Evolution of SNOMED CT Reference Set in Improving Report

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Summary

Since the successful development of the first reference set (ref set) for Cardiology in generating Key Performance Indicators (KPI) which was started back in 2013, the Health Information Centre (HIC), Planning Division, Ministry of Health (MoH) Malaysia together with the Oral Health Programme (OHP), MoH Malaysia and MIMOS Berhad has expanded its unstructured data analytic capabilities by developing an Oral Health Reference Set and integration of MyHarmony to harmonize and codify free-text into the new system. This was made possible when a web-based data collection system, eReporting V2.0 Oral Health was developed as another source system in Malaysian Health Data Warehouse (MyHDW). It enables collection of granular data from all Oral Healthcare facilities; hospitals and clinics throughout Malaysia.

History of Implementation

In the development of unstructured data analysis for eReporting V2.0 Oral Health, the ref set is the most important element. It acts as a framework where we were able to selectively choose a few concepts from SNOMED CT which Subject Matter Experts (SMEs) considered to be essential for generating report. Unstructured data entry for eReporting V2.0 were collected from the free text box (Procedure Description) where clinicians will have to enter necessary information performed during each patient visit. MyHarmony then will harmonize and codifies free text into SNOMED CT Concept and Code for further analysis. This was revolutionary to Oral Health SMEs since they only accustomed to aggregated data analysis.

Introduction

In previous years, reports for OHP arises from manual collection (written form) of each patient's visits to healthcare facilities and later data compile at the dental clinic and dental district office as aggregated data. Reports were submitted as a prefix manual form or through Health Information Management System (HIMS) eReporting system.

The first development of the Oral Health reference set (Ref Set A) began back in Jan 2019. The reference set was baselined using the January 2019 version of International Edition release. About 1173 concepts were selected involving attributes such as procedure, social contact, qualifier value, physical object, and substance. Ref set A was then uploaded as the production version of eReporting V2.0 Oral Health.

Ref Set B later then finalized on the 3rd of Jun 2020 based on the Jan 2020 version of International Edition release, developed as part of MyHarmony machine learning initiative. A total of 2892 concepts were selected for this ref set and further involved more attributes.

Sample of codification for both ref sets as follows (Fig. 1):

No.	Procedure Description	MyHarmony					
		Free Text Codification	SCT Concept (Procedure)	SCT ID	Free Text Codification	SCT Concept (body structure)	SCT ID
1.	Extraction of permanent tooth 11, 12	Extraction of permanent tooth	Extraction of permanent tooth (procedure)	57703000	11	Structure of maxillary right central incisor tooth (body structure)	22120004
					12	Structure of maxillary right lateral incisor tooth (body structure)	11712009

Fig. 1 : MyHarmony codifies free text writing in Procedure Description (source from clinician) to respective SNOMED CT (SCT) Concept

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Aim and Objective

- To assess the codification between two reference sets (base line A&B) uploaded in MyHarmony during the development of MyHDW eReporting V2.0 Oral Health.

Method

- Data was requested from MyHDW as part of an internal audit to improve the ability of MyHarmony machine learning.
- Essential data that were collected for this analysis consist of Serial Number (SN), Data Group from each Submodule (Specialist and Primary Oral Health Services), free text procedure description and codified free text (**Fig. 2**) from 17 pilot facilities in the states of Selangor, Kuala Lumpur Federal Territory and Putrajaya Federal Territory, Malaysia from November 1st, 2021 until March 31st, 2022.

PROCEDURE_DESCRIPTION
Search
- CR (13), CR (12), CR (11) , CR (22), CR (23)
- INSERTION OF PREVENTIVE RESIN TOOT...

DATAGROUP
All

SN	DATAGROUP	PROCEDURE_DESCRIPTION	SNOMEDCT_PROCEDURE_CODE	SNOMEDCT_PROCEDURE_DESC	PROCEDURE_CODIFICATION_STATUS
KPdKKKL22112021RES2019	Restorative	- CR (13), CR (12), CR (11) , CR (22), CR (23)	234789004	Insertion of composite restoration into tooth (procedure)	Codified
KPdKKKL22112021RES2019	Restorative	- INSERTION OF PREVENTIVE RESIN TOOTH RESTORATION	234790008	Insertion of preventive resin tooth restoration (procedure)	Codified
KPdKKKL22112021RES2019	Restorative	- MICRO ABBRASION OF TOOTH ENAMEL	-1	NOT AVAILABLE	Not Codified
KPdKKKL22112021RES2023	Restorative	- TAKE IMPRESSION OF DENTAL STUDY MODEL	281621005	Cast dental study model (procedure)	Codified

Fig. 2: Table showing some sample data extracted for analysis

- Our data obtained from the patient-based clinical data source from all Primary Oral Healthcare services (Primer, Outreach, School) and Specialist Oral Health Care Services involving Oral and Maxillofacial Surgery, Oral Pathology and Oral Medicine, Orthodontics, Paediatric Dentistry, Periodontics, Restorative Dentistry, Special Care Dentistry excluding Forensic Dentistry.
- Data was then further analysed using Microsoft Power BI.

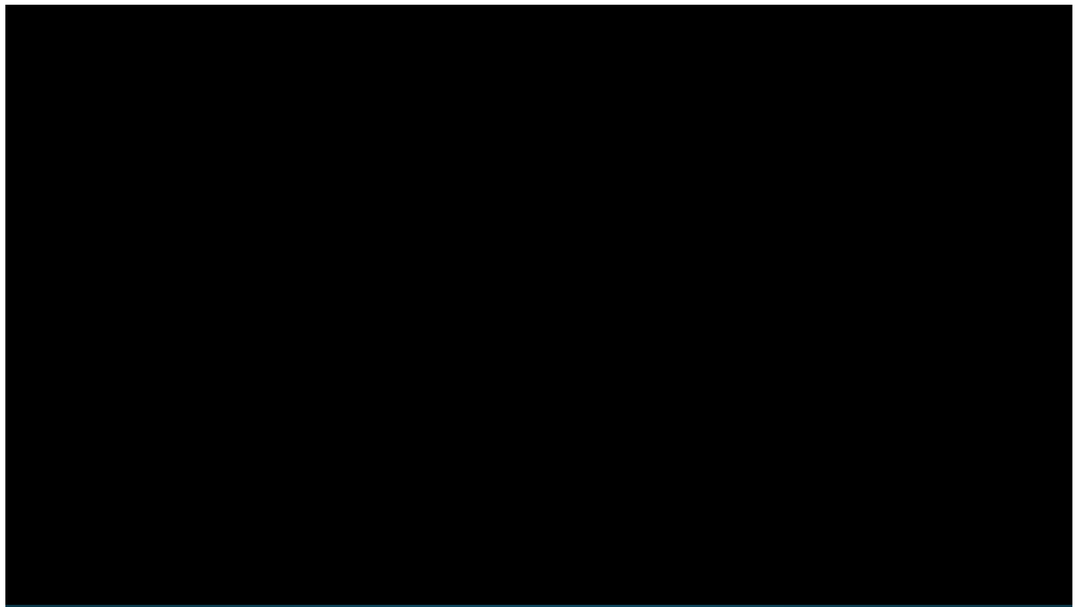

Fig. 3: Video showing results on analysis of reference set codification in Microsoft Power BI according to different submodule

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Result

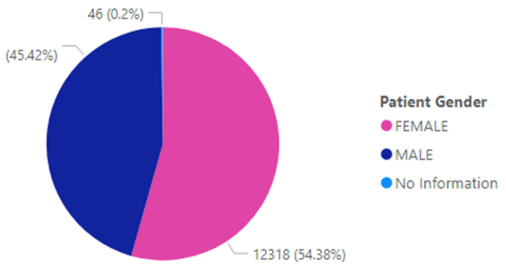


Fig. 4 : Number of visits by gender

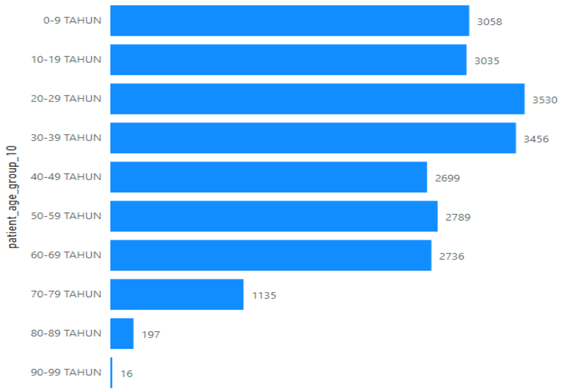


Fig. 5 : Number of visit by age group

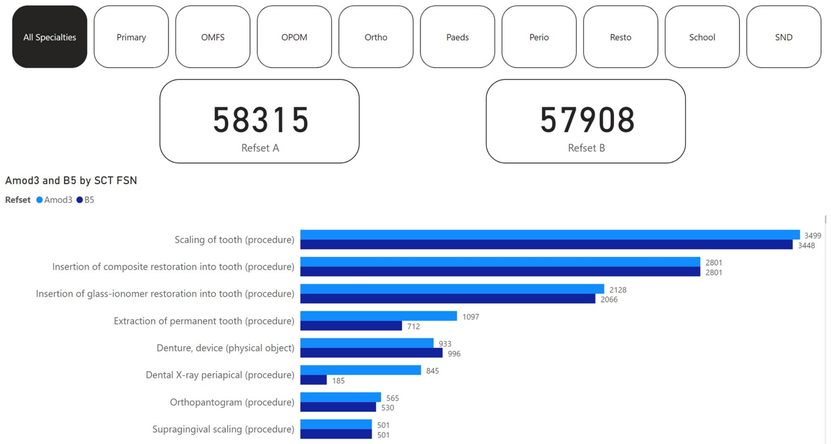
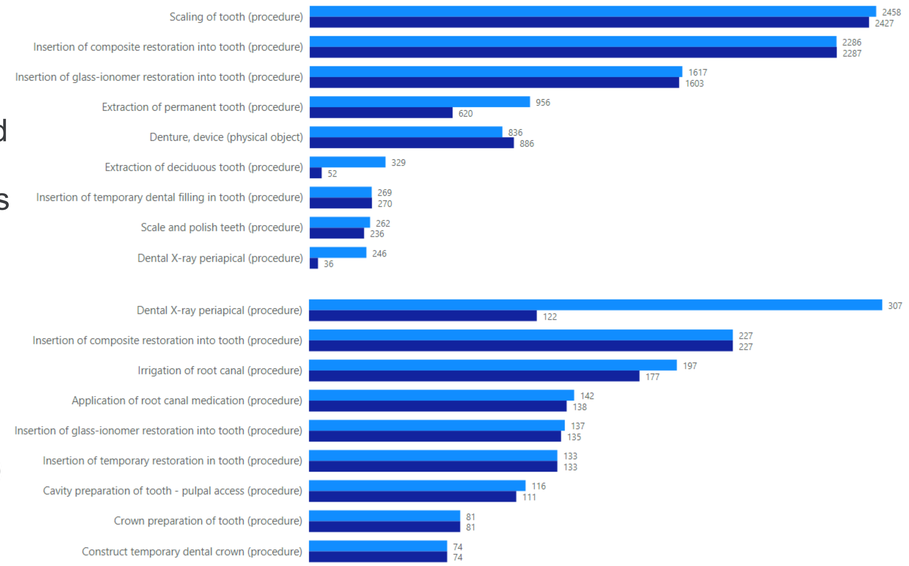


Fig. 6 : Fig 3 : 8 of the most common concepts codified by MyHarmony using both ref set A and B for all the Primary and Specialist Oral Healthcare Services in Malaysia from November 1st 2021 until March 31st 2022 (using Microsoft Power BI)

Results

Fig 7,8 : Most common concepts codified for a hospital-based Specialists / Oral and Maxillofacial Surgery (above) and a non hospital-based specialists; Restorative Dentistry (below)



Summary

- A total of 22,651 patients visit our pilot facilities. 54.38 % are male while 45.42% are female (**Fig. 4**)
- From the daily procedure submitted by the clinician into the free text procedure description, 58,315 free texts were codified into SNOMED CT concept when we were using Ref Set Baselined A while using Ref Set B, 57,908 were codified (0.01 % reduction of codification) (**Fig. 6**).
- More than half (53.4%) of procedure descriptions originated from Specialist Oral Healthcare services.
- The highest number of concepts codified by MyHarmony is scaling (Scaling of tooth (procedure) | 173333008), almost 3,500 procedure.
- There is a 34.5% and 78.11% reduction in codified concepts between ref set A and ref set B for Extraction of permanent tooth (procedure) | 57703000 and Dental X-ray periapical (procedure) | 241047004.

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Discussion

- We noted that there were marked reduction of codified concept between ref set A and ref set B (**Fiq. 6**). This is mainly because of the enrichment of local terms in ref set A (modified version of ref set A, Amod3) was uploaded much later (in 2021), than ref set B (**Fig. 9**)
- We could also detect changes in SNOMED CT concept, codes and duplication of concept or synonyms between 2 ref sets.
- 14 concepts in ref set A were obsolete due to SNOMED versioning when uploaded into MyHarmony.

No.	Procedure Description	MyHarmony codification					
		Free Text Codification	SCT Concept (Procedure)	SCT ID	SCT Synonyms	Ref Set A Local Term for SCT procedure	Ref Set B Local Term for SCT procedure
1.	Extraction of tooth permanent 11,12	Extraction of tooth permanent	Extraction of permanent tooth (procedure)	57703000	Extraction of permanent tooth (procedure), Extraction of permanent tooth	Extraction of tooth permanent, permanent tooth extraction, permanent Xtn, permanent Xn, Xtn permanent, Xn permanent, cabutan gigi kekal, Extraction of permanent	Extraction of tooth permanent

Fig. 9 : Local term differences in both reference set (A and B)

- With the introduction of the local term, MyHarmony would be able to analyses and codifies any character/ language used by the clinician.
- Most clinician does not follow the verbatim text writing style/ concepts proposed by SNOMED CT. Therefore, some post-coordination mapping is needed at the local level

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Discussion

- Efforts to revise local terms for future reference sets, allow variation, improve the number of codifications and further enhance the report since it rely on which version of International Edition used for production.
- Setback for the usage of local term in a ref set is one local term has to be mapped to one SCT Concept.

Conclusions

- In summary, enrichment of local terms and revision of ref set enable improvement on codification of free text writing and further improve our analysis. However, with the implementation of eReporting V2.0 Oral Health, the number of codified concepts does not truly reflect the needs required by SMEs

Future Directions

- Future works will include identifying the change of concepts between the version hoping we could find some solution regarding this issue. We would also hoping to baselined another reference set as required by SMEs by the end of the year 2022.

References

1. Sheikh Ahmad M.K, Mohd Salleh S, Mohamad Saron M.F, Mazlan. M.A, Latip A. A. Analysis of Dental Process and Procedure Using Snomed CT and MyHarmony. SNOMED CT Expo 2019.

Acknowledgement

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