The use of pharmacy workflow management system and Health Level Seven (HL7) bi-directional communication with an electronic health record at Houston Methodist Hospital System

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EXECUTIVE SUMMARY

Pharmacy workflow management systems have helped to increase patient safety, but recently, Houston Methodist Hospital System discovered that the use of Baxter's **DoseEdge** Pharmacy Workflow System opened a pathway to unexpected benefits – improved waste identification, increased billing, cost savings, and tangible return-on-investment.

The experience of the pharmacy team at Houston Methodist with the **DoseEdge** Pharmacy Workflow System with Health Level Seven (HL7) bi-directional communication demonstrates that there are many solutions and financial improvements to take advantage of in a short period of time. Even if a pharmacy is meeting safety expectations and believes they are operating efficiently, the additional benefits and cost savings realized at Houston Methodist indicate the potential impact the workflow system can provide a pharmacy.

The exchange of information from the pharmacy, through **DoseEdge**, back to the Electronic Health Record (EHR) provides data that can add a new level of precision and accuracy over the information captured through the defaulted setting of the EHR. Specifically, Houston Methodist's use of **DoseEdge** produced the following results:

- Dose waste billing increased by almost 74% and remained higher than pre-implementation billing for the five subsequent months.
- EHR waste documentation orders in the month of implementation increased by 503 orders from the previous month, a 74% improvement.
- Combined, waste documentation orders and waste billing dollars increased by 63.5% in three months after go-live.
- Preparation and documentation time decreased by 6.12 hours per day, or 28%, after implementation.

Therefore, other health systems and pharmacies could benefit from opportunities to decrease time spent on pharmacy preparation and documentation, while increasing billing dollars.

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INTRODUCTION

Houston Methodist Hospital System is the flagship hospital of Houston Methodist and comprises a leading academic medical institution in the Texas Medical Center and seven community hospitals serving the Greater Houston area. Houston Methodist was already utilizing Baxter's **DoseEdge** Pharmacy Workflow Manager for several years with a uni-directional print-feed from the EHR. In late-2019, the healthcare system launched the HL7 bi-directional interface project and went live in early 2020.

Through HL7 bi-directional communication, the health system:

- ⊘ Exceeded their projected return on investment;

- ⊘ Benefited from more accurate financial reporting;

- ⊘ Automated and enhanced billing compliance; and

- ⊘ Created new opportunities to further streamline processes.

Pharmacy Workflow Management System

In a typical medication use process, attention is focused on order entry, verification, and administration with bedside scanning systems confirming that doses are administered appropriately. Use of a pharmacy workflow management system can help ensure that dose preparation is accurate and key information is appropriately recorded.

Per the Institute for Safe Medication Practices (ISMP) Guidelines for Safe Preparation of Compounded Sterile Preparations (CSPs), technology solutions can be utilized to augment manual processes for preparing and verifying CSPs.[1] These systems include:
- Barcode scanning validation of ingredients;
- Gravimetric validation of drug and diluent volumes; and
- Robotic image recognition.

At a minimum, both barcoding and gravimetrics (through several semi-automated and highly automated robotic systems) should be used when preparing chemotherapy and, ideally, for pediatric CSPs.[2] **DoseEdge**, which provides barcode and gravimetrics verification for IV, oral, and chemotherapy doses, intercepts a potential medication error every 24 seconds.[3] In recent years, the focus of what a workflow management system can offer has expanded beyond just the critical job of identifying medication errors. These benefits include bi-directional HL7 communication with the Electronic Health Record (EHR) to enable a closed-loop system, in which auto-documentation of key dose information helps drive compliance with USP and other best practice organizations. This also includes improved pharmacy operations and billing integrity through the ability to streamline and standardize preparation for even the most unique doses.

Bi-directional HL7 Integration

Health Level Seven International (HL7) is a not-for-profit, ANSI-accredited standard-developing organization dedicated to providing a comprehensive framework and related standards for the exchange, integration, sharing, and retrieval of electronic health information.[4] Any pharmacy can take advantage of the benefits and opportunities offered from an independent workflow management system with bi-directional communication.

Through bi-directional HL7 integration, after doses are prepared and verified, **DoseEdge** communicates critical, instance-specific dose information such as the National Drug Code (NDC) of each component used for compounding, as well as any unused portion, back to the EHR as a natural part of the compounding process. For instance, the pharmacy team at Houston Methodist used the data to organize and streamline IV room operations and inventory management, which the organization referred to as "the black hole". Prior to the bi-directional interface, the EHR was used for documenting certain preparations at the hospital for reporting and compliance of key reimbursement programs, but this made operations less efficient because it was a manual process. Upon implementing the bi-directional interface, **DoseEdge** was used not only for the preparation benefits, but also for the automatic documentation of critical details that previously required manual inputting and duplicate documentation into the EHR. The discovery of additional unexpected benefits beyond anticipated advantages - what the team would later term "hidden gems" — were facets of HL7 that otherwise had not previously been uncovered.

Houston Methodist identified issues and imperfections of using the EHR alone for compliance data. Recognizing the urgency of these issues, the health system realized the solution could come from outside the EHR. Given how quickly compliance/ regulatory requirements are updated, it's important to have technology that is agile enough to adjust to various compliance needs. The team noted that standard EHR workflow systems lack the more sophisticated workflows, functionality,

*A dedicated system like **DoseEdge** is justifiably much better organized and a more robust system for compounding, inventory, and regulatory processes.*

and customizability that are available in a dedicated IV workflow system. EHR-based systems lack the comprehensive tools and focus that make meaningful improvements in safety and efficiency in workflow. A dedicated IV workflow technology system is a robust option to support compounding, inventory, and regulatory processes, illustrating how investing in the proper technology can help organizations excel operationally.

Maximizing Value and Compliance of Billing for Outpatient Drugs

Cost savings, reimbursement optimization, and enhanced waste documentation and billing are key economic factors every healthcare system strives to optimize. While bi-directional communication can help any hospital system, it can also specifically help facilities that participate in government programs. The 340B Drug Pricing Program allows hospitals to obtain special pricing on covered outpatient drugs for qualified patients. A workflow system that tracks individual vial contents and volume remaining in real-time between pharmacy workflow systems and the EHR can ensure compliance with these regulatory requirements. It can also improve facility compliance with billing for waste, typically referred to as a JW modifier workflow. In the outpatient setting, hospitals use the JW billing modifier to identify the discarded portion of certain drugs and biologics for which payment may be available. Use of the JW modifier allows healthcare systems to recoup costs associated with the unused portions of certain single dose drug containers. Facilities are allowed to count wasted drug from a single-dose vial (e.g., JW billing) for 340B usage, which in turn allows for purchasing more drugs at 340B prices.

. . . after the HL7 integration was implemented . . . Houston Methodist saw marked improvement in both waste billing documentation and the number of orders with proper waste documentation.

Houston Methodist has two facilities that are part of the 340B Federal Drug Pricing Program, while all submit documentation for JW waste billing. **DoseEdge** captures and reports on the usage and expired quantities of drugs at a vial-specific NDC level. Accuracy is preserved through 340B usage, which maximizes purchase discount ability available through 340B. Billing for waste is maximized through JW waste billing by capturing every instance of waste in each vial, with NDC-level and individual vial within that NDC specificity. Prior to the **DoseEdge** HL7 interface, the documentation process was manual as there was no communication in place back to the EHR from **DoseEdge**. In many facets of the healthcare continuum, manual processes may contribute to increased errors. One of the goals of implementing the bi-directional interface was to eliminate the manual process, and associated reporting errors, enabling an automated system to maximize efficiencies.

For example, prior to the HL7 bi-directional interface, the process for documenting the accumulation of medication products used to prepare CSPs for patients at the 340B hospitals was very complex. The HL7 interface provides control to the end user during the preparation process by implementing a waste determination action to the established procedures, that allows the end user to make the decision to send or not send the waste information to the EHR. Without the bi-directional interface, the team assessed that it would not have been possible to satisfy all the workflows through the functionality of the EHR alone. The team also saw improved efficiency in billing, which was considered another "hidden gem". This was not anticipated until after the integration and was a welcome surprise.

Through these and other examples, after the HL7 integration was implemented in March 2020, Houston Methodist saw marked improvement in both waste billing documentation and the number of orders with proper waste documentation. In just one month after the bi-directional interface go-live, dose waste billing increased by almost 74%, and remained higher than pre-implementation billing for the five subsequent months (Fig. 1). Correspondingly, the number of EHR waste documentation orders also increased in the month of implementation by 503 orders. This increase also remained consistent during the next five months of measurement. (Fig. 2). Compared to the same timeframe before go-live, both JW dose waste documentation orders and waste billing dollars increased by 63.5% in three months after go-live.

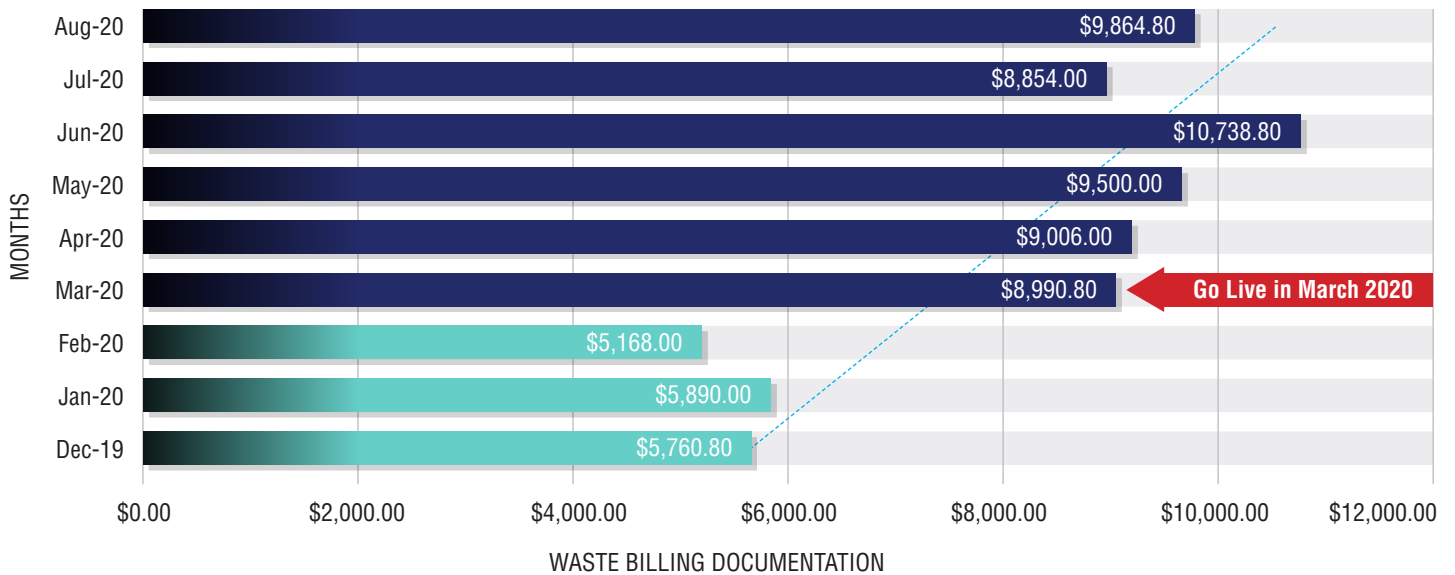## DOSE WASTE BILLING PRE- AND POST-BI-DIRECTIONAL INTERFACE[5]

Figure 1. Increased JW waste billing dollars in EHR. Houston Methodist. Data on file.

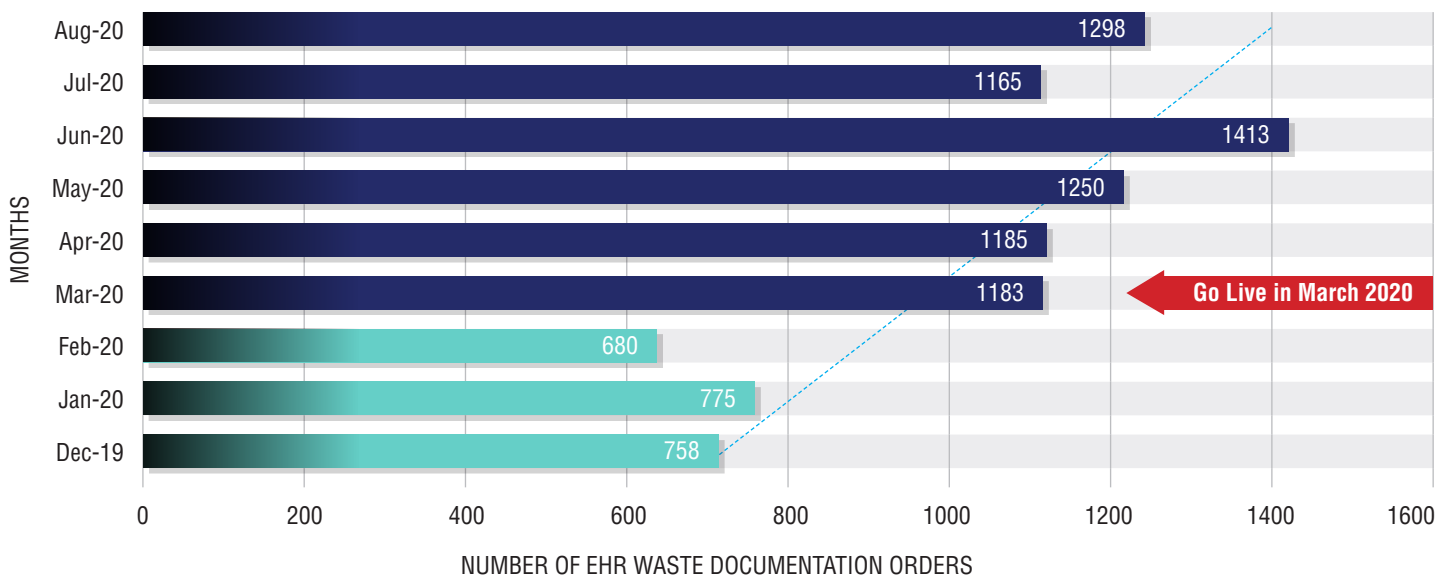## DOSE WASTE DOCUMENTATION PRE- AND POST-BI-DIRECTIONAL INTERFACE[5]

Figure 2. Increased number of orders with JW waste documentation in the EHR. Houston Methodist. Data on file.

Bi-directional communication allows pharmacies to automatically record necessary information for proper documentation: NDC numbers used during compounding, amount dispensed, amount wasted, lot number, expiration date, etc. By requiring individual ingredient barcode scanning and communicating the NDC through an interface, accuracy is realized at 100%. Exceptions could occur if a dose is not processed through **DoseEdge**, meaning it will not send over the preparation documentation to the EHR; in which case a manual correction would be necessary.

Houston Methodist and HL7 Integration – Time Savings and Increased Productivity

The implementation provided the tools needed to identify any issues and ensure compliance with applicable programs, which was the main driver behind pursing the integration. However, additional, unanticipated benefits were identified that created an even stronger ROI for Houston Methodist. Beyond the medication error identification, optimized billing and enhanced compliance, and the automation of manual processes it became clear to the pharmacy team that increased productivity from time saved would be another advantage of using **DoseEdge** and bi-directional communication. Double documentation had been an inefficiency that the integration helped to eliminate. The data produced by **DoseEdge** allows for detailed analyses, which in turn, pinpoint areas where documentation efforts were being duplicated.

Dispensing was also enhanced by the ability of the **DoseEdge** System to prepare syringe labels, based on the dispense code, as well as the capability to print syringe bag labels. **DoseEdge** can also be configured to automatically indicate hazardous or non-hazardous medications on the labels. **DoseEdge** populates NDC information with expiration dates and lot numbers, within the patient's profile. The enhanced semi-automated process uses a robust system to guide compounding processes by adding specific details, such as intended dose storage temperature.

Various studies have estimated the cost of wasted IV medications to exceed three percent of total IV costs and close to a full-time equivalent in wasted personnel productivity.[6] In a 2018 study, pharmacists reported various opportunities to reduce waste throughout the pharmaceutical supply chain, but not all were broadly implemented.[7]

The capabilities provided by **DoseEdge** have not only assisted Houston Methodist with developing efficient processes and cost savings, but an added benefit — time savings. Comparing the three-month average prior to the bi-directional interface implementation to the three-month average after implementation, preparation and documentation time decreased by 1.8 hours per 100 doses, a 27% decrease (Fig. 3). Comparing the same time periods, preparation and documentation time decreased by 6.12 hours per day, or 28%, after implementation. (Fig. 4). The decreases for both key performance indicators remained in the six months post implementation. This time savings amounts to three-quarters of an average workday saved for 1 FTE, helping the Houston Methodist team redirect those critical pharmacy resources. This data was operationally significant as it made a substantial impact on Houston Methodist's operations.

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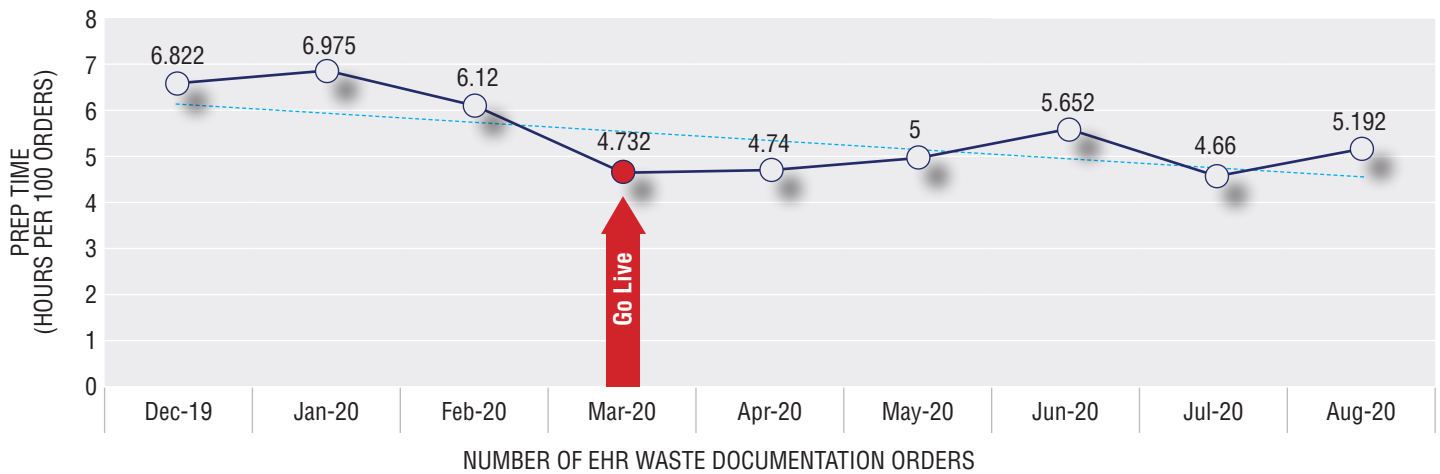## PREP AND DOCUMENTATION TIME PRE VS POST BI DIRECTIONAL INTERFACE[5]

Figure 3. Decreased preparation time (i.e., completed) in hours per 100 doses. Houston Methodist. Data on file.

PREP AND DOCUMENTATION TIME PRE VS POST BI DIRECTIONAL INTERFACE[5]

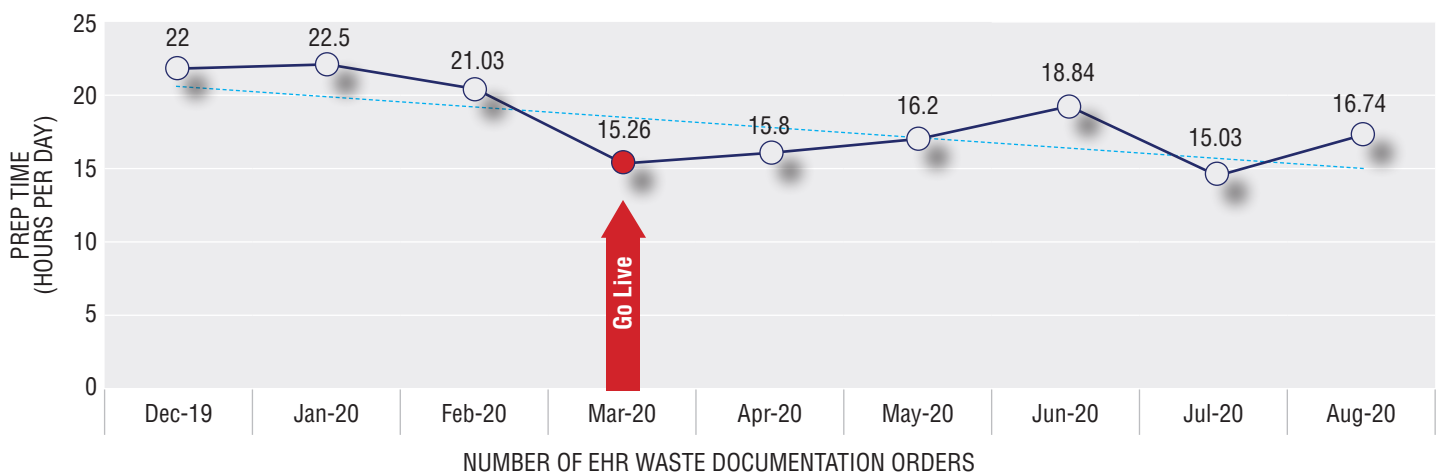Figure 4. Decreased preparation time (i.e., completed) savings in hours per day. Houston Methodist. Data on file.

HL7 Bi-directional Communication – Operational Efficiencies & Increased Flexibility

What makes bi-directional communication through an independent workflow manager more robust? Houston Methodist has produced several examples. One area that illustrates the potential and possibilities of HL7 was seen with units of measure. The unique unit of measure the pharmacy deals with include combination antibiotics, such as piperacillin-tazobactam. Particularly for pediatric patients, the pharmacist needs to know exactly how much, and how to express the units of that measure on component ingredients, in this case piperacillin, where each component needs to be separated out. **DoseEdge** with HL7 bi-directional interface can recognize and fully process those types of drugs, thus improving utilization rates and safety measures.

Houston Methodist and HL7 Integration – Implementation Best Practices

Along with the successes, the team also experienced informative lessons while implementing the new technology. Houston Methodist pursued three **DoseEdge** projects at one time: a **DoseEdge** software version upgrade, a hardware upgrade, and the HL7 bi-directional interface. The software version and hardware upgrade are not required for all hospital systems using **DoseEdge** to implement the bi-directional interface, but they coincided in their timing at Houston Methodist. The version upgrade created a situation where the team was working in two different servers for a short period before the migration from the old server was completed. The experience illustrated the need for setting timing expectations, including adding time between projects to allow for adjustments and to take it step-by-step versus tackling all milestones at one time.

Another important lesson is to understand how the various preparation and documentation workflows operated prior to the implementation and being able to anticipate how processes could be affected. As an example, something as innocuous as location names can cause unanticipated challenges. For example, the EHR has the unit and room number information, but when the system went live, there was confusion in the new interface caused by the system trying to use abbreviated department names.

It is acknowledged that with any implementation, issues and obstacles will be encountered, but those issues were addressed quickly through on-going discussions with the individual hospital sites. By answering questions and learning from

one another, the pharmacy team saw the value of the bi-directional communication. The feedback from all the sites, as well as senior management, has been extremely positive with no significant issues reported.

Wider Adoption

Despite the new technology and subsequent benefits, the adoption rate across health care is relatively low. Only 42% of hospital facilities use IV workflow technology to help prevent preparation errors,[8] and an even lower percentage of these facilities have implemented HL7 bi-directional integration with their EHR. The exact reasons are yet to be measured and determined, but the team believes that a lack of education, resources, and understanding of true ROI could be factors. ISMP is an advocate of augmenting manual processes with the technological solutions provided by a workflow management system,[9] and the continued inclusion of IV workflow technology in guidelines and best practice recommendations are essential to advancing adoption.

Moreover, the costs of adopting and implementing IV workflow technology may be justified with benefits gained. Data submitted to the ISMP National Medication Errors Reporting Program has repeatedly shown that the manual inspection of IV admixture ingredients by pharmacy technicians and pharmacists is not effective in preventing preparation and dispensing errors.[9] The relatively low cost of adoption coupled with the ROI gained from a reduction in errors, operational efficiencies, automated documentation, automating manual processes, and optimized billing more than offset the costs. Houston Methodist's

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pharmacy team and management are 100% committed to investing into tools, technologies, and processes that enhance patient safety and help optimize work along the continuum of care.

Inventory Management

In the spirit of continual improvement, the health system is now targeting pharmacy inventory management as an area that could benefit from bi-directional communication. Any pharmacy can improve visibility and accountability in their inventory through a workflow management system. However, Houston Methodist is venturing into enhancing inventory management processes with the HL7 bi-directional interface. The team is investigating the possibility of integrating the interface with the EHR inventory management module. This could enable an interface with **DoseEdge** and other pharmacy tools for even better oversight to inventory. There is significant interest in having communication with the EHR system and other ancillary systems, such as dispensing cabinets and packagers. This information could be sent from the IV room and shared with the pharmacy team or other areas. While this ability would not be mandatory, without this capability, Houston Methodist believes what they refer to as the "black hole" will continue in inventory management. Integration with the EHR inventory management system is a prime opportunity and shows that the technology can adapt with future ambitions and goals.

Conclusion

Since late 2019, the Houston Methodist team has undergone internal data analysis to quantify the improvements and identify potential areas that could be improved via HL7 bi-directional communications. Capturing this information and the willingness to share the story with the implementation could establish best practices across health care. Consequently, the lessons and data acquired may enable wide adoption of the technology and its integration with existing processes and provide further justification and promote wider adoption of IV workflow systems. It has been established that bi-directional systems can potentially improve medication safety and are recommended by organizations such as ISMP.[2] However, in addition, these systems could precipitate stronger compliance and billing efficiencies, as well as improve cost savings, automating manual processes, and increase staff productivity.

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