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Quantifying the Economic Impact of Poor Quality (Hemolyzed) Blood Samples from the Emergency Department

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ABSTRACT

Hemolysis is the most common source of error in laboratory samples; it can potentially affect the results of several frequently ordered lab tests, and is responsible for almost 60% of rejected samples,[1,2] requiring re-collection.

One study in the literature identified hemolysis as "financially important",[5] and another calculated the possible avoidable expenditure resulting from hemolysis to be as high as 22.8% of the total cost of serum sample collection.

In collaboration with the BD Solutions Group, we developed a model to determine the costs of hemolyzed samples using the average hemolysis rate in the ED of 10%. The potential cost savings were then calculated if the rate of hemolysis in the ED could be reduced from 10% to 2%.

A substantial portion of time must be allocated to manage a hemolyzed sample. The actual testing (or re-testing) in the laboratory (including reagents and labor) must be incorporated in any costs associated with hemolyzed samples.

By reducing hemolysis in the ED to 2%, a comparable hospital could realize an annual savings of approximately $144,000, which includes both materials and labor.

Quantifying the Economic Impact of Poor Quality (Hemolyzed) Blood Samples from the Emergency Department

Hemolysis—the rupturing of red blood cells and the release of their contents into surrounding fluid—is a common problem observed in blood samples obtained in hospitals, with Emergency Departments (EDs) identified as a significant source. Hemolysis is the most common source of error in laboratory samples; it can potentially affect the results of several frequently ordered lab tests, and is responsible for almost 60% of rejected samples,[1,2] requiring re-collection. More importantly, this is a serious safety concern for patients, since the need to re-collect these samples may delay diagnosis and care, as well as add to the time in the ED, time that could be used to treat other patients. According to a survey by Press Ganey, the average patient spends more than four hours from entrance to the ED to discharge. The survey also found that as wait time increases, patient satisfaction decreases.[3] In addition, ED throughput is adversely affected by hemolyzed samples.[4]

A prior grant project established by the Centers for Disease Control (CDC) in collaboration with the Cleveland Clinic studied the impact of hemolysis on patient care. The results of the project reiterated that hemolyzed blood samples can contribute to inaccurate results, delays in the initiation of appropriate care and prolonged stay in the ED.

While the clinical effect of hemolysis has been widely documented, the financial implications have not. One study in the literature identified hemolysis as "financially important",[5] and another calculated the possible avoidable expenditure resulting from hemolysis to be as high as 22.8% of the total cost of serum sample collection.[6]

Evaluating the cost of hemolyzed blood samples can help healthcare organizations prioritize and determine the extent to which resources, including labor and supplies, are consumed to address the suboptimal sample quality. This information allows a better understanding of the potential savings that could be gained by implementing process improvements to combat this problem. In this report, we present a model that was developed to further clarify the potential financial impact of hemolyzed ED blood samples.

An Economic Model Discloses the Costs of Hemolyzed Samples

In collaboration with the BD Solutions Group, we developed a model to determine the costs of hemolyzed samples using the average hemolysis rate in the ED of 10%. The American Society of Clinical Pathology recommends a baseline hemolysis rate of 2%.[5] The potential cost savings were then calculated if the rate of hemolysis in the ED could be reduced from 10% to 2%.

Real time observations, ED staff interviews and the data from electronic medical records (EMR) were utilized to identify each component of the blood collection process: personnel (labor), equipment (materials) and the time spent to collect blood from ED patients. The metrics included material costs, labor costs, and staff hours, as well as throughput times (ED length of stay [LOS]). By entering each component of the blood collection process, including materials and labor, into an Excel program, a model was created that calculated the financial impact of varied percentages of hemolyzed samples. One quarter of the data was used to generate estimates that were then annualized. Costs for supplies (needles, intravenous catheters, syringes, alcohol, bandages/gauze)

were determined using average pricing across most Group Purchasing Organizations (GPO) and were not specific to one GPO or any facility or organization.

The number of patients typically seen in the ED yearly was entered, followed by the percentage of patients that require blood drawing for laboratory testing, and the number of tubes collected for each laboratory request. The percentage of hemolyzed blood samples collected from ED patients was also recorded.

Table 1a. Patient Throughput in the ED and Laboratory Testing	
Annual patient throughput in the ED	65,000
Percentage of ED patients that require laboratory testing	28%
Average number of blood collection tubes collected per laboratory request	3
Current rate of hemolyzed blood samples from the ED (in percent)	10%

Table 1a: Table of Emergency Department volume, percent of laboratory testing, average number of blood collection tubes utilized, and percent of hemolysis.

Table 1b. Labor Rates of Staff Who Collect Blood from ED Patients*	
Minutes In An Hour (For Calculating Labor Rates Per Minute)	60.0
Per Hour Labor Rate Of Laboratory or Nursing Unit Associate (Clerical)	$18.00
Per Minute Labor Rate Of Laboratory or Nursing Unit Associate (Clerical)	$0.300
Per Hour Labor Rate Of Registered Nurse	$28.00
Per Minute Labor Rate Of Registered Nurse	$0.467
Per Hour Labor Rate Of Respiratory Therapist (Stat Lab)	$27.40
Per Minute Labor Rate Of Respiratory Therapist (Stat Lab)	$0.457
Per Hour Labor Rate Of ED Technician	$14.90
Per Minute Labor Rate Of ED Technician	$0.248
Per Hour Labor Rate Of Phlebotomist	$10.10
Per Minute Labor Rate Of Phlebotomist	$0.168
Per Hour Labor Rate Of Medical Technologist	$23.55
Per Minute Labor Rate Of Medical Technologist	$0.393

Table 1b: Table of labor rates for Emergency Department personnel, per hour and minute.
* Salaries for personnel were established using average salary hourly rates for Midwest states for all job classes included in the study.

The Costs of Labor to Manage and Redraw the Hemolyzed Sample

A substantial portion of time must be allocated to manage a hemolyzed sample. Once the hemolyzed sample has been discovered and reported (usually by the laboratory), additional labor is involved for laboratory re-testing, for communication between the clerical staff and laboratory technologists, and potentially, for a discussion with physicians to re-collect or not to re-collect the sample (Table 2). Additionally, the time needed to re-draw a blood sample is not limited to the clinician. As seen in Figure 1, the annualized labor associated with re-draw of the samples amounts to 720 hours of rework at a cost of about $11,000 (a summation of the time for each employee handling their part of the sample, and their hourly rate annualized).

Table 2. Eliminating Labor Costs to Manage Suboptimal Quality (Hemolyzed) Samples	
Nursing Unit Associate Cost To Manage Suboptimal Samples	$5,400
Register Nurse Cost To Manage Suboptimal Samples	$20,682
Respiratory Therapist Cost To Manage Suboptimal Samples	$0
ED Technician Cost To Manage Suboptimal Samples	$4,464
Phlebotomist Cost To Manage Suboptimal Samples	$0
Laboratory Technologist Cost To Manage Suboptimal Samples	$21,222
Laboratory Medical Technician Cost To Manage Suboptimal Samples	$2,081
Combined Potential Savings	**$53,849**
Removal Of Administrative Hours for Re-collection of Samples	**2,520**

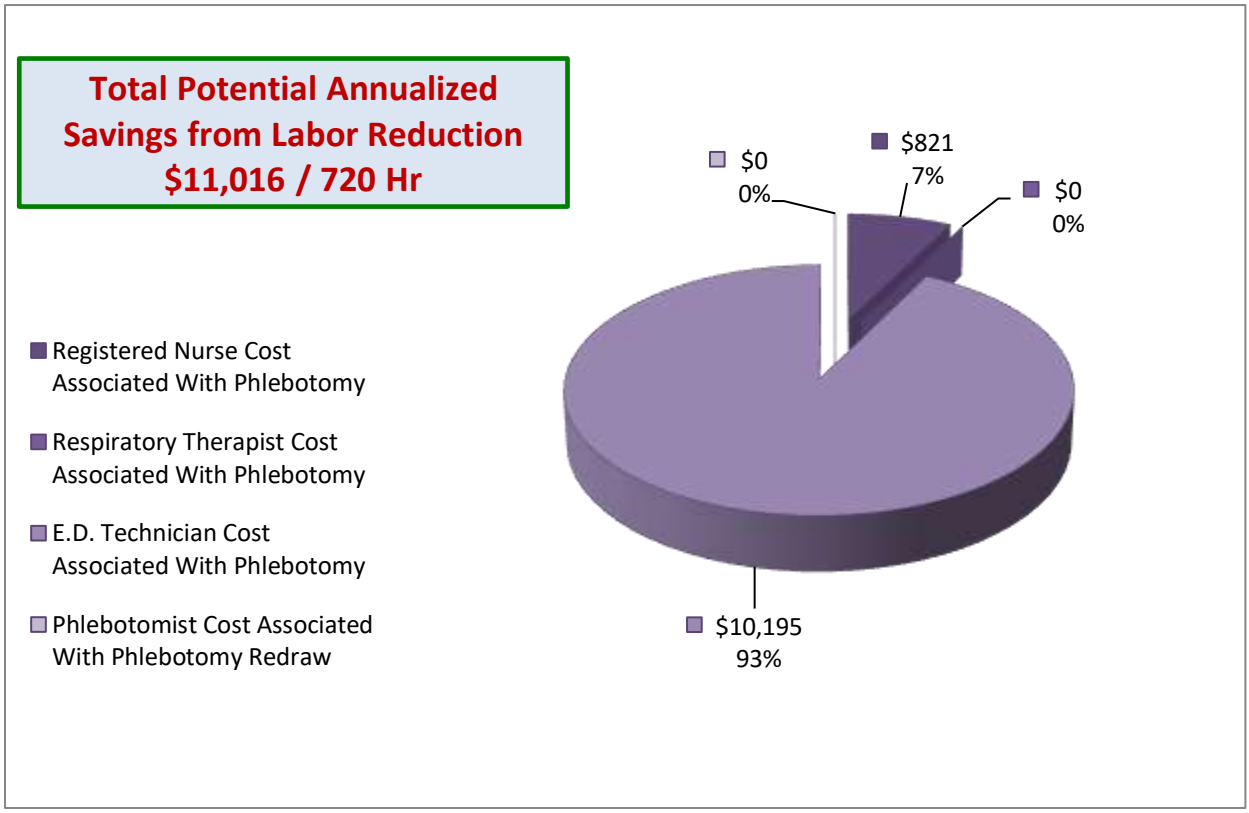

Figure 1. Potential cost savings from labor reduction to re-collect hemolyzed samples.

Table 3. Potential Reduction in Supply Costs	
Reduction Of Blood Collection Tubes	$1,028
Reduction Of Blood Draw Needles	$468
Reduction Of Blood Draw Tourniquets	$108
Reduction Of Alcohol Swabs	$18

Reduction Of Blood Draw Bandages/Gauze	$36
Reduction Of Alcohol Caps (Recapping)	$1,800
Combined Potential Savings in Supply Costs	**$3,458**

Table 3 presents the potential reduction in the cost of supplies that would be directly related to obtaining a new sample. There are other materials consumed such as reagents, pipettes, analyzer cups, etc. used in the laboratory, which are not reflected in the table. While these numbers may not appear substantial, they still represent annual avoidable expenses for the hospital.

Testing in the Laboratory vs. Point of Care (POC)

The actual testing (or re-testing) in the laboratory (including reagents and labor) must be incorporated in any costs associated with hemolyzed samples. While the cost for reagents may be small for repeat testing in the laboratory (around $9,700[Figure 3]), the cost of re-testing samples with POC equipment is variable, but can contribute to a significant increase in costs. POC testing can cost "dollars per test" as compared to "pennies per test" utilizing traditional lab testing.[7]

OVERALL RESULTS

Hemolyzed ED blood samples result in increased costs and result in considerable burden on the hospital, including laboratory consumables, healthcare personnel (nurses, technicians, and laboratory technologists) in addition to an impact on patient discomfort and delays in care.[8] By reducing hemolysis in the ED to 2%, a comparable hospital could realize an annual savings of approximately $144,000, which includes both materials and labor (Figure 3). It is important to note that these savings are possible by reducing hemolysis in samples collected from just the ED. There are opportunities for additional savings if reduction is achieved in other departments as well.

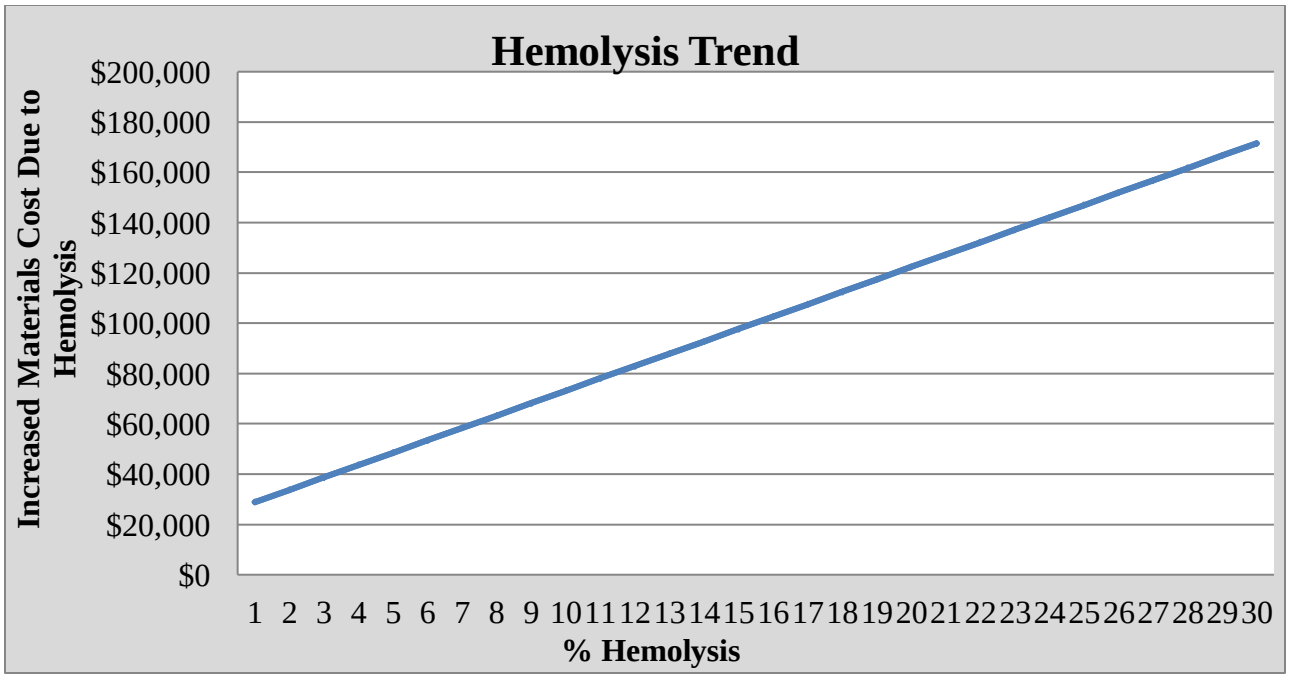

Figure 2. As shown, as hemolysis increases, the associated costs for the hospital increase.

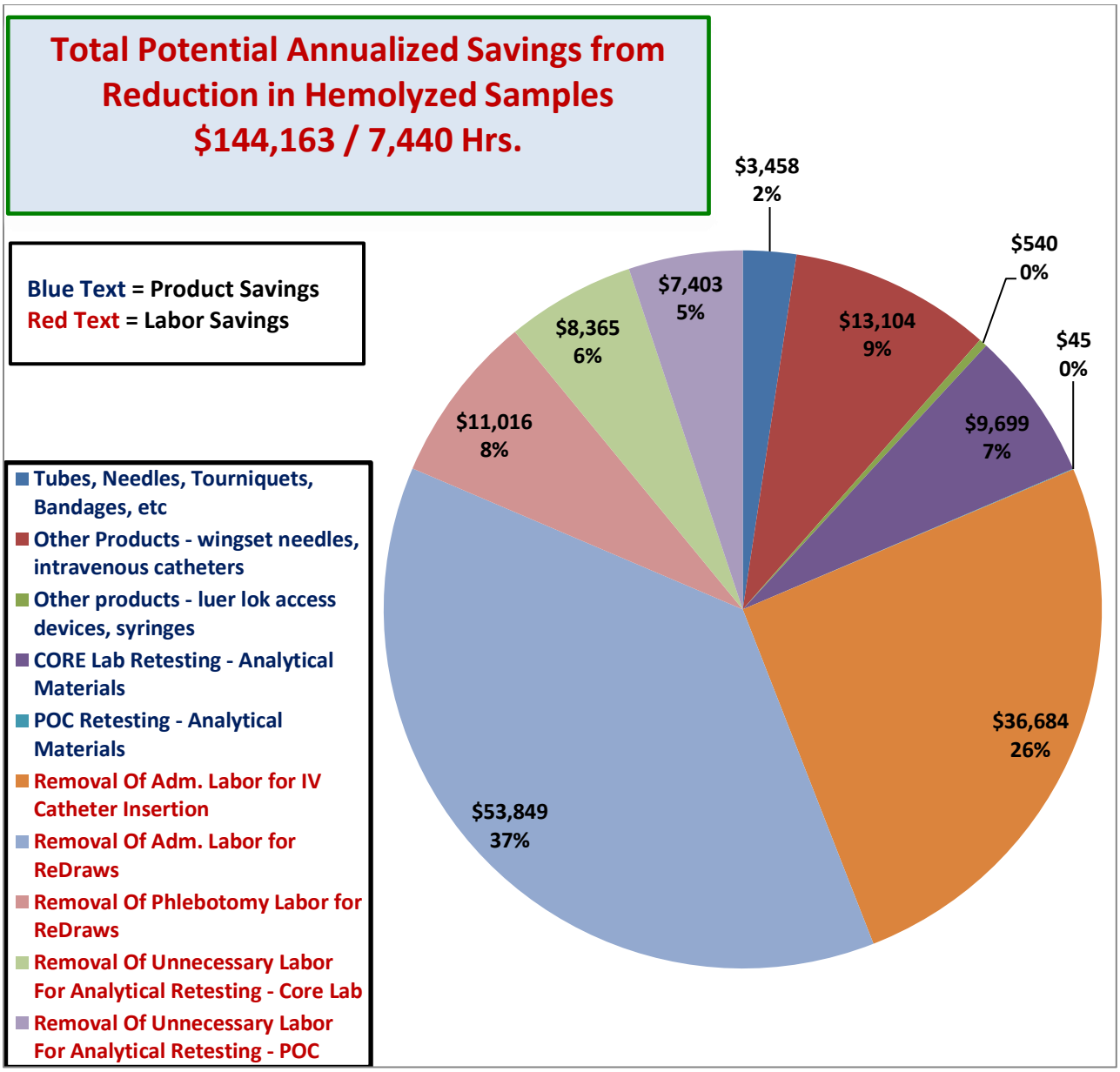

Figure 3. Pie chart illustrates the total potential annual savings with a 2% hemolysis rate.

SUMMARY

Developing an economic model such as the one presented is an effective tool to evaluate the costs generated by hemolyzed blood samples. This model focused on consumable and labor factors; a more comprehensive model could include intangible costs like those associated with delays in ED care, causing longer length of stays in the ED. While the numbers presented illustrate the potential savings from reduction in the rate of hemolysis from 10% to 2%, any decrease should offer cost savings opportunities.

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