

Medfusion® 4000 Syringe Infusion Pump and PharmGuard® Infusion Management Software: The Results of Smart Infusion Technology on Workflow at Children's National Health System

Summary

Children's National describes how using the Medfusion® 4000 syringe infusion system improves nursing, pharmacy, and biomedical engineering workflow and patient safety.

Background

Children's National Health System, based in Washington, DC, has been serving the nation's children since 1870. With a community-based pediatric network, eight regional outpatient centers, an ambulatory surgery center, two emergency rooms, an acute care hospital, and collaborations throughout the region, Children's National is recognized for its expertise and innovation in pediatric care and as an advocate for all children. Children's National's hospital is Magnet® designated, and is consistently ranked among the top pediatric hospitals by U.S. News & World Report and the Leapfrog Group. The hospital houses 303 inpatient beds, including 54 dedicated to the Neonatal Intensive Care Unit, which is recognized by the American Academy of Pediatrics with its highest designation. Children's National has more than 60 intensive care beds and includes the only pediatric Neuro-Intensive Care and Cardiac Intensive Care units in the mid-Atlantic region. Home to the Children's Research Institute and the Sheikh Zayed Institute for Pediatric Surgical Innovation, Children's National is one of the nation's top NIH-funded pediatric institutions.

Dedicated to continuously improving patient care and safety, Children's National is continually discovering ways to streamline processes and provide quality care. The design and implementation of measures to reduce medication administration errors is a cornerstone in patient safety and it is Children's firm belief that the assistive technology of smart infusion syringe pumps plays an essential role. Children's National Health System's Medication Safety Program "incorporates excellent bedside clinical care with state-of-the-art computerized tools to ensure children receive the medications they need for speedy recovery." - <http://www.childrensnational.org/about/QualityMeasures/> "The goal is to proactively manage risk," states Sharon Bostic, MBA, BSN, RN, CPN, Director of Nursing Safety and Patient Satisfaction at Children's National. In October 2012, Children's deployed Smiths Medical's Medfusion® 4000 wireless syringe infusion system and improvements to hospital-wide workflow quickly followed.

Patient Safety and Nursing Workflow Impact

To improve patient care and prevent medication administration errors, the Children's National nursing staff leverages the PharmGuard® Medication Safety Software in the Medfusion® 4000 pump with configurable clinical alerts. The alerts prompt the staff when programming the pump to double check the syringe in use, and confirm that the drug along with its parameters (such as concentration) matches the drug program selected prior to starting each drug infusion. "When you are busy doing day to day tasks, you get in a mind set of 'get things done' and you need those alerts as a checklist to prevent errors." - Tina Humbel, MSN/MHA, RN-BC, CPN, CCRN, Interim Performance Improvement Coordinator at Children's National.



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“At Children’s National Health System, we have worked hard over the years to improve medication safety within the organization to include the implementation of computerized provider order entry, integration with the pharmacy information system, medication ordering decision support, multiple process improvements and medication reconciliation automation” said Brian Jacobs, MD, CMIO and CIO at Children’s National. “Medication administration safety represented one of the most important areas requiring attention in augmenting other medication safety initiatives within the organization”. The Medfusion® 4000 syringe infusion system with PharmGuard® infusion management software has enabled the nursing staff to reduce clinical interruptions and allow time for other critical patient care matters. Patient care is no longer interrupted by the removal of the pump to manually update the drug library. The PharmGuard® software wirelessly deploys new libraries out to the pumps and ensures that all syringe infusion pumps are operating with the most current approved drug library and safety profiles. This eliminates the potential for pump by pump differences and reduces the contribution of pumps with outdated drug libraries to medication administration errors. The end benefit is improved patient care as well as patient safety.

Pharmacy Operational Optimization

“The library software associated with the Medfusion® 4000 pump is very versatile, there are so many different build options, and other pumps we’ve worked with aren’t that flexible.” – Jason Corcoran, PharmD, BCPS, Clinical Director in the Division of Pharmacy at Children’s National. With the complex drug administration environment at Children’s, several aspects of the PharmGuard® infusion management software contribute to the prevention of medication errors:

Flexible individual drug program characteristics – the drug programs have the ability to contain unique and customizable limits or settings around concentration, dose, rate, time, loading and bolus parameters. The software can account for different ways of using the same drug by allowing drug program names that can be customized with up to 30 characters (same drug with different concentrations, different dosing parameters, etc.).

Customizable profile for unique needs of each patient care area – each unique profile provides for extensive customization of alarm types, infusion options, delivery modes and prompts allowing the same pump to function in very different ways to meet the unique needs of critical care units, the operating room, oncology, general pediatric floors, and catheterization labs.

Extensive library programming capabilities – drug programs can be designed with standard concentration and dose or with a combination of concentrations and doses. The flexibility of the software accommodates the needs of chemotherapeutic protocols in clinical studies.

Versatility in intravenous (IV) and enteral administration – the availability of different hard and soft limits for low and high values of doses and concentrations provide flexibility in building safety checks based on the risk level of the drug. In addition to IV use, the pumps can be used for accurate delivery and monitoring of enteral nutrition for the smallest patients. Recognition of major brands of enteral syringes provides an added safety check.

Reduction of time building and revising library – when building profile-specific libraries the software provides the option for having two names for each drug program, a display name on the pump and an internal name for use only within the programming software, which codes a drug for use in a specific profile. This ability to associate one drug program with multiple profiles can be a huge time saving factor when making changes to the database because it prevents having to build a drug program multiple times when used in multiple profiles.

Automation - Biomedical Engineering

Children’s National has minimized the labor costs associated with updating the library on their syringe infusion pumps. The Medfusion® 4000 syringe infusion system utilizes wireless communication with the PharmGuard® server software allowing the currently deployed drug library to be available on each syringe

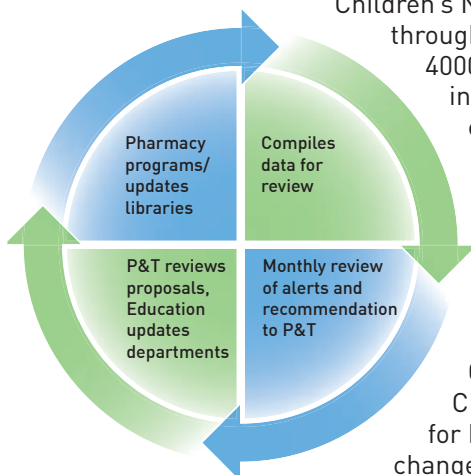
infusion pump. Previously, a “hands-on” pump by pump drug library modification would take up to seven (7) Biomedical Engineering staff approximately ten (10) days to complete an update of over 800 syringe pumps. This translated to approximately \$25,000 in avoided work force costs for each update, or \$100,000 each year in savings. “Placing smart infusion pumps on our network has resulted in significant improvements in both data acquisition and in uploading new medication safety profiles. Historically we would have to touch each device individually. With over 800 devices, this amounted to over \$25,000 in labor expenses which are now avoided” – Brian Jacobs MD, CMIO and CIO at Children’s National.

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Hospital-wide Optimization through Commitment to Performance Improvement

Children’s National has improved quality and safety throughout the hospital with the use of the Medfusion® 4000 syringe infusion system and PharmGuard® infusion management software. Children’s National continues improving through monthly meetings dedicated to reviewing all infusion related alarms. These meetings are held by a subcommittee of the Pharmacy & Therapeutics (P&T) committee, named the Alerts Review Team Subcommittee (ARTS). ARTS is a multidisciplinary team of Biomedical Engineering, Pharmacy, Physicians, Residents, Nursing Decision Support Specialists, Quality Improvement Leadership and the CMIO/ CIO. ARTS focuses on developing recommendations for P&T regarding device medication libraries, process changes, educational needs or other actions that may be implemented to improve patient safety and care.



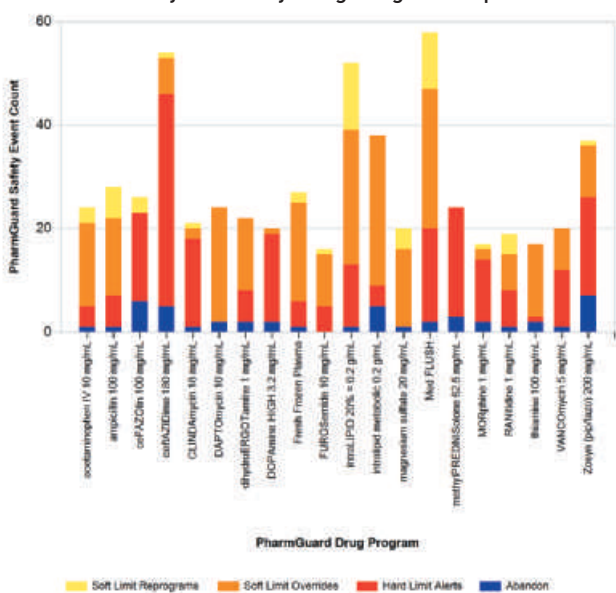
ARTS leverages the actionable data through the device-specific reports of the PharmGuard® infusion management software to support their recommendations. Of the 26 reports available, ARTS regularly reviews six (6) reports, including ‘Compliance Trending’, ‘Safety Events – Summary’, ‘Safety Events - by Profile’ and ‘Safety Events - by Time of Day’. The two (2) most frequently used in the ARTS meetings are the ‘Safety Events by Drug Program’ and ‘Configuration Assessment’ reports.

ARTS evaluates the ‘Safety Events by Drug Program’ report to review the top alerting drug programs along with their settings and alert parameters to see if a change to the library, re-education to the staff, or follow-up with specific users needs to occur.

ARTS also uses the ‘Configuration Assessment’ report to understand what drug programs are being abandoned and those with the highest percentage rates are used to surmise which drugs might be adding to the ‘basic infusion’ or ‘non-PharmGuard® software’ infusion rate. “High reliability organizations are obsessed with preventing failure. You are constantly monitoring and looking to see how things are changing. We need the data from the reports in order to do that.” – May-Britt Sten, RN-BC, MSN, Director, Performance Improvement at Children’s National.

Prior to the Medfusion® 4000 system deployment, Children’s National did not have the ability to quickly identify drug programs with the highest alerts and abandons, or have insight as why these errors were occurring. However, now Children’s National can target these high risk areas for drug administration errors, implement strategies to effectively impact improvement to medication safety by utilizing the reports. Additionally, Children’s National leaders measure their investment in CQI programs by utilizing the Compliance Trending report and obtain expedient feedback to ensure their CQI initiatives are effective (‘Compliance Trending’ report). The Medfusion® 4000 system has “really changed the efficiency, accuracy and effectiveness of movement of data around the organization.” – Brian Jacobs MD, CMIO and CIO at Children’s National.

Safety Events by Drug Program Report



We estimate that use of the Medfusion® 4000 has resulted in \$5.3 million in savings from avoidable medication errors over this 10-month time period

Cost savings calculation:

Based on estimates of 6,000 good catches from a 10-month period, on average 10% of good catches result in ADEs, and \$8,750/event facility cost

As a result:

$(6,000 \times \$8,750) \times 10\%$
= 5.3 million

Results

Within ten (10) months of utilizing the Medfusion® 4000 system and PharmGuard® infusion management software, Children's National has safeguarded their patients with over 6,000 'good catches' from the system. These 'good catches,' which are alerts, prevented potential key stroke errors at the time of drug administration and/or provided Children's National with valuable information regarding drug programs which should be changed. The benefits of these 'good catches' are two fold, (1) the prevention of potential medication administration errors and (2) the improvement of programming in the drug library, which translate into cost savings, not over alerting the nursing staff and efficient workflow.

According to Moyen et al.¹, 10% of medication errors, defined as any error in the medication process, whether there are adverse consequences or not, result in an adverse drug event (ADE) and per Aspden et al.², in 2007 these errors cost the organization approximately \$8,750 per occurrence. Based on these estimates and the number of good catches at Children's National, we estimate that use of the Medfusion® 4000 has resulted in \$5.3 million in savings from avoidable medication errors over this 10-month time period.

In addition, Children's National benefits from the return on investment from reduced staff time and operational costs averaging \$100,000 per year for the Biomedical Engineering team to update each pump.

The Medfusion® 4000 system and PharmGuard® infusion management software provides Children's National with the tools to prevent harm by improving hospital wide medication safety, workflow and efficiency for Nursing, Pharmacy and Biomedical Engineering.

Multi-departmental Workflow Improvement

Nursing

- Reduction of drug administration errors
- Ease of use, shifting time for other critical patient care matters
- Fewer clinical interruptions during library update (automation)

Pharmacy

- Flexible individual drug program characteristics
- Customizable profile for unique needs of each patient care area
- Extensive library programming capabilities
- Versatility in administering IV and enteral fluids
- Reduction of time building & revising library

Biomedical Engineering / Performance Improvement

- Real time availability of data - reports
- Real time library uploads - removal of labor to update pumps
- Multi-departmental online visibility
- Improved maintenance tracking

References

1. Moyen E, Camire E, and Stelfox HT. Clinical review: Medication errors in critical care. Crit Care 2008; 12(2): 208.
2. Aspden P, Wolcott J, Bootman JL, et al. Preventing medication errors: quality chasm series. Washington, D.C.: National Academy Press; 2007.

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