

IMPROVING PATIENT SAFETY AND CUTTING COSTS WITH HEALTHCARE AUTOMATION

BENEFIT ANALYSIS OF TWO EUROPEAN HOSPITALS USING AUTOMATED DRUG
MANAGEMENT SYSTEMS FROM SWISSLOG HEALTHCARE SOLUTIONS



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EXECUTIVE SUMMARY

The clinical and economic consequences of adverse drug events are potent drivers motivating hospital administrators to continually improve patient safety. Yet, what is the best, most cost-effective way to achieve this end?

Increasingly, hospitals the world over are creating "closed-loop medication management systems". These drug management systems seamlessly connect their varied applications and automation technologies to support the drug management and administration processes from end to end.

This paper details the real-world cases of two European hospitals. They both implemented pharmacy automation solutions to improve patient safety, better utilize their labor forces and reduce spending.

And in so doing, they demonstrated how a modern hospital can effectively apply closed-loop medication management principles to support its healing mission.

ABBREVIATIONS AND ACRONYMS

ADC	Automated Dispensing Cabinet
ADE	Adverse Drug Event
ADMS	Automated Drug Management System
CBU	"Contrat de Bon Usage"
CPOE	Computerized Physician Order Entry
CSF	Critical Success Factor
EHR	Electronic Health Record
EMR	Electronic Medical Record
FTE	Full Time Equivalent
HIS	Hospital Information System
HPIS	Hospital Pharmacy Information System
KPI	Key Performance Indicator
PCFS	Proof of Concept Fact Sheet
PLC	Product Life Cycle
PRN	When necessary (from the Latin " <i>pro re nata</i> ")
ROI	Return On Investment
STAT	Immediately (from the Latin " <i>statim</i> ")
UDDS	Unit-Dose Distribution System
UDMS	Unit-Dose Management System
USP	Unique Selling Point/Proposition
WSS	Ward Stock System

TRENDS DRIVING THE ADOPTION OF AUTOMATED DRUG MANAGEMENT SYSTEMS (ADMS)

Every year, nearly three-quarters of a million hospital patients are injured or die from adverse drug events (ADEs)¹. The human toll that these errors take is incalculable, and goes against medical practitioners' oaths of "first, do no harm." Moreover, medication errors have a profound and well-documented economic impact. ADEs result in additional required treatments, longer hospital stays, boosts in insurance costs and costs associated with lawsuits. One recent study in Germany showed that ADE-related costs totaled € 1 billion per year.²

Not surprisingly, these realities motivate hospital administrators and healthcare practitioners to improve the safety of their drug management and administration systems.

Consequently, they scrutinize their safety-oriented processes and invest in process-supporting technologies.

THE CLOSED-LOOP MEDICATION MANAGEMENT APPROACH

To combat the ill effects of ADEs, and to promote a safer medication management and administration environment, hospitals are increasingly implementing what are referred to as closed-loop medication management systems. Figure 1 below illustrates how such a system is applied to the ordering, dispensing, delivering, and administering of medications.

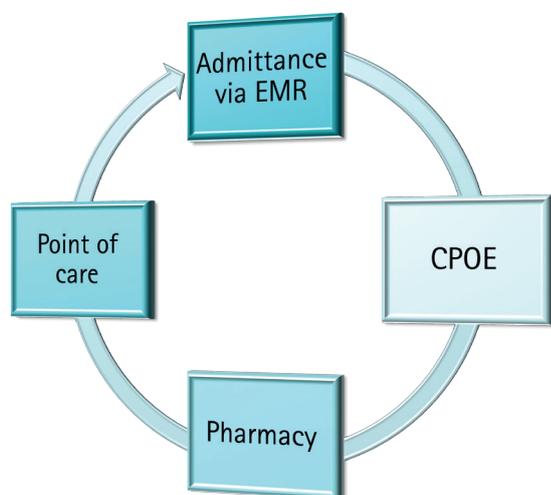


Figure 1: A Closed-Loop Medication Management System.

The closed-loop system relies heavily upon IT resources, software applications and automation solutions. Ideally, all these systems are integrated—from electronic medical records (EMRs) to

computer physician order entry (CPOE) solutions to pharmacy automation technologies. Moreover, each of the systems in the loop adds patient-relevant information that caretakers can draw upon. This "single data view" provides consistent information to all caregivers, and is readily available to users at each step of the medication process.

To understand the full impact that automation systems can have, consider the traditional dispensing process. This process consists of various manual steps to dispense medications from ward stock in their original packaging. In this case, the number of human "touches" in the process introduce the possibility of human errors—a possibility that grows exponentially with every step.

By automating the medication-specific processes, closed-loop systems eliminate many steps, along with the chances for human error. The impact that this action has on patient safety can be significant. For example, one 371-bed regional medical center automated its drug distribution process through the implementation of profiled automated dispensing cabinets that work in harmony with its CPOE system, among other systems.³ Over time, managers successfully reduced the number of steps for medication administration from 17 to 5.⁴ This led to a reduction of ADEs from 3.5 per 1 000 to 0.52 per 1 000 patients.⁵

¹ Klass, Barbara, "Reducing and Preventing Adverse Drug Events To Decrease Hospital Costs", AHRQ Publication Number 01-0020, Issue 1. Agency for Healthcare Research and Quality, Rockville, MD., March 2001.

² D. Rottenkolber, J. Hasford, J. Stausberg; "Costs of adverse drug events in German hospitals—a microcosting study," Value Health, epub August 9, 2012, 15(6):868-75.

³ Nicol, Natasha, PharmD, "Case Study: Closing the Medication Management Loop," Pharmacy Purchasing & Products, April, 2005.

⁴ Ibid.

⁵ Ibid.

PHARMACY AUTOMATION SOLUTION BENEFITS

The implementation of pharmacy automation solutions can be a challenging, and at some points, a painful experience. Still, hospital administrators and pharmacists find that the experience is worth the investment for a number of compelling reasons.

Increased patient safety

Manual processes rely upon the accuracy of pharmacy technicians and specialists. As good as they are, they are still human, and humans make mistakes. The implementation of automation technologies in healthcare settings has been shown to reduce errors by reducing the number of human touches.



Improved compliance

Pharmacy automation solutions allow pharmacists to incorporate compliance measures into their workflows. Moreover, accompanying software applications ease the administrative burden of providing reports to governmental agencies.

Lowered costs

In addition to improvements in patient safety, pharmacy automation solutions deliver cost savings. For example, one pharmacy PillPick® Automated Packaging and Dispensing System implementation showed a reduction in inventory overhead of US\$ 350 000 annually, along with a 40 percent reduction in missing doses, while at the same time slashing cart fill-time by 71 percent.⁶

Increased efficiency

The implementation of pharmacy automation solutions requires pharmacists to review their departmental processes. This allows low- or no-value-add steps to be eliminated while minimizing the impact to safety and users. Hence, automation solutions promote increases in the efficiency of pharmacy operations.⁷ That includes increases in the number of prescriptions dispensed per full-time-equivalent (FTE) pharmacist.⁸

Contributes to a holistic approach to medication management

Pharmacy automation solutions are an essential building block of closed-loop medication management systems. By integrating with existing systems, and contributing to the collection and dissemination of useful patient and operational data, they promote a robust, patient-centric and safe medication management ecosystem.

⁶ Kasbekar, Nishaminy PharmD, FASHP, "PillPick and BoxPicker from Swisslog," Pharmacy Purchasing & Products. July, 2013. Vol. 10, No. 7, p. 40.

⁷ James, KL, et al, "The impact of automation on workload and dispensing errors in a hospital pharmacy." Int J Pharm Pract. 2013 Apr;21(2):92-104.

⁸ Cousein E, Mareville J, Leroy A, et al. Effect of automated drug distribution systems on medication error rates in a short-stay geriatric unit: Drug distribution and medication errors. J Eval Clin Pract 2014;20:678-84.

DOCUMENTING SOLUTION IMPLEMENTATION RESULTS

In 2014 Swisslog Healthcare Solutions' managers hired GPP Support, a third-party Dutch consulting firm. They were selected because of their experience and expertise in the areas of hospital drug management systems and logistic processes. Their task was to complete an evaluation of the major benefits achieved by two European hospitals who implemented Swisslog ADMS solutions.

The primary goal was to answer the question, "What are the benefits that hospitals have realized from the Swisslog PillPick® Automated Packaging and Dispensing System as well as the BoxPicker™ Automated Pharmacy Storage System?"

To answer that question, GPP Support experts met with personnel in two European hospitals: The Ospedale Spirito Santo in Pescara, Italy and the Centre Hospitalier de Valenciennes in France. The quality of patient care was evaluated using both quantitative and qualitative measures.

GPP Support specialists collected data using face-to-face interviews and questionnaires as well as querying each hospital's health information system (HIS) and electronic health record (EHR) system. They then cross-referenced the data with pharmacists to validate the data sets. After that, GPP Support experts consolidated the findings and analyzed the results.

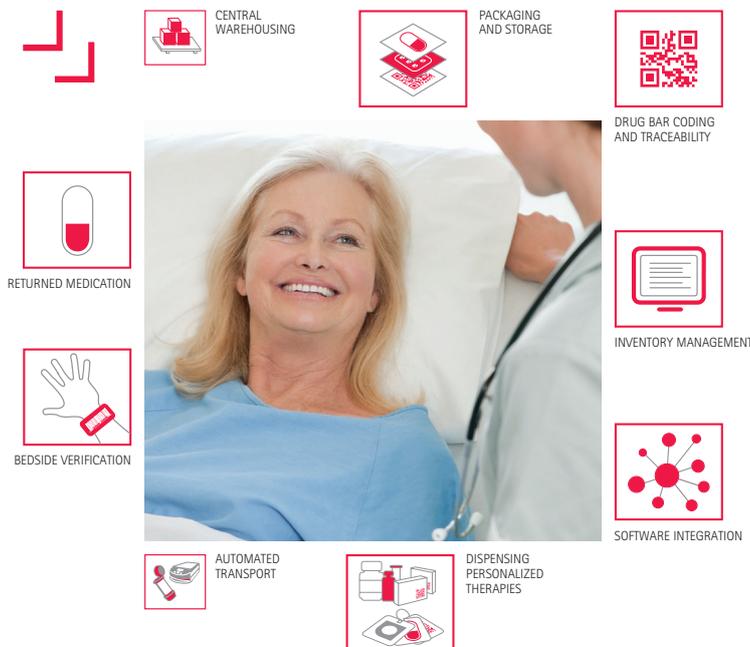
The selected sites had similar characteristics:

- Age of solution implementation, previous distribution method, European locations
- Country and configuration of the technological solution.

Previously, both hospitals used a traditional, manual ward-stock-based drug dispensing model for patient drug-therapy preparations. Today, both hospitals use Swisslog pharmacy automation systems to centrally dispense patient-specific daily therapies.

AN INTEGRATED CLOSED-LOOP ECOSYSTEM PROMOTES SUCCESS

Note that the GPP Support study assessed the entirety of the drug dispensing process. That included a holistic evaluation of all the hospitals' drug management systems as illustrated in Figure 2 below. It's important to note that each of these elements—supplied by various vendors—contributes to the medication process outcome.



Note too that a closed-loop medication management process can only work if there is a CPOE system as well as a software application—sometimes part of the CPOE—for nurses to process drug barcode scans before the administration of drugs. Moreover, some of the results of this study may be attributed to the integration of software technologies with pharmacy automation solutions.

For example, the implementation of a CPOE system improves patient safety by reducing manual mistakes during the prescription process.

Last but not least, a drug inventory control system incorporating barcode scanning functionality is necessary to help reduce overall drug consumption as well as lower or eliminate drug waste from expiration or spillage.

Figure 2: The drug dispensing process at two European hospitals.

SUMMARY OF RESULTS

Prior to the implementation of the Swisslog PillPick Solution, both hospitals used a traditional model to manage their drug dispensing process.

This included using original medication packs in ward stocks along with using nurses to manually create patient therapies according to a hand-written medication record. The Swisslog implementations significantly increased the automation of these processes.

Both hospital management teams were deemed to be "very satisfied" with the automated process of dispensing drugs in unit-dose format using the PillPick Solution. So much so that both hospitals confirmed that they would "never go back to the old system."

The implementation of the Swisslog pharmacy automation solutions contributed to a number of benefits:

Improved patient safety

The Valenciennes hospital reduced its error rate by 53 percent.

Boosted caregiver efficiency

The automation of drug-therapy preparations liberated nurses from manual activities which translated into labor-savings of 0.47 FTEs for 80 beds.

Increased cost savings

The Pescara hospital projects a 30 percent drop in drug consumption.

CENTRE HOSPITALIER DE VALENCIENNES, FRANCE

ABOUT THE HOSPITAL

The Centre Hospitalier de Valenciennes is one of the 30 largest hospitals in France. The 1 850 bed facility is equipped with advanced technologies for the treatment of all medical and surgical specialties.

Its 4 300 employees provide healthcare services to 800 000 area residents through 12 medical facilities.

Administrators wanted to achieve three main goals:

1. To improve patient safety via a 24/7 available drug dispensing solution.
2. To improve control over operations.
3. To more efficiently utilize labor resources.

MEDICATION MANAGEMENT PROCESSES

In 2008, the hospital began transitioning from a traditional, manual-based medication management process to a more automated process.

Following the implementation of these systems, therapies are dispensed in a unit-dose, patient-specific daily format. Pharmacy personnel receive prescriptions electronically and validate them.

They use the Swisslog PillPick Automated Packaging and Dispensing System to process dispensing orders. Medications not managed in unit dose formats are processed using warehouse automation solutions along with automated dispensing cabinets (ADCs.)

To help achieve these ends, decision-makers implemented four automated drug management systems, including

- Stock management automation solution
- Unit-dose dispensing system
- Automated medication dispensing cabinet
- Warehouse management software



CENTRE HOSPITALIER
DE VALENCIENNES

OSPEDALE SPIRITO SANTO - PESCARA, ITALY

ABOUT THE HOSPITAL

The Azienda Unità Sanitaria Locale di Pescara (AUSL Pescara) is a public healthcare institution in the province of Pescara, Italy. AUSL Pescara includes three hospitals, the main one being the "Ospedale Spirito Santo", a 750-bed facility located in the city of Pescara. Collectively, the three hospitals employ 2 000 workers who see 27 000 inpatients annually among the 300 000 inhabitants served.

MEDICATION MANAGEMENT PROCESSES

In 2007, the Spirito Santo hospital implemented a unit-dose medication distribution system. Today, the pharmacy hosts the unit-dose department, where the Swisslog PillPick and BoxPicker automated pharmacy storage systems have been installed.

The hospital's new distribution method dispenses therapies in a unit-dose, patient-specific daily format. Pharmacy personnel receive prescriptions electronically and validate them. They use the Swisslog PillPick Automated Packaging and Dispensing System to process dispensing orders. Non-unit-dose medications are managed with the Swisslog BoxPicker Solution.

The new distribution method bar codes all medications and medical devices to ensure complete traceability. This results in increased patient safety and improvements to operational efficiencies and logistics.



ANALYSIS OF RESULTS

To quantify what was achieved by the introduction of the unit-dose distribution process, GPP Support used a Proof-of-Concept Fact Sheet to analyze different project elements.

These are segregated into two major categories, Benefits (those that improved Quality, and those that reduce Costs) and Conditions (items that most impacted the decision drivers: considerations of the Occasion, Purchase, Implementation and Operation).

Besides collecting and consolidating existing data from each hospital, GPP Support consultants developed a high-resolution questionnaire to analyze specific elements before, during and after the implementation of the unit-dose system. The score-based model allows results from different sites to be compared. Moreover, it delivers a clearer picture of the most important benefits realized by implementing an automated solution.

QUALITY BENEFITS

Both hospitals reported a positive stakeholders' satisfaction rating for the introduction of the unit-dose system. This included "very positive" ratings for "quality of service" as well as for "patient safety" for all the steps of drug management process—from the pharmacy through to the patient's bedside.

The Valenciennes Hospital experienced a 53 percent decrease in medication errors following the introduction of the unit-dose system according to a very detailed study of its short-stay geriatric ward. It was not possible to calculate an error rate differential for the Pescara Hospital because pre-implementation data was not available.

Figure 3 below illustrates post-implementation scores for Stakeholder Satisfaction, Overall Quality and Patient Safety at the Pescara and Valenciennes hospitals.

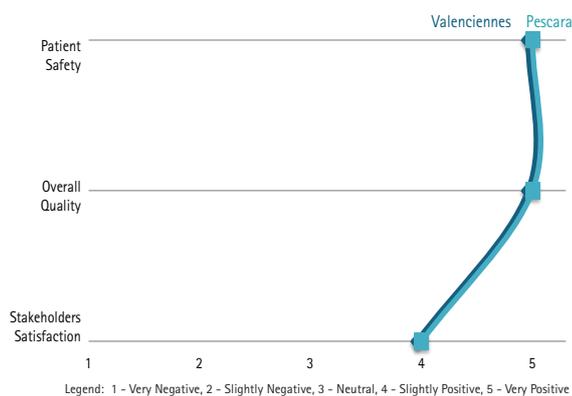


Figure 3: Quality benefits scores at Valenciennes and Pescara hospitals.

COST-CUTTING BENEFITS

The key results of both hospitals were very similar.

Pharmacy Space

The Valenciennes Hospital reported a slight increase in space requirements for the central pharmacy due to the installation of automation technologies and to host additional staff. The space requirements of the Pescara hospital were not comparable to its previous layout because the automated solution was installed into a new-build pharmacy site.

Pharmacy and Nurse Workloads

The pharmacy workload at each hospital increased slightly due to the new process of dispensing drugs in a patient-specific, unit-dose format. However, the majority of the patient-therapy-preparation workload was absorbed by the automated systems. Additionally, some of the pharmacy workload was eliminated by replacing the manual process with a more automated process to dispense drugs in original packs for ward-stock replenishment. Notwithstanding notable automation benefits, the pharmacy staff still completes some operational and control tasks.

The bottom line is that both hospitals reported a decrease in nurse workloads for the dispensing of drugs. The Valenciennes Hospital measured a decrease of 0.47 full-time equivalent (FTE) nurses for 80 beds. This is due to a significant reduction in nurse logistic activities including: less ward-stock management and significantly less manual preparation of patient drug therapies.

Drug Consumption

Both hospitals realized a reduction in drug consumption by eliminating waste, expiry and spillage of drugs.

The Valenciennes Hospital realized about an 11.5 percent decrease on a geriatric ward and the Pescara Hospital posted a 30 percent drop in overall drug consumption according to a seven-month study.

Following the introduction of the unit-dose system, the Valenciennes Hospital ward stock drug levels dropped to nearly zero while in the Pescara Hospital they still use ward stock to manage first doses, STAT and PRN medication during periods when the central pharmacy is closed.

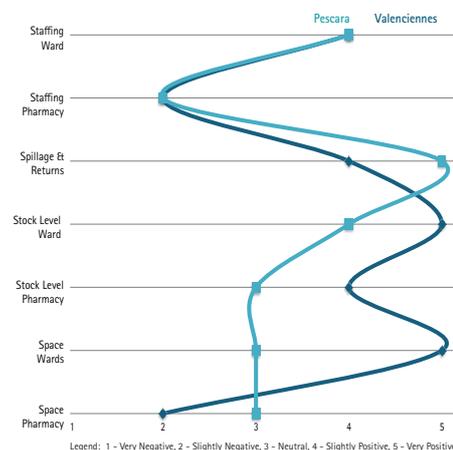


Figure 4: Post-implementation scores for cost-cutting benefits at Valenciennes and Pescara hospitals.

CONDITIONS THAT MOTIVATED ADMINISTRATORS TO SEEK OUT PHARMACY AUTOMATION SOLUTIONS

The second part of the GPP Support assessment focused on the pre-purchase conditions during the different phases of the project: Occasion, Purchase, Implementation and Operation. We'll discuss each category in turn below.

OCCASION CONDITIONS

Each hospital had several triggering events, or "occasions" that motivated managers to start looking for a different medication distribution system (see Figure 5 below.)

For both hospitals, the building or renovation of a hospital/ pharmacy seemed to be a strong driver. Two additional key drivers were the desire to improve patient safety as well as to improve and to protect their hospital's reputation.

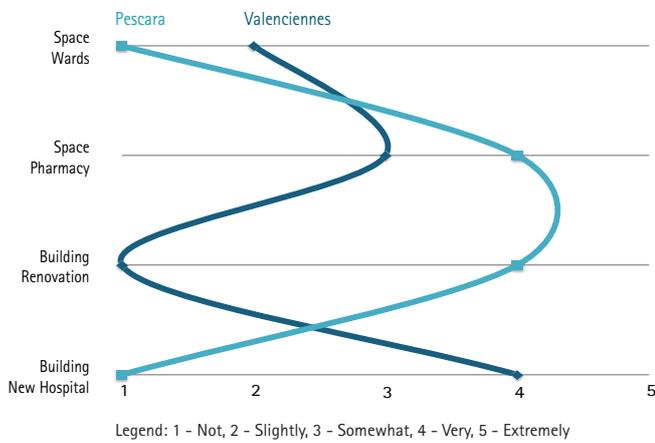


Figure 5: Drivers that motivated hospital administrators to seek out pharmacy automation solutions.

Figure 6 below details a number of additional drivers. These include the desire to cut costs. In fact, the Pescara Hospital created detailed return on investment (ROI) projections before purchasing their automated solutions.

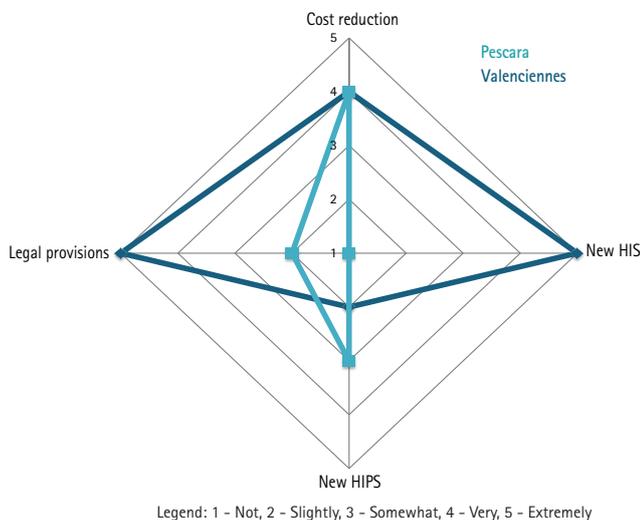


Figure 6: More drivers that motivated hospital administrators to seek out pharmacy automation solutions.

In addition to cost considerations, the Valenciennes Hospital factored in legal provisions ("Contrat de Bon Usage (CBU) des médicaments"), which significantly increased the financial value of the unit-dose system to its pharmacy. That's because the French CBU requires hospitals to implement electronic prescription systems as well as a safe and secure distribution solution such as the Swisslog PillPick Automated Packaging and Dispensing System. Failing to do so would result in reduced drug-spending reimbursements.

Finally, the introduction of a new HIS, along with a full-fledged CPOE motivated Valenciennes Hospital administrators to seek out complementary pharmacy automation solutions. Collectively, they provide the foundation for an effective, closed-loop drug management system.



PURCHASE CONDITIONS

The purchase of a new medication distribution system is a complex process that involves many stakeholders in the decision-making process. Consequently, the GPP Support assessment analysed the purchasing process along with what each hospital considered before they purchased the Swisslog pharmacy automation solutions.

FINANCIAL STAKEHOLDERS

Both hospitals did an internal ROI analysis comparing the traditional process (manual ward-stock system) with a unit-dose process driven by a central pharmacy automation solution. These analyses identified potential cost savings in the areas of reduced drug consumption and less nursing time required for drug therapy preparation. The break-even time period for the automation investment was calculated to be seven years for the Valenciennes Hospital and six years for the Pescara Hospital. Note that the expected physical life expectancy (time of usage) of a properly maintained and operated system like PillPick is at least 10 years.

TECHNICAL STAKEHOLDERS

Both hospitals did a technical buyer analysis to scope out detailed specifications and requirements. The Pescara Hospital specified a unit-dose system for a maximum capacity of 1 000 beds plus an automated warehouse for drugs in their original packaging.

Before choosing the Swisslog pharmacy automation solutions, the Valenciennes Hospital completed a very intense comparison of different automation solutions available in the market. These included benchmark comparisons of strip packager systems and even pack-dispensing solutions like those found in the United Kingdom.

USER STAKEHOLDERS

The Valenciennes Hospital factored in the pharmacy staff required to migrate from the existing ward-stock system (WSS) to a personalized dispensing system and compared dispensing with the carousels to dispensing with robotic unit-dose dispensing system. The ultimate decision to move from a WSS to a unit-dose dispensing system was based upon the savings expected from fewer nurse hours needed to complete medication tasks.

EXECUTIVE STAKEHOLDERS

Executives at both hospitals were keen to improve medication safety. The Pescara Hospital management team further sought to reduce hospitalization time by reducing medication errors.

Beyond increases in patient safety, executives at the Valenciennes Hospital wanted to meet regulatory requirements. Moreover, they sought to integrate companion technologies such as EHR and CPOE systems at the newly built hospital with automation technologies.

IMPLEMENTATION CONDITIONS

Given the complexity of implementing a medication distribution system, such projects require the guidance of change management methodologies. In practice, successful pharmacy automation solution implementations need the purposeful shepherding of people, processes and technology.⁹

PEOPLE

The project's "people" were those that would be affected by the new solution. That includes the obvious pharmacy personnel such as technicians, specialists and pharmacists. And it also includes the executive team (President, CFO, CIO, HR) who are accountable for the financial success of the project as well as downstream system "users" (doctors, nurses, practitioners) who are accountable for the clinical success of the project.

PROCESSES

In order to optimize the use and benefits of pharmacy automation solutions, core processes need to be reevaluated. Pharmacist champions have the opportunity to eliminate non-value-added steps and to make other tasks transparent to the user.

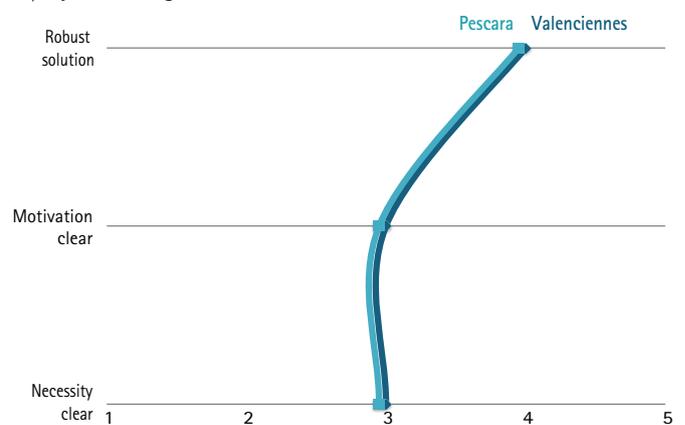
TECHNOLOGY

The implementation of a new technology requires attention to detail. That includes accommodating the installation of the physical components along with integrating their associated software applications with existing systems.

Conceptually, accounting for all three areas in an implementation will significantly improve the chances to realize the full potential of pharmacy automation solutions. Moreover, it makes the process easier and reduces user anxiety.

VISION/STRATEGY

In addition to People, Processes and Technology, successful implementations incorporate an overall vision and strategy for the project. See Figure 7 below.



Legend: 1 - Not, 2 - Slightly, 3 - Somewhat, 4 - Very, 5 - Extremely
Figure 7: Managers laid the foundation for a successful pharmacy automation solution implementation.

⁹ For a detailed discussion of pharmacy automation change management, download Swisslog's white paper "Managing Technical Change in Your Pharmacy".

Both hospital teams reported that they believed in the success of the project and were highly motivated to contribute to its success, as shown in figure 8 below.

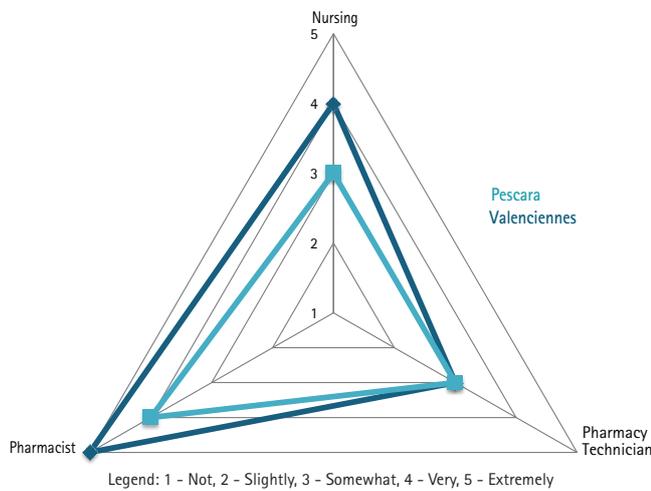


Figure 8: Faith in the success and benefits of the pharmacy automation solutions

That suggests that their respective management teams did a good job in explaining why it was necessary to migrate to automation solutions. They also fostered motivation among those affected to create project momentum. And of course, they positioned their hospitals to optimize the use of their automation solutions with legacy systems.

CONCLUSIONS

Administrators at both hospitals were faced with the same challenges that most practitioners face: **The need to improve patient safety while improving operational efficiencies and lowering costs.** Like many of their peers they have adopted technological solutions including EMRs and CPOE systems. And they are making better use of these technologies as part of a holistic, closed-loop medication management system.

This paper features the documented experiences of two European hospitals who successfully implemented automated medication management systems. Today, both hospitals are very satisfied with the results they achieved from their implementation of the Swisslog pharmacy automation solutions. This is due to the fact that administrators feel they achieved their stated objectives:

- To increase patient safety
- To improve operational efficiency, and
- To lower costs



The pharmacy automation solutions have proven their value in daily operations. So much so that administrators and users universally state that they would “never go back to the old system”.

SKILLS

In order for solution users to be successful, they must be properly trained. For example, nurses in the Pescara Hospital were trained to use IT solutions such as personal digital assistants (PDAs) at patient bedsides.

The pharmacists and the IT departments at both the Valenciennes and Pescara Hospitals were confident with their needed skills to use the new solution. Both hospitals had a dedicated project team to manage the project internally.

Swisslog was supporting this implementation phase by different specialists (software developers and pharmacists) and was conducting customized training sessions to the pharmacy team.

OPERATION CONDITIONS

The last element assessed was the operation of the new solutions. Both hospitals reported a high level of satisfaction with the Swisslog PillPick Automated Packaging and Dispensing System.

Additionally, both hospitals reported that nurses can now focus more on patients because they don't spend nearly as much time on logistical tasks and the preparation of therapies.

LEARN MORE ABOUT SWISSLOG PROVEN PHARMACY AUTOMATION SOLUTIONS

Swisslog Healthcare Solutions offers total system design, manufacturing, installation and customer support— providing an integrated solution for lean workflow and operations that enhances information access, patient safety and cost efficiency. The leading supplier of automation and software solutions for material transport and medication management in healthcare facilities, Swisslog has installations in more than 3,000 hospitals worldwide.

For years, hospitals have used our tested pharmacy automation solutions to:

- Improve patient safety by reducing errors.
- Increase the operational efficiency of their systems and personnel.
- Reduce inventory overhead and medication preparation and delivery expenses.

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Or contact us today to discuss your unique needs with our automation experts.

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