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Performing analytics on SNOMED CT coded database, Serdang Hospital use-case

SNOMED CT EXPO 2015

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Agenda

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1. **Start-up project: overall objective**

2. **Methodology to get SNOMED CT codified data**
   a. Prepare the data from eHIS database
   b. Codify the data with SNOMED CT
   c. Validate the codification

3. **Analytics over SNOMED CT codified data**

4. **Challenges and Future work**
   a. SNOMED CT versioning
   b. Performance
   c. Integration into the Malaysian Health Data Warehouse

Start-up project: overall objective

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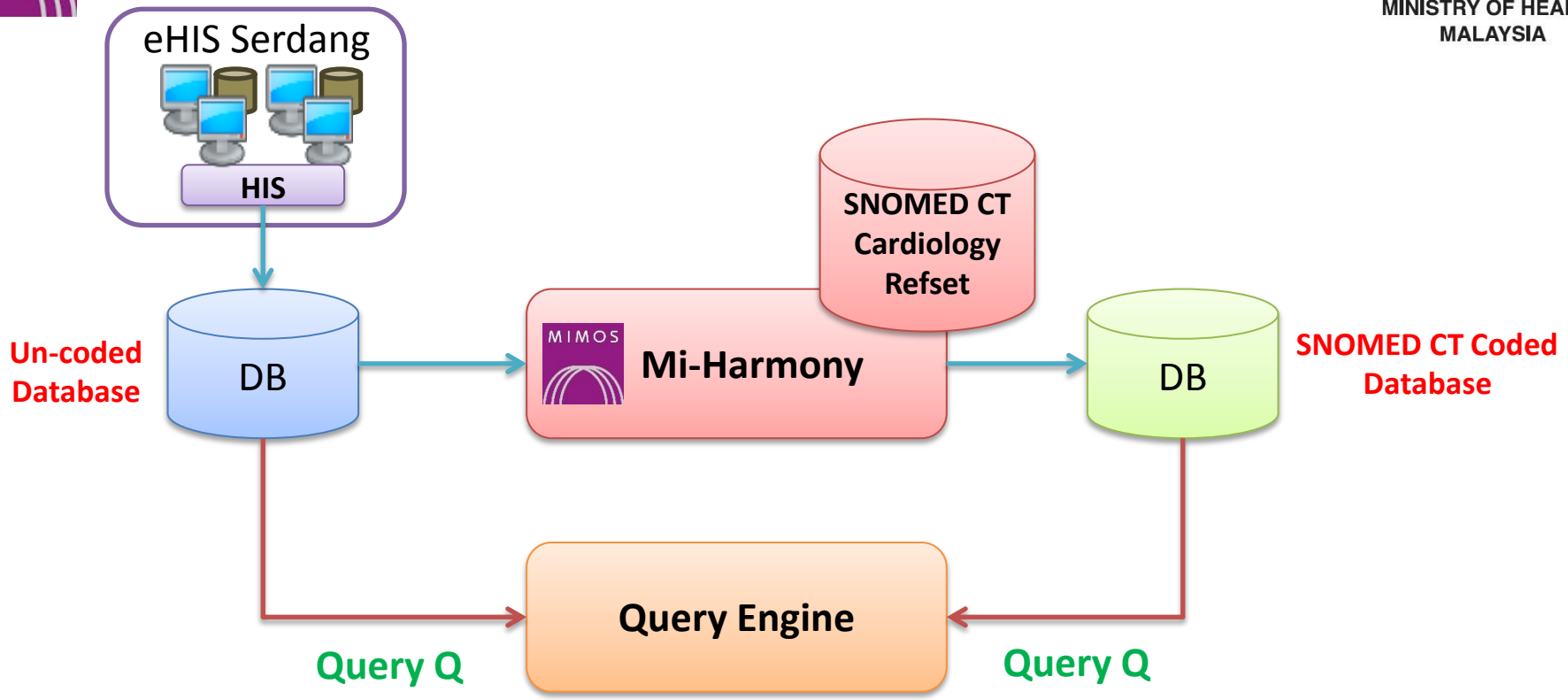
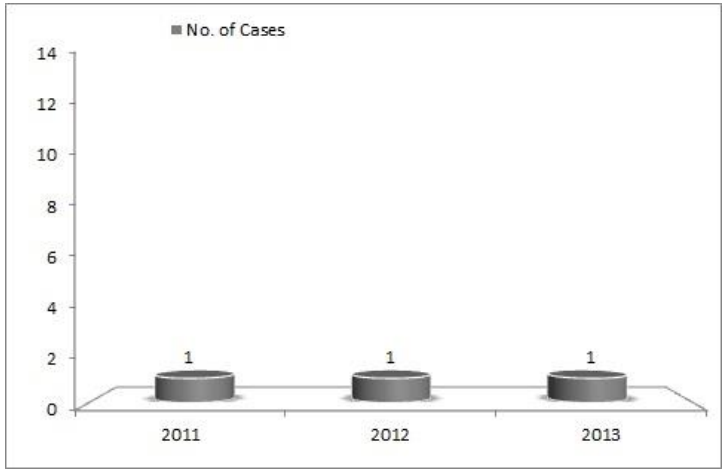
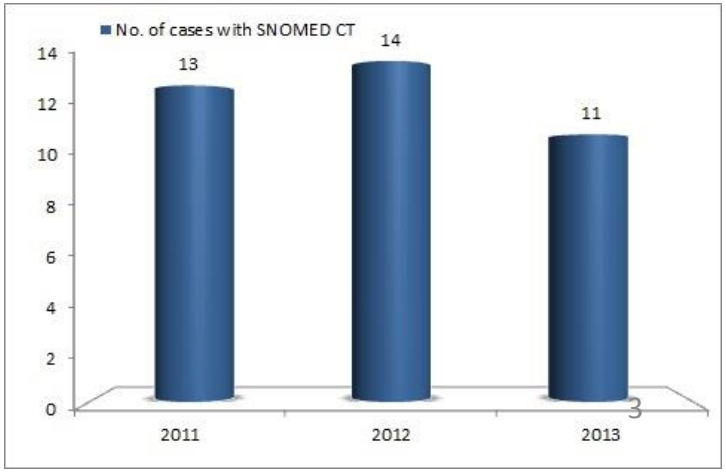




Same Query

Different Results?



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Prepare the data from eHIS database

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- eHIS Database:
  - 2K+ tables
  - Contain data from Cardiology Department

- Identify table with doctor-written patient diagnoses
  - PR_PROBLEM_ASSESSMENT (col. PROBLEM_REMARKS)
  - 491,612 records

- Identify patterns related to cardiology terms
  - 31 patterns identified: %heart%, %card%, %coronar%, %fibril%, %mitral%, %angio%, %angina%, %stemi%, %lad%, %2vd%, %3vd%, %ccs%, etc.

Prepare the data from eHIS database

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- Extract the data using identified cardiology related patterns: 10,692 records were extracted

- Filter cardiology related data: 10,228 records verified as Cardiology related diagnoses. Confirmation done by 2 verifiers and with crosschecking method

Examples of diagnosis:

- Missed anterior MI (killpi 3) , IHD h/o NSTEMI
- 3VD, Unstable angina (evolving ECG changes, Trop T negative), carotids normal
- NSTEMI and mixed with AF and atrial flutter

Codify the data with SNOMED CT

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- Use the Malaysian Cardiology Refset to guide the codification:
  - Built jointly by Cardiologists, Ministry of Health of Malaysia and MIMOS Berhad
  - Derived from the NCVD ACS & PCI (**N**ational **C**ardio**V**ascular disease **D**atabase patient registry form -**A**cute **C**oronary **S**yndrome & **P**ercutaneous **C**oronary **I**ntervention)
  - 380 existing SNOMED CT Concepts
  - 108 new concepts not existing in SNOMED CT
  - 30 post-coordinated concepts proposed
  - 1656 terms (including synonyms and short forms)

Codify the data with SNOMED CT

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- Examples of SNOMED CT codified diagnoses:

- Missed anterior MI ([killpi 3, #0000013#]) , [IHD, #414545008#] h/o [NSTEMI, #401314000#]

- 3VD, [Unstable angina, #4557003#] (evolving [ECG, #46825001#] changes , [Trop T, #102682001#] [negative, #260385009#]), carotids normal

- [NSTEMI, #401314000#] and mixed with [AF, #164889003#] and atrial flutter

Validating the codification

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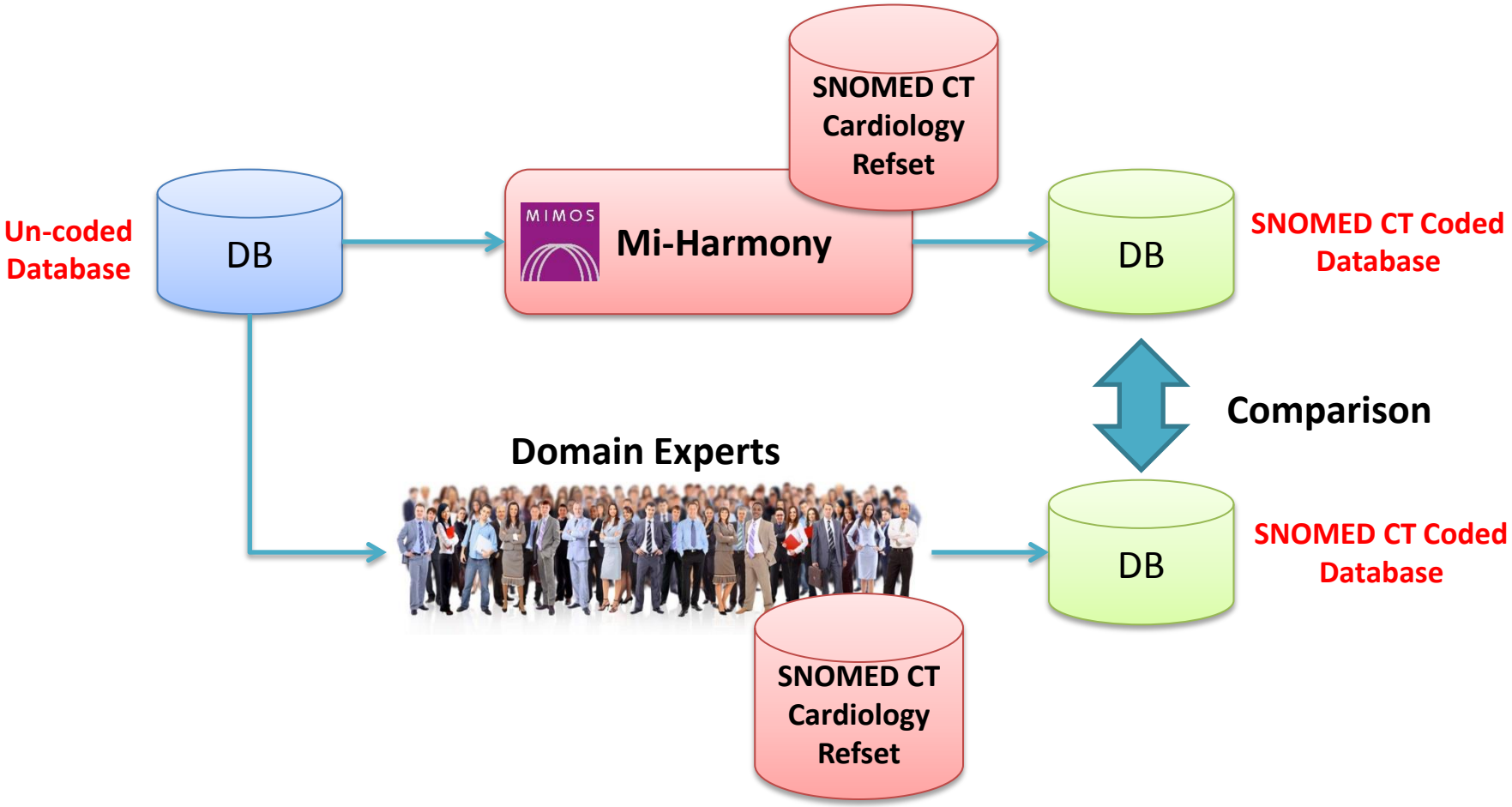

Validating the codification

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- Results of the comparison over 100 diagnoses:
  - Precision: 95%
  - Recall: 94%

- For precision, we considered context-based terms to be wrongly codified, such as:
  - “symptoms of [heart disease, #56265001#]”
  - “h/o [NSTEMI, #401314000#]”

- For recall, the missed terms are mainly due to the informal way of writing. Example:
  - “CCS 1 - 2” which should be understood as “in between CCS 1 & CCS 2”

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Analytics over SNOMED CT codified data

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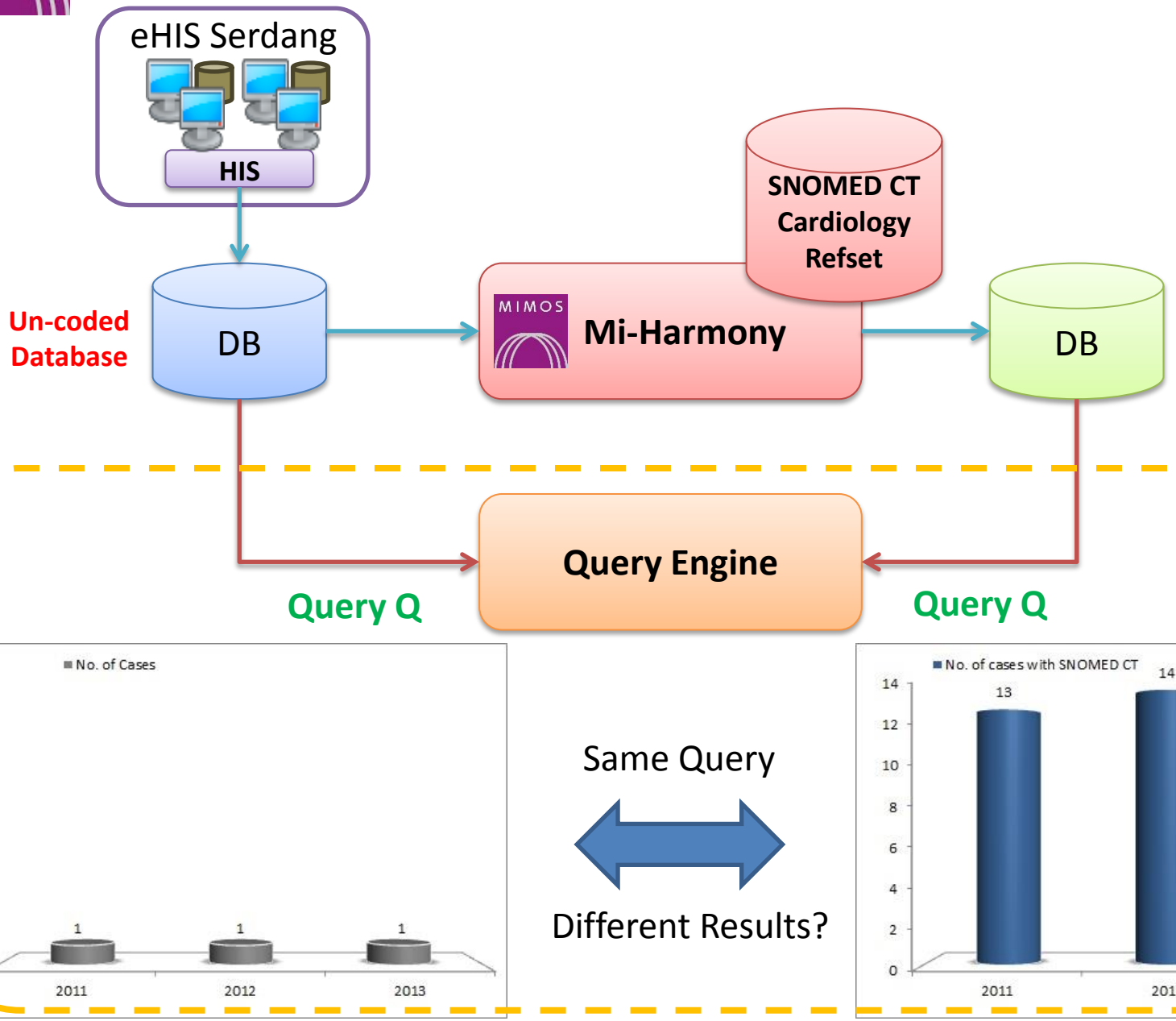

Analytics over SNOMED CT codified data

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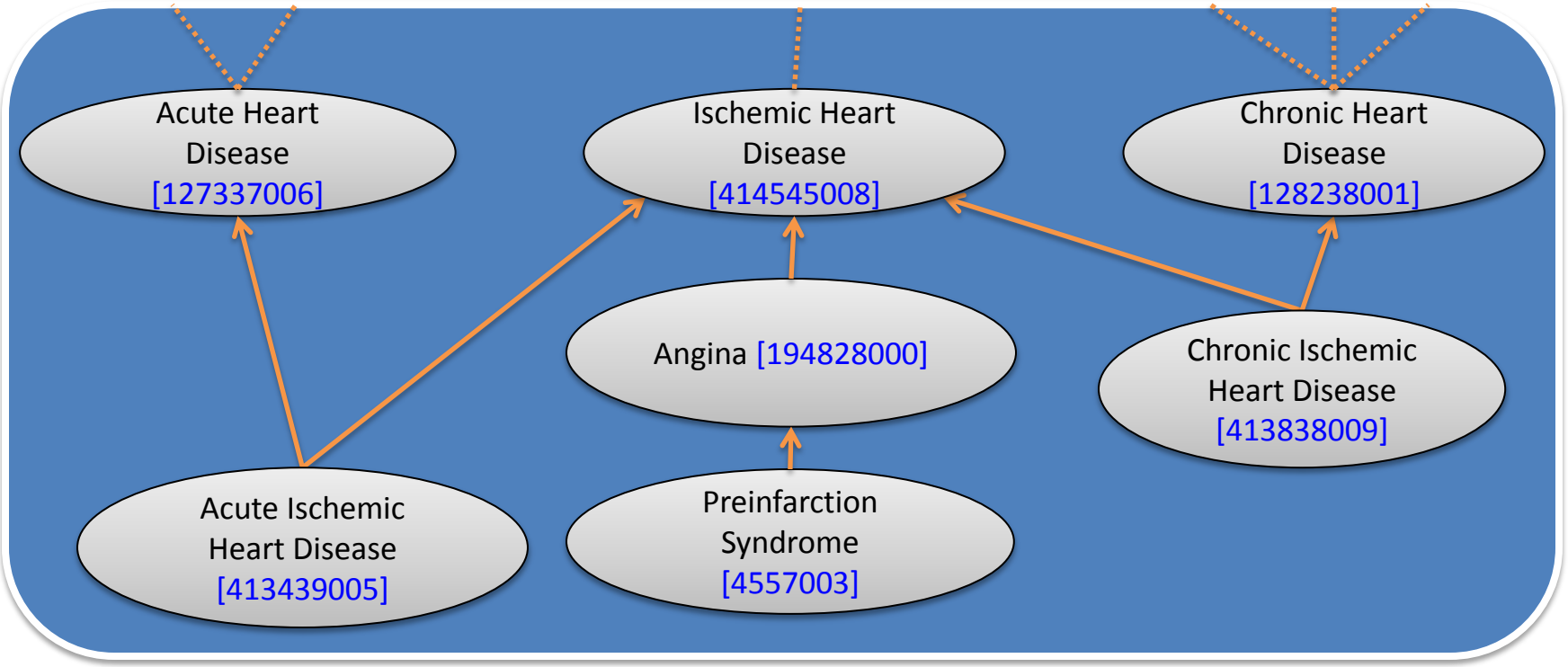
- Use of SNOMED CT at the reporting stage (fixed queries)
- Use of SNOMED CT subsumption relationships during query processing



Analytics over SNOMED CT codified data

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- Expand the query, guided by the Malaysian Cardiology Refset

- Example of input query:

- SELECT COUNT(*), YEAR(DATE) FROM PATIENT_DIAGNOSIS WHERE DIAGNOSIS LIKE "%#**Ischaemic Heart Disease**#%" GROUP BY YEAR(DATE);

- Example of expanded query:

- SELECT COUNT(*), YEAR(DATE) FROM PATIENT_DIAGNOSIS WHERE DIAGNOSIS LIKE "%**#414545008#**%" OR DIAGNOSIS LIKE "%**#4557003#**%" OR DIAGNOSIS LIKE "%**#394659003#**%" GROUP BY YEAR(DATE);

"**414545008**" is the SNOMED CT code for "**Ischaemic Heart Disease**"
"**4557003**" is the SNOMED CT code for "**Unstable Angina**"
"**394659003**" is the SNOMED CT code for "**Acute Coronary Syndrome**"

Analytics over SNOMED CT codified data

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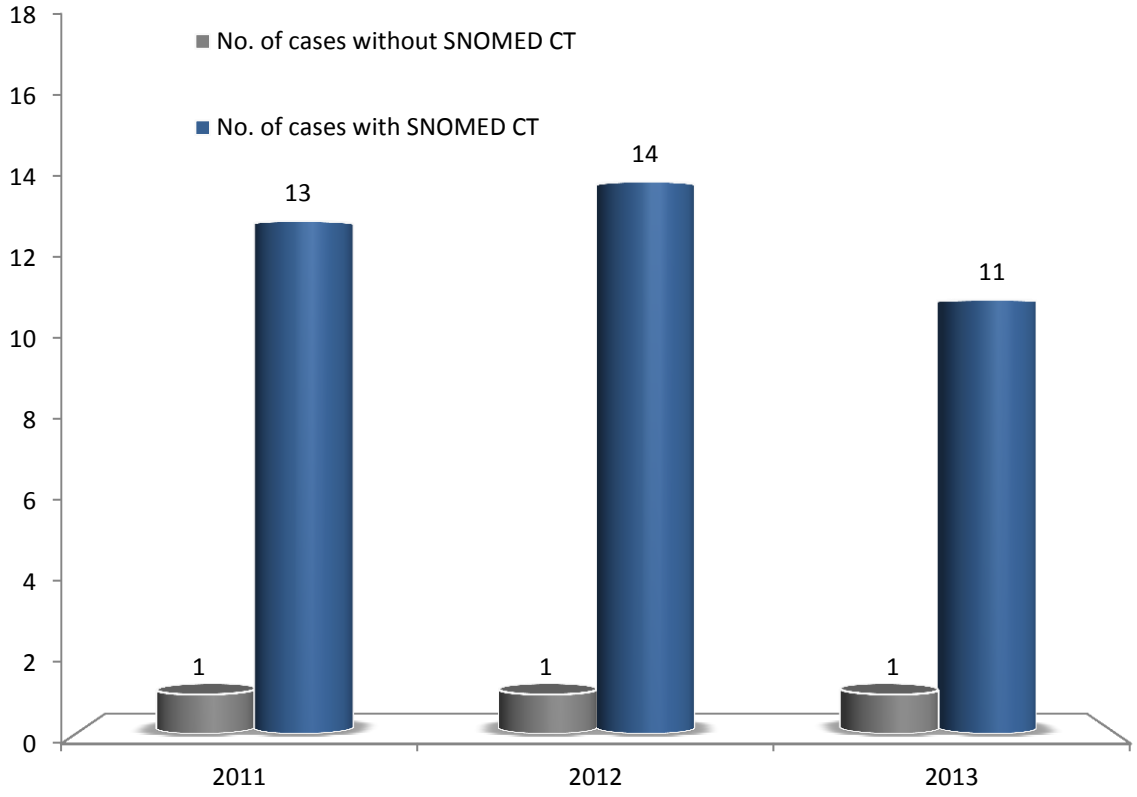
1. Results for 100 encounters manually validated



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Handling SNOMED CT versioning

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- As per now:
  - Refset is derived from SNOMED CT INTERNATIONAL RELEASE
  - Coding is based on the Refset
  - Query expansion is using the same version of SNOMED CT INTERNATIONAL RELEASE

- What happens when we want to move to a newer SNOMED CT INTERNATIONAL RELEASE?
  - Refset has to be modified?
  - Behavior of query expansion has to be different?
    - Some data might have been codified with “old” codes while new data will use the “new” codes

Improving SNOMED CT Coding Performance

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1. Improving Precision
    - Handling context of terms

2. Improving Recall
    - Increasing the number of handled short forms and acronyms
    - Handling certain forms of informal writing

3. Improving Speed
    - Moving to GPU-based parallel processing

Improving SNOMED CT Querying Performance

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1. Improving Speed
   - Moving to GPU-based parallel processing

2. Handling versioning of SNOMED CT
   - To be investigated

Integration into MyHDW

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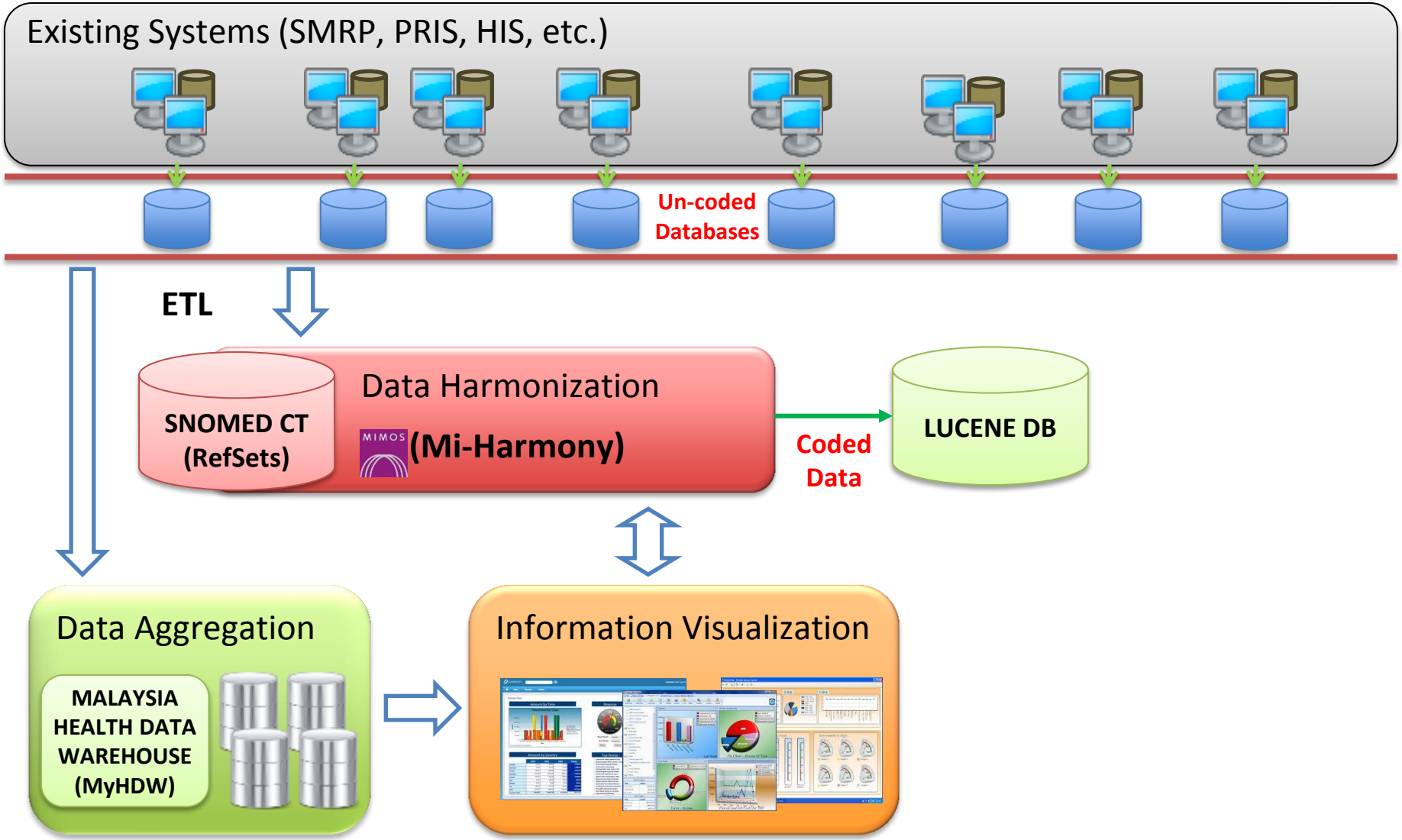

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Q&A and Feedback

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TERIMA KASIH

THANK YOU