



# Enhancing Pediatric Outcomes: *The Role of a Connected, Refrigerated Medication Inventory Management Solution at Yale New Haven Health System*

YaleNewHavenHealth



# Customer Profile

Yale New Haven Health System (YNHHS) stands as one of the largest academic multispecialty healthcare institutions in New England, offering family-focused services across more than 100 specialties at over 94 locations. With five top-ranked academic hospitals, boasting a total of 2681 licensed beds, Yale New Haven Hospital (YNHH) has earned national recognition, particularly in cancer care and pediatrics, according to US News & World Report. From its inception, YNHH has been at the forefront of medical innovation, delivering world-class patient care with a commitment to excellence. As a leader in pediatrics, YNHH proudly offers a state of the art 68-bed Level IV Neonatal intensive care unit.<sup>1</sup>

## The Challenge

Effective medication inventory management lends to supporting efficient, safe, and quality patient care. However, managing this challenge becomes increasingly complex for more vulnerable populations, such as neonatal and pediatrics.<sup>2,3</sup> These patients have distinct and varying medication dose requirements based on their age, and weight—therefore, more controls are required:

- **Ensuring availability of diverse medications:** Children require different formulations, doses, and types of medications compared to adults—which necessitates additional oversight to address the dynamic inventory needs.<sup>4,8</sup>
- **Managing small dosage units:** Pediatric medications are often prescribed in small, and even nano, dosages; therefore, typical challenges include unit dose misplacement, unit dose storage and monitoring shortened expiration dates.<sup>4,8</sup>
- **Increased risk of medication errors:** The risk of medication errors is high due to pediatrics' weight-based dosing, given the need for dilution or reconstitution. Inaccurate inventory management can exacerbate these risks, causing potential harm to this vulnerable patient population.<sup>4,8</sup>
- **Regulatory constraints:** Maintaining compliance with regulations surrounding pediatric medication use, storage, and dispensing adds another layer of complexity to medication management. It's critical to accurately track and report medication usage for regulatory audits that include strict temperature control for certain medications, secure storage systems to prevent misuse or theft, and precise expiration date management.<sup>9-11</sup>

## Summary

### Challenge

- Labor-intensive, inefficient workflow for refilling and compounding short-dated products when securely storing at room temperature in patient care areas.

### Solution

- BD Pyxis™ ES MedStation™
- BD Pyxis™ ES Refrigerator
- BD HealthSight™ Inventory Optimization Analytics

### Impact

- Smarter, more connected medication management strategy
- Enhanced medication safety for high acuity neonatal and pediatric population
- Identified opportunities to improve waste management strategy and cost avoidance

YNHH recognized the importance of safeguarding the pediatric population while improving medication waste and workflow inefficiencies. YNHH addressed these imperatives with technology, by optimizing medication management in their patient care areas by maximizing usage of commonly used, refrigerated compounded sterile preparations per USP <797> guidelines, as demonstrated in this case study.

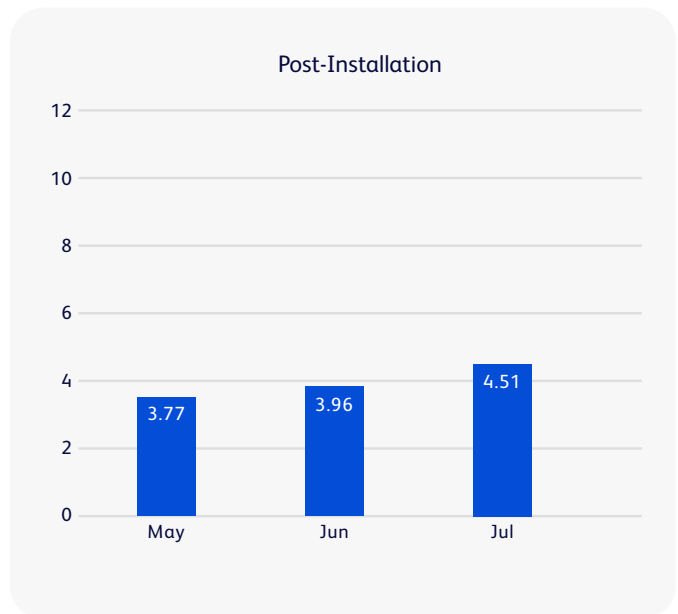
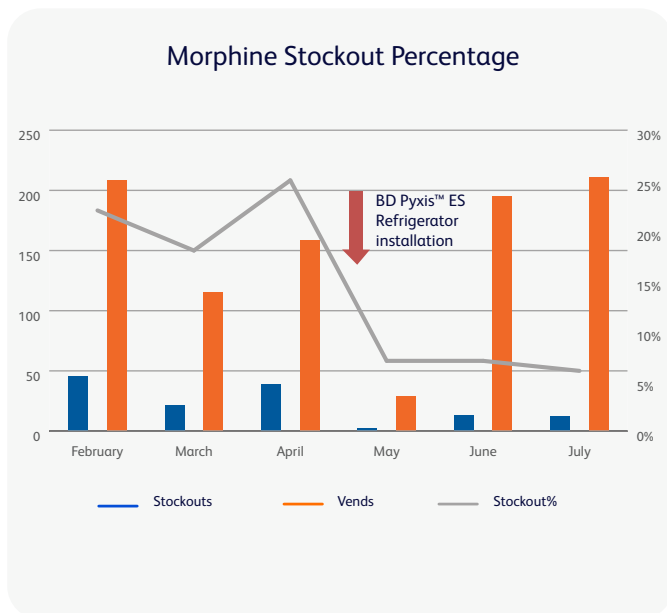
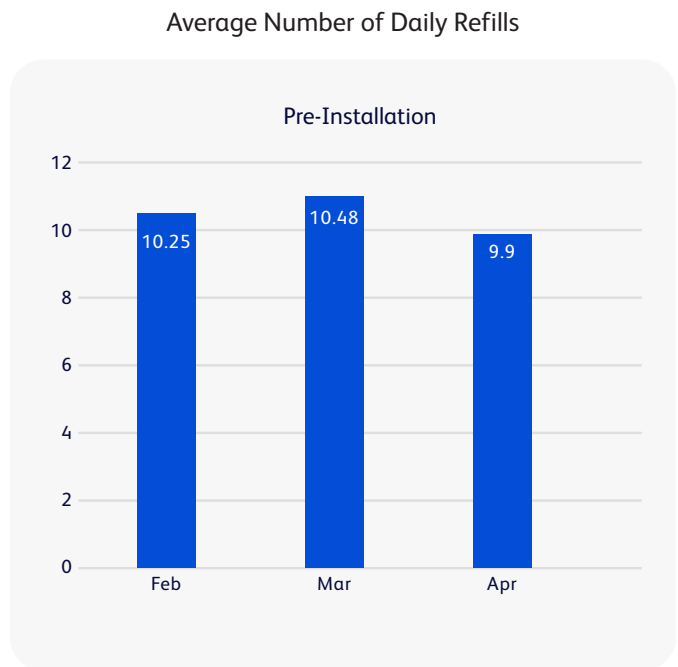
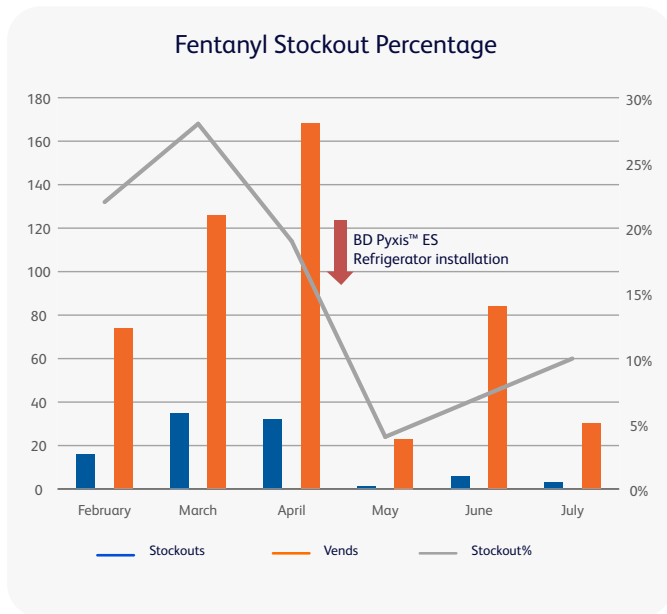
## The Solution

With the opportunity to enhance pediatric medication management, YNHH partnered with BD to adopt an enterprise inventory management system that includes integrated refrigerated medication management. In April 2023, YNHH implemented the BD Pyxis™ ES Refrigerator in six pilot locations. For the first time, secured cold storage areas were integrated and controlled via the BD Pyxis™ ES eco-system. This change also allowed YNHH to start leveraging the connected data and analytics tool, BD HealthSight™ Inventory Optimization, which generates automated stock level changes for the newly housed refrigerated items. This versatile integrated system supports medication management across their multi-hospital system, but has recently demonstrated positive outcomes in their pediatric settings:

**Inventory Management:** Connected medication management enables accurate tracking of drug usage, helping to ensure devices contains appropriate stock levels. YNHH experienced benefits in the following areas:

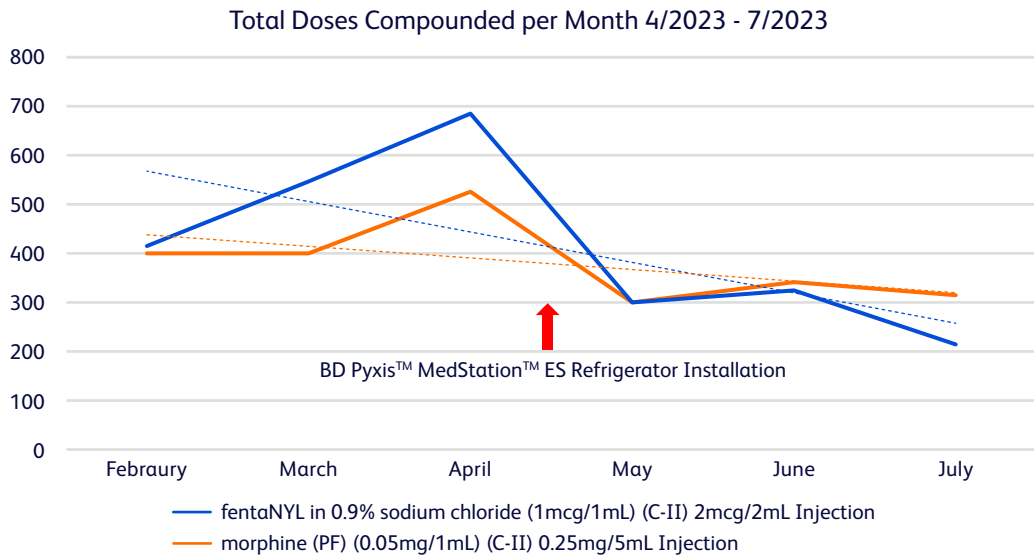
- Medication Availability:** The two most used medications during the pilot, morphine 0.25mg/5mL injection and fentanyl 2mcg/2mL, each showed a 16-percentage point stockout reduction (22% stockout pre-implementation vs. 6% post). While overall fentanyl use declined during the post-implementation period and may have impacted stockout rates, morphine utilization mirrored pre-implementation levels while still maintaining the significantly lower stockout rate.

- Automated dispensing cabinet (ADC) workload efficiency:** A question health systems commonly ask whenever medication availability improves is how labor was impacted. At YNHH, there was a 60% reduction in the three month period after installation when compared to the three month period prior to installation in ADC refill trips for fentanyl and morphine after the Pyxis™ ES Refrigerators were installed. Additionally, a total of two periodic automated replenishment (PAR) levels were changed for the pilot medications prior to installation, while 45 occurred after- suggesting an improvement in the ability to manage stock levels through the use of BD HealthSight™ Inventory Optimization, a software analytics tool that helps determine, model, and prioritize PAR-level adjustments for medications.



- **Maximizing USP <797> guidelines for critical meds:**

The Pyxis™ ES Refrigerator installation permitted pharmacy operations to extend the beyond use date for the pilot products from 24-hours at room temperature to 9-days stored in the fridge. This resulted in downward trends in both medication compounding and waste among the fentanyl and morphine preparations, despite continued demand. The perception of the YNHH compounding personnel complimented this objective data. Per Chelsea Carnaroli, PharmD, BCPPS, Pharmacy Manager, “Staff members had positive feedback as they had to prepare less volume due to extended dating of the products.”



*BD Pyxis™ MedStation ES Refrigerator Installation*

- **Enhanced Safety:** The BD Pyxis™ ES refrigerator provides additional safety measures over traditional solutions, including secured storage, access controls, and integrated near real-time temperature monitoring. This is essential for preventing medication errors or misuse - a vital consideration given the vulnerability of the pediatric population.

## The Future

YNHH looks forward to expanding the BD system’s capabilities to support additional initiatives. With the positive results seen during their pilot period, additional opportunities exist to expand medications covered in the pilot locations, add BD Pyxis™ ES refrigerators in other non-pediatric units, and implement at sister hospitals within the integrated delivery network (IDN). Possible short-term expansion includes:

- **Secure Storage of High-Value Refrigerated Medications:** the technology offers a secure environment for storing high-value medications, such as biologics in 340B-clinic setting. Its security features, including access controls and

real-time tracking, provide addition functionality to help mitigate the risk of loss or misplacement of these expensive drugs and could potentially translate to substantial cost savings.

- **Shortage mitigations:** medication shortages continue to be a top challenge for health-system pharmacists. 503b (outsourcing) variability exacerbates this challenge,<sup>12</sup> often requiring health-systems to compound medications normally provided by a commercial entity. As compounded medications often require refrigeration to support longer beyond-use-dates,<sup>13,14</sup> the new solution presents an opportunity to continue offering medication availability within the ADCs.
- **Patient-Specific Medication Storage and Expanded Patient Population:** Refrigerated Medication can be stored in a patient-specific manner. Storing in an integrated refrigerator could provide additional security for decentralized inventory while potentially decreasing the need or frequency of patient-specific batches in the central pharmacy.

BD's powerful enterprise medication management solution helps address several challenges, including sensitive refrigerated medications for special populations. Additionally, the use of the connected BD Pyxis™ and HealthSight™ solutions provided YNHH with advanced data and analytics, enabling better ongoing inventory maintenance. Through these advancements, Yale New Haven Health System has demonstrated improvements in medication safety, operational efficiency, and overall quality of pediatric patient care.

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