Closing the circle

Creating a clinically relevant data model for pathology

Laszlo Igali - RCPath and PRSB

Closing the loop

Creating a clinically relevant data model for pathology

Laszlo Igali - RCPath and PRSB

PREVIOUSLY

PATHOLOGY CODING AND MESSAGING WAS A

SIMPLE AFFAIR: REQUEST FOLLOWED BY RESULT

NOW

LIFE IS MORE COMPLICATED – ACCESS FOR PATIENTS, KPIs, TATs, DASHBOARDS ETC.

WE HAVE SNOMED CT, JOB DONE – THANKS FOR YOUR ATTENTION…

WHAT DO WE NEED TO DO?

TO FIND A CONTEMPORARY DATA/INFORMATION/MESSAGING MODEL WHICH REFLECTS LIFE BETTER

ELEMENTS

CODING

COMMUNICATION/MESSAGING

PATIENT AND LABORATORY DATA FRAMEWORK(S) – EHR/ LIMS

INTERPRETATION OF DATA

(DECISION SUPPORT/AI/AUI)

The story so far – UK pathology coding history

2016

2015

2008

1997

NLMC

the proposed new code ecosystem to address the shortcomings of the PBCL

for requesting and reporting - same code set

developed by RCPath and X-Lab

taken over by the HSCIC in summer 2015

PBCL

the pathology bounded code list established in 1997 - as EDIFACT messaging product for PMIP (path messaging implementation project)

linear code system with (limited) translation to CTV3 and SNOMED

not suitable for all pathology disciplines (microbiology, genetics, cell path)

retired and

coding choices

PRE-COORDINATED

specific test items with detailed specification

numerous codes – in mainly linear list - not so good for microbiology, genetics and cell path

SNOMED CT
The global
language
healthcare

POST-COORDINATED

leaner code system, but with many codes

requires “grammar”

not well suited for lab tests

vendors not ready for ontology - yet

pre vs post coordination

HUNGARIAN

settenkedik - moving stealthily in the shadows behind to avoid detection, usually in the dark

lopakodik - moving quietly in the background, to avoid detection, the emphasis on quiet approach

mögéoson- moving behind someone swiftly and stealthily, to avoid detection

ENGLISH

sneak/ creep upon etc but with more qualifiers… see other column…

LOINC

PRE COORDINATED SYSTEM

component (analyte e.g. sodium)

property measured (e.g. substrate concentration)

timing (e.g. a point in time)

system/specimen (e.g. serum or plasma)

scale (e.g.quantitative mmol/l)

method used (e.g. ISE - used only when different methods have different results)

SNOMED CT

POST COORDINATED SYSTEM

concepts - joined in hierarchical order (ontology)

needs ‘grammar’ - joining the concepts to express the same amount of information

gives better understanding for the pathologists if the tests requested with clinical info attached

tecnical preview of LOINC-SNCT cooperation - but limited scope, never took off

SNOMED CT Oct 2017 GA decided – seek to review of non-duplication agreement - UK can develop LOINC-type concepts - observable entities containing precoordinated elements

further issues . . .

ADDITIONAL THINGS TO CONSIDER

clinical context - diseases, gender, age, pregnancy etc.

grouped results - ‘batteries’ or test sets

reflex testing

urgency

differences in methods - portability/combinability of results

expected action based on the report

handover of info/chain of custody

further issues . . .

ADDITIONAL THINGS TO CONSIDER

users do not like complicated selection – UI has to be simple yet should provide a granular choice

the question is often simple - the tests to decide may be complex/not the one originally intended

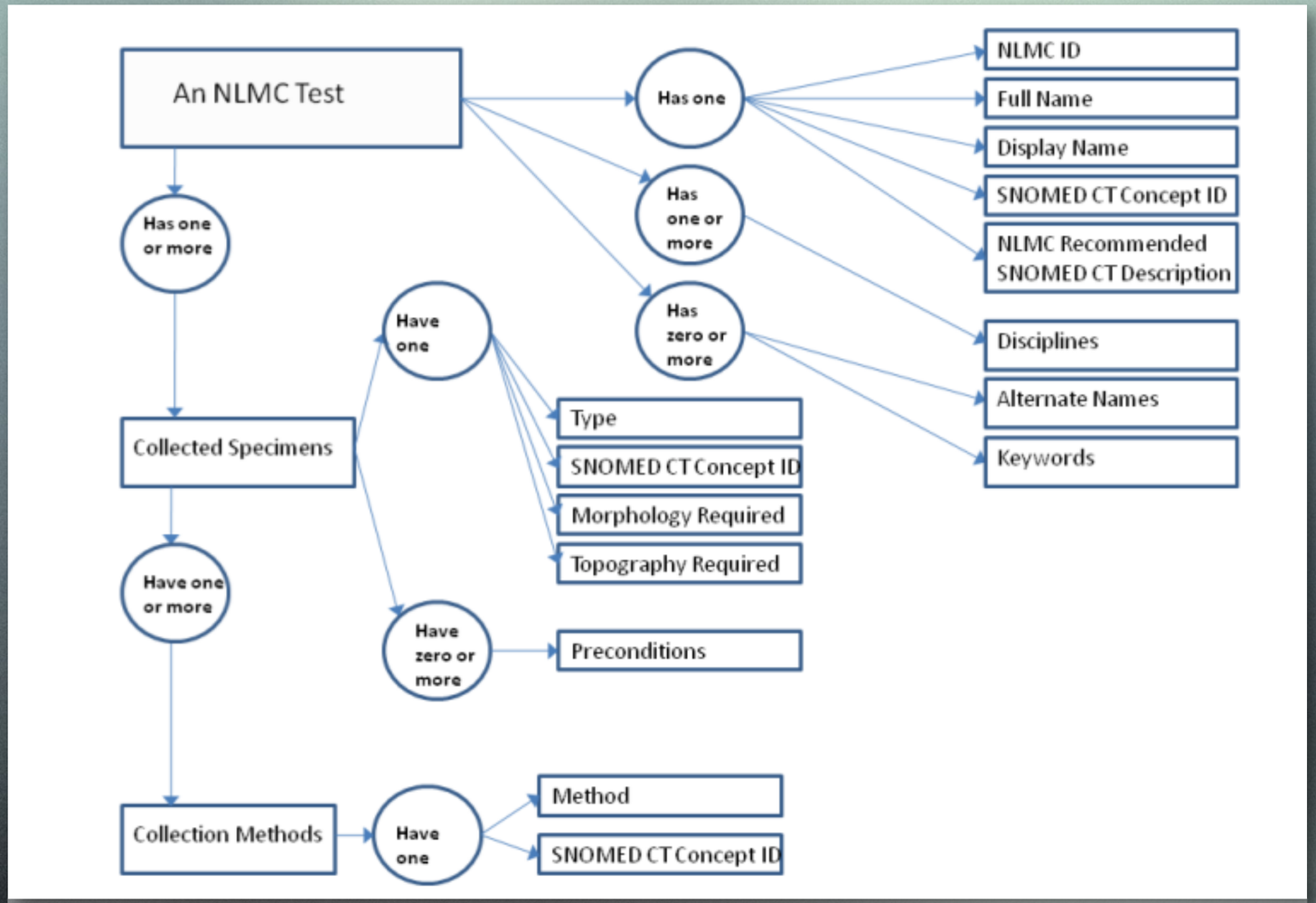
NLMC logic

Results – requests

Direction of basic structure –expansion based on clinical need

Existed as a necessary middleware – to plug in SNOMED CT's previous difficulty to code lab results simply (see SNOMED – LOINC tech preview)

Logical predecessor of the observable model


An NLMC Test
Has one
NLMC ID
Full Name
Display Name
SNOMED CT Concept ID
NLMC Recommended SNOMED CT Description
Has one or more
Disciplines
Alternate Names
Keywords
Has zero or more
Has one or more
Collected Specimens
Have one
Type
SNOMED CT Concept ID
Morphology Required
Topography Required
Have zero or more
Preconditions
Have one or more
Collection Methods
Have one
Method
SNOMED CT Concept ID

Problem: linear code systems cannot express the complexities of pathology examinations

new data model

PRINCIPLES

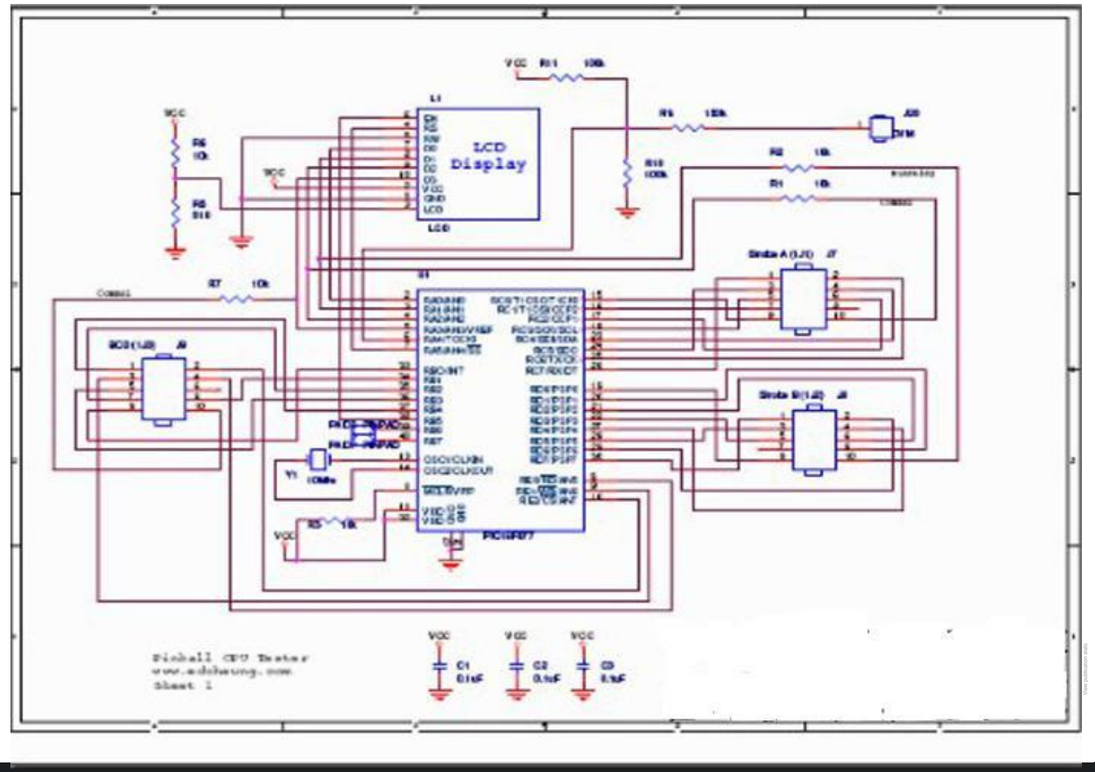
driven by clinical needs

mirrors clinical processes

covers the whole cycle from request through report to action – new element

can be fully expressed in SNOMED CT

understanding SNOMED CT inside

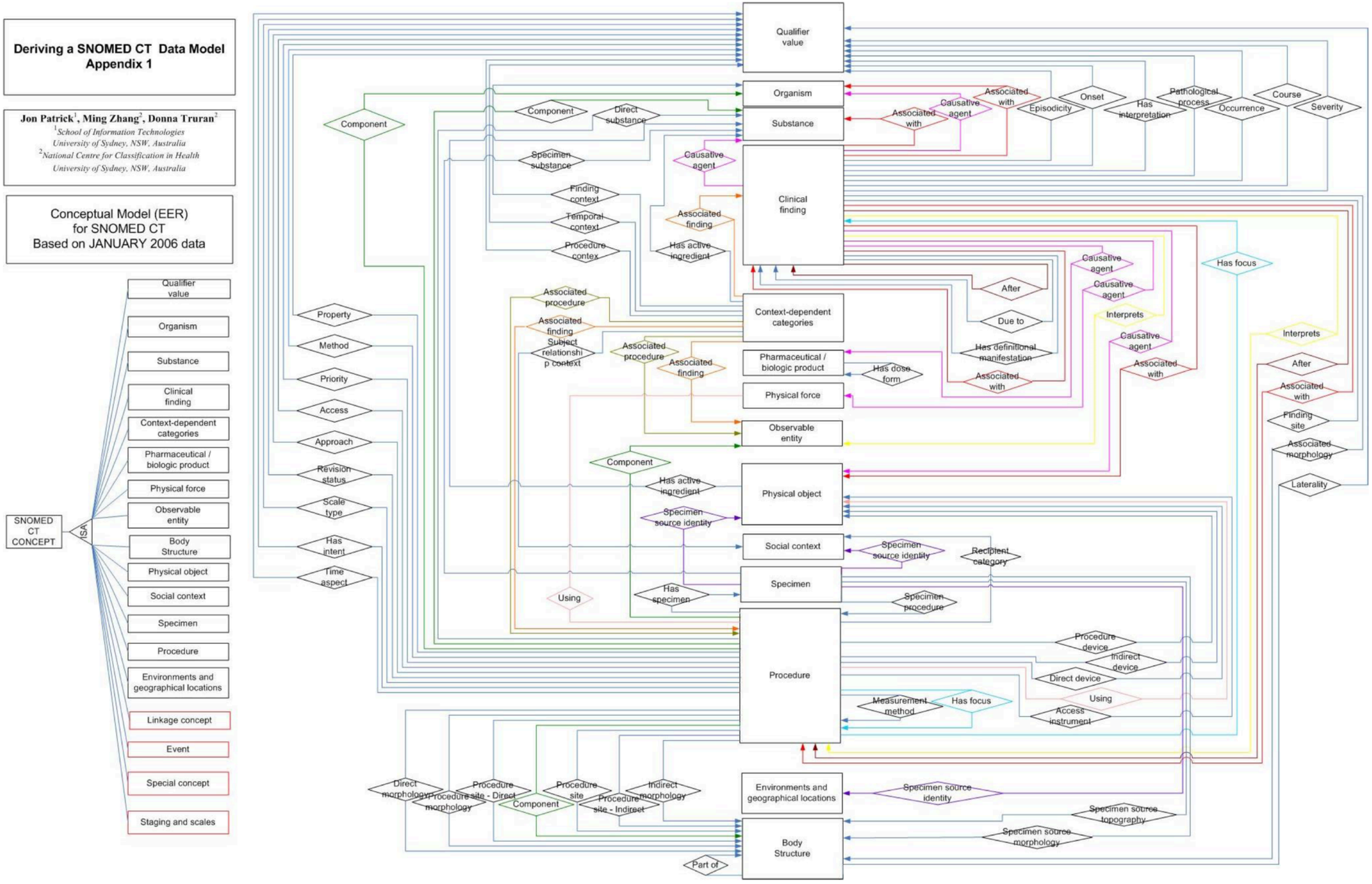


APPENDIX 1: INFERRED EER MODEL

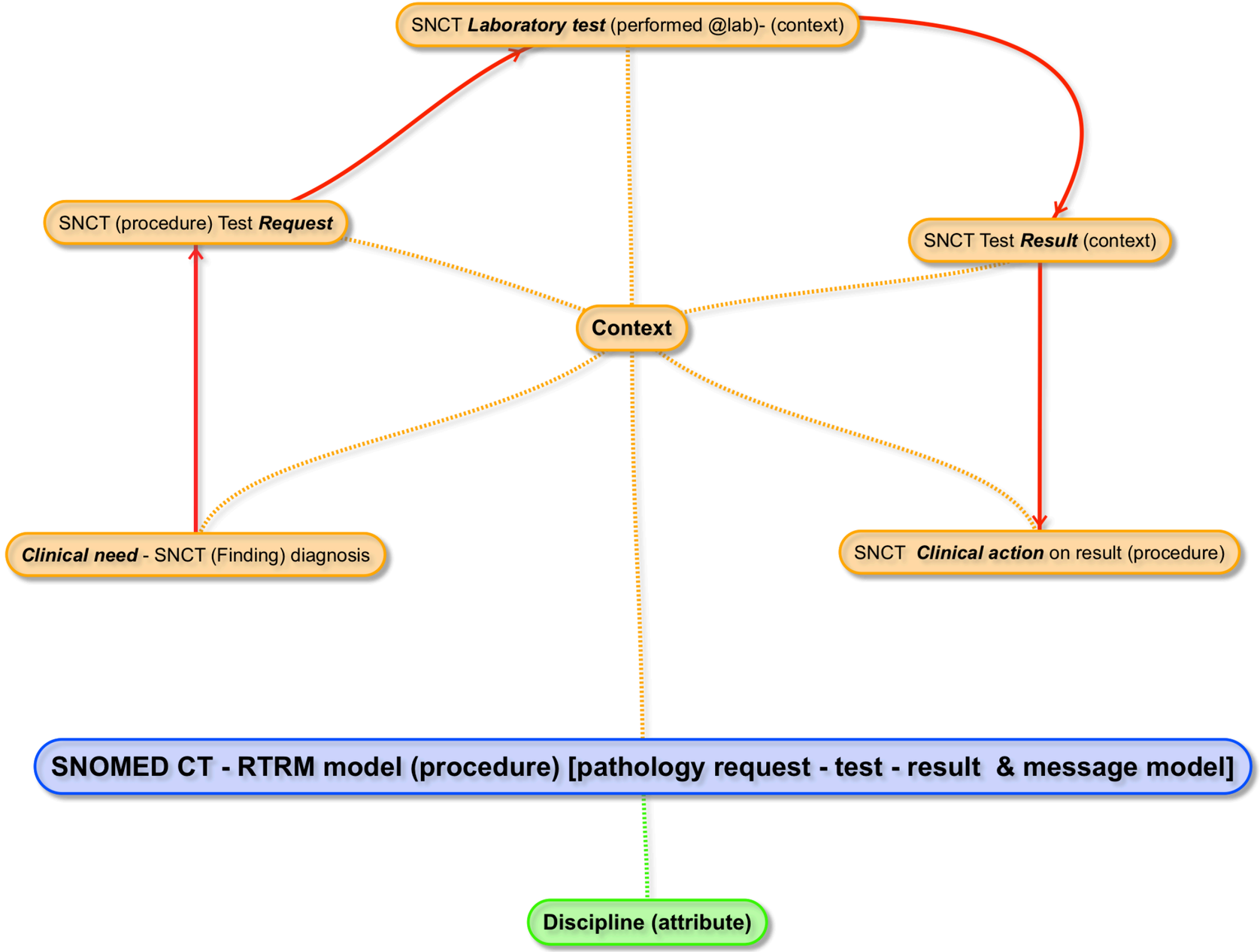
Deriving a SNOMED CT Data Model
Appendix 1

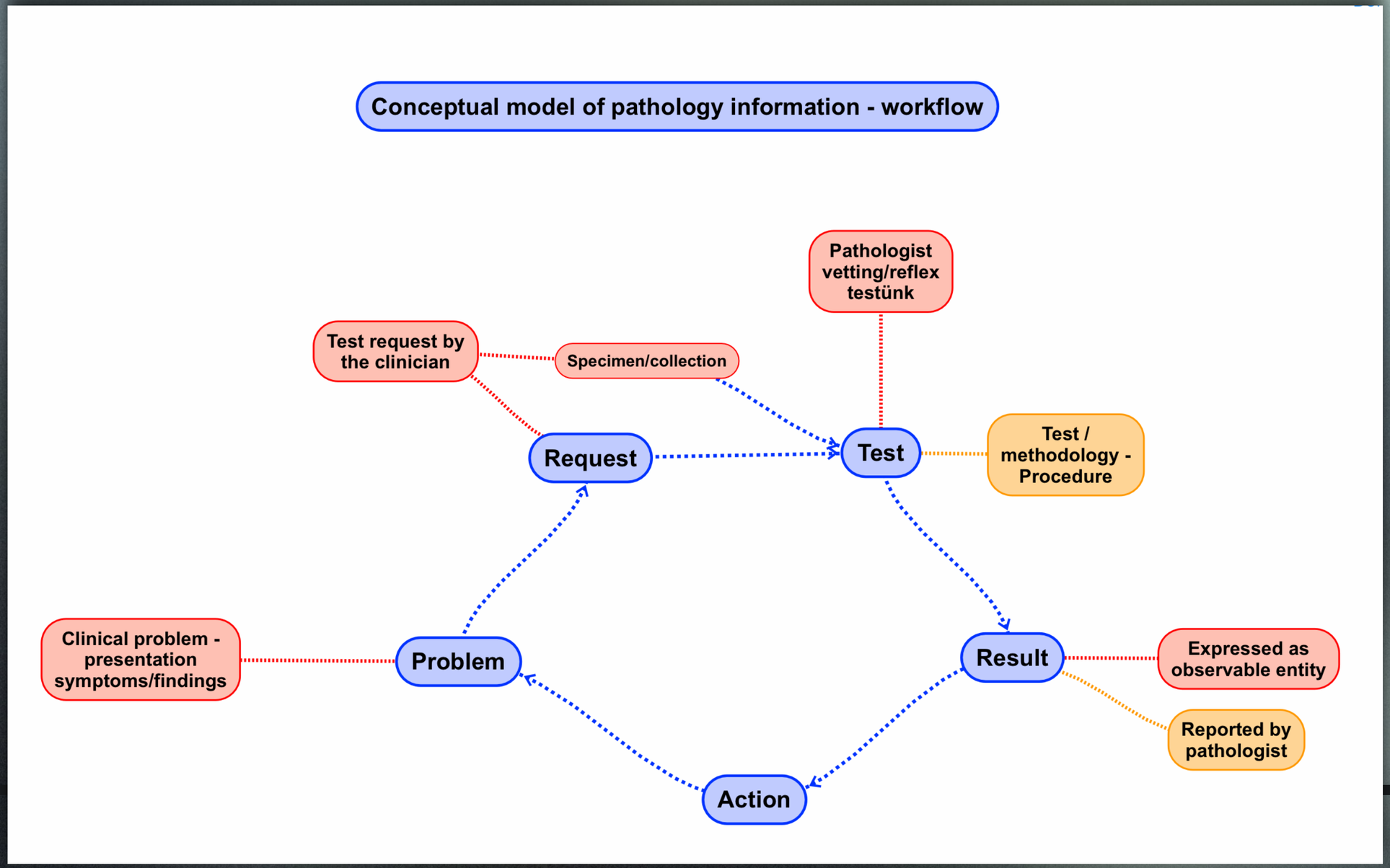
Jon Patrick[1], Ming Zhang[2], Donna Truran[2]
[1]*School of Information Technologies*
University of Sydney, NSW, Australia
[2]*National Centre for Classification in Health*
University of Sydney, NSW, Australia

Conceptual Model (EER)
for SNOMED CT
Based on JANUARY 2006 data



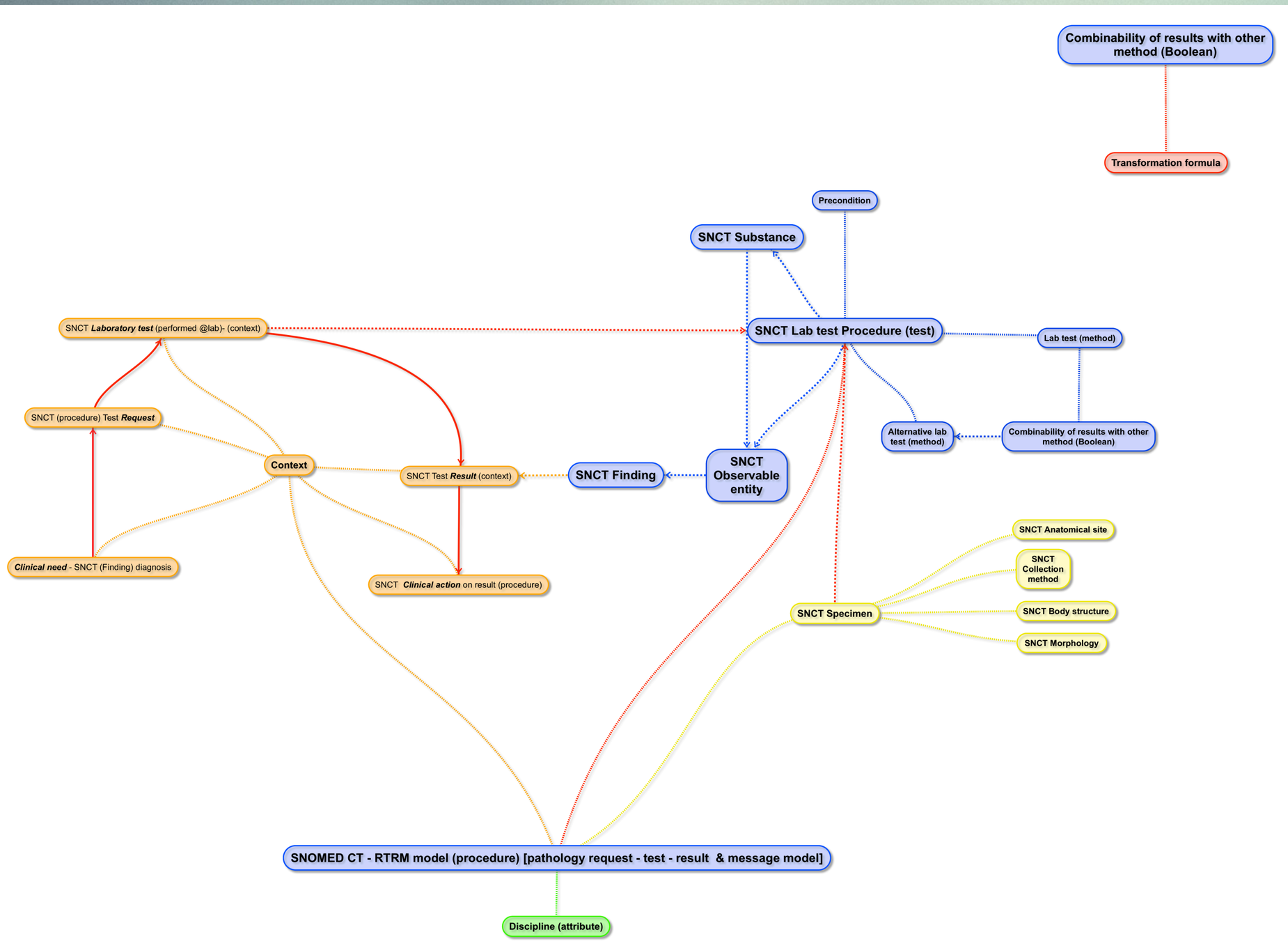
new data model 1st iteration



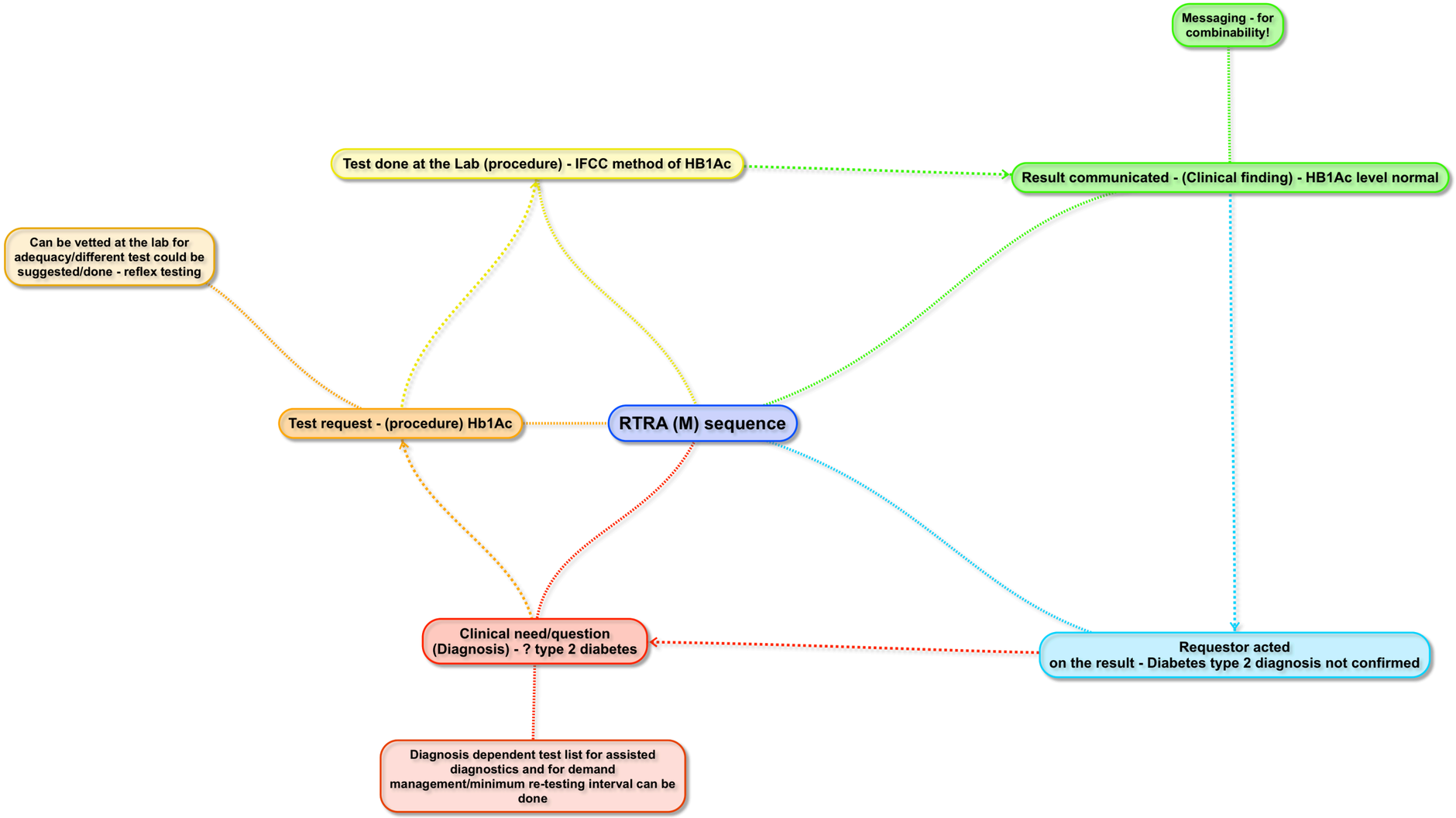


new data model current

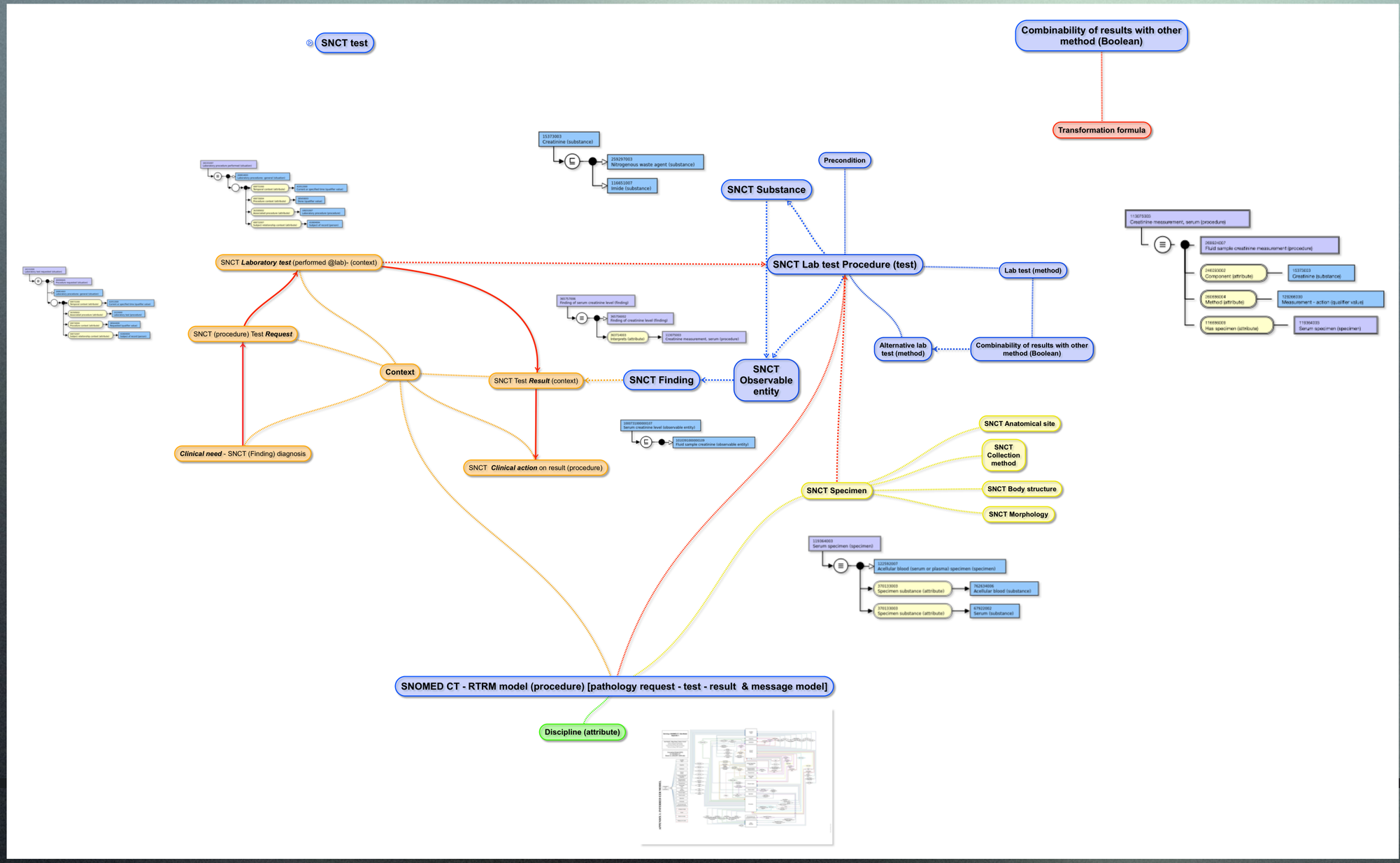
new data model

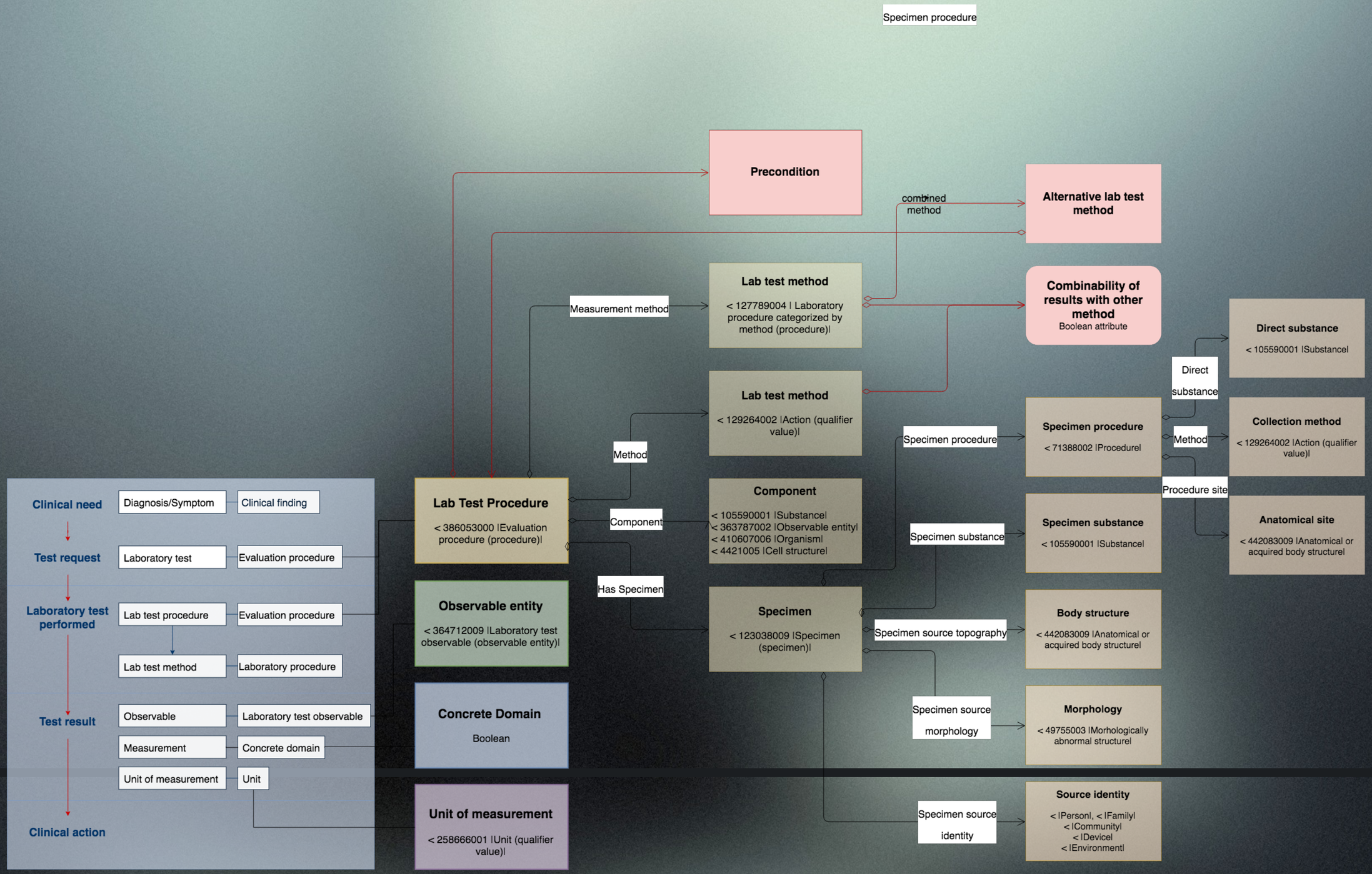


new data/flow model



new data model




Specimen procedure
Precondition
combined method
Alternative lab test method
Lab test method
< 127789004 | Laboratory procedure categorized by method (procedure)|
Measurement method
Combinability of results with other method
Boolean attribute
Lab test method
< 129264002 |Action (qualifier value)|
Method
Component
< 105590001 |Substance|
< 363787002 |Observable entity|
< 410607006 |Organism|
< 4421005 |Cell structure|
Has Specimen
Specimen
< 123038009 |Specimen (specimen)|
Specimen procedure
Specimen substance
Specimen source topography
Specimen source morphology
Specimen source identity
Direct substance
Specimen procedure
< 71388002 |Procedure|
Method
Procedure site
Specimen substance
< 105590001 |Substance|
Body structure
< 442083009 |Anatomical or acquired body structure|
Morphology
< 49755003 |Morhologically abnormal structure|
Source identity
< |Person|, < |Family|
< |Community|
< |Device|
< |Environment|
Direct substance
< 105590001 |Substance|
Collection method
< 129264002 |Action (qualifier value)|
Anatomical site
< 442083009 |Anatomical or acquired body structure|
Lab Test Procedure
< 386053000 |Evaluation procedure (procedure)|
Observable entity
< 364712009 |Laboratory test observable (observable entity)|
Concrete Domain
Boolean
Unit of measurement
< 258666001 |Unit (qualifier value)|
Clinical need
Diagnosis/Symptom
Clinical finding
Test request
Laboratory test
Evaluation procedure
Laboratory test performed
Lab test procedure
Evaluation procedure
Lab test method
Laboratory procedure
Test result
Observable
Laboratory test observable
Measurement
Concrete domain
Unit of measurement
Unit
Clinical action

patient vignette

Michael Kay, a 58 year old man, attends an oncology outpatient clinic at Lingfield Royal Infirmary. The consultant, Dr Ibrahim Khan, gives Michael a blood test form for a **PSA** test and asks him to attend the hospital phlebotomy department. On the same day, Michael attends the appointment with the blood form and has blood taken and sent to the laboratory based in the hospital. The test results are sent back electronically to the hospital's EPR system and the GP practice system [single request, single result]

Clinical need

Test request

Test performed at lab

Test result

Clinical action

Diagnosis -finding

Diagnosis/finding
Name: Suspected prostate cancer (situation)
Code: 315268008

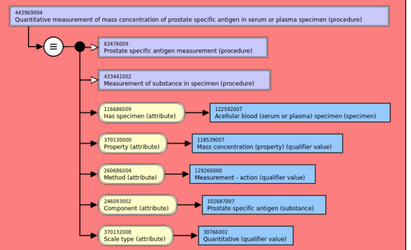
Test order

Test Order
Name: Prostate specific antigen measurement (procedure)
Code: 63476009

Test Requested
Name: Blood test requested (situation)
Code: 413672003

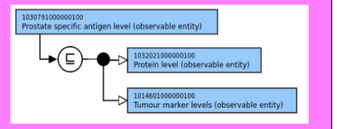
Test procedure(s)

Test Procedure
Name: Quantitative measurement of mass concentration of prostate specific antigen in serum or plasma specimen (procedure)
Code: 443969004



Test result(s)

Result - observable entity
Name: Prostate specific antigen level (observable entity)
Code: 1030791000000100



Value
5.0

UoM
Name: Nanogram/milliliter (qualifier value)
Code: 258806002

Analysed specimen
Name: Serum (substance)
Code: 57922002

Age range
Name: Age group (qualifier value)
Code: 720431000000109

Relation to Reference range
Name: Measurement finding outside reference range
Code: 442096005

Timeliness
Name: Single point in time (qualifier value)
Code: 123029007

Clinical action

Clinical action
Name: Referral to urology service for elevated prostate specific antigen (procedure)
Code: 396151003

patient vignette

Sarah Smith, a midwife sees a 5 day old baby Jane Archer with jaundice and requests a ***total bilirubin*** and a ***conjugated bilirubin*** which is sent using a paper test request form to the laboratory based in the local hospital, St John's Infirmary. The result is phoned to the midwife and reported electronically to primary care (using an order comms system) and the secondary care EPR system. Jane is admitted to the Special Care Baby Unit at the hospital for phototherapy. [two tests requested, two results reported]

Clinical need

Test request

Test performed at lab

Test result

Clinical action

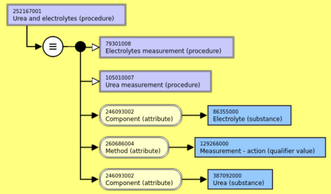
Diagnosis -finding

Diagnosis/finding
Name Hypertensive disorder, systemic arterial (disorder)
Code 38341003

Test order

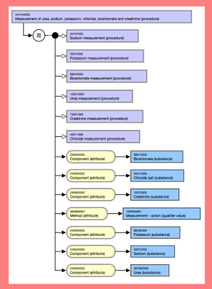
Test Order
Name Urea and electrolytes (procedure
Code: 33476009

Test Requested
Name Blood test requested (situation)
Code 413672003



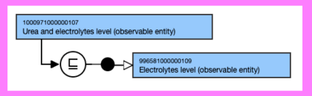
Test procedure(s)

Test Procedure
Name Measurement of urea, sodium, potassium, chloride, bicarbonate and creatinine (procedure)(procedure)
Code 444164006



Test result(s)

Result - observable entity
Name Urea and electrolytes level (observable entity)
Code 1000971000000107



Analysed specimen
Name: Serum (substance)
Code 57922002

Timeliness
Name: Single point in time (qualifier value)
Code 123029007

Relation to Reference range
Name: Normal Serum test findings (finding)
Code 414878005

Age range
Name: Age group (qualifier value)
Code 720431000000109

SodiumValue
139

UoM - Sodium
Name: Millimole/liter (qualifier value)
Code 258813002

PotassiumValue
5.0

UoM - Potassium
Name: Millimole/liter (qualifier value)
Code 258813002

Urea Value
4.8

UoM - Urea
Name: Millimole/liter (qualifier value)
Code 258813002

BicarbonateValue
27

UoM - Bicarbonate
Name: Millimole/liter (qualifier value)
Code 258813002

Chloride Value
102

UoM - Chloride
Name: Millimole/liter (qualifier value)
Code 258813002

Creatiinine value
80

UoM - Creatinine
Name: Micromole/liter (qualifier value)
Code 258814008

Clinical action

Clinical action
Name Medical follow-up - normal (record artifact)
Code 748901000000108

patient vignette

Lisa Stanner, a 60 year old woman, attends Manor GP Practice for monitoring her ***hypertension***. Lisa's GP, Dr Jane Green, requests renal function tests (***electrolytes*** and ***creatinine*** or ***Urea and creatinine (U&E)***). The request is sent electronically using an order comms systems to the pathology laboratory based in the local hospital, Midtown District Hospital. Dr Green books an appointment with the practice nurse, Alice Jones. Lisa attends the appointment the following day where the blood sample is taken and sent to the laboratory. The test results are sent back electronically to the GP practice system. [one profile requested, multiple results sent back]

Clinical need

Test request

Test performed at lab

Test result

Clinical action

Diagnosis -finding

Diagnosis/finding
Name Hypertensive disorder, systemic arterial (disorder)
Code 38341003

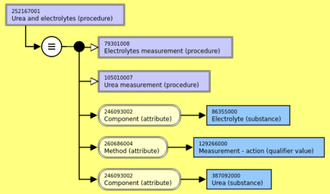
Test order

Test Order
Name Urea and electrolytes (procedure
Code: 63476009

OR

Test Order
Name Measurement of urea, sodium, potassium, chloride, bicarbonate and creatinine (procedure)
Code: 444164000

Test Requested
Name Blood test requested (situation)
Code 413672003



Test procedure(s)

Test Procedure
Name Electrolytes measurement (procedure)
Code 79301008

Test Procedure
Name Urea measurement (procedure)
Code 105010007

Test Procedure
Name Creatinine measurement (procedure)
Code 70901006

Test Procedure
Name Chloride measurement, blood (procedure)
Code 104589004

Test Procedure
Name Blood urea measurement (procedure)
Code 250623007

Test Procedure
Name Corrected serum creatinine measurement (procedure)
Code 313822004

Test Procedure
Name Blood sodium measurement (procedure)
Code 312469006

Test Procedure
Name Blood potassium measurement (procedure)
Code 312468003

Test Procedure
Name Bicarbonate measurement (procedure)
Code 88645003

Test result(s)

the tests' relationship to request can be handled through their parent concept…

Result - observable entity
Name Serum sodium level (observable entity)
Code 1000661000000107

Analysed specimen
Name: Serum (substance)
Code 67922002

Timeliness
Name: Single point in time (qualifier value)
Code 123029007

UoM - Sodium
Name: Millimole/liter (qualifier value)
Code 258813002

SodiumValue
139

Relation to Reference range
Name: Normal Serum test findings (finding)
Code 414878005

Age range
Name: Age group (qualifier value)
Code 720431000000109

Result - observable entity
Name Serum potassium level (observable entity)
Code 1000651000000109

Analysed specimen
Name: Serum (substance)
Code 67922002

Timeliness
Name: Single point in time (qualifier value)
Code 123029007

UoM - Potassium
Name: Millimole/liter (qualifier value)
Code 258813002

PotassioumValue
5.0

Relation to Reference range
Name: Normal Serum test findings (finding)
Code 414878005

Age range
Name: Age group (qualifier value)
Code 720431000000109

Result - observable entity
Name Serum urea level (observable entity)
Code 1000951000000103

Analysed specimen
Name: Serum (substance)
Code 67922002

Timeliness
Name: Single point in time (qualifier value)
Code 123029007

UoM - Urea
Name: Millimole/liter (qualifier value)
Code 258813002

Urea Value
4.8

Relation to Reference range
Name: Normal Serum test findings (finding)
Code 414878005

Age range
Name: Age group (qualifier value)
Code 720431000000109

Result - observable entity
Name Serum bicarbonate level (observable entity)
Code 1000681000000103

Analysed specimen
Name: Serum (substance)
Code 67922002

Timeliness
Name: Single point in time (qualifier value)
Code 123029007

UoM - Bicarbonate
Name: Millimole/liter (qualifier value)
Code 258813002

BicarbonateValue
27

Relation to Reference range
Name: Normal Serum test findings (finding)
Code 414878005

Age range
Name: Age group (qualifier value)
Code 720431000000109

Result - observable entity
Name Serum chloride level (observable entity)
Code 1000671000000100

Analysed specimen
Name: Serum (substance)
Code 67922002

Timeliness
Name: Single point in time (qualifier value)
Code 123029007

UoM - Chloride
Name: Millimole/liter (qualifier value)
Code 258813002

Chloride Value
102

Relation to Reference range
Name: Normal Serum test findings (finding)
Code 414878005

Age range
Name: Age group (qualifier value)
Code 720431000000109

Result - observable entity
Name Serum creatinine level (observable entity)
Code 1000731000000107

Analysed specimen
Name: Serum (substance)
Code 67922002

Timeliness
Name: Single point in time (qualifier value)
Code 123029007

UoM - Creatinine
Name: Micromole/liter (qualifier value)
Code 258814008

Creatinine value
80

Relation to Reference range
Name: Normal Serum test findings (finding)
Code 414878005

Age range
Name: Age group (qualifier value)
Code 720431000000109

Clinical action

Clinical action
Name Medical follow-up - normal (record artifact)
Code 748901000000108

what are we trying to achieve

Interoperable

Unambiguous

Simple and granular

Flexible and adaptable model for the disciplines

Reflects clinical practice

disciplines involved

- lab medicine
- immunology
- haematology
- cellular pathology
- microbiology
- blood transfusion
- ?genetics

LEVELS OF INTEROPERABILITY

"Foundational" interoperability develops the building blocks of information exchange between disparate systems by establishing the inter-connectivity requirements needed for one system or application to share data with and receive data from another. It does not outline the ability for the receiving information technology system to interpret the data without interventions from the end user or other technologies.

"Structural" interoperability defines the structure or format of data exchange (i.e., the message format standards) where there is uniform movement of healthcare data from one system to another such that the clinical or operational purpose and meaning of the data is preserved and unaltered. Structural interoperability defines the syntax of the data exchange. It ensures that data exchanges between information technology systems can be interpreted at the data field level.

"Semantic" interoperability is the ability of two or more systems to exchange information and to interpret and use that information.Semantic interoperability takes advantage of both the structuring of the data exchange and the codification of the data, including standard, publicly available vocabulary, so that the receiving information management systems can interpret the data. Semantic interoperability supports the electronic exchange of patient data and information among authorized parties via potentially disparate health information and technology systems and products to improve quality, costs, safety, efficiency, experience and efficacy of healthcare delivery.

"Organizational" interoperability encompasses the technical components as well as clear policy, social and organizational components. These components facilitate the secure, seamless and timely communication and use of data within and between organizations and individuals. Inclusion of these non-technical considerations enables interoperability that is integrated into end-user processes and workflows in a manner that supports efficiencies, relationships and overall health and wellness through cooperative use of shared data both across and within organizational boundaries. source: ***HIMMS***

PRACTICAL INTEROPERABILITY

pathology codes sent and received

access/link to various laboratory information systems

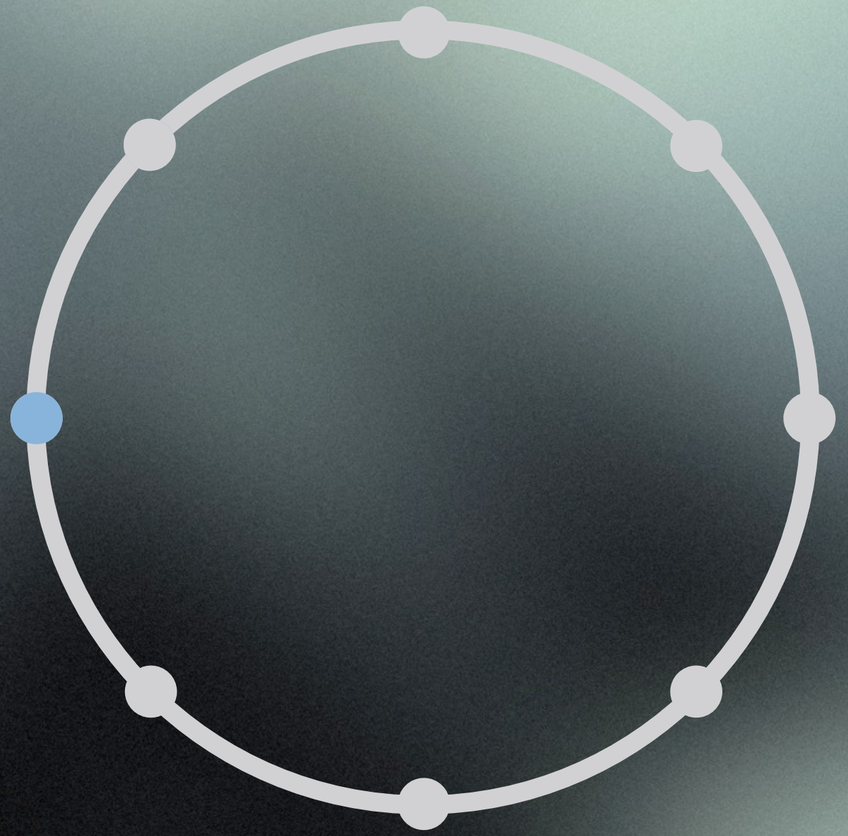
access/translate between various code systems/interpretations/variations

experience with code maintenance and governance

access to code transmission to visualise through dashboard - “Atlas of variations” live

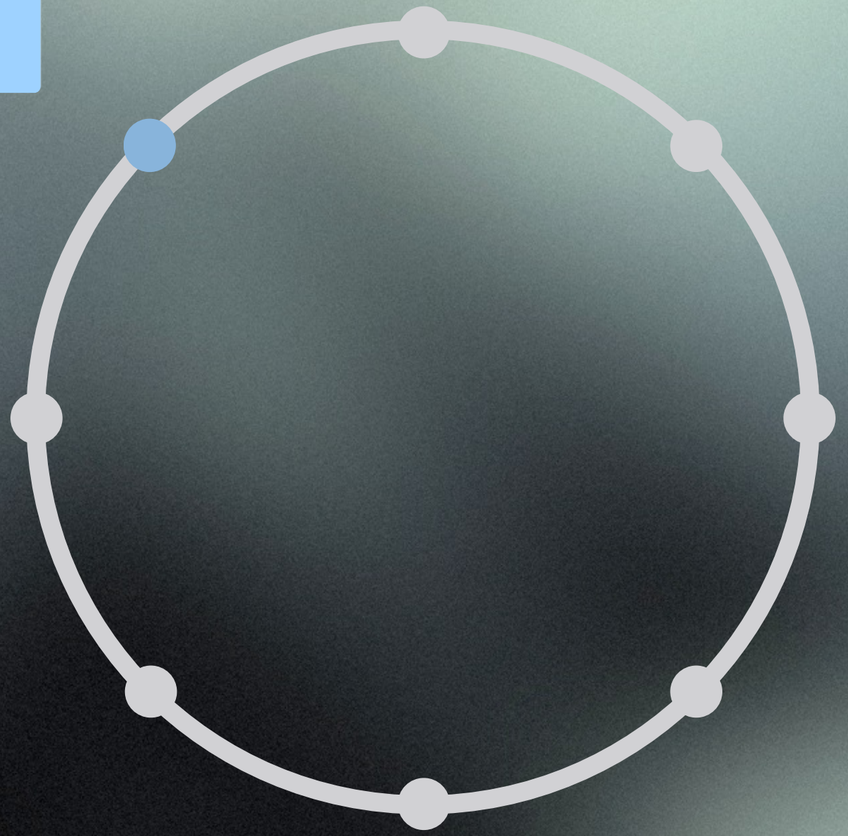

based on...

PATIENT PRESENTING



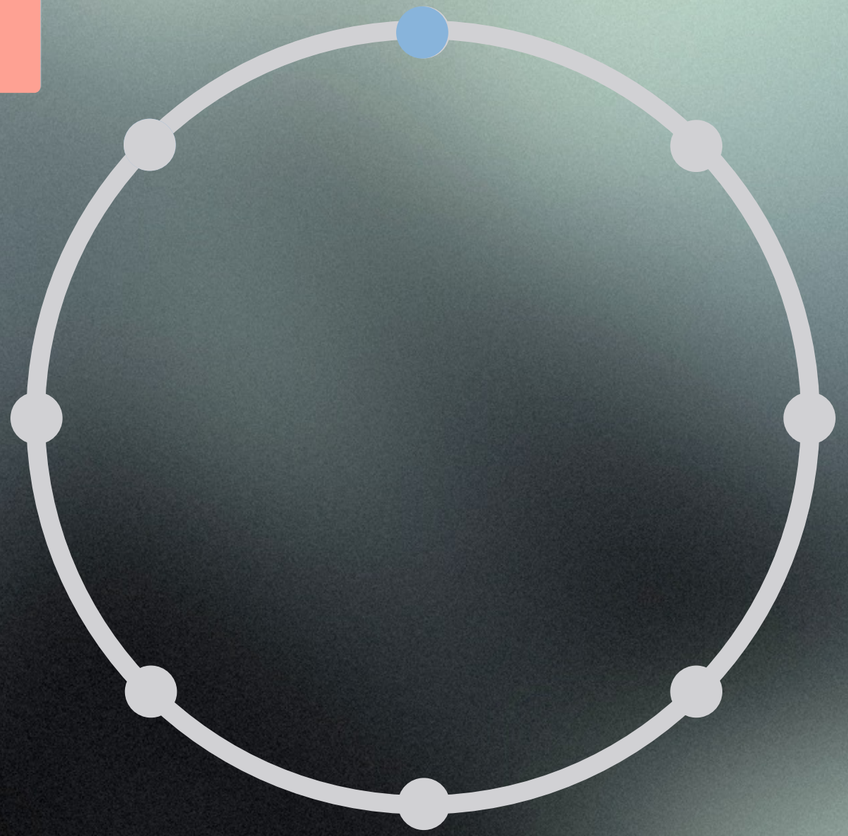
CLINICAL PROBLEM

PATIENT PRESENTING



TEST REQUESTED

CLINICAL PROBLEM

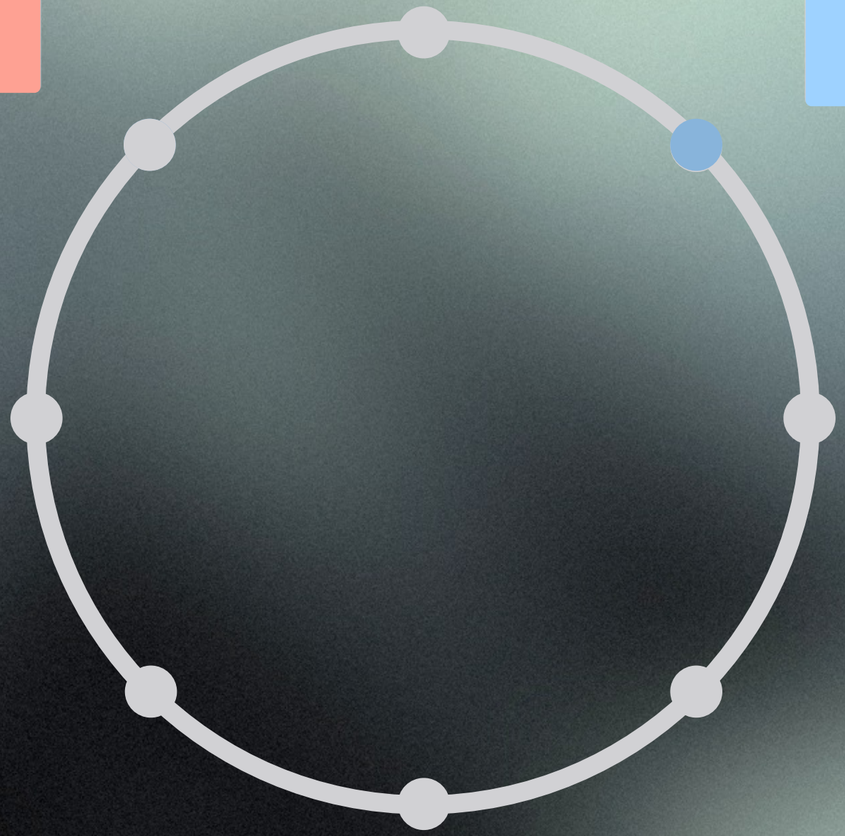


PATIENT PRESENTING

TEST REQUESTED

CLINICAL PROBLEM

SAMPLE COLLECTED

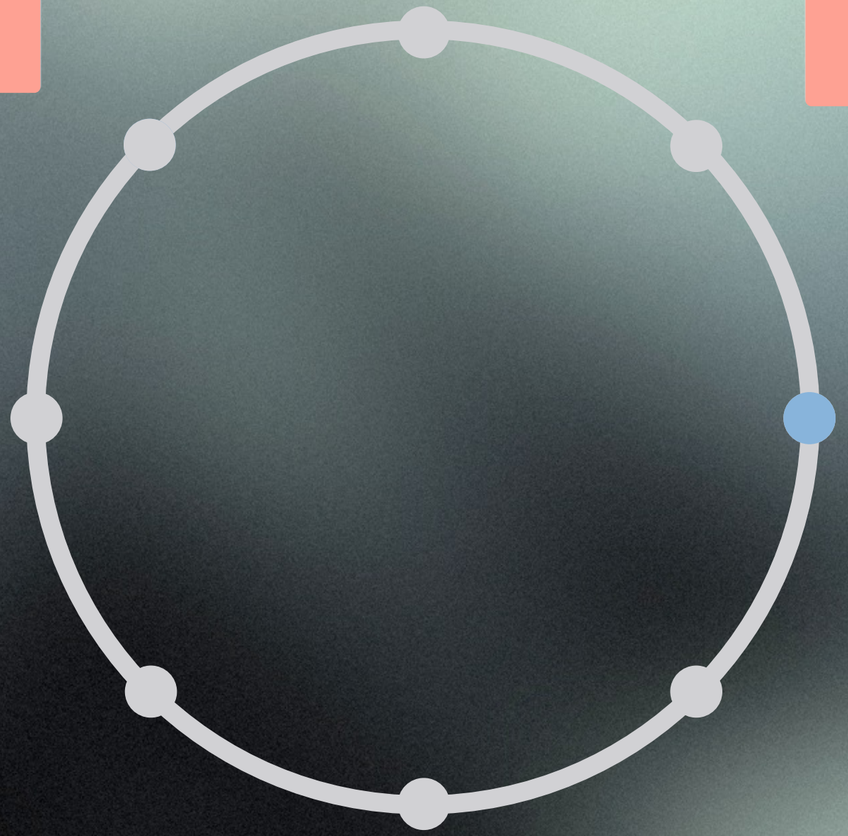


PATIENT PRESENTING

TEST REQUESTED

CLINICAL PROBLEM

SAMPLE COLLECTED



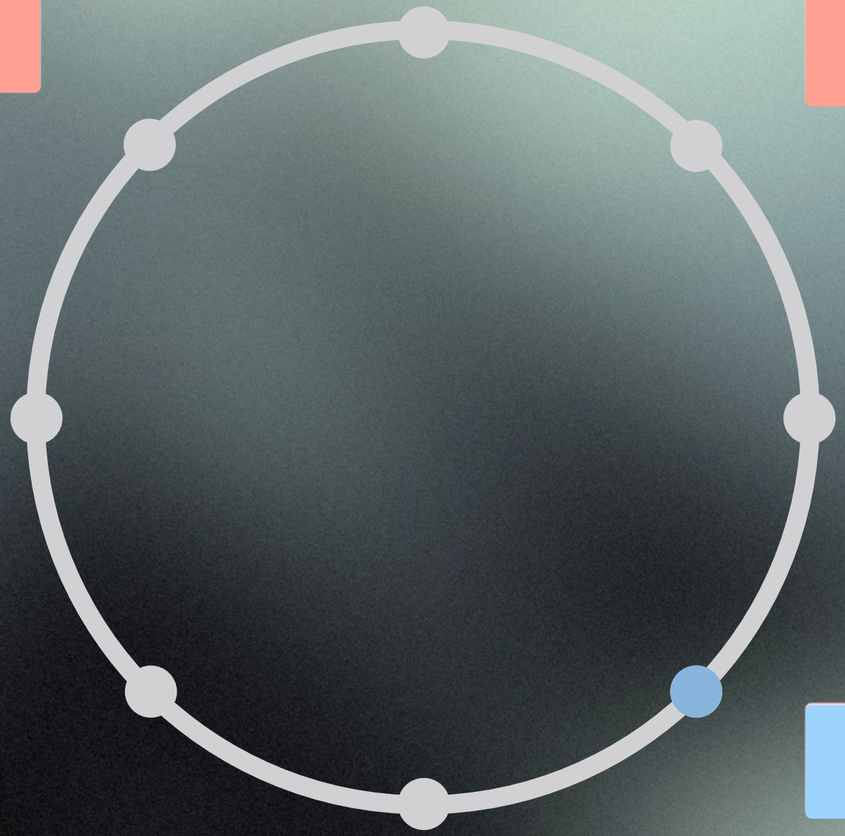
PATIENT PRESENTING

TEST PERFORMED

TEST REQUESTED

CLINICAL PROBLEM

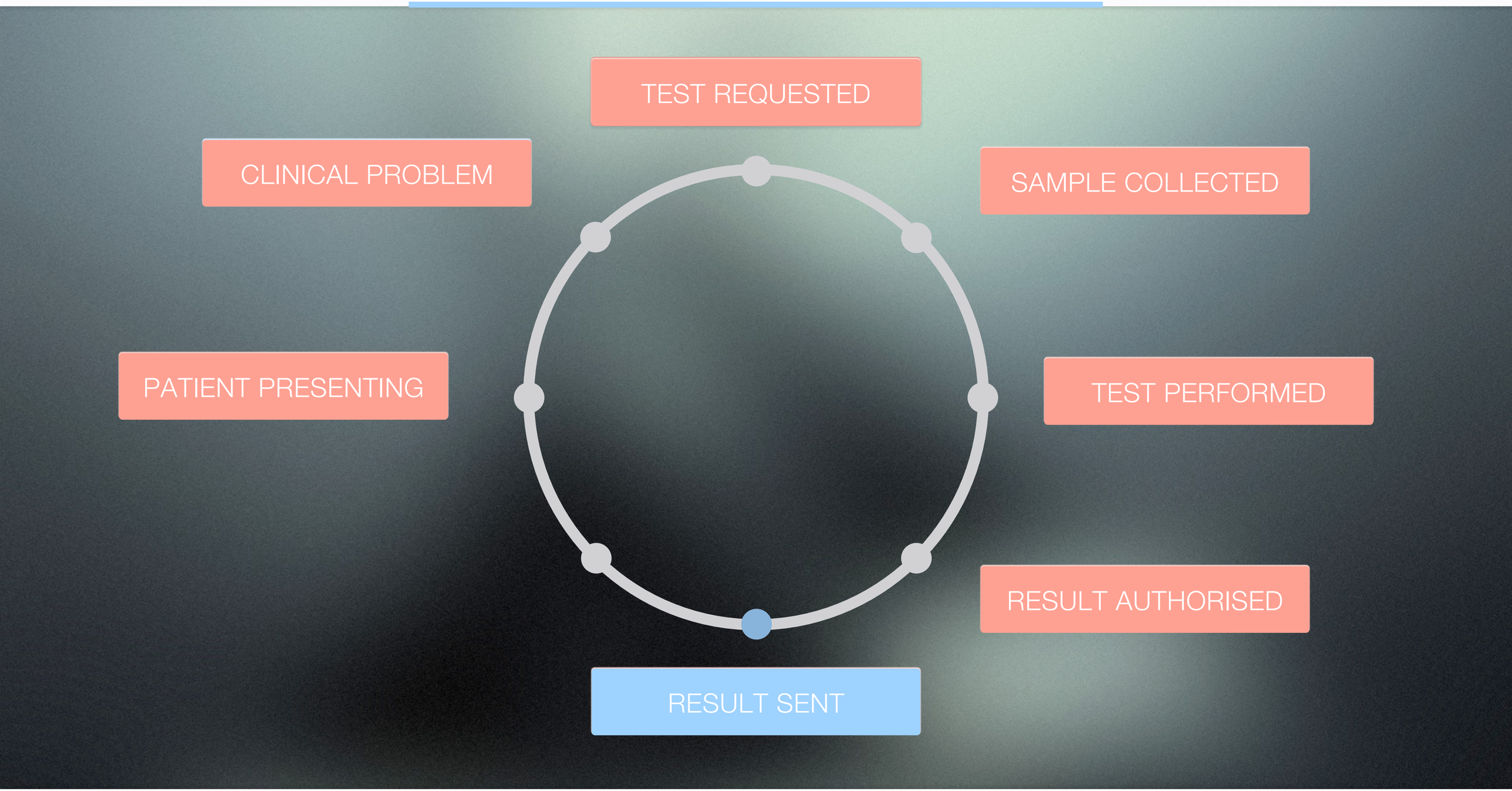
SAMPLE COLLECTED

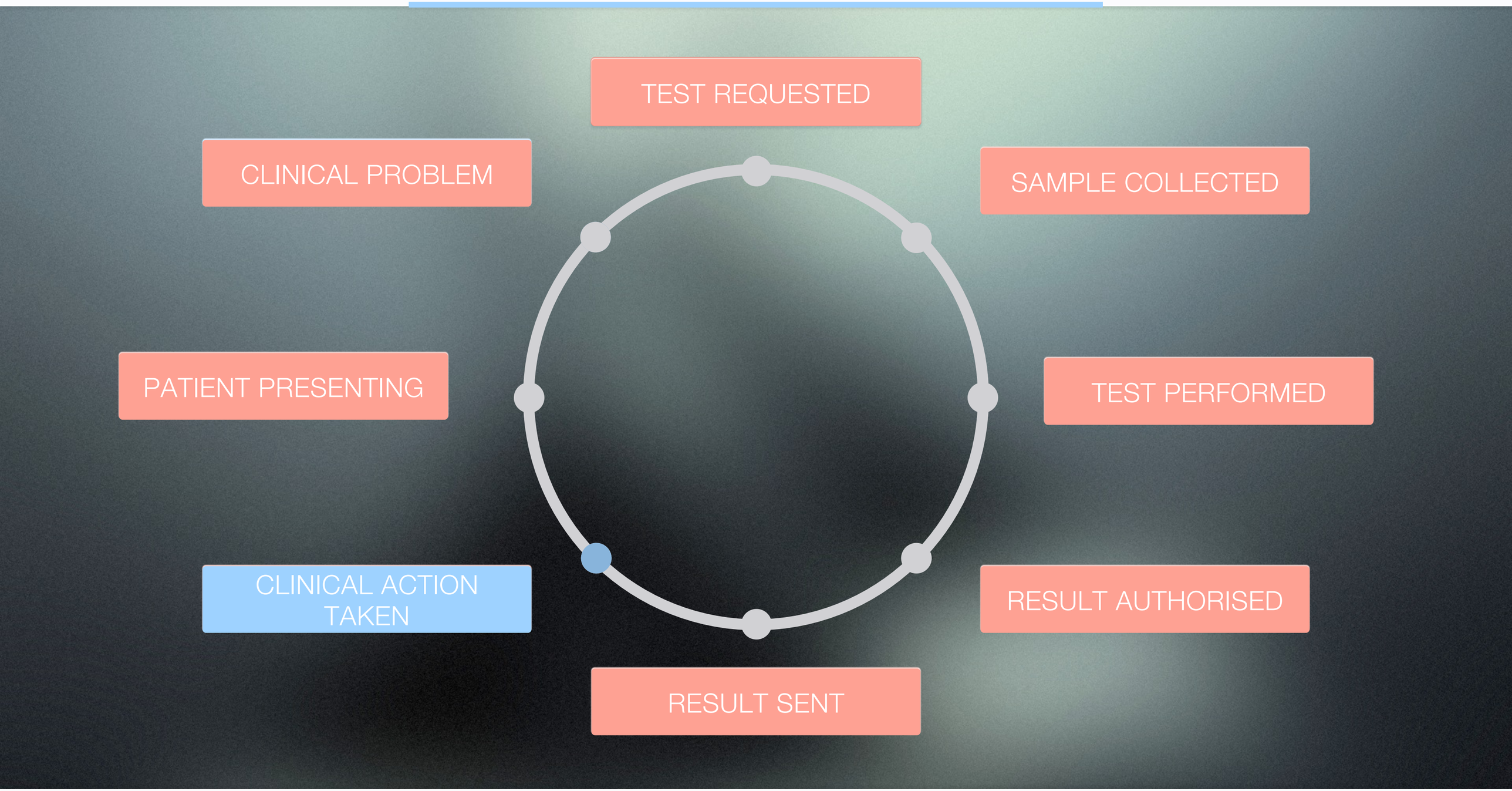


PATIENT PRESENTING

TEST PERFORMED

RESULT AUTHORISED


TEST REQUESTED
CLINICAL PROBLEM
SAMPLE COLLECTED
PATIENT PRESENTING
TEST PERFORMED
RESULT AUTHORISED
RESULT SENT


TEST REQUESTED
SAMPLE COLLECTED
TEST PERFORMED
RESULT AUTHORISED
RESULT SENT
CLINICAL ACTION TAKEN
PATIENT PRESENTING
CLINICAL PROBLEM

PRO-RE-TE-R-A

pathology TEST

REQUEST for test

test RESULT

clinical PROBLEM

clinical ACTION

THANKS FOR YOUR ATTENTION