Improving Patient Safety: Automating Specimen Collection and Transfusion Management Reduces Errors

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Diagnostic laboratories have an important role to play in ensuring patient safety. The chance for human errors and omissions is high in specimen collection, testing, and blood transfusions because these processes have so many manual steps. Automating specimen collection and transfusion management can create closed loop systems that virtually eliminate errors in labeling of specimens, incorrect patient draws, and incorrect transfusions.

Adding specimen collection management and transfusion management solutions to the laboratory information system (LIS) promotes patient safety by ensuring that specimens are collected from the right patient, for the right tests, at the right time, with the right indicators, for the right diagnosis. In addition to a significant improvement in patient safety, automating results in cost efficiencies, improved quality of care, and increased revenues.

Hospital research conducted in the US and Canada quantifies the values of automation and suggests that return on investment (ROI) in automation systems is extremely high. In a case study of one sample hospital, an investment of about $600,000 generated a positive return in less than one year, with a three-year net present value (NPV) of $3.8M and an 820 percent ROI.

Key patient safety challenges facing labs and hospitals

Sunquest Information Systems interviewed LIS managers, laboratory directors and managers, physicians, pathologists, and IT support managers at 15 hospitals in the US and Canada, and asked them about the challenges they face in specimen collection and testing and blood transfusion. Their responses fell into four main areas:

1. Matching patients and test

The need for positive patient identification programs is paramount to patient safety, ensuring the right patient is matched to the right tests, procedures, and products. When done manually, this process can be time consuming and prone to human error. Patients can become separated from their wristbands or staff may fail to conduct properly all steps of a bedside check, resulting in incorrect or incomplete patient identification.

This point is well illustrated by a 2003 audit of transfusion procedures in 660 hospitals, which showed that during bedside identification checks, there was a failure to:

- Ask patient name and match to wristband 57 percent of the time.
- Match wristband ID to the blood bag label 24 percent of the time.
- Match wristband data with the request form 46 percent of the time.
- Check results of compatibility testing and expiration 27 percent of the time.
- Do all four of the bedside check steps correctly 75 percent of the time.

2. Tracking test requests

There are many manual steps required from test order request to specimen receipt into the lab and these manual touch-points can lead to human error. For example, phlebotomists often travel from the labs with multiple sets of labels for multiple patient draws that need to be made, creating the risk that the wrong labels are affixed to the specimens once drawn. If the patient is not available for a scheduled draw, the phlebotomist must also make a note of this and remember to alert the lab that the draw did not take place and needs to be rescheduled.

3. Speed versus safety

Reducing turnaround times (TAT) for labs, emergency departments (EDs), and other areas of the hospital while ensuring that the right results are matched with the right patient and delivered in near real-time is critical, so treatment decisions can be expedited with maximum data. In addition, the inability to instantly record results into the patient’s electronic medical records (EMR) and consolidate them with the previous patient history can reduce the chances that the most effective course of treatment is delivered, or result in an incorrect course of treatment because a previously existing condition is not known.

Lab capacity can also be restricted by long turnaround times, allowing fewer patient results to be delivered at any given time. This is also true of areas like the ED, where long turnaround times can result in fewer patients being seen or longer wait times before medical care can be given.

For example: using an automated system, Sunquest’s Collection Manager dramatically decreases TAT in the ED. In the case study described in detail below, the hospital ED reduced TAT from 65 minutes to 46 minutes per test, increasing capacity, and netting more than one million dollars in annual incremental revenue.

4. Dealing with errors

Lost or mislabeled specimens or incorrectly administered products or procedures can result in significant follow-up time to determine why the error occurred and how to prevent it in the future. The worst cases may result in serious adverse events. The time and number of staff required to follow-up on errors can be extensive, averaging anywhere from 2-3 hours to 1-2 weeks, and including phlebotomists, nurses, physicians, lab techs, lab managers, CMO’s, safety officers, and legal staff.

An error might also result in significant financial impact, including lack of reimbursement for added patient care, increased insurance premiums, or legal action taken against the facility. One study found that 1 in 18 sample identification errors led directly to an adverse event.

Automated specimen collection and transfusion management adds value

Those interviewed for this research believe there is significant value in automating specimen collection and transfusion management. Values fall into three main categories, each with a series of specific benefits, shown in Figure 1.

Figure 1 – Specimen Collection and Transfusion Automation Values and Benefits

Value Area	Specific Benefits
Cost Efficiencies	Decrease insurance and litigation costs Reduce specimen collection time Reduce time needed to resolve labeling and transfusion errors Minimize wasted/unused units of blood Eliminate need for second independent PPID before administering a blood transfusion
Improve Quality of Care	Reduce adverse events resulting from mislabeled specimens Reduce adverse events resulting from transfusion errors Reduce time to record patient information per transfusion
Increase Revenues	Increase lab capacity by reducing TAT Increase ED capacity by reducing TAT

Case study of automated specimen collection and transfusion management

The following case study illustrates the potential value of automated specimen collection and transfusion management solutions for each value area, based on a sample hospital with the characteristics shown in Figure 2. The cost savings, productivity, or revenue benefits of automation for the sample hospital are shown on Figure 3.

The evaluation of features and benefits of automated systems is based on the use of Sunquest’s automated specimen collection solution, Collection Manager (CM) and automated transfusion management solution, Transfusion Manager (TM).

Figure 2 – Sample Hospital Case Study Characteristics Before Automation	
Number of lab tests per month	500,000
Average revenue per lab test	$40
Time spent on travelling to/from lab and specimen receipt per hour	25 minutes
Current turnaround time per specimen	65 minutes
Number of ED patients per day	80
Average LOS per ED patient	220 minutes
Average charges per patient in the ED	$1,896
Number of blood transfusions per month	1,500
Time spent recording patient vitals per transfusion	10 minutes
Time required for positive patient identification per transfusion (x2 for each of two required independent confirmations)	5 minutes

Cost Efficiencies

Reduce specimen collection time - With automatic collection, labels can be printed at the bedside, eliminating traveling. Moving to such a system allowed a hospital whose phlebotomists were spending 15 minutes per hour on travel, and whose lab techs were spending 10 minutes per hour on specimen receipt, to reduce these times by 60 percent and 100 percent, respectively, with an impact of $415,200 in annual productivity improvements.

Reduce time needed to resolve labeling issues – An automated system completely eliminates labeling errors and the associated follow-up time. For a sample hospital that averaged 8-10 labeling errors per month, and 1.5 hours average follow-up time per error, this could be reduced to zero, yielding about $3,400 in annual productivity improvements.

Decrease insurance and litigation costs as a result of mislabeled specimens - Mislabeled specimens that result in adverse events can result in significant financial issues for hospitals, both in terms of increased insurance premiums and the potential for legal actions brought against the facility as the result of an adverse event. A sample hospital that incurs even one lawsuit every four years could save an average of $200K in litigation costs and $1.0M in settlement costs. This is about $300,000 in annualized cost savings

Reduce time needed to resolve transfusion errors - Moving to an automated transfusion management solution can virtually reduce the number of transfusion errors and the associated follow-up time to zero. In the sample hospital, transfusion

errors were reduced from three per year to zero, eliminating 12-14 hours in follow-up time per error, yielding about $22,800 in annual productivity improvements.

Minimize wasted/unused units of blood - The start and stop time of each bag of transfused blood is recorded, as well as where and by whom it was administered, providing confirmation that all units were used and providing the data needed to determine trends in unused units and make positive practice changes. In the sample hospital, the automated system avoided the use of 6-8 units of blood, at an average cost of $300 per unit, about a $28,800 annual cost savings.

Eliminate the need for second independent confirmation - Normally, two independent patient identification confirmations are required for every transfusion, but with Transfusion Manager, regulatory boards have approved the elimination of the second person. The remaining staff member's time is reduced because one swipe of the barcodes on the patient wristband and the unit of blood to be transfused ensures a match between patient and blood. The sample hospital reduced the time required for positive patient identification (PPID) from five minutes for each of the two staff members to just two minutes for one staff member, about $104,200 in annual productivity improvements.

Decrease insurance and litigation costs as a result of transfusion errors - Transfusion Manager virtually eliminates the chance that the wrong blood will be administered. A sample hospital that incurs even one lawsuit every four years could save an average of $200K in litigation costs and $1.0M in settlement costs. Annualized, this is $300,000 in cost savings.

Improve Quality of Care

Reduce adverse events resulting from mislabeled specimens - Adverse events resulting from mislabeled specimens can mean increased hospital stays for the affected patient, additional procedures and treatment, and added medications. With Collection Manager the patient barcodes are scanned, the required tests are confirmed and matched with the order in the system, the specimen is collected, and a label is immediately printed, all at bedside, virtually eliminating the possibility of an adverse event.

Reduce time to record patient information for each transfusion - Recording all patient vitals, reactions, and other pertinent details during a transfusion is critical to quality patient care, but could also be time consuming and incomplete as notes would be made by hand and later entered into the LIS. With Transfusion Manager, all vitals, reactions, and caregiver instructions can be automatically entered into the handheld device at the bedside and immediately received in the patient's EMR. The sample hospital improved accuracy of patient records while decreasing the time spent recording patient data by 30 percent, resulting in $39,100 in annual productivity improvements.

Eliminate adverse events resulting from transfusion errors - With TM, the patient barcode and the barcodes on the blood units are scanned right at bedside to confirm the blood to be administered and the patient are a match, virtually

eliminating the possibility of a patient getting the incorrect blood, and thereby eliminating the chance of an adverse event occurring. This is especially important since reimbursement is no longer provided for care associated with preventable transfusion errors.

Increase Revenues

Increase lab capacity by reducing TAT - With Collection Manager the handheld device can signal the need for a specimen collection to a care provider on the floor as soon as it is requested, so collection can be done immediately. The specimen is then labeled right at bedside and scanned so that it is instantly received into the LIS. This reduces TAT for test results, freeing up significant lab capacity to take on additional testing, leading to additional revenue.

The sample hospital reduced TAT from 65 minutes to 46 minutes per test. Taking advantage of 1 percent of the added capacity that was created by these timesavings, the hospital netted about $1,028,600 in annual incremental revenue.

Increase ED capacity by reducing TAT - With Collection Manager the staff in the ED can pro-actively collect patient specimens in anticipation of these being needed, as the device can be used to scan a wristband and print a set of labels to identify “draw and hold” collections prior to the order being placed in the LIS. Once the order is placed, specimens can quickly be sent to lab, significantly reducing TAT. This creates added capacity in the ED, allowing more patients to be seen per day and thereby increasing revenues.

The sample hospital reduced the LOS per patient in the ED by 10 minutes each. Taking advantage of even 10 percent of the added capacity created by this time savings netted about $263,600 in annual incremental revenue.

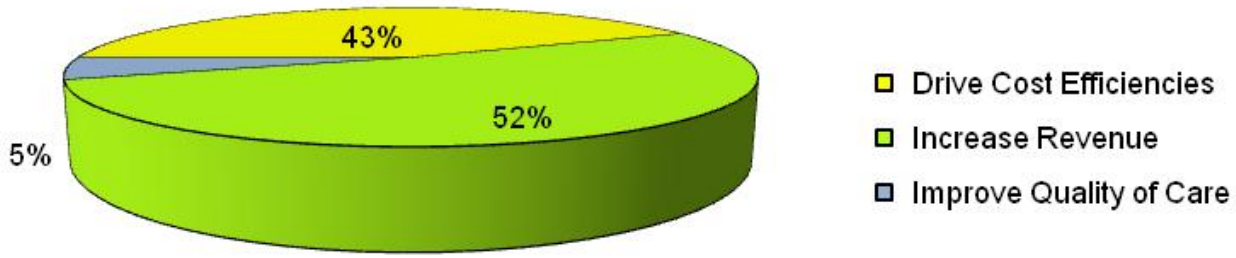
Figure 3 – Sample Hospital Case Study Annualized Specimen Collection and Transfusion Automation Cost Savings/Revenue	
Cost Savings/Revenue	Automation Benefit
$300,000	Decrease insurance and litigation costs
$415,000	Reduce specimen collection time
$26,200	Reduce time needed to resolve labeling and transfusion errors
$28,800	Minimize wasted/unused units of blood
$104,200	Eliminate need for second independent PPID before administering a blood transfusion
$50,300	Reduce adverse events resulting from mislabeled specimens
$53,000	Reduce adverse events resulting from transfusion errors
$39,100	Reduce time to record patient information per transfusion
$1,028,600	Increase lab capacity by reducing TAT
$263,600	Increase ED capacity by reducing TAT
$2,308,800	TOTAL Annualized Savings/Revenue

Overall Return on Investment for Automated Systems

Figure 4 illustrates that the sample hospital's three-year $592,000 investment generates a positive return in 9.1 months. The three-year net present value (NPV) and return on investment (ROI) are $3.8M and 820 percent, respectively.

Figure 4 – Return on Investment Assumes a 10% cost of capital	
Financial Metric	3-year Value
Payback (months)	9.1 months
NPV	$3,820,604
ROI	820%

Figure 5 shows the extent to which each value driver contributes to the total value of the automated specimen collection and transfusion management solutions. For the sample hospital, cost efficiencies and increasing revenue represent the majority of the value.



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