

Moving the Laboratory into the Wards

January 2011



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As healthcare seeks to provide better care with fewer resources, Point-of-Care Testing steps in to move key diagnostic or screening tests to the patient's bedside. The results can have a significant impact on a patient outcome and operational costs.

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Healthcare is reaching its tipping point, where resources will fail to meet the demands of the current systems. During this century the world's population will age across two thirds of the globe. A mere thirty years ago, in 1980, the median global age was 33 years. Today the median age is 40 years. In a quarter of a century, the median age is expected to peak at 52 years.

While some might find this an interesting trivia factoid, the fact is that our world population is rapidly moving into the years where more healthcare is required. Added to the increased need is the decreased budget to provide this care. Where 18 % of the population was beyond age 60 in 1980, this percentage has risen to 25 % and will continue to increase to 32 % before 2050 [12]. This

has placed significant pressure on healthcare to improve the care it provides while reducing costs. Where does the Laboratory fit into the equation?

Demand for laboratory services going forward

Laboratory science has advanced to be one of three key healthcare components. In both the outpatient and inpatient practices of medicine, the results of lab tests impact 80 % of diagnosis and treatment. Given its impact on patient care, it is surprising that Laboratory operations only comprise 4 % of a hospital's budget [4]. Even more surprising is the fact that each year the demand for Laboratory services increases by approximately 8 %. While the tools to perform testing have greatly improved over the last 30 years, fewer laboratorians are being licensed each year.

During the last two decades, the number of new graduates has decreased by 50 % in the United States. All of these factors are driving administrators to view lab testing in a new way. Considering these factors, a

process engineer would look at this piece of the whole patient-care process in more depth. While it is true that laboratory testing processes are more automated and streamlined, requiring only 25 % of the turnaround time (TAT) they did half a century ago, the truth is that most critical tests still require approximately 1 hour of time.

Most of this time is spent on what a lean process engineer would classify as “non-value adding” processes; things like specimen transportation, handling and releasing results. To many laboratorians, this statement is very uncomfortable, even offensive. However, to understand the direction laboratory medicine is headed, it is critical to understand why it is on the course.

Laboratory medicine practiced outside of the laboratory

The term “value adding” indicates a step or piece that could be removed without affecting the final product. Consider the act of accessing the Internet on your home computer. Very few people choose to enable their computer’s security to require a secure login. Most people do not see the value in the step; it is non-value adding.

In traditional laboratory practices, there are many process steps that do not add value: specimen packaging, handling, processing, result review and release. However, this does prompt the question, “How can healthcare remove these parts of the process and still provide lab results?” The answer is Point-of-Care Testing (POCT). POCT, or Near-Patient Testing (NPT), is laboratory medicine practiced outside of the Laboratory, at or near the patient. These tests are performed by patient-care staff as part of the patient assessment process. Thoughtful healthcare organizations create POCT programs as well as patient assessment and treatment protocol algorithms to direct staff through the assessment and treatment.

For example, in the Emergency Department (ED), a patient arrives by ambulance with chest pain and shortness of breath. The patient is admitted and their medical records are downloaded into the system. When the nurse enters the patient’s presentation, chest pain and shortness of breath, the assessment record opens a series of standard tests and vital signs. Among these are the POCT Cardiac Panel and B-Natriuretic Peptide (BNP). As the IV is started, the lab specimens are collected, as well as a POCT specimen.

The POCT specimen is immediately tested and within 17 minutes the BNP and Cardiac Panel are complete. In the meantime, the provider has arrived and begins assessing the patient and reviews the EKG as it is performing. Before the provider has left the patient’s side, the critical lab results are available. Based on mild Cardiac Enzyme elevation and a normal BNP, the provider is able to diagnose the issue and move the patient onto more advanced care – an angiogram and intervention.

In the chart on next page, the variability between traditional lab process and POCT lab process demonstrates the positive impact.

This model was placed into use in the Australian Outback, where resources are extremely limited and distances to major medical facilities are measured in hours by plane [2]. The results showed decreases in mortality and morbidity (M&M), 30-day re-admission, and 1.2 days total length of stay (LOS).

“Rule in/rule out” principle

Savings derived by POCT are not limited to EDs alone. POCT or NPT offer the ability to improve the patient-care flow across both inpatient and outpatient medical settings. By moving the most common and critical lab tests to the patient’s side, the provider is able to apply the “Rule in/Rule out” principle at the time of the patient care or assessment [8]. By applying similar testing and

ED Patient flow comparison in minutes			
Milestone	Current practices	With EHR	With EHR and POCT ¹
Ambulance transport	15	15	15
ED assessment	10	10	15
Order transcription	7	1	1
Call to action ²	10	5	5
Lab test turnaround	35	35	(NA for initial diagnosis)
Check back for results to determine treatment	15 (check back for paper or e-copies)	5 (with PDA notification)	(NA – POCT results available during assessment and charting)
TOTAL TIME FROM ONSET	102	81	46
Cost of care saving (USD)	0	1,100	3,200
Average length of stay (Inpatient)	6 days	4 days	3 days
1. POCT for potential cardiac event = cardiac enzymes. With breathing issues = add blood gases and BNP. 2. Period between notification and activity: lab specimen collection, X-ray, etc. EHR: Electronic Healthcare Record PDA: Personal Digital Assistant			

assessment algorithms, the information is pushed to the provider at the time they are focused on the patient. This not only prevents the need for follow-up calls, but allows the provider to direct their assessment and treatment before the patient has left the exam room.

Children's Hospital, Miami, Florida, United States, moved the most common lab tests out of the Laboratory. By adopting a model where nurses perform common tests as POCT or NPT, Children's was able to move 85 % of lab testing to the bedside and focus laboratorians on more complex testing such as Blood Banking and Microbiology [1].

This model is becoming more widely adopted, allowing tests such as Prothrombin Time, Basic Metabolic Panel and glucose testing at the patient's bedside and other testing that is not available on portable instruments, such as blood gases, ionized calcium and bilirubin, to be tested on instruments housed on the patient's floor. Despite these advantages for the total patient-care

process, many laboratorians are still uncomfortable with moving lab testing to areas and staff outside of the lab.

POCT costs, lab quality results and training of staff

As POCT has evolved from the bedside glucose in the 1980s to the very large and inclusive menu of today, many laboratories are reticent to support POCT. The greatest concerns are the cost of POCT and ensuring lab quality results. While each healthcare organization holds its own unique budgetary structure and processes, one truth is universal. If the simple cost per test is the basis for POCT approval, it will fail every time.

However, if a fully burdened cost of care is examined as a basis for POCT approval, POCT is very likely to receive approval. When the fully burdened cost of providing patient care is examined, POCT reduces the cost by nearly half. The reason is simple: non-value adding steps are removed from the process of providing care. This reduces the time to treatment, length of stay and cost of providing care. Although cost containment is an important focus

for healthcare, it is not the reason anyone becomes a member of the patient-care team. This leads to the second concern: ensuring lab-quality results.

Laboratorians are trained to focus on all the little nuances that lead to the best-quality result. One could say laboratorians are trained to focus on the atomic level. Nurses, on the other hand, are trained to focus on the key clues and quickly move to the next step in care. In effect, their training is to move beyond the non-value adding step quickly to reach the best intervention quickly. Both professions and foci have their place in the process of patient care. It is these key differences that make laboratorians uneasy.

However, openly acknowledging and celebrating these differences in a robust training program can create a very successful POCT or NPT program. It is accurate to state that in the United States there are an average of four deaths and 250 injuries as a result of erroneous POCT glucose results [6]. However, it is also accurate to state that the same is true of testing performed in the Laboratory. Children's Hospital is a prime example of successful collaboration for improved patient care. By placing lab testing in the hands of those at the bedside, great improvement can be achieved.

The chart on next page illustrates how POCT/NPT can remove the non-value adding steps from the lab testing process, decreasing the TAT by nearly 90 % while providing additional savings and care improvements.

Information technology

It is important to acknowledge that advances in information technology plays a major role in moving lab testing outside of the Laboratory. Interfaces between instruments and the electronic medical record (EMR) allow results to flow swiftly and safely to the patient's chart. Along the way software applies algorithms of acceptability to the result. Those meeting acceptability are auto-validated.

Those not meeting acceptability are flagged for a laboratorian to review and release. New program

features facilitate correct patient and specimen identification. The end result is a safer process with improved turnaround time. Even when testing does not employ an instrument, it can provide checks and balances to ensure quality lab results.

The future trend

Each year the POCT sector of Laboratory Medicine increases by 15 % as the most commonly performed lab test move outside of the Laboratory [10]. It is a trend that is expected to continue not out of a desire to remove the Laboratory from lab testing, but to focus the limited resources where they can have the greatest impact on the patient's care and outcome. By moving lab testing outside of the Laboratory, providers and nurses can provide more timely care. Evidence based, in the moment patient care practices provide the most focused and effective treatment.

Care can be focused in the moments spent with the patient. The result is improved mortality and morbidity and reduced costs in providing care with fewer resources. Movement of Laboratory to the patient's bedside or the POCT setting is an evolutionary step in the practice of medicine that will enable laboratorians to focus on more complex tasks and continue to be the keystone in medical processes.

Time savings by test in minutes			
Test	Lab TAT	POC/NPT TAT	Savings/Improvements
Urinalysis (dipstick)	47	4	47 minutes LOS
Prothrombin Time (PT)	43	5	22 % reduction in blood product utilization
Basic Metabolic Panel (BMP)	27	2	43 % in staffing cost
Lipid Panel	98	8	43 % in staffing cos
A1C (Glycohemoglobin)	117	13	Patient assessment and counseling within one visit
Glucose	37	2	34 % cost of care
Creatinine	27	2	81 % improvement in Diagnostic Imaging schedule adherence
Hemoglobin & Hematocrit (H&H)	22	2	43 % in staffing cost
hCG (pregnancy)	78	7	47 minutes ED LOS
Strep A Screen	44	7	Patient assessment and treatment in one visit
Strep B Screen (culture v POCT)	1920	7	Improved patient outcomes and reduced antibiotic use
Influenza Screen	41	13	Assessment and treatment in one visit. Improved isolation
Rupture of Membrane Screen (PAMG-1)	42	13	Reduced infant mortality and distress
Mononucleosis Screen	33	13	Patient assessment and treatment in one visit
Urine Drug Screen	104	16	Single-visit patient assessment and management
Cardiac Panel (enzymes)	110	17	Decreased ED stay 47 minutes, improved time to treatment by 1.8 hours, decreased LOS by 25 % or 2.5 days
B-Natriuretic Peptide (BNP)	109	17	Reduced uses of antibiotics, reduced M&M for COPD, reduced LOS by 28 % or 3 days, improved post LOS by more than 60 days M&M, cost of care savings USD 3K
Activated Thrombin Time (PTT)	46	5	Reduced blood product use and LOS
Bilirubin (serum/plasma)	33	3	Improved patient outcome
LOS: Length of Stay M&M: Mortality and Morbidity COPD: Chronic Obstructive Pulmonary Disease			

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