


Tools: mindmap

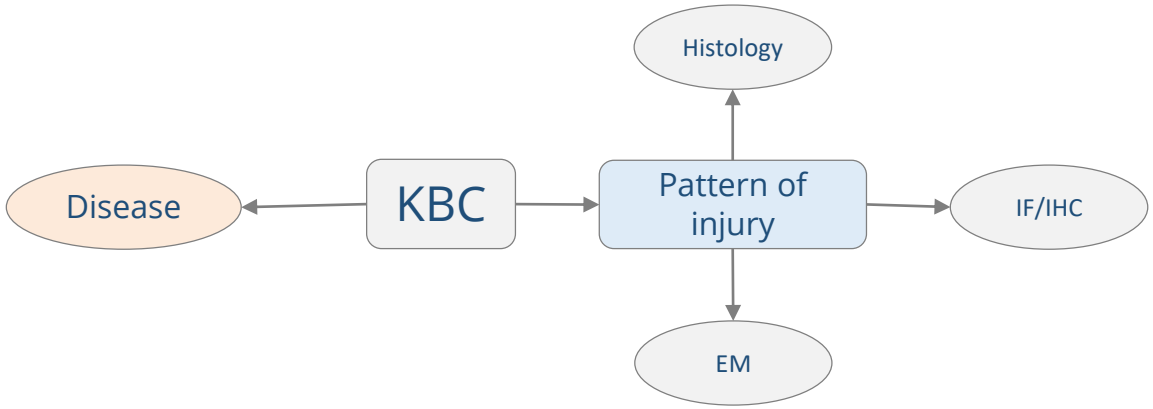




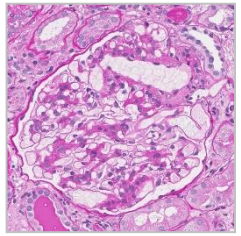
Hierarchical structure



Coding along several axes

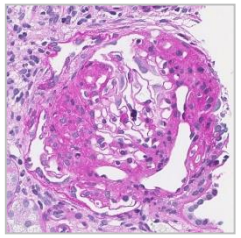


Coding along several axes: example IgA nephropathy



Focal segmental glomerulosclerosis

Mesangial hypercellularity



Histology

IgA nephropathy

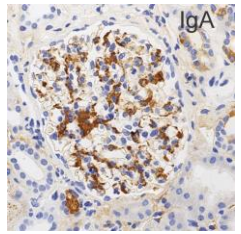
Disease

KBC

Pattern of injury

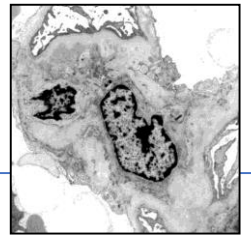
IF/IHC

Mesangial immune complex deposition



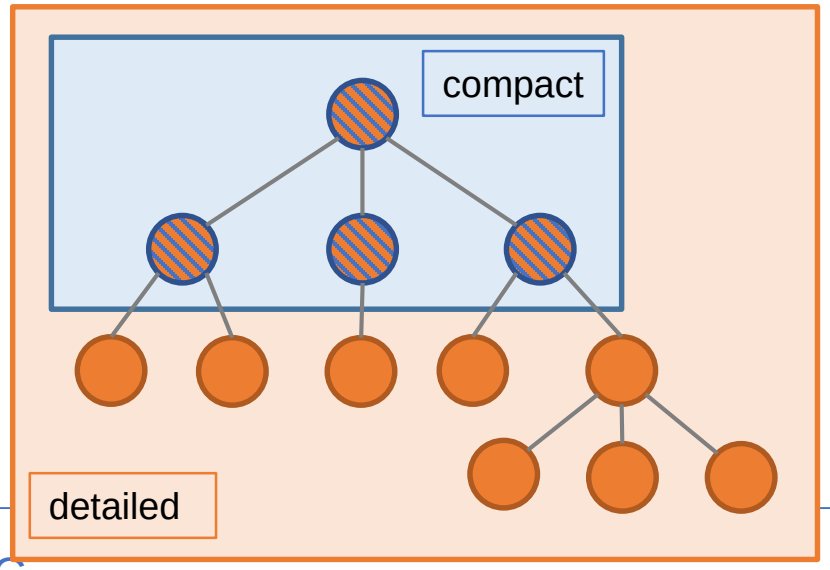
EM

Electron-dense deposits, glomeruli



Compact / detailed

	Number of concepts
Compact	**142**
Detailed	369
Sum	511



IgA vasculitis, HSP
Infection-related GN
Infection-related GN, viral
Infection-related GN associated with hepatitis B
Infection-related GN associated with hepatitis C
Infection-related GN, bacterial
Infection-related GN, bacterial, streptococcal infection related
Infection-related GN, bacterial, staphylococcal infection related
Endocarditis-associated glomerulonephritis
Infection-related GN associated with syphilis
Infection-related GN associated with Lyme disease
Infection-related GN, parasites
Infection-related GN associated with malaria
Autoimmune immune-complex glomerulonephritis
Lupus nephritis
Lupus nephritis class I
Lupus nephritis class II
Lupus nephritis class III
Lupus nephritis class IV
Lupus nephritis class V
Lupus nephritis class VI
Mixed connective tissue disease-associated
Immune-complex glomerulonephritis drug-induced
Membranous nephropathy
Membranous nephropathy, primary
Membranous nephropathy, primary, PLA2R
Membranous nephropathy, primary, THSD7A
Membranous nephropathy, primary, neutral endopeptidase
Membranous nephropathy, secondary
Membranous nephropathy, secondary, drug-induced
Membranous nephropathy, secondary, hematopoietic stem cell transplantation
Membranous nephropathy, secondary, associated with malignancy
Pauci-immune glomerulonephritis
Pauci-immune glomerulonephritis, ANCA-associated
Pauci-immune glomerulonephritis, ANCA-associated, PR3-ANCA-positive
Pauci-immune glomerulonephritis, ANCA-associated, MPO-ANCA-positive
Microscopic polyangiitis
Granulomatosis with polyangiitis
Eosinophilic granulomatosis with polyangiitis
Pauci-immune glomerulonephritis, not ANCA-associated

Infection-related GN
Autoimmune immune-complex glomerulonephritis
Lupus nephritis
Immune-complex glomerulonephritis drug-induced
Membranous nephropathy
Pauci-immune glomerulonephritis

Attributes

… are few additional concepts outside of the two main axes

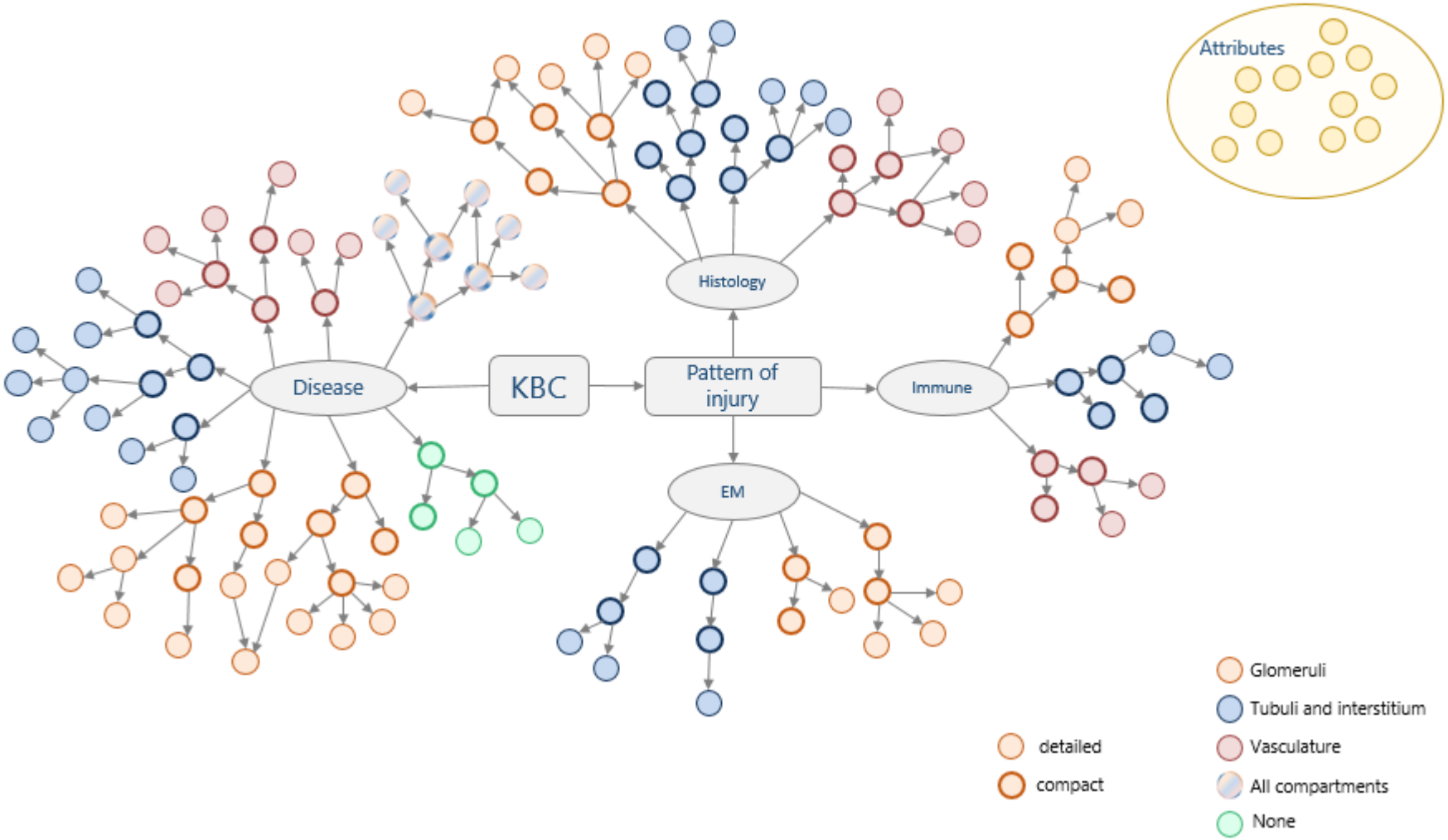
… are always related to a *disease concept* or *pattern of injury* concept

… are used for additional information without changing the related concepts.

Diagnostic certainty
Confirmed
Probable
Suspected

Genetic investigation
Genetic investigation performed
Genetic investigation performed, no genetic abnormality found
Genetic abnormality found
Genomic sequence variant, pathogenic
Genomic sequence variant, likely pathogenic
Genomic sequence variant of uncertain significance (VUS)
Genomic sequence variant, likely benign
Genomic sequence variant, benign

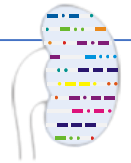
Special cases
Case of interest for publication
Teaching case
Consultation/revision case
Consultation case sent from another pathologist
Consultation case sent to another pathologist
Revision case sent from another pathologist
Revision case sent to another pathologist
Kidney transplant biopsy
Interesting unresolved case


Attributes
Histology
Disease
KBC
Pattern of injury
Immune
EM
detailed
compact
Glomeruli
Tubuli and interstitium
Vasculature
All compartments
None

Structure of KBC list: sum-up

Codes:

- are organized along to axes: pattern of injury and disease
- are part of a polyhierachy with child/parent relations
- are related to compartments
- belong to a compact and/or detailed list
- include concepts for attributes
- have synonyms



Initial draft

Basic design

Use cases

KBC code list v0.6

Central project team

Quality assurance

KBC code list v0.6

Use cases

WP3 participants

Selected problems

WS Nice

KBC code list v0.7

Central project team

Ready for consensus

Workshop Nice 09.09.2019

There is a terminology around we can use

SNOMED CT
The global language of healthcare

World Health Organization

ICD-11

orphanet

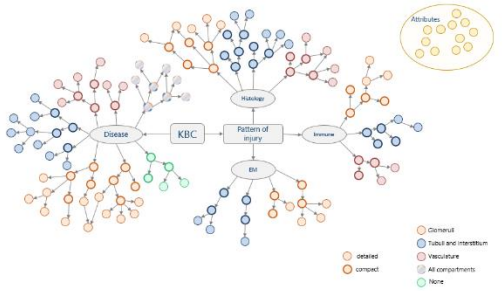
Orphanet Rare Disease ontology (ORDO)

era edta
LEADING EUROPEAN NEPHROLOGY

Primary renal disease (PRD) codes

human phenotype ontology

Mapping exercise



Axis	Nr of terms	SNOMED alternative available	SNOMED term is a renal term	'General' (not-specific glomerular) term
Pattern of injury-Histology	49	23/49	12/23	11/23
Pattern of injury-Immune studies	13	1/13	0/1	1/1
Pattern of injury-Electron microscopy	28	5/28	0/5	5/5
Disease concept	105	59/105	46/59	13/59

As-is

- Describe coding systems: Kidney biopsy registries and nephropathology centres
- Describe international terminologies

Principles

- Define the requirements the KBC has to fullfill
- Build the principles for the solution

Design

- Technical description of the basic design and a rational for choosing a specific system
- A complete code list and an example how to map an existing diagnosis list to the new codes

Review

- Organize and conduct a review process, align with international partners
- Implement suggestions for improvement and comments

Governance

- Build structures for maintenance and further development; provide a economical model
- Online publication of the KBC

Review process (WP4) and governance (WP5)

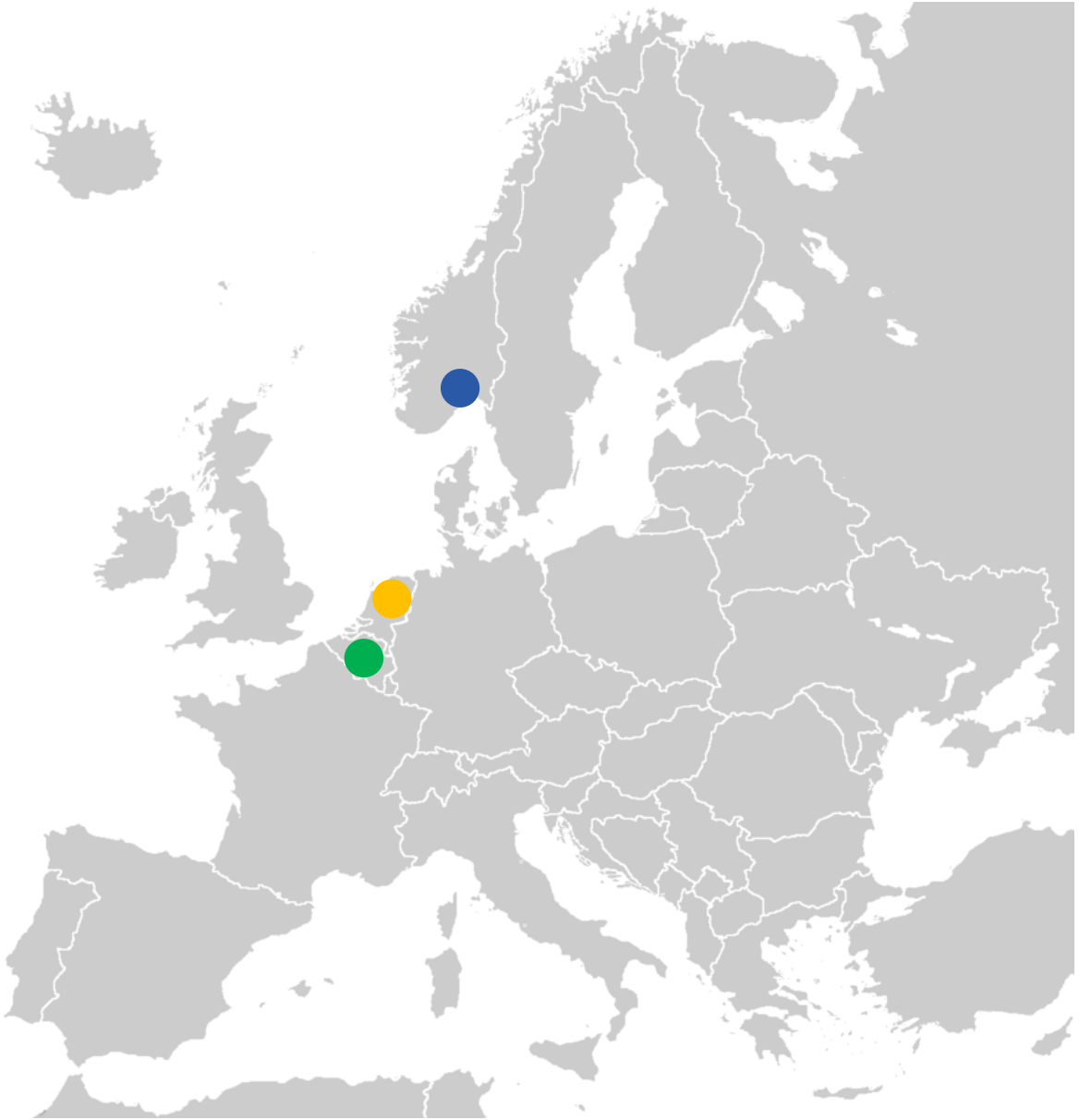
Establish an international review process with input from pathologists worldwide, explore avenues for implementation, provide digital tools, establish a structure for governance

Problems we are facing

- Digital tools
  - represent the complexity
  - visualize the system
  - can handle a review process
  - enable maintenance
- Manpower (terminology experts, IT competence)
- Funding

Status of contacts with NRCs SNOMED CT

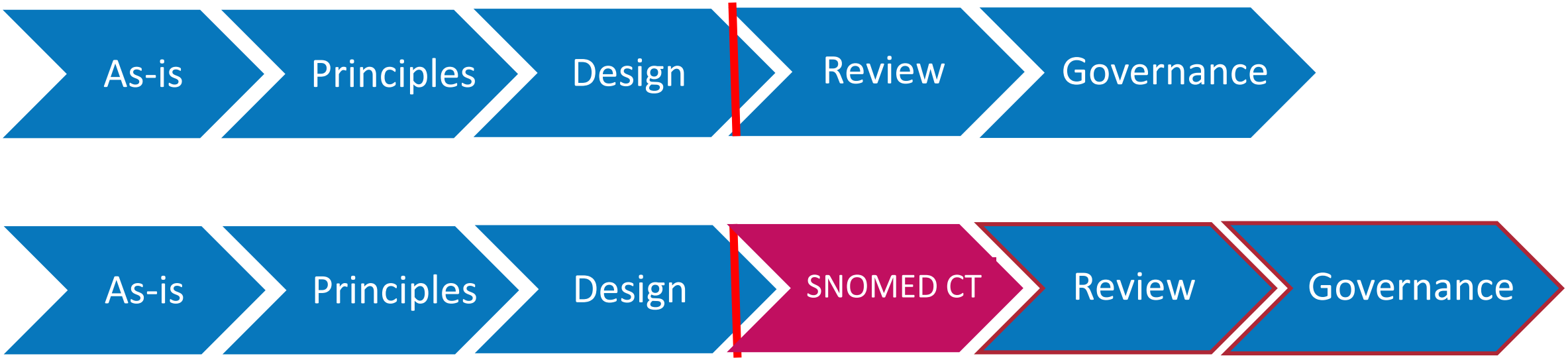
- The Norwegian Directorate of eHealth
- federal public service HEALTH, FOOD CHAIN SAFETY AND ENVIRONMENT
- Nictiz



Current work

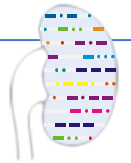
- To make a documented use case for a subset of terms for non-neoplastic kidney pathology in SNOMED CT based on the work of the KBC project
- Collect letters of support/endorsement from international scientific organizations in the nephrology and pathology field
- Introduce and submit use case by NRCs (Norway, Belgium, Netherlands?) to SNOMED international/IHTSDO

Project plan



Use cases

Examples where KBC will help out

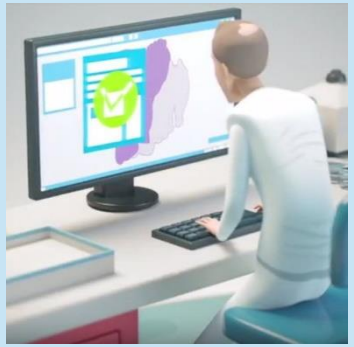


Use case Norway

Pathology diagnostics

Norwegian Renal Registry

International collaboration



NORPAT Codes

Proprietary, ERA-EDTA

KBC

KBC

KBC

Clinician, patient

Images: freepik by macrovector, Nasjonal prosjekt digital patologi

Use case Norway

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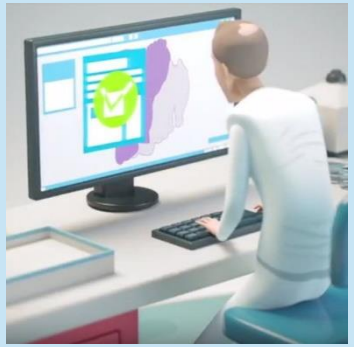
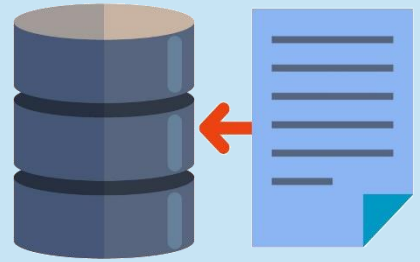


NORPAT Codes

KBC subset SNOMED CT



Proprietary, ERA-EDTA

KBC subset SNOMED CT

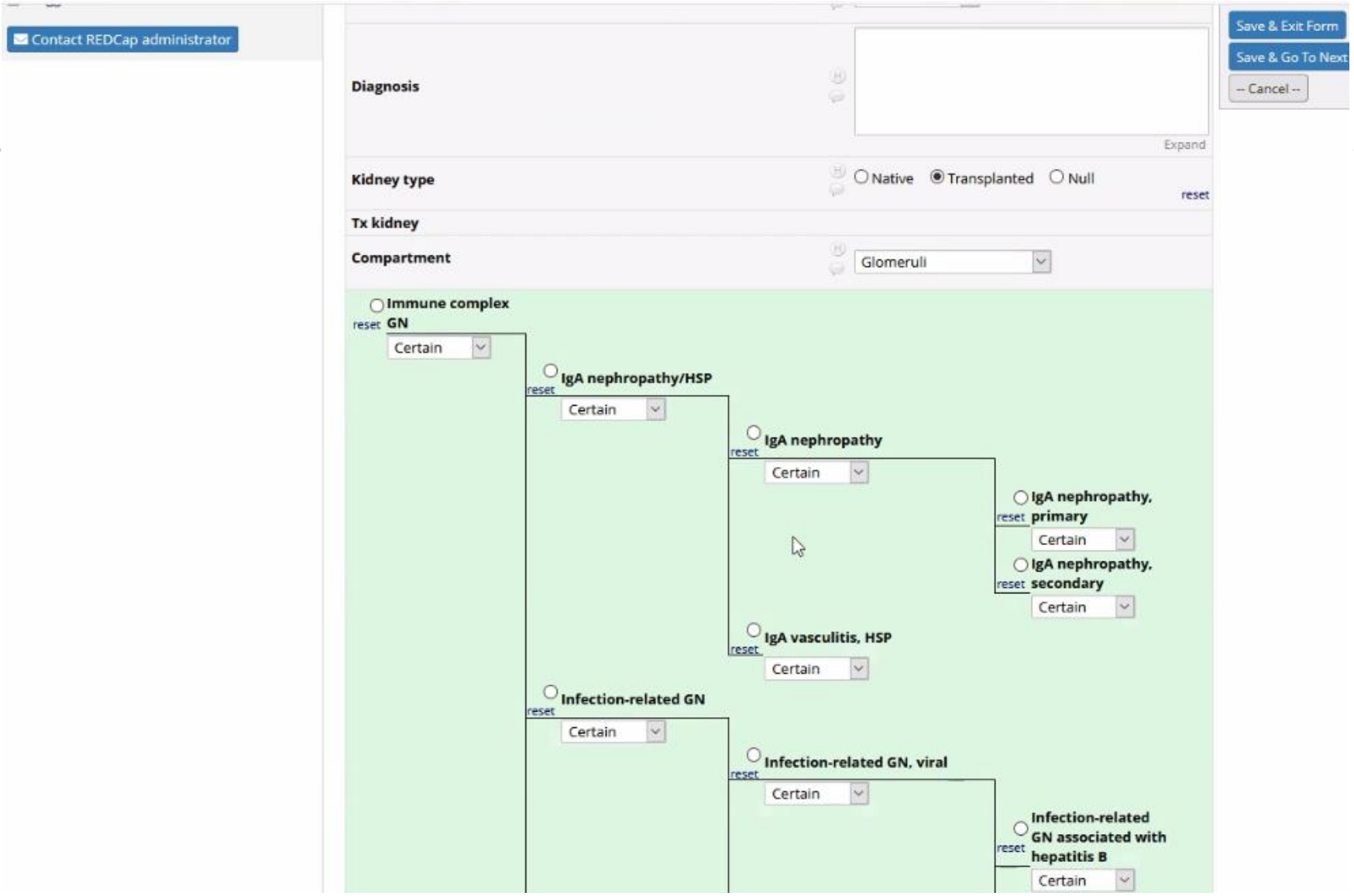
KBC subset SNOMED CT

Clinician, patient

USE CASE ERLANGEN GERMANY

- Need for a database for registration of kidney biopsies
- For research and quality control
- Quick and user-friendly

Personal communication by Kerstin Amann and Maike Buttner-Herold



REDCap solution

Structure of KBC term list

Disease concepts

Codes linked in background

Quick and easy coding

Personal communication by Kerstin Amann and Maike Buttner-Herold

Contact

Contact

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Core project team at the last physical meeting in Belgium 21.02.20
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ESP European Society of Pathology
RPS Renal Pathology Society
ISN International Society of Nephrology
ERA-EDTA European Renal Association – European Dialysis and Transplant Association
NBVN Nederlandstalige Belgische Vereniging Nefrologie
NNR Norwegian Renal Registry

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SNOMED CT NRC's from Belgium, Norway, the Netherlands

Discussion