Nursing Informatics Journey Towards Improvement in Patient Safety through Infusion Management Technology

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Introduction:

Heart Hospital of HMC in Qatar had the world's first integration between Cerner and BBraun on September 2016 with implementation of Infusion Management. The project aims to provide interoperability between electronic medical record and IV infsuion devices.

Infusion Management is the association of patient, infusion devices and medication orders. This streamlines data to patient's electronic file with a closed-loop process ensuring the highest possible level of patient safety in medication administration.

It improves patient safety by reducing programming errors and abiding five basic medication rights verification process. Barcode scanning accurately identifies the patient, the medication and the infusion pump.

By associating the patient, the infusion device and the medication order, the system automatically captures the information and sends it to the EHR for improved viewing interpretation and analysis. This technology gives you a single, centralized view for all your medication infusion information.

Aims:

- All infusion devices will be able to connect to hospital network either through wirelessly and wired connection.
- All infusion devices will associate with specific patient and IV medication
- Barcode recognition will identify the IV infusions/medications and Infusion devices
- Infusion devices will automatically program from the pharmacist and nurse-reviewed physician's order.
- System will protect against manual programming errors of IV infusion order entry, rate changes, boluses, single and continuous infusions.
- All infusion activities will be captured by the system such as rate changes and will streamline to patient's electronic medical record.
- Infusion status of the patients will be available for the clinicians to view.
- Patients receiving IV medications will be continuously monitored with appropriated vital signs, blood glucose and laboratory values in a single platform.
- Established a closed-loop system of IV medication administration workflow to avoid gaps of possible causes of medication errors.

Setting:

Heart Hospital is one of the facility of Hamad Medical Corporation. It is a specialized hospital in Qatar for cardiology and cardiothoracic surgery.

It has a total 482 Bbraun infusion devices distributed to its different units. Infusion management implementation had focused on the Emergency and Inpatient units (CICU, CTICU, Surgical High Depency Unit, Telemetry Units , Day Care and Non-invasive units) as they fit to the closed-loop system workflow.

Medical Devices Profile:

- **Infusomat Space Infusion System/ Large Volume Pumps**
Stackable large volume infusion pump system. Can integrate wirelessly

- **Perfusor Space Infusion Pump**
Syringe pump for syringe-based drug delivery.

- **Space Station**
The Space Station is the docking station for Space infusion pumps. When pumps are used in Space Station,
integration connectivity will be throuh LAN network.

Project Phases:

Nursing Informatics team actively involved as stakeholder of this integration playing a central role along other disciplines with Heart Hospital Administration, Pharmacy Dept., Nursing SME's, Cerner and Bbraun.

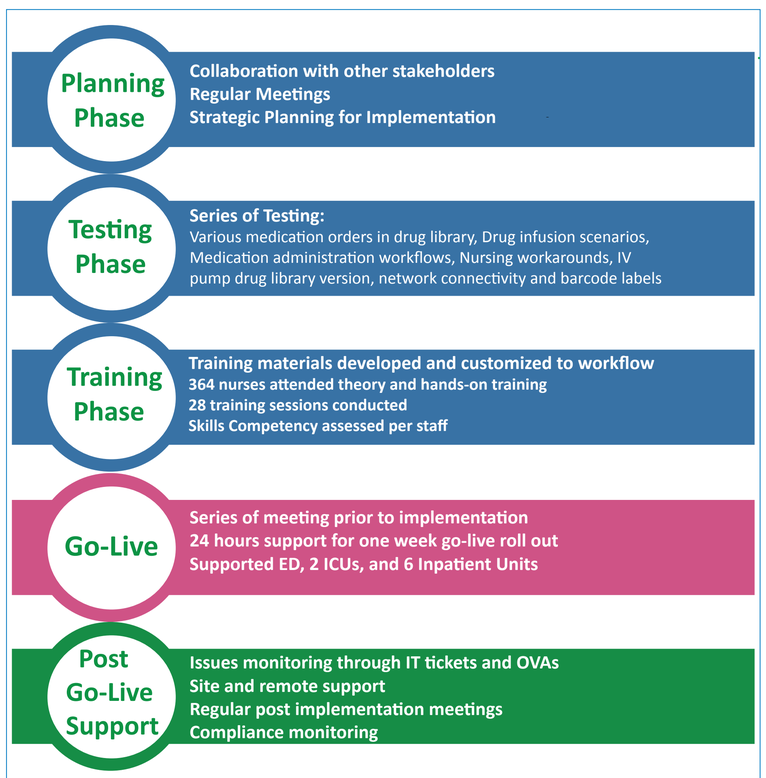

Figure 1. Project Phases

Demonstration of Improvement:

- The closed-loop medication administration of infusion management was one of the highlighted feature of Heart Hospital when it was awarded HIMSS Analytics Electronic Medical Record Adoption Model- EMRAM (see Fig. 2) Stage 6 distinction, an international benchmark for the use of advanced IT to improve patient care. This is one of the first HIMSS Analytic Stage 6 achievement in Qatar.

Middle East EMR Adoption Model℠

Stage	Cumulative Capabilities
Stage 7	Complete EMR; CCD transactions to share data; Data warehousing; Data continuity with ED, ambulatory, OP
Stage 6	Physician documentation (structured templates), full CDSS (variance & compliance), closed loop medication admin
Stage 5	Full R-PACS
Stage 4	CPOE, Clinical Decision Support (clinical protocols)
Stage 3	Nursing / clinical documentation (flow sheets), CDSS (error checking), PACS available outside Radiology
Stage 2	CDR, Controlled Medical Vocabulary, CDS, may have Document Imaging; HIE capable
Stage 1	Ancillaries - Lab, Rad, Pharmacy - All Installed
Stage 0	All Three Ancillaries Not Installed

Figure 2. EMRAM Model showing Closed loop medication administration as one of the requirement for HIMSS Level 6 Accreditation (Source: HIMSS Analytics Database)

- Structured a closed-loop medication administration workflow bridging the gap of the traditional old way IV medication administration (which can avoid of causes of medication errors.(see Fig. 3)
- Maintained benchmark HIMSS compliance of 95% positive electronic patient identification. (see Fig. 4)
- OVA medication error reported decreased (see Fig. 5)
- End-User survey shows infusion management can improve safety delivery of care. (see Fig. 6)
- Nurses see that CPOE integration to the devices greatly helped in their workflow. (see Fig. 6)
- End-Users stated that system alerts had helped them avoid possible patient and medication identification errors. (see Fig. 6 and Fig. 7)
- The project contributed valuable technical, workflow and strategic lessons for future implementations.

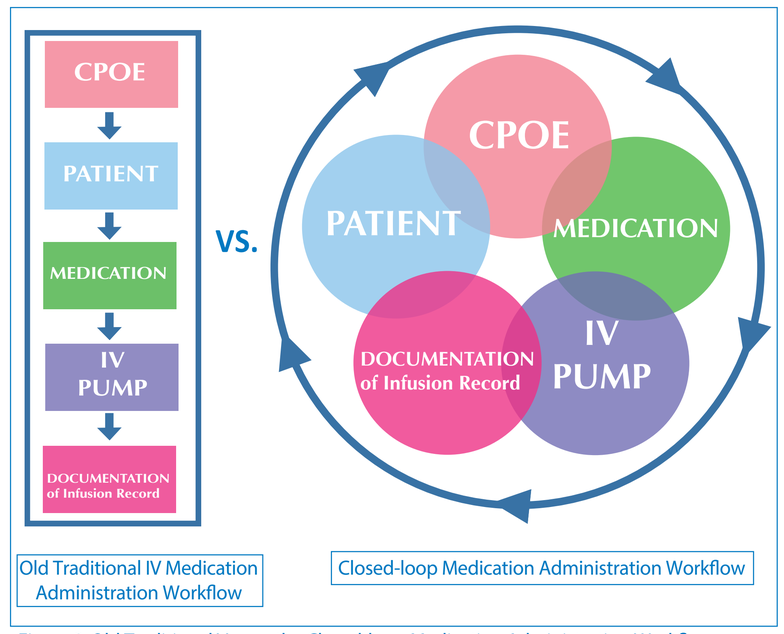

Figure 3. Old Traditional Versus the Closed-loop Medication Administration Workflow

The new closed-loop IV medication workflow is a seamless integration of the five components of medication administration: Patient, CPOE, Medication, Infusion Device, Infusion Documentation ensuring highest patient safety through a secure system.

In this system, a physician orders a medication into EMR. Pharmacist and nurse verifes the order. Prior to administration, a nurse scans the patient's wristband and drug barcode label to verify right patient, medication, time, dose and route against the order. For infusions, nurse scans the barcode label of the pump that triggers the wireless transmission of the ordered infusion details from EMR to the pump.The nurse then verfies the correctness of the flown data and start the infusion. Any actvities of the pump then will be captured for the infusion documentation in EMR.

This bridges many gaps in the old workflow: manual verification of patient and medication,manual entry of infusion details in the pump, nurse relies on her memory for detailsof the infusion activities such as time of rate change, bolus , hold and the accuracy of the actual volume of IV intake.

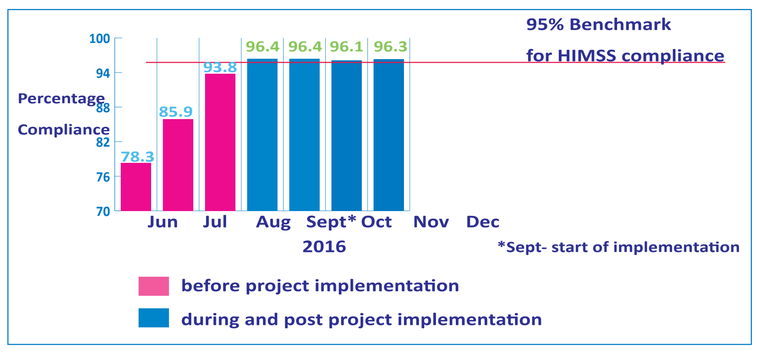

Figure 4. Maintained Benchmark HIMSS compliance of 95% positive electronic patient identification

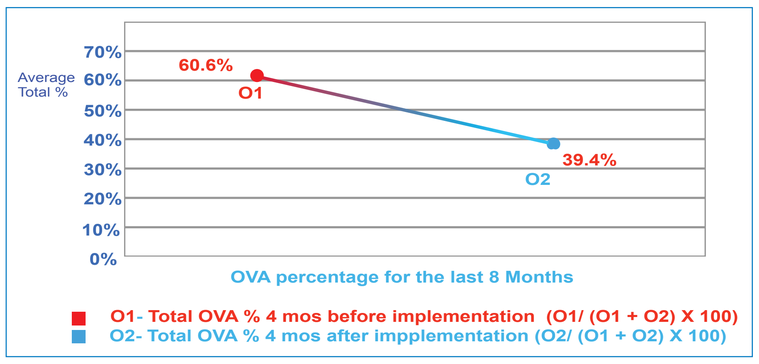

Figure 5. OVA Comparison from the last previous 8 Months after implementation (Data Source: Project Analyst Heart Hospital)

Comparison of OVA 4 months before and 4 months after closed-loop workflow for implementation. The OVA data, a general report about medication error issues shows a significant decrease of medication error OVA after project implementation.

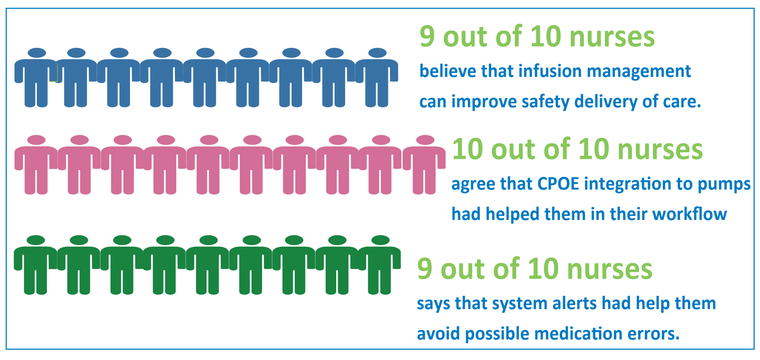

Figure 6. End-User Perception Survey about the concept of Infusion Management (post-implementation survey)

Ex. of System alerts captured	% (from all total alerts)
Avoided Overdosage	10.33 %
Avoided Patient Misidentification	1.48 %

Figure 7. Actual system alerts captured related to medication administration. A Closed-loop system also bridges the gap of manual voluntary reporting of near miss medication issues.

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