Integrating MyHarmony
(Harmonization & Codification of Unstructured Data using SNOMED CT)
and Malaysian Health Data Warehouse

Transforming unstructured to structured data using SNOMED CT

Authors

Md. Khadzir Sheikh Ahmad[1], 'Ismat Mohd Sulaiman[1], Mohd Syazrin Mohd Sakri[1], Muhammad Aiman Mazlan[2], Abdul Aziz Latip[2], Omar Ismail[1]

[1]Ministry of Health Malaysia, [2]MIMOS

SNOMED CT Expo 2019
Kuala Lumpur, Malaysia
Oct 31-Nov 1, 2019

OVERVIEW of MyHDW

OPERATIONAL SYSTEMS -
for primary use

MyHDW: MALAYSIAN HEALTH DATA WAREHOUSE

Data collection systems

Analytical systems – *for secondary use*

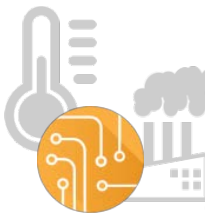
To support evidence based decision making for the effective Management of the Health System

Government Clinics

TPCHCIS
BRINGING HEALTHCARE CLOSER TO YOU

Government Hospitals

Private Hospitals



Pollution & Weather

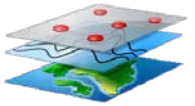
Meteorology & Environment

SMRP
Sistem Maklumat Rawatan Pelanggan

PRIS
Patient Registry Information System

MyHDW
version 1.0

Reporting, Dashboard Ad-hoc Analytics



Geographic Information System (GIS)

Research & Statistical Analysis

World Health Organization

SDG, UHC, Performance Indicators

Text analytics for unstructured data

CLINICAL NOTES

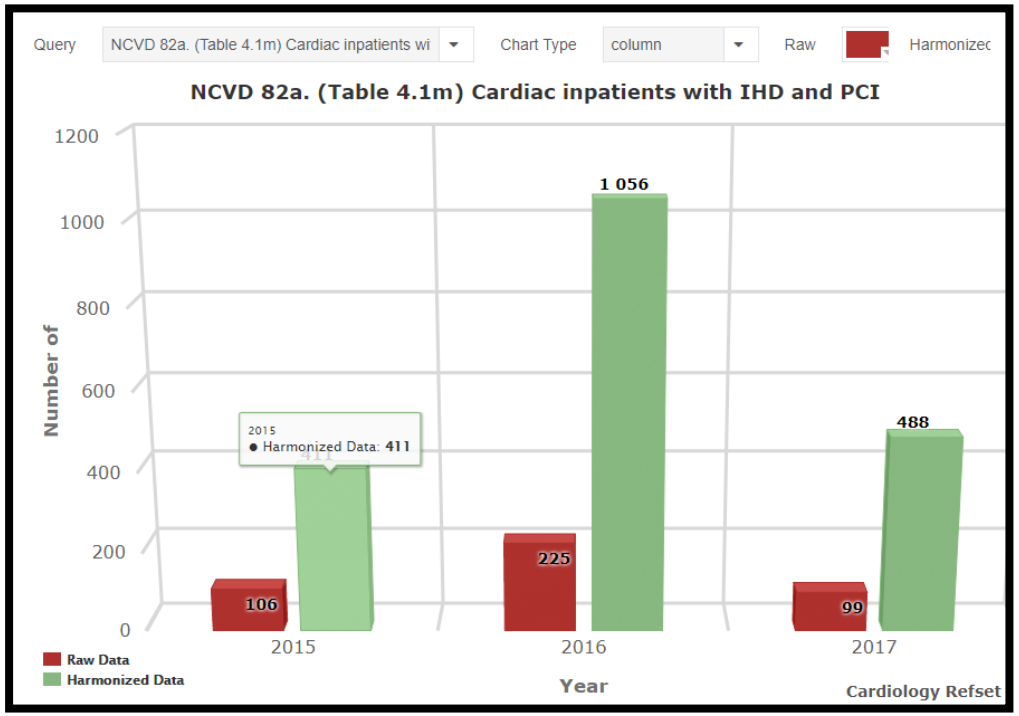
DISCHARGE RECORDS

RADIOLOGY REPORTS

LAB TEST REPORTS

MyHarmony

MyHarmony



Generate reports required by the stakeholders

More time-efficient

- Information timeliness
- Continuous monitoring

New questions can be answered

- Reuse available data – saves cost and avoid new system development

No Duplication of Data Entry - Data from the source

- Reduce workload and transcribing error

1.

Create codified enumeration dimension in MyHarmony

2.

Create datamart (OLAP) to be consumed by MyHDW

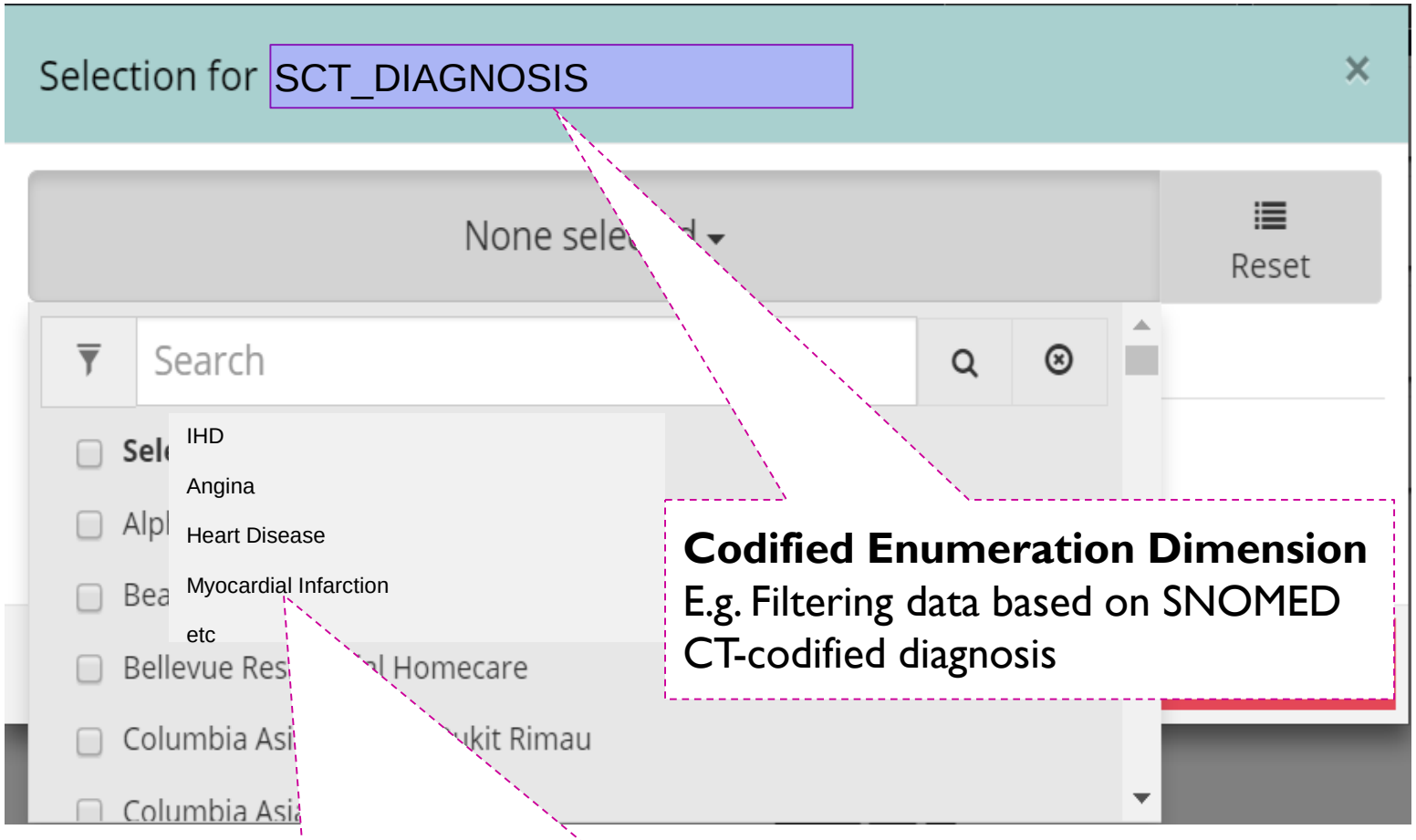
3.

Create Dashboard and ad-hoc queries

Structuring the unstructured (SNOMED CT codified) data

1. Codified Enumeration Dimension

- "Codified Enumeration" dimension is a **virtual dimension** to abstract the complexity of the terminology from the BI
- MyHarmony expands the codified enumeration into a set of Codified Enumeration Items, which are SNOMED CT concepts defined by the Refset owner.
- As a result, BI could be used to analyse codified data without the need to address the complexity of SNOMED CT and the refset used to codify it.



Codified Enumeration Dimension
E.g. Filtering data based on SNOMED CT-codified diagnosis

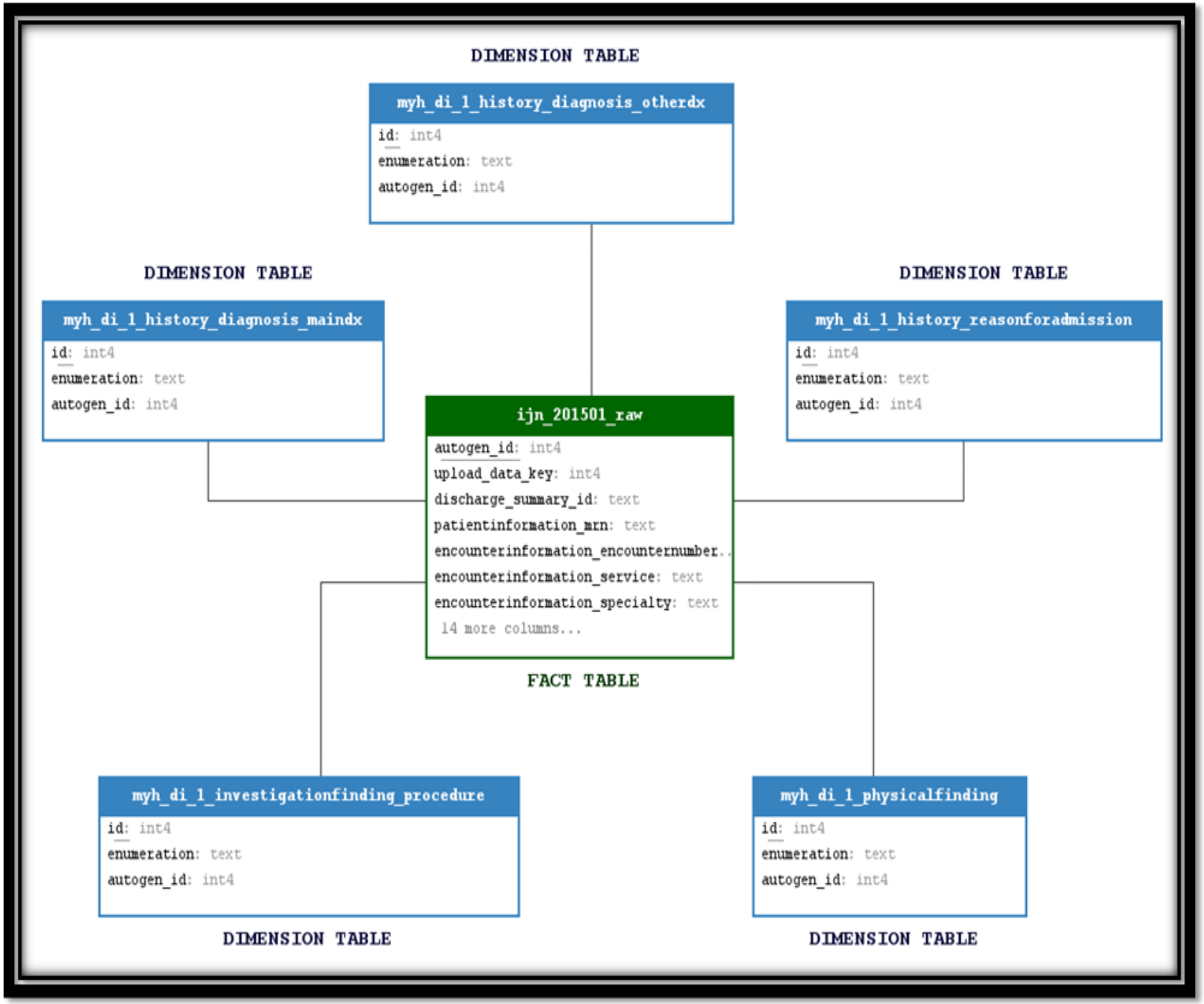
Codified Enumeration Items

- The codification engine expands each item when query is made.
- It allows generalizability and specificity.
- E.g. "IHD" is expanded to include STEMI, UA, ACS as defined in SNOMED CT relationship structure and the Refset used.

2. Create datamart in Mi-BIS

Fact table and Dimension table in a Star Schema model are created.

Codified data in MyHarmony are mined to generate Dimension tables.



Codified Enumeration Dimension Transformed into Dimension Table

Data marts provides all possible combination of dimension i.e. enumeration values for each diagnosis. Because of that, to do aggregate count (on OLAP CUBE), a "DISTINCT" keyword must be introduced. SQL: COUNT (DISTINCT(primary_key)) instead of COUNT(primary_key).

myh_di_history_reasonforadmission

Output pane

Data Output | Explain | Messages | History

	autogen_id integer	enumeration text
1	19	Complete heart block
2	19	Heart block
3	19	AV block
4	51	Hypertension
5	51	Ischemic heart disease
6	55	Acute non-ST segment elevation myocardial infarction
7	55	Hypertension
8	55	Acute myocardial infarction
9	55	Coronary artery disease
10	55	Ischemic heart disease
11	56	Coron
12	63	Valvu
13	82	Acute
14	82	Acute
15	82	Ischemic heart disease

Unique ID - MRN is unique per patient, but not unique per visit

myh_di_history_diagnosis_maindx

Output pane

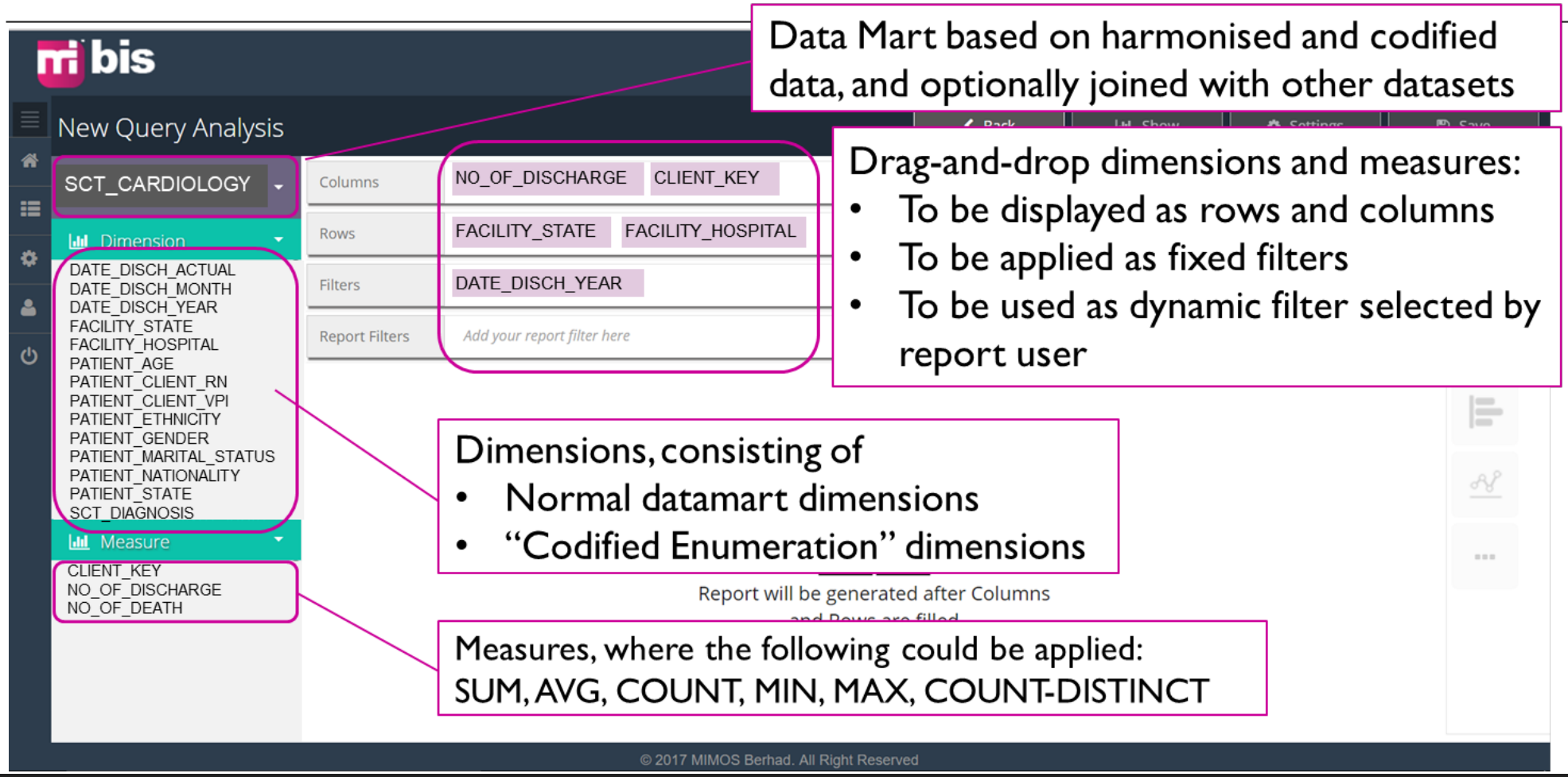
Data Output | Explain | Messages | History

	autogen_id integer	enumeration text
1	14	Hypertension
2	17	Acute non-ST segment elevation myocardial infarction
3	17	Acute myocardial infarction
4	17	Coronary artery disease
5	17	Ischemic heart disease
6	19	Acute non-ST segment elevation myocardial infarction
7	19	Heart block
8	19	Acute myocardial infarction
9	19	Ischemic heart disease
10	21	Coronary artery disease
11	23	Coronary artery disease
12	25	
13	27	
14	28	
15	29	
16	30	Coronary artery disease

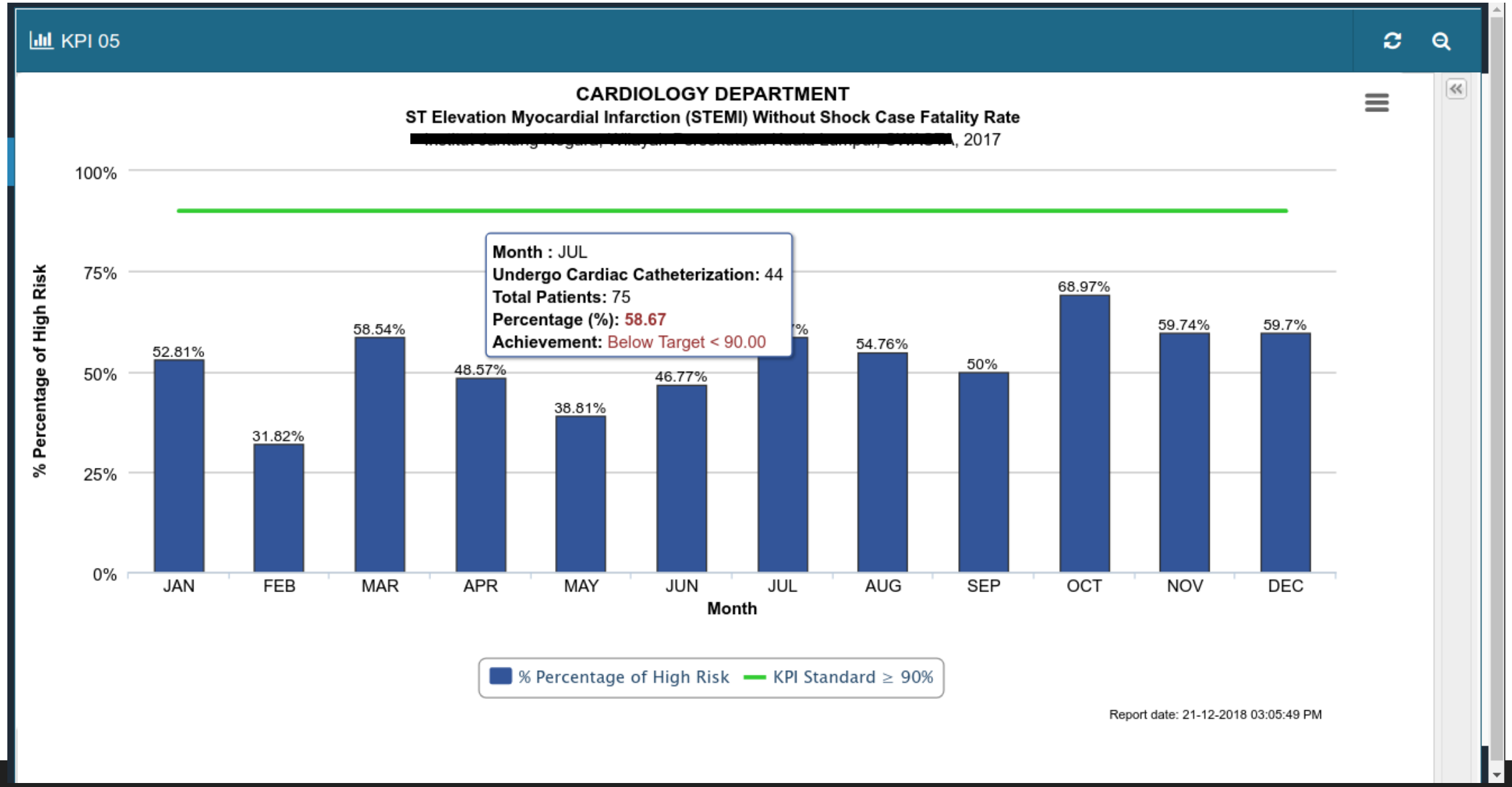
A patient can have multiple diagnosis and enumeration (codified data)

3. Unified Analytics Using Mi-BIS

Mi-BIS: Business Intelligence platform in MyHDW developed by MIMOS



Dashboard


KPI 05
CARDIOLOGY DEPARTMENT
ST Elevation Myocardial Infarction (STEMI) Without Shock Case Fatality Rate
[redacted], 2017
100%
75%
50%
25%
0%
% Percentage of High Risk
Month : JUL
Undergo Cardiac Catheterization: 44
Total Patients: 75
Percentage (%): 58.67
Achievement: Below Target < 90.00
52.81%
31.82%
58.54%
48.57%
38.81%
46.77%
54.76%
50%
68.97%
59.74%
59.7%
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Month
% Percentage of High Risk
KPI Standard ≥ 90%
Report date: 21-12-2018 03:05:49 PM

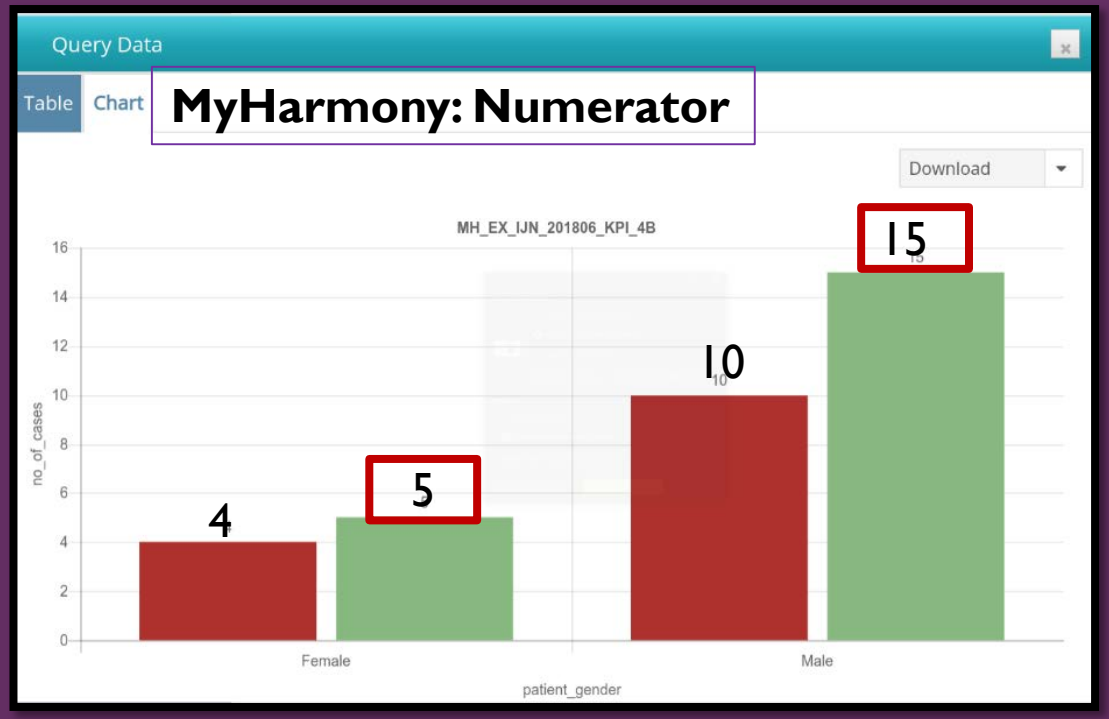
IMPLEMENTATION & VALIDATION

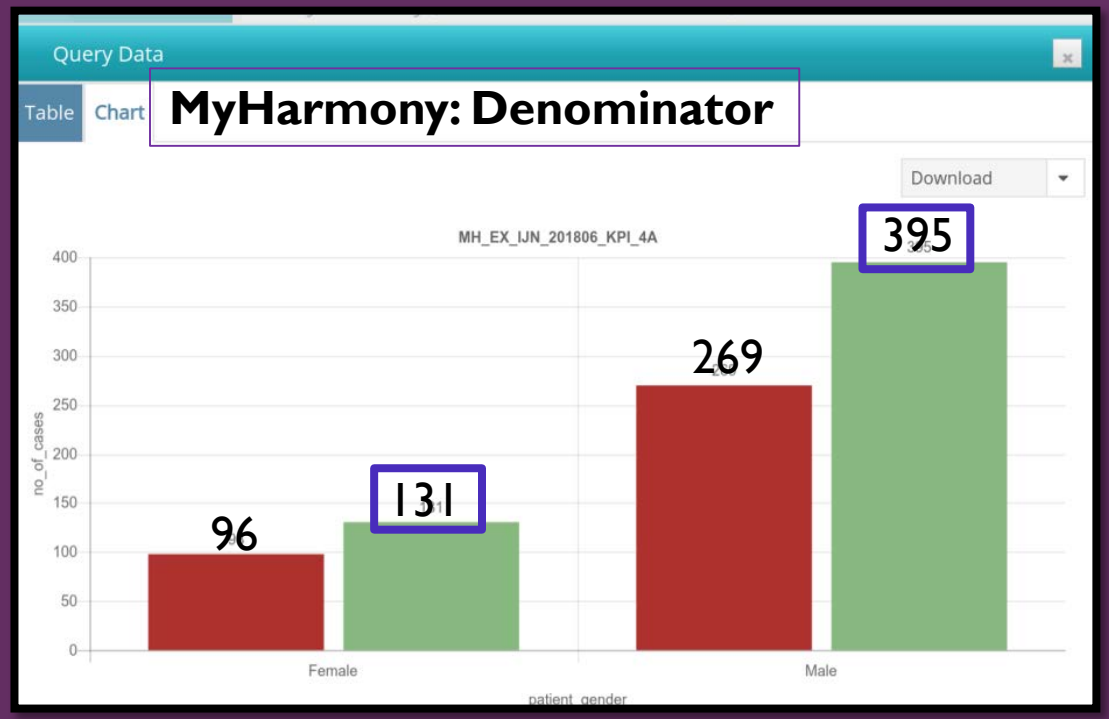
Generating National Cardiology Key Performance Indicator (KPI)

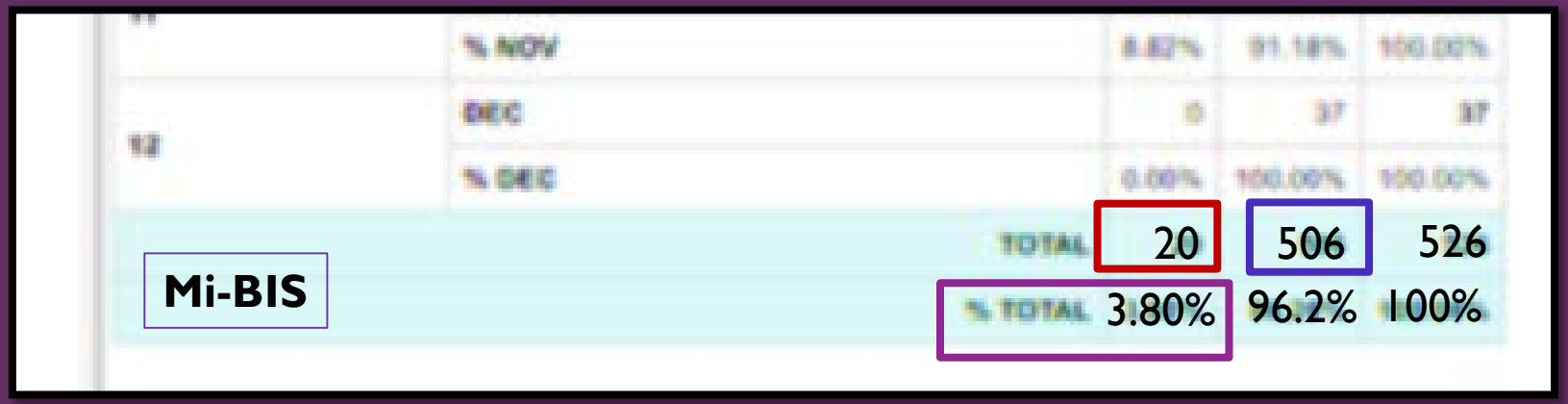
{ 1 KPI = 1 Datamart }

National Cardiology Key Performance Indicator (KPI) No. 4:

Non-ST Elevation Myocardial Infarction (NSTEMI) Case Fatality Rate







NSTEMI Case Fatality Rate (Hospital X), 2017:

MyHarmony / Mi-BIS : 3.8%

CONVENTIONAL

Multiple data entries at the health facilities

Prone to transcribing error & increase workload

Manual data entry and manual submission (even for IT hospitals)

Aggregated data submitted monthly to CKPP

Figures can be manipulated

Result published yearly or upon request

Prone to delayed reaction and action

MyHARMONY

Single entry at electronic discharge summary in free text

Requires proper documentation and awareness

Semi-automated submission, automated codification, and automated KPI generation

Able to filter & drill down for every KPI due to granular data

More timely results and auto-generated results

BENEFIT OF USING MyHARMONY

in generating KPI in MyHDW

Future works

SNOMED CT

- Managing SNOMED CT versioning for consistent results
- More efficient manner to develop SNOMED CT Refsets
- Use of SNOMED CT attribute relationship

Improve MyHarmony

- Additional context and word sense disambiguation
- Codification processing time for partial matched terms

Expand MyHarmony

- To other clinical specialties
- In Electronic Medical Record (front-end) – automated codification during documentation

Thank you

'ISMAT MOHD SULAIMAN
Health Informatics Centre, Planning Division, Ministry Of Health Malaysia
drismat@moh.gov.my