Development and Pilot Evaluation of a Real-Time Clinical Decision Support Module Integrated with an Enterprise Anesthesia Information Management System

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Introduction: Real-time clinical decision support (CDS) mediated through Anesthesia Information Management System (AIMS) has been shown to improve quality of care and revenue capture. However, the adoption of real-time anesthesia CDS is currently limited to a few institutions that have developed and customized such systems to work with their institution's AIMS[1,2]. Additionally, these CDS modules have been typically developed to work with standalone AIMS that are not part of an enterprise electronic health record.

Objective: Our objective was to integrate a real-time decision support module, Smart Anesthesia Manager (SAM), with an enterprise AIMS - SurgiNet Anesthesia (Cerner Inc., N. Kansas City, MO). A second objective was to perform a pilot evaluation of SAM in a hospital different from where it was originally developed.

Method: SAM, originally developed at the University of Washington (Seattle, WA), is a real-time decision support for anesthesia care. It was at first developed to work with a stand-alone AIMS (Merge AIMS, Hartland, WI). Based on predefined decision rules SAM generates real-time "popup" reminders on the AIMS computer screen if ongoing clinical or documentation issues are detected. SAM is built in a modular fashion and uses an AIMS independent data dictionary and rule definitions. Hence, for SAM to integrate with different AIMS, only data exchange interfaces and data translators need to be developed. Through a 3-way partnership between University of Washington (Seattle, WA), Virginia Commonwealth University (Richmond, VA) and TransformativeMed Inc. (Seattle, WA) we developed a data interface (Restful calls using Cerner Command Language scripts) to obtain real-time data from an enterprise AIMS - SurgiNet Anesthesia. Decision support alerts were presented using a SAM client program. The system was piloted in Virginia Commonwealth University Medical Center with decision support activated to improve redosing of perioperative antibiotics and documentation of invasive lines. Compliances to antibiotic (Cefazolin) redose and complete documentation of invasive lines were compared for 3 months each before and after SAM implementation.

Results: SAM successfully interfaced with enterprise SurgiNet Anesthesia system extracting comprehensive intraoperative data in real time with no negative impact on AIMS operation. The time required for data extraction per anesthetic record averaged 2 seconds. SAM could provide real-time decision support with minimal data latency (< 5 seconds). Compliance to redosing antibiotic (Cefazolin) for long duration cases (> 4 hours) improved from 69% (N=252) to 89% (N=276) with SAM reminders ($p<0.001$). Similarly, with SAM alerts, compliance to complete documentation of arterial and central venous lines increased from 31.6% (N=659) to 75.8% (N=669) ($p<0.001$) and 38.0% (N=166) to 89.1% (N=147) ($p<0.001$) respectively.

Summary: Recent consolidation of AIMS market has resulted in most hospitals migrating to enterprise AIMS systems. Enterprise systems are mostly marketed by a handful of electronic health record vendors as Epic (Epic Inc. , Verona, WI) and Cerner (Cerner Inc., N. Kansas City, MO). Hence, integration of real-time decision support systems with enterprise AIMS is important for its wider dissemination and benefit. In this study we show that through proper design considerations a real-time decision support system can be integrated with an enterprise AIMS. We also show that such a system has the potential to improve quality of care and revenue capture even in hospitals where the system was not originally developed.

References:

1. Automated Documentation Error Detection and Notification Improves Anesthesia Billing Performance. Anesthesiology; 106(1):157-163; 2007.
2. Nair BG, Newman SF, Peterson GN, Schwid HA; Smart Anesthesia Manager™ - A Real-time Decision Support System for Anesthesia Care during Surgery. IEEE Trans Biomed Eng. 60(1):207-10; 2013.