Integration and aggregation of Anesthesia into the OMOP CDM : proposal aggregation methods

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Abstract

After the integration of raw and fine-grained data into the OMOP CDM (e.g. peroperative anesthesia data), we need to perform aggregation to obtain usable information. We defined to aggregated concepts: the period and the aggregated indicator. We developed a R package and provide two tables for the computing and storage of these aggregated information.

Research Category

Observational data management, ETL

Introduction

To characterize the patient or the care, we need have usable information on specific periods of times (e.g. the duration of hypotension during the anesthesia procedure). These information are not always directly available in the source database, and have to be computed afterwards with raw data in defining an aggregation method. This is generally named “feature extraction” [1,2]. It is not suitable to store these aggregated information in the current tables (procedure_occurrence, condition_occurrence, measurement), which are more appropriate for the storage of raw data.

The objective of this work was to integrate anesthesia peroperative data into the OMOP common data model (CDM) and to propose a generalization of the methods of detection of periods and computing of aggregates.

Methods

We integrated anesthesia data into the OMOP CDM through semantic and structural mapping. Based on the CDM, we produced clinical dashboards with Rshiny.

We propose two aggregate concepts: period and period_aggregation. The period defines periods of interest (e.g. the 10 minutes following the induction), while the period_aggregation defines aggregated information of raw data, during a selected period (e.g. the min/mean/max values of mean arterial pressure after the induction).

A period is defined by 2 milestones: a start event and an end event. For each milestone, there could be more than one candidate event. Each event is defined by an event_concept_id, a start/end datetime of the event, an optional delta to be added to the datetime, the method to choose the event if there is more than one candidate event. An aggregate is defined by the association of three concepts: a period, a raw signal and an aggregation method. We proposed a R package with the mentioned methods, and two tables definition for storing aggregates. These methods were implemented with the computation of the min/mean/max values of mean arterial pressure around induction of anesthesia and the duration of hypotension during anesthesia procedure, for otorhinolaryngology (ORL) surgery in 2018 in Lille University Hospital. The case study is presented in Figure 1.

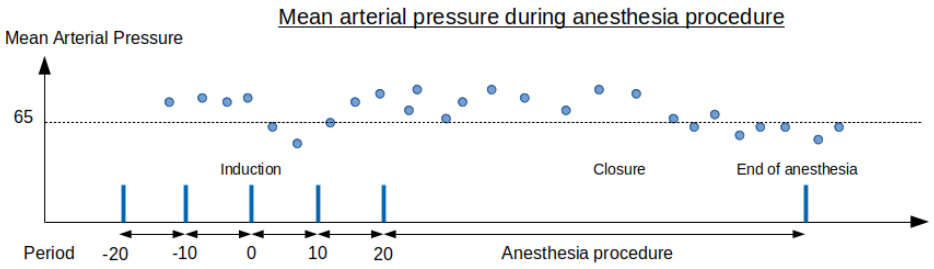

Figure 1. Study of the evolution of mean arterial pressure during anaesthesia. Highlighting of the different periods of interest.

Results

Overall, we integrated data from the 585 846 anesthesia procedures, realized between 2010 and 2018 in the Lille University Hospital, into 8 tables of the Standardized Clinical Data Tables section (Figure 2). We also produced four dashboards to visualize anesthesia data. Tables period and period_aggregation allow the storage of aggregates. Information about ETL and dashboards is available here [3].

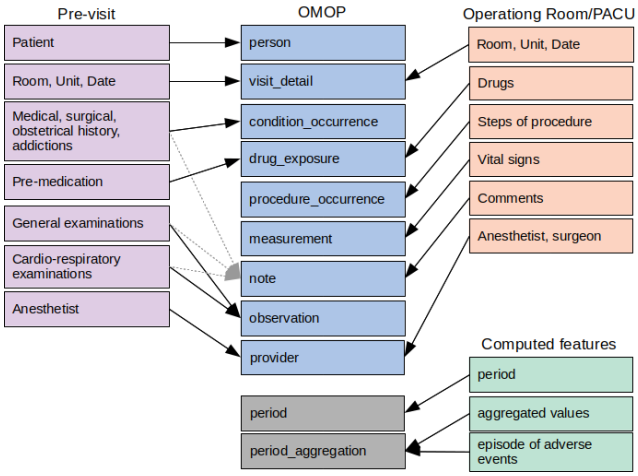

Figure 2. Structural mapping of anesthesia data (from pre-visit anesthesie, operating room and Post Anesthesia Care Unit (PACU) and computed features) into the OMOP CDM

There were 3098 anesthesia procedures in ORL in 2018. The mean (standard deviation) of duration of hypotension below 65 mmHg between induction and end of anesthesia was 51.331 (55.863) min. The interest periods were calculated based on the induction time (= 0) by adding or subtracting 10 or 20 minutes. Results are presented in Table 1. The package code for getting these results is available here [4].

Interval around induction (0)	]-20;-10]	]-10;0]	]0;10]	]10;20]
Min	95.1 (16.6)	94.3 (16.4)	70.0 (18.4)	64.9 (14.6)
Max	99.6 (16.5)	100.2 (16.6)	91.1 (19.1)	77.3 (17.2)
Mean	97.4 (16.2)	97.3 (15.8)	79.7 (16.8)	70.9 (14.9)

Table 1. Average (standard deviation) of min/mean/max values of mean arterial pressure around induction event (=0)

Conclusion

In this study, we have integrated intraoperative data into the OMOP model. We proposed ETL scripts, aggregation methods and clinical dashboards corresponding to frequent queries related to anesthesia activity.

References

1. Lamer A, Jeanne M, Vallet B, Ditilyeu G, Delaby F, Tavernier B, et al. Development of an anesthesia data warehouse: Preliminary results. IRBM. déc 2013;34(6):376-8.
2. Lamer A, Jeanne M, Ficheur G, Marcilly R. Automated data aggregation for time-series analysis: study case on anaesthesia data warehouse. Stud Health Technol Inform. 2016;221:102-6.
3. https://gitlab.com/antoinelamer/omop_anesthesia/
4. https://gitlab.com/mathilde.frchrt/aggregate