

A Novel Approach to Systematically Translate Anesthesia Quality Measures into Computable Representations for Clinical Decision Support Systems

Presenting Author: Rocky Reston, MD, PhD, Chief Medical Information Officer, Cognitive Medical Systems

Co-Author: Andrew Simms, PhD, Principal Informatics Scientist, Cognitive Medical Systems

Object of Study: The impact of quality measures on clinical care delivery and reimbursement within the anesthesia community is undeniable. In order to maximize the positive impact of these measures, it is desirable to create computable representations of them so that they can be used efficiently at the point of care--ideally in a clinical decision support (CDS) system. Unfortunately, translating the human-readable narratives present in quality measure guidelines into an executable version that reflects the original clinical intent is not straightforward. We propose the application of a knowledge representation framework in conjunction with a quality measure semantic model to provide the foundation for a reproducible process for this translation.

Methods: To create these knowledge bases, we developed a systematic approach to translate clinical intent into computable artifacts using a multi-layered framework for representing knowledge [1, 2]. Beginning with a human-readable quality measure narrative (Level 1), we created a semi-structured representation with appropriate data bindings (Level 2) using a semantic model that captured quality measure intent. An example of a semantic model that was used for postoperative nausea and vomiting is depicted in Figure 1.

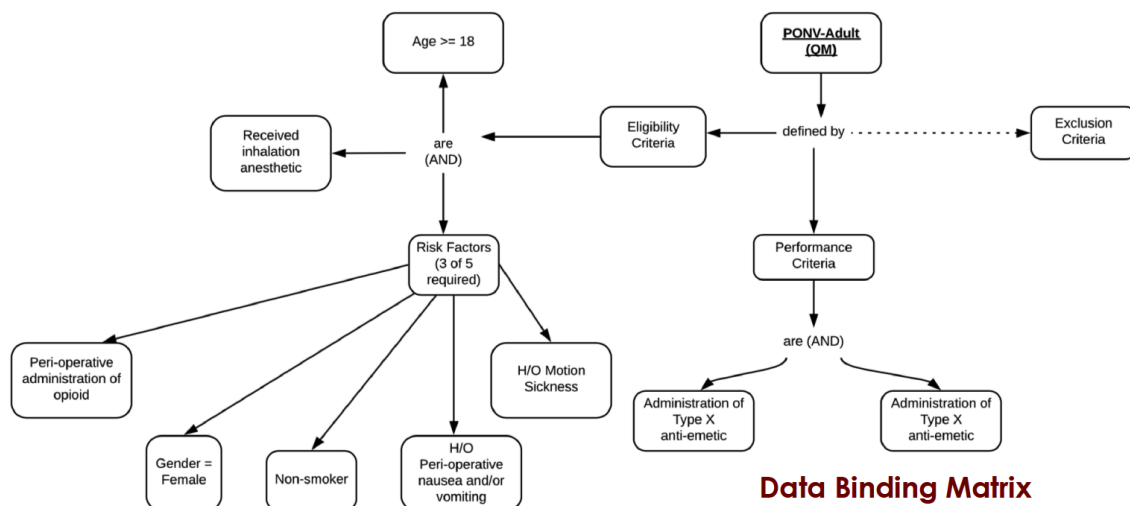


Figure 1: A representative Level 2 semantic model for quality measure MIPS #430 [3].

From this Level 2 representation, we created a standardized structured document reflecting the clinical context, intent, and logic to make the measure computable at the machine level (Level 3). In addition, where possible, this was aligned with standard terminologies including SNOMED CT, LOINC, and Rx NORM to facilitate broad use of existing coded data elements. Finally, the Level 3 representation was converted to computable code using Drools and implemented within a clinical decision support system as a knowledge base.

For the purposes of validating the run-time representations, we used our CDS platform, CORA, integrated with the Draeger Innovian[®] anesthesia information management system (AIMS) [4]. CORA is a standards-based, extensible CDS platform that collects and analyzes data from an AIMS as it is generated, using algorithms and logic encoded in knowledge bases. Following the process described above, we implemented and validated the following core anesthesia quality measures:

- MIPS #44: CABG: Preoperative Beta-Blocker in Patients with Isolated CABG Surgery
- MIPS #76: Prevention of CVC-Related Bloodstream Infections
- MIPS #404: Anesthesiology Smoking Abstinence
- MIPS #424: Perioperative Temperature Management
- MIPS #426: Post-Anesthetic Transfer of Care Measure: Procedure Room to PACU
- MIPS #427: Post-Anesthetic Transfer of Care Measure: Procedure Room to ICU
- MIPS #430: Prevention of Postoperative Nausea and Vomiting
- MIPS #463: Prevention of Postoperative Vomiting (Pediatrics)

Conclusions: We successfully demonstrated a repeatable process to translate core anesthesia quality measure guidelines into computable representations. These representations were then implemented and validated within CORA and Innovian[®] to ensure that the executable version of the quality measure reflected the original clinical intent from the human-readable narrative. Furthermore, this work demonstrates a capability which will facilitate the rapid deployment of clinical knowledge and support the governance and refinement of deployed clinical knowledge to reflect current evidence.

References:

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