

Hemolysis; The Last Frontier of Specimen Quality

PETER J. HOWANITZ MD

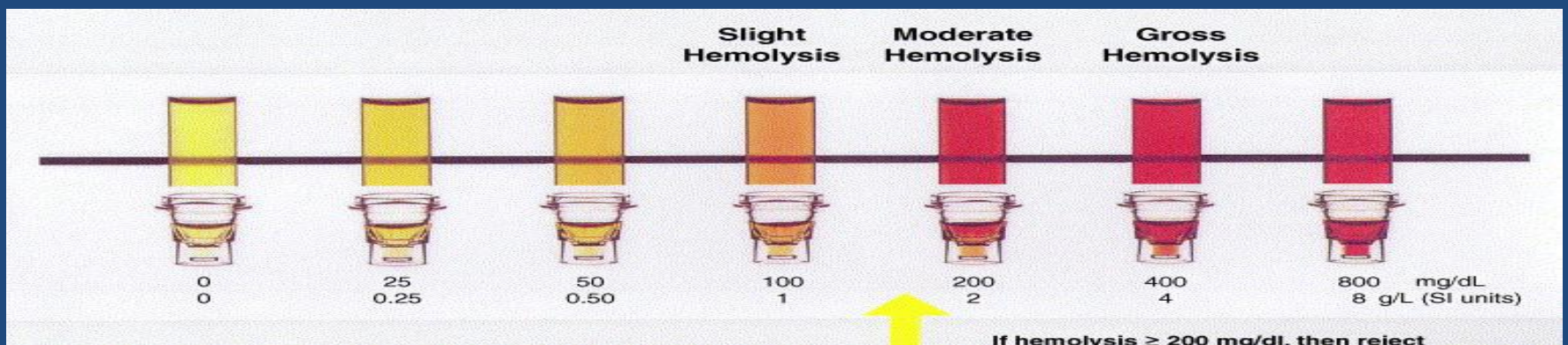
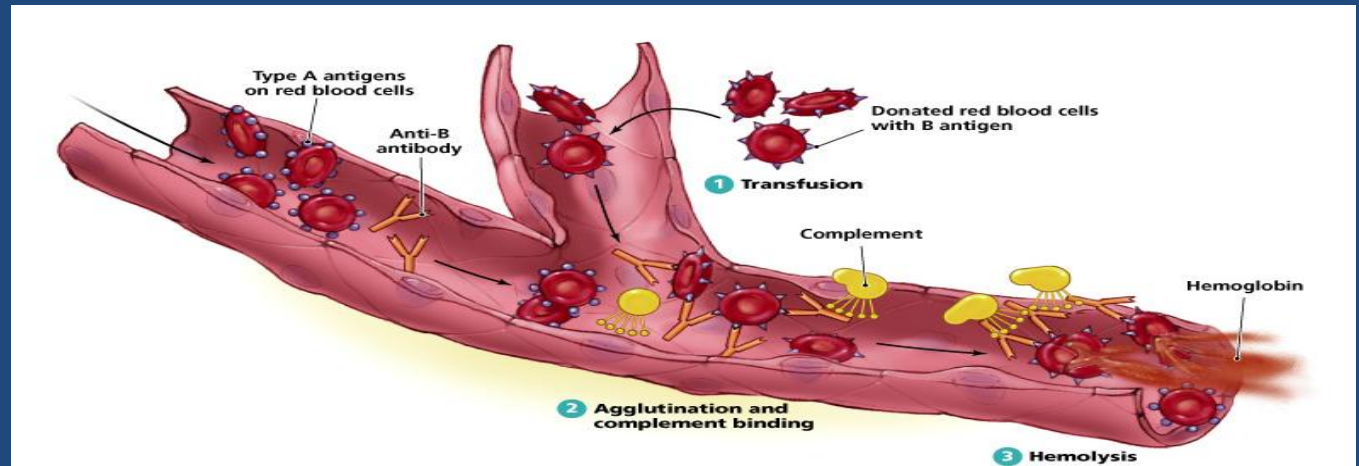
PETER J. HOWANITZ MD

PROFESSOR, VICE CHAIRMAN &
CLINICAL LABORATORY DIRECTOR
DEPARTMENT OF PATHOLOGY
STATE UNIVERSITY OF NEW YORK
Downstate Medical Center
Brooklyn , NY, USA
Peter.Howanitz@downstate.edu

INTRODUCTION

- Definition & Significance Of Hemolysis
- Discuss Practice Patterns
- Determine Causes
- Propose Improvements
- Conclusions

Hemolysis is the disruption of the blood cell membrane with the release of the blood cell contents into the surrounding fluid.



SOME IN VIVO HEMOLYSIS CAUSES

- Hemolytic Transfusion Rx, Autoimmune Warm Ab
- Hereditary Spherocytosis, G6PD Def, Sickle Cell
- Hemolytic Transfusion Rx, Autoimmune Warm Ab
- Anti-malarials, Aspirin, Chloramphenicol
- Malaria, Clostridia, DIC
- Burns, Liver & Renal Disease, PNH
- March Hemoglobinuria, Prosthetic Heart Valves

PHLEBOTOMY RELATED CAUSES

Catheter IV Collection
Drawn From Hematoma
Capillary Collection
Phlebotomy Equipment
Phlebotomy Antiseptic
Tourniquet Time

Location of Stick
No Mixing In Tube
Vigorous Mixing In Tube
Traumatic Draw
Tube Under Filling
Syringe Transfer

Lippi....Green et al. Clin Chem Lab Med 2009;47:143

PRACTICE PATTERNS OF HEMOLYSIS

CAP QUALITY PRACTICES COMMITTEE STUDY

Q-Probes Format

CAP Chemistry Resource Committee Assistance

7 CAP Chemistry Survey Participants

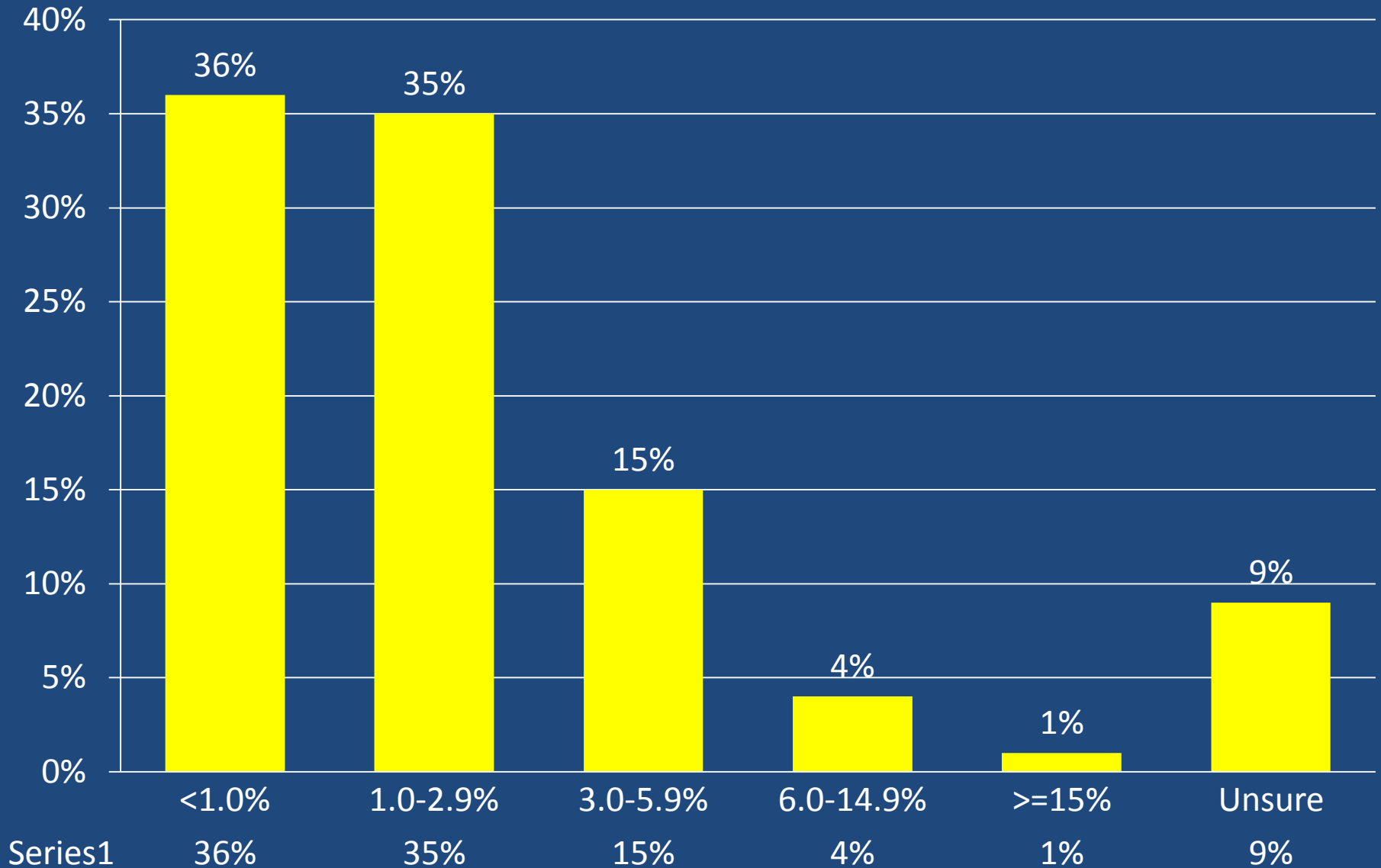
On-Line Questionnaire

28 Multiple Choice Questions

7 “Other, Please List” Questions

846 Participants

LABORATORY OVERALL HEMOLYSIS RATE (%)

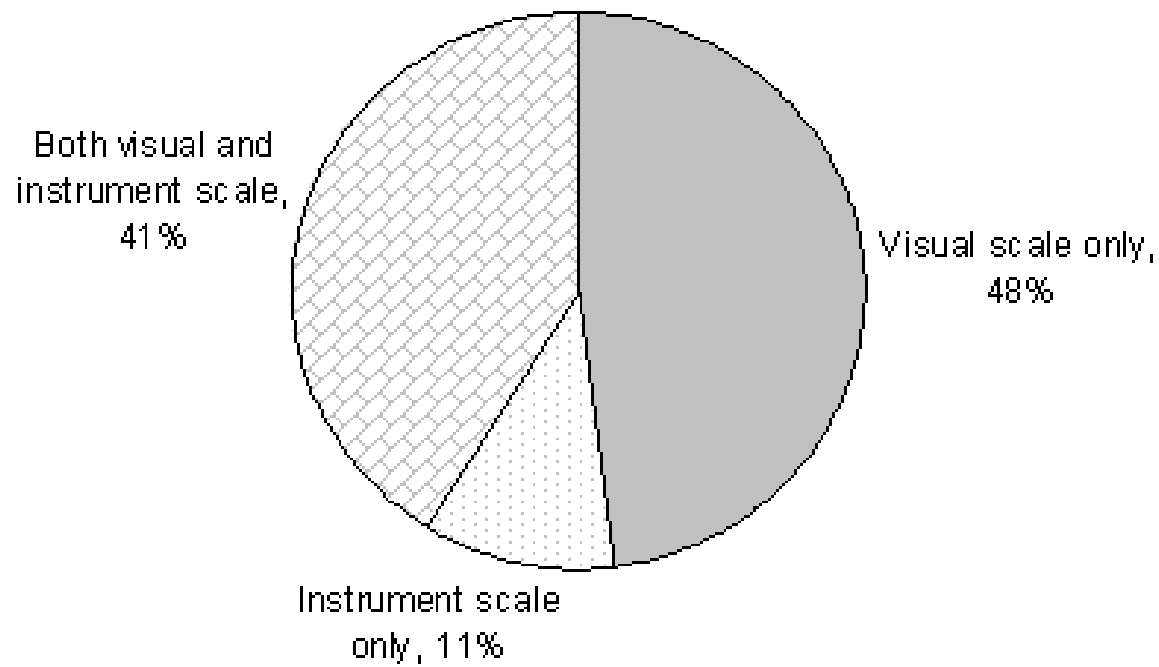


LABORATORY CATEGORY BASED ON HEMOLYSIS RATE

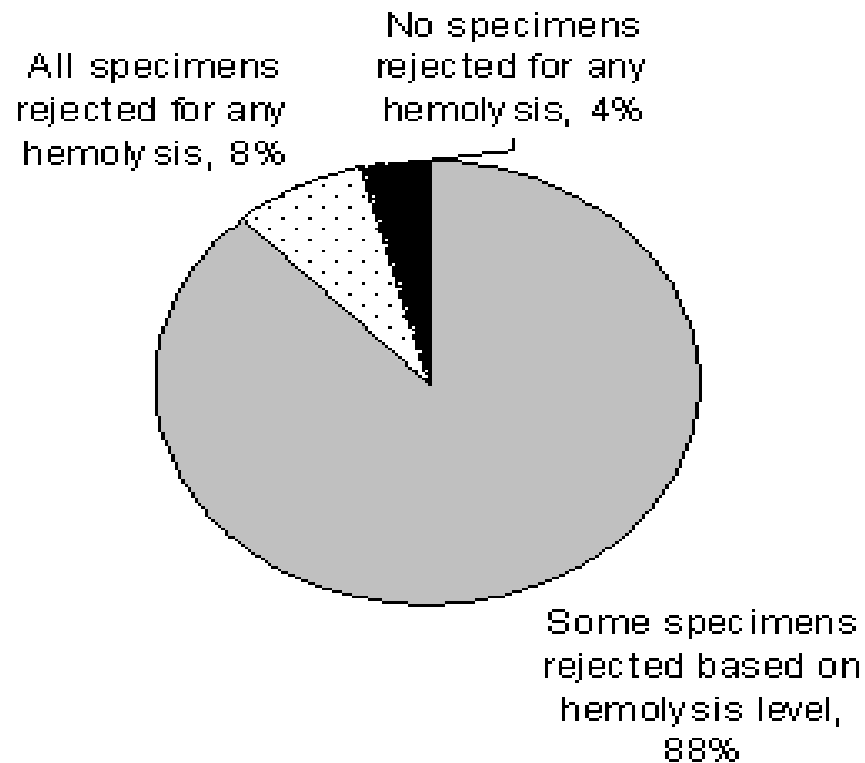
PROCEDURES USED FOR HEMOLYSIS ID

Parameter	% Yes	% No	% Unsure
Hemolysis visually graded compared to a picture	40	57	3
Visual grading evaluated by competency assessment	18	73	9
Manual procedures identify hemolysis in difficult cases	8	88	4
Able to send automated hemolysis flags to med record	36	50	14
Used automated result verification primary chem analyzer	32	66	2
Same hemolysis scale all analytes primary chem analyzer	81	14	5
Same hemolysis scale primary chem & IA analyzer	70	23	8
Same hemolysis scale primary & backup chem analyzer	74	19	7
Systematically/regularly monitors hemolyzed specimens	47	46	7

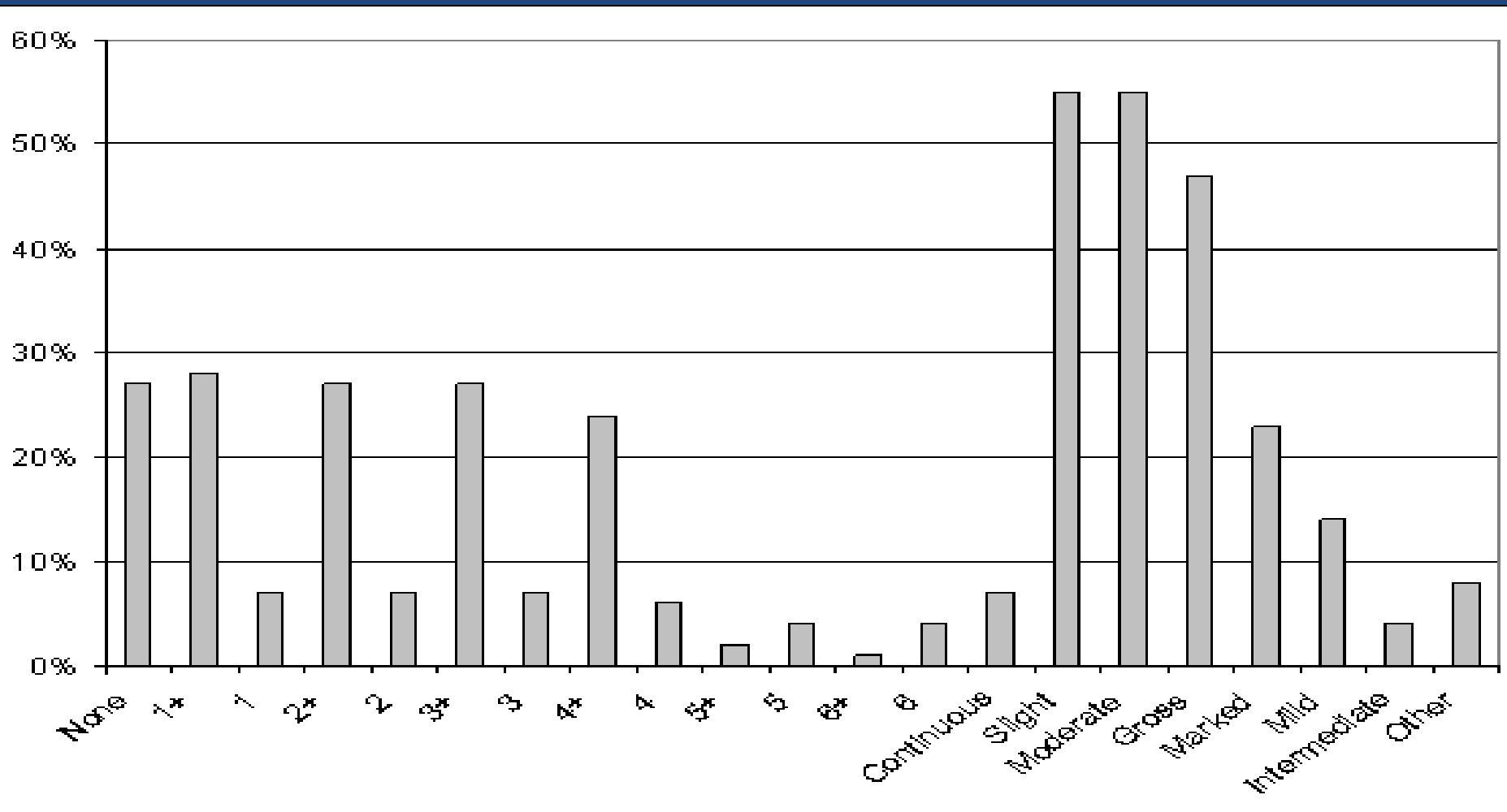
HEMOLYSIS SCALES USED 710 LABS



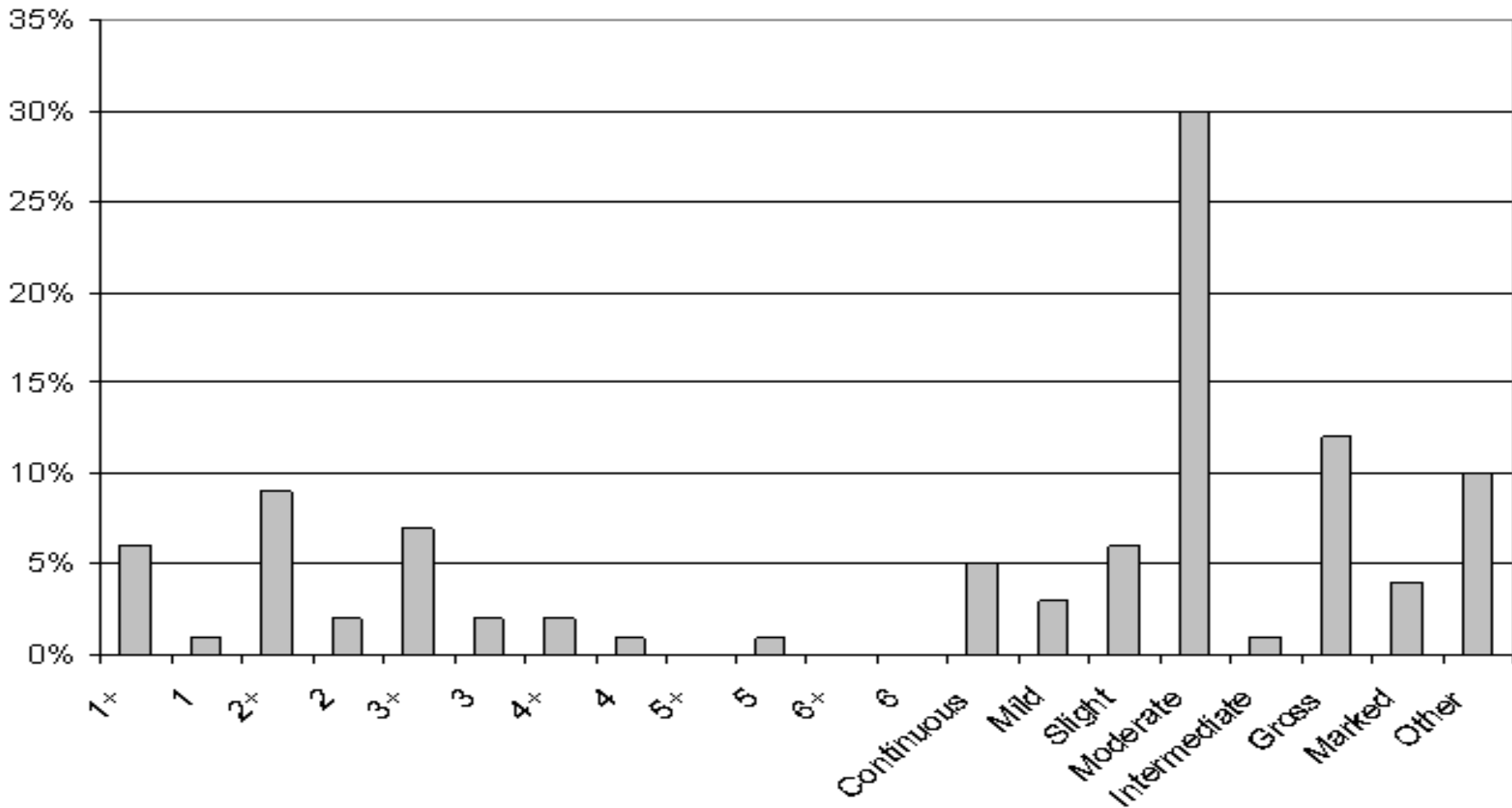
HEMOLYSIS REJECTION PRACTICES



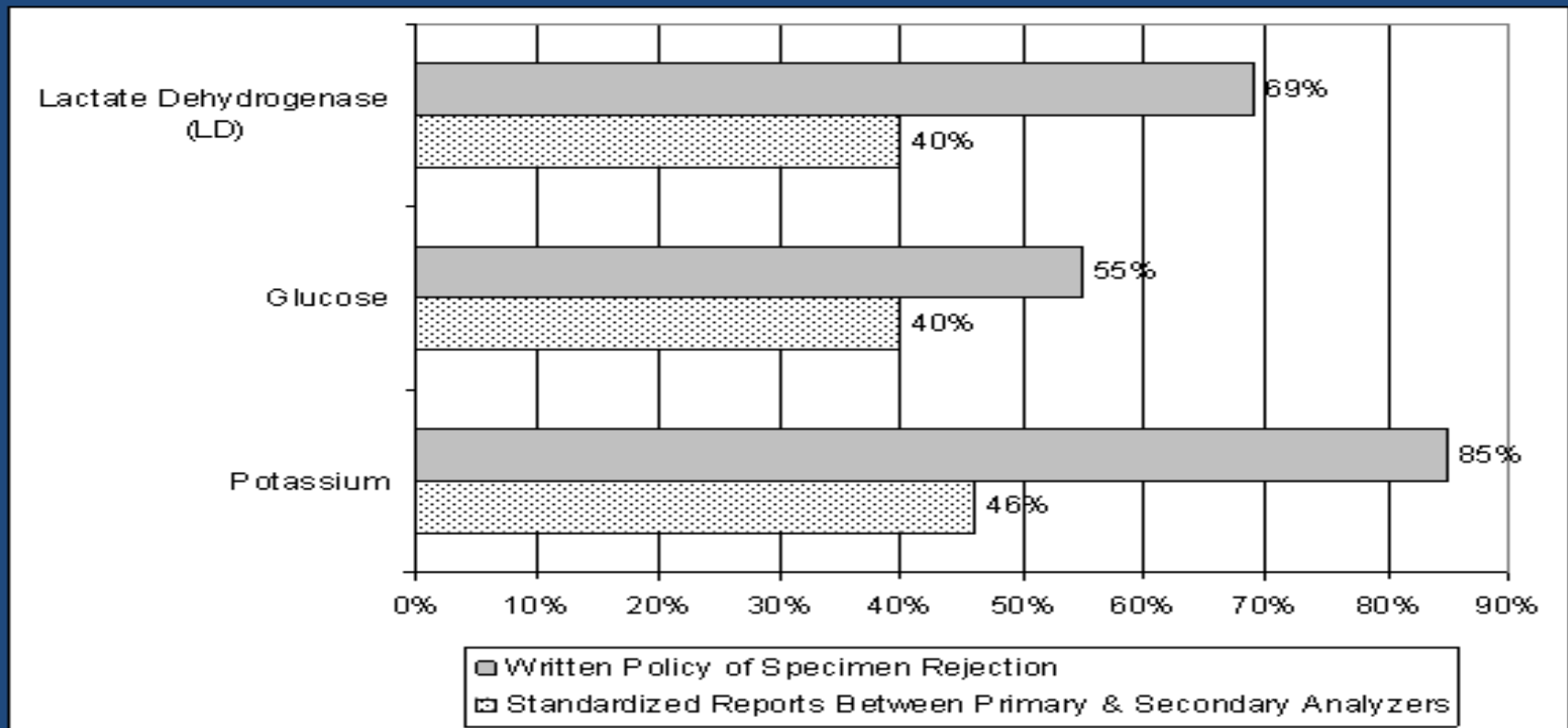
21/69 MOST COMMONLY USED HEMOLYSIS DESCRIPTIVE TERMS



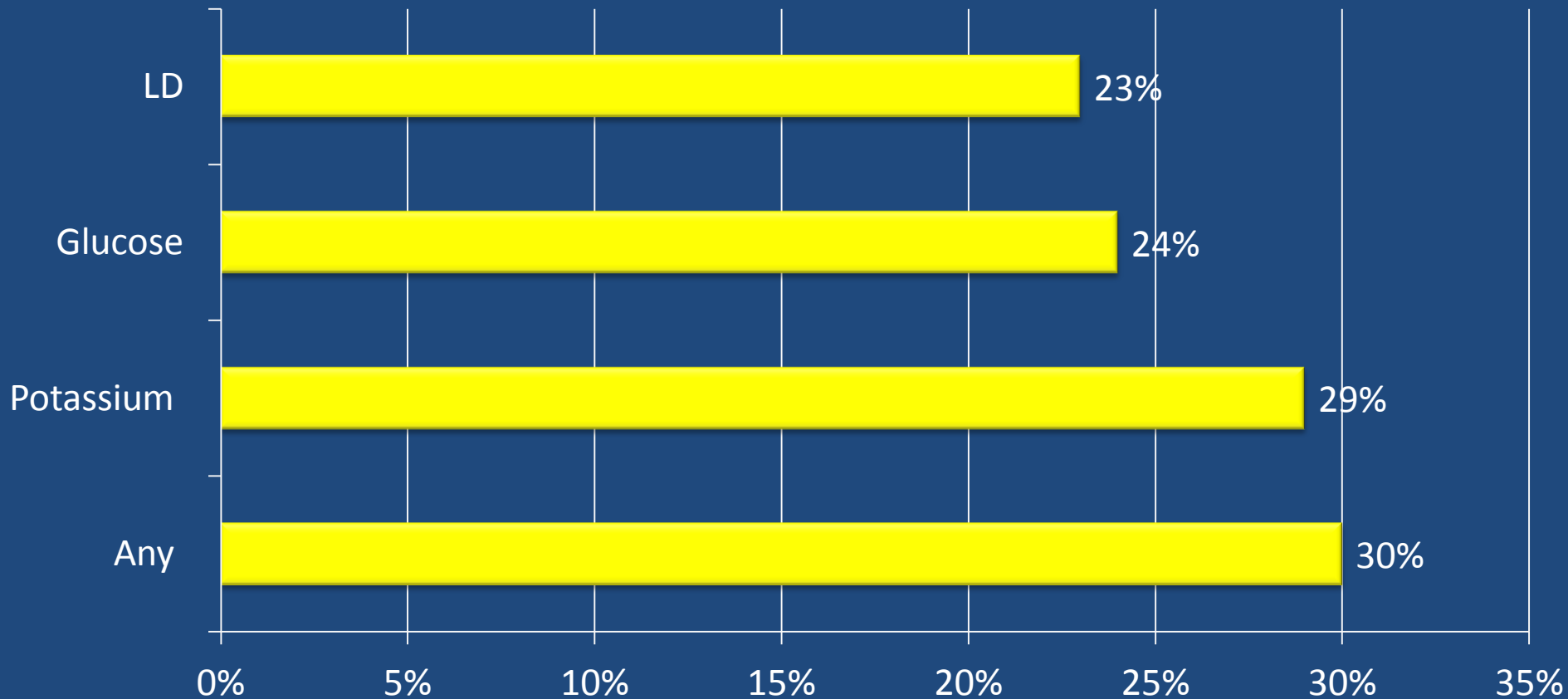
USE OF 20 CUTOFF HEMOLYSIS TERMS



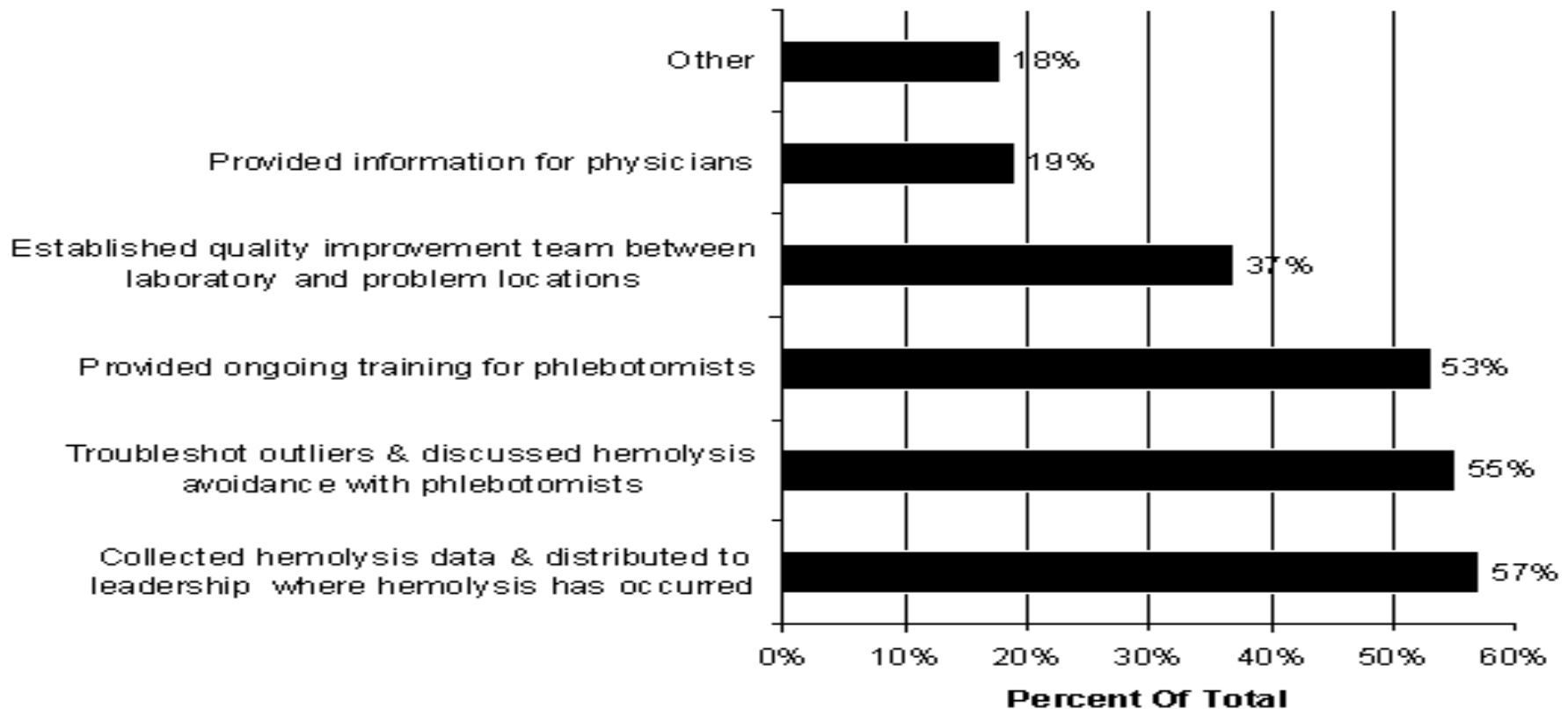
ANALYTE SPECIFIC HEMOLYSIS POLICIES



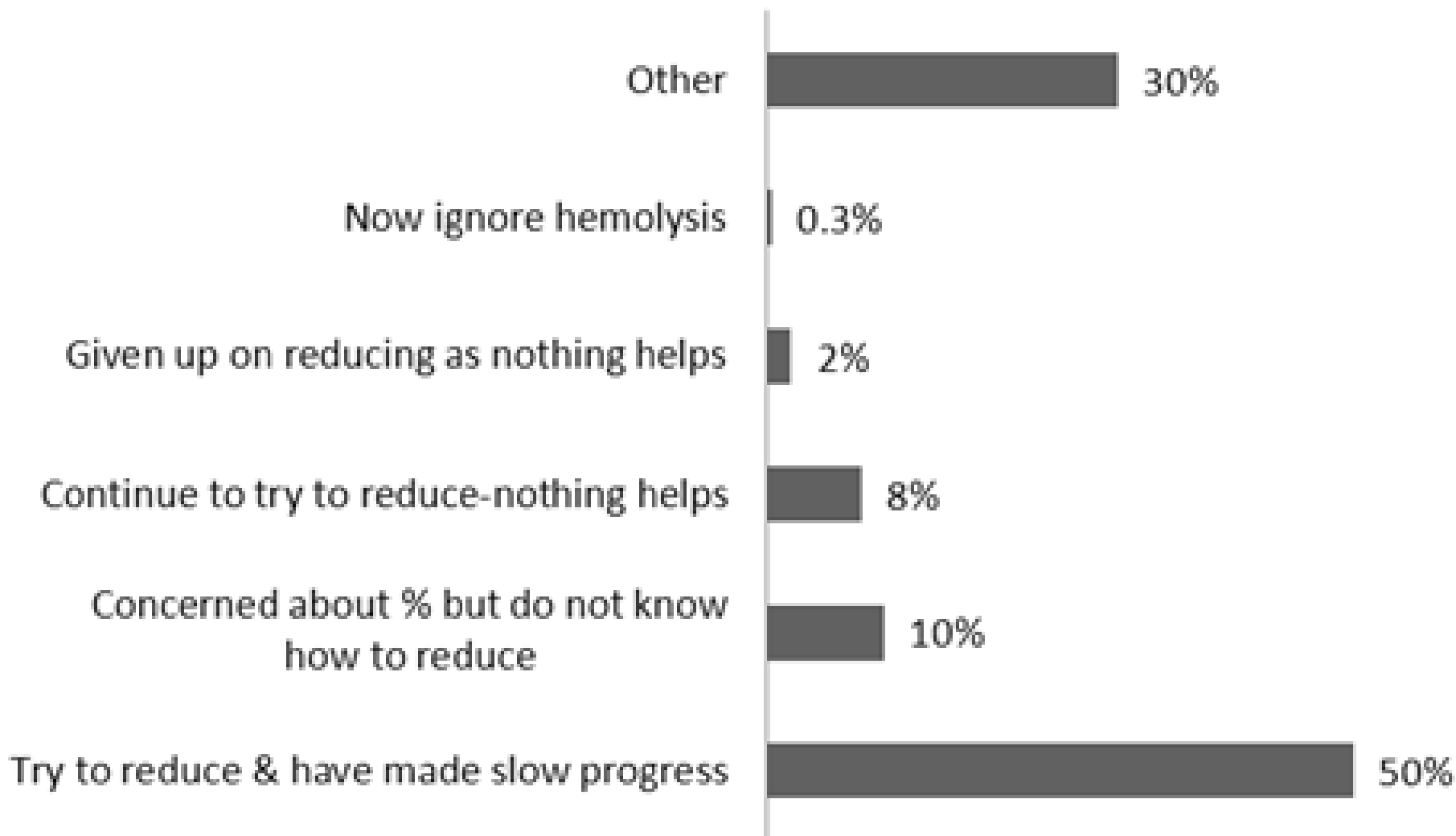
ATTEMPTED TO VALIDATE HEMOLYSIS FOR ANALYTES



CORRECTIVE ACTION DURING PAST YEAR



LACK OF SUCCESS IN HEMOLYSIS REDUCTION (N=567)

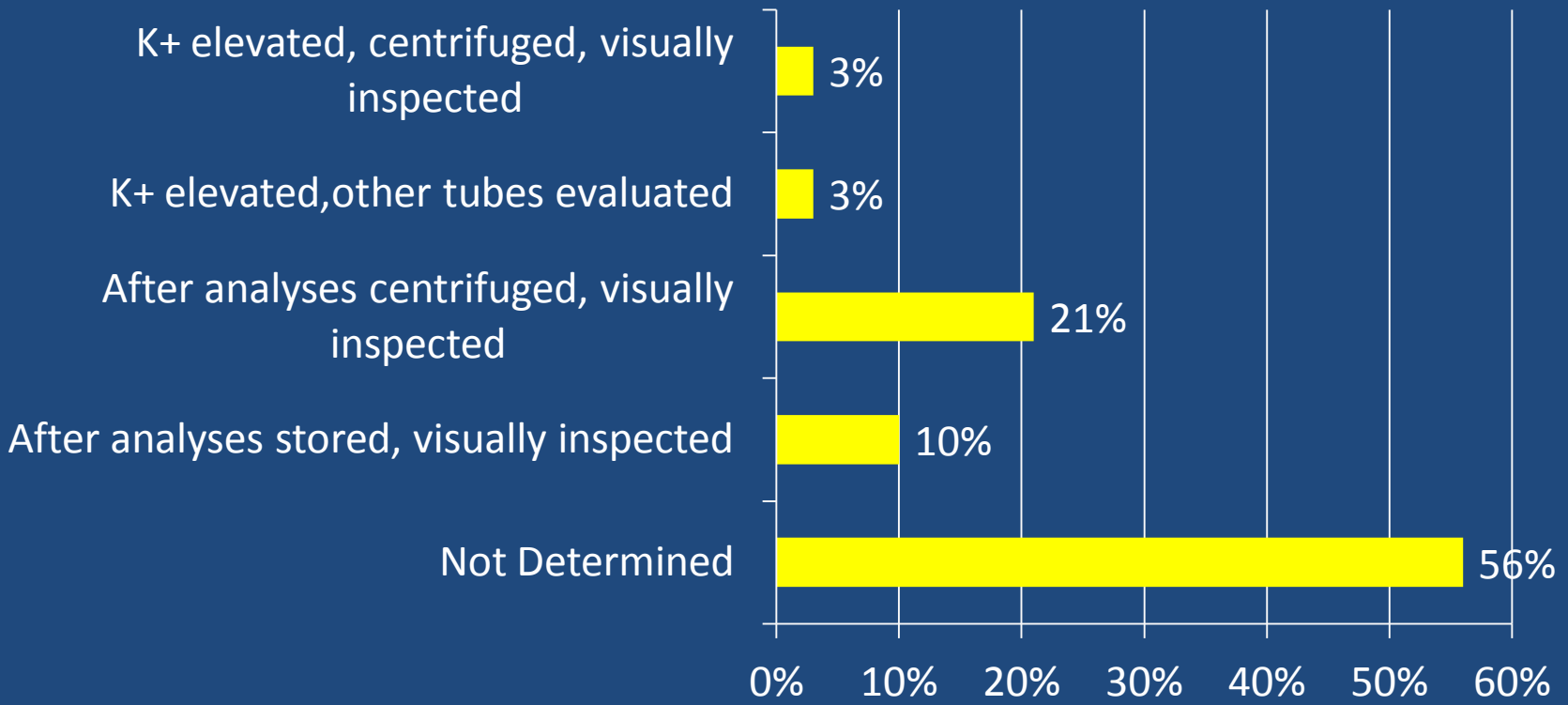


PHLEBOTOMY RELATED CAUSES

Catheter IV Collection
Drawn From Hematoma
Capillary Collection
Phlebotomy Equipment
Phlebotomy Antiseptic
Tourniquet Time

Location of Stick
No Mixing In Tube
Vigorous Mixing In Tube
Traumatic Draw
Tube Under Filling
Syringe Transfer

WHOLE BLOOD HEMOLYSIS DETECTION



CASE REPORT

Ismail et al BMJ 330:949,2005

40 Year Old Woman Admitted –Dx SLE

5 Days Vomiting, Diarrhea, Weakness

Hb 8.9 g/dl, WBC 6.1×10^9

BUN 87 mg/dl Creatinine 4.8 mg/dl

Blood Smear –Diffuse Fragmented Cells Consistent With
Microhemangiopathic Hemolytic Anemia

Potassium Cancelled-Hemolyzed

CASE REPORT CONTINUED

Dx-Hemolytic Uremic Syndrome &
Acute Renal Failure

Treated Aggressively, & Planned To
Transfer To Dialysis Next Day

Cardiac Arrest & Died

POST MORTEM ? K

If Known, Immediate Dialysis?

RECENT INSTRUMENTATION ADVANCES

- Measure Hemolysis
- Download Hemolysis To LIS
- Provide Extensive Hemolysis Evaluations
- Allow Unique Hemolysis Flag By Analyte
- Hemolysis Measurements FDA Approved

COST OF HEMOLYSIS

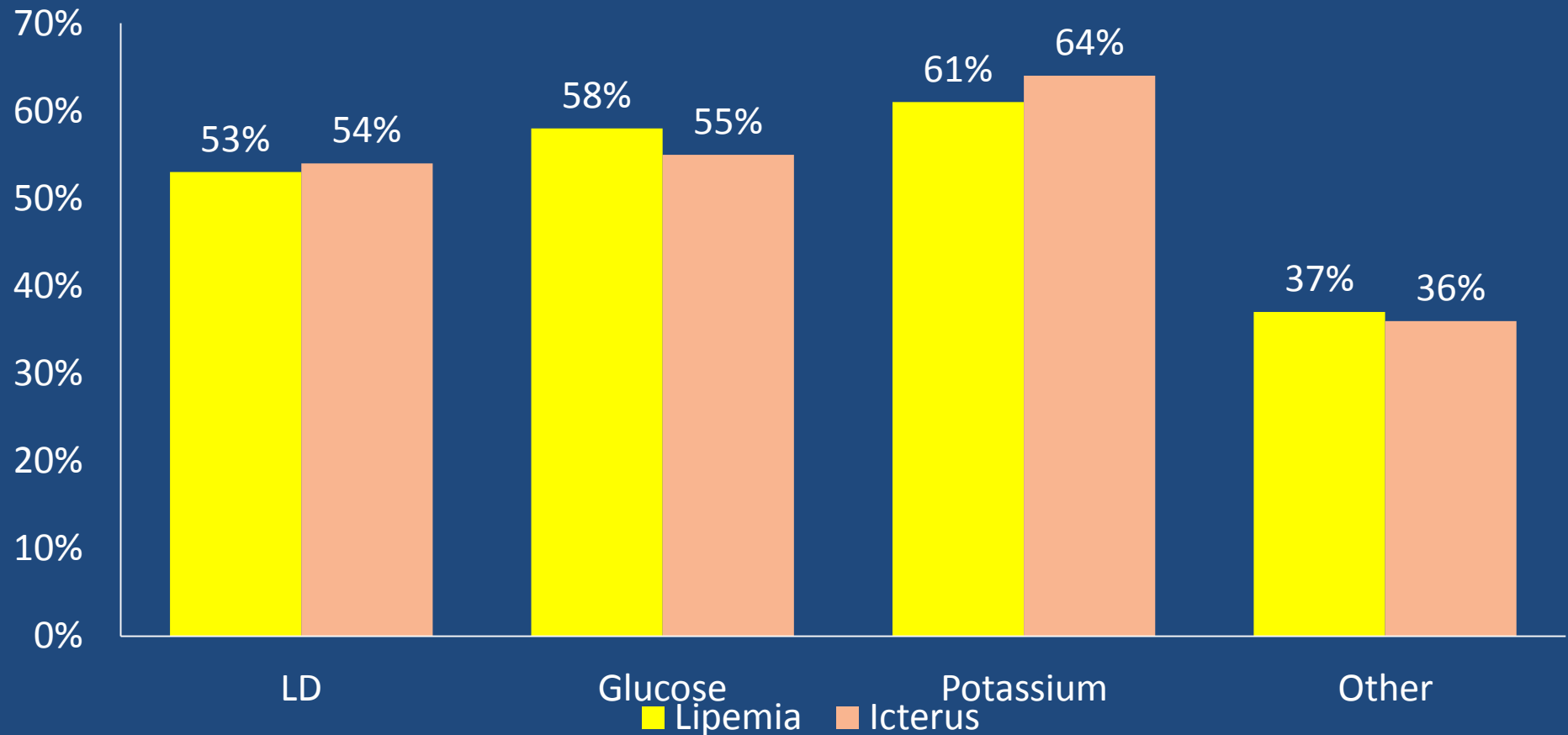
- \$203,037 /Yr
- Reduced Hemolysis 19.8% To 4.9%
- Singapore General Hospital ED
- 200 'Lyses & Bun/Day
- \$18.67/Test

Ong et al Am J Med 2009: 122:1054

COST OF HEMOLYSIS

- ICU/DAY
- Hospital Charge/Day

SAME HEMOLYSIS FLAGS AS LIPEMIA OR ICTERUS

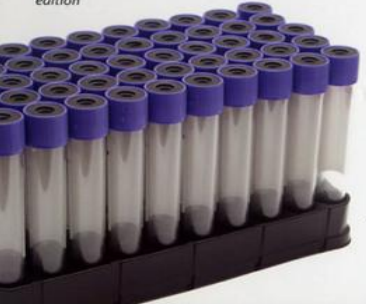


AIDS FOR IMPROVEMENT

So you're going to collect a Blood Specimen

An introduction to Phlebotomy

Fourteenth edition



CCIP PRESS
Frederick

LabNotes

A Newsletter from BD Diagnostics - Preanalytical Systems

Volume 16, No.2, 2006

Troubleshooting Hemolysis Issues in the Clinical Laboratory

INDUSTRY NEWS
BD (Beckman, Dickinson and Company) (NYSE:BDX) has acquired GeneOhm



Helping all people live healthy lives



Indispensable to human health

LabNotes

Volume 13 No.1, Winter 2003

The Hemolysis Causes, Effect

The issue of hemolysis has always plagued clinical laboratories and continues to be a growing concern. In many hospitals, nurses and other healthcare workers have received traditional lessons of highly skilled phlebotomists. Often this "decision" is, as it is called, occurs with little or no phlebotomy training for the new staff, as facilities make flawed assumptions that "suckers" perform to obtain blood is a set procedure. In fact, a great deal of knowledge, skill, and experience is necessary to collect a quality blood specimen that yields the desired results.



This publication is a service to the customers and friends of laboratory. It is not intended for the competitors or press.

See Inside For Instructions On How to Obtain Your FREE Subscription

Hemolysis is defined as the (RBC) membrane release of hemoglobin, internal cellular or the surround

LAB NOTES

VOLUME 7 Number 1

Summer/Fall 1996

Rethinking Phlebotomy

FACTORS AFFECTING HAEMOLYSIS PREANALYTICAL SPECIMEN WORKFLOW

PATIENT	PHLEBOTOMY	SPECIMEN TRANSPORT	PROCESSING	ANALYSIS	SPECIMEN STORAGE
<p>Patient ID</p> <p>In Vivo Hemolysis due to patient factors</p> <ul style="list-style-type: none"> Metabolic Disorders (eg. Liver disease) Chemical Agents (eg. Medication) Physical Agents (eg. Mechanical heart valves) Infectious Agents (eg. Bacteria) 	<p>Catheter, IV Collection</p> <p>Capillary Collection</p> <p>Needle Gauge</p> <p>Position of Arm</p> <p>Location of Venipuncture</p> <p>Antiseptic Used for Phlebotomy</p> <p>Tourniquet Time</p> <p>Traumatic Draw</p> <p>Fist Clenching</p> <p>Tube Type Collected</p> <p>Tube Under Filled</p> <p>Order of Draw</p> <p>Mixing</p> <p>No Mixing</p> <p>Swings transfer</p>	<p>Origin of Specimen</p> <p>Miscellaneous, Emergency & Intensive Care</p> <p>Origin of Specimen In-patient</p> <p>Origin of Specimen Physician Office Lab</p> <p>Origin of Specimen Outpatient</p> <p>Tubes Transported Vertical or Horizontal</p> <p>Transport by Pneumatic Tube</p> <p>Courier Transport</p> <p>Transport Duration</p> <p>Pre-Centrifugation & Transport Temperature</p>	<p>Verify Tube with Request</p> <p>Generate Laboratory Barcode</p> <p>Time between Collection & Centrifugation</p> <p>Type of Centrifuge</p> <p>Centrifuge Calibrated</p> <p>Centrifuge Temperature Extremes</p> <p>Speed of Centrifuge</p> <p>Duration of Centrifugation</p> <p>Poor Separator, Ringer Intensity</p> <p>Automated Decapping</p> <p>Specimen Re-Centrifugation</p> <p>Aliquot Labeling</p> <p>Specimen Aliquoted</p>	<p>Long Time after Centrifugation</p> <p>Serum vs. Plasma vs. Whole Blood</p> <p>Tube Mixed Prior to Analysis</p> <p>Re-Run Specimen (Same Day)</p> <p>Verify Instrument Call & Controls</p> <p>Identify Instrument Used for Testing</p> <p>Identify Tech Performing Testing</p> <p>Verify Report Value</p>	<p>Re-Centrifugation Add-On</p> <p>Post-Analysis Storage Temperature</p> <p>Duration of Storage</p> <p>Red- Steps that may cause haemolysis</p> <p>Black- Steps not likely the cause of haemolysis</p>

Therapists, and others can perform phlebotomy. As a result, he says, many administrators are questioning the effectiveness of retaining a cadre of full-time phlebotomy responsibilities extensions as part of their

As a result, he says, many administrators are questioning the effectiveness of retaining a cadre of full-time phlebotomy responsibilities extensions as part of their

As a result, he says, many administrators are questioning the effectiveness of retaining a cadre of full-time phlebotomy responsibilities extensions as part of their

As a result, he says, many administrators are questioning the effectiveness of retaining a cadre of full-time phlebotomy responsibilities extensions as part of their

As a result, he says, many administrators are questioning the effectiveness of retaining a cadre of full-time phlebotomy responsibilities extensions as part of their

As a result, he says, many administrators are questioning the effectiveness of retaining a cadre of full-time phlebotomy responsibilities extensions as part of their

As a result, he says, many administrators are questioning the effectiveness of retaining a cadre of full-time phlebotomy responsibilities extensions as part of their

As a result, he says, many administrators are questioning the effectiveness of retaining a cadre of full-time phlebotomy responsibilities extensions as part of their

As a result, he says, many administrators are questioning the effectiveness of retaining a cadre of full-time phlebotomy responsibilities extensions as part of their

means. In addition, a significant amount of money can be saved by consolidating positions. Although healthcare providers argue at using financial savings as validation for change, they can no longer overlook opportunities to save large sums of money.

Debate about decentralization often focus on the potential for decline in specimen quality and patient satisfaction. Responses to the survey from the Vaccination Safety Institute substantiated a decline in specimen quality. For example, one respondent commented that "additional totally personnel drawing blood has contributed to greater specimen reject rates due to hemolyzed samples, clotting samples, improperly labeled samples and misidentified patient samples."

Increased Risk
There seems to have been little consideration of the potential for increased blood and body fluid (BBF) exposure as a result of these changes. Whether or not decentralization of phlebotomy will result in more people suffering exposure to blood and body fluids is an important question that should be considered now, rather than in hindsight. Organizations that are contemplating such changes in phlebotomy services need to be aware of how this risk may increase and what steps to take to avoid compromising the benefits.

Since decentralization is a relatively new process, actual increases in BBF exposures have yet to be documented. This does not mean that increased risk cannot be foreseen, given what is known about the current process. Consider the following hypothetical decentralized phlebotomy program.

At ABC Hospital, both the decentralization of phlebotomy and the inclusion of phlebotomy responsibilities in other jobs mean that more people are performing phlebotomy than in the past. Without a doubt, these staff are having less training, practice, and skilled supervision than the traditional phlebotomist, because more people are performing the same amount of work, but often in isolation from each other. Because blood

Route to:

Continued on page 4

Continued on page 2

VALIDITY OF DATA ON CAUSES

- Many Studies By Nursing Personnel
- Difficulty In Controlling Variables
- Unaware Lab vs Nursing Phlebotomists
- Some Data Conflicting
- Need For Published Studies

VENIPUNCTURE VERSUS IV CATHETER

TABLE 4

Specimen hemolysis by group—cross tabulation

Group	Specimen hemolyzed		% hemolysis	Total
	No	Yes		
Group				
Venipuncture	354	1	<1	355
Intravenous catheter	470	28	5.62	498
Total	824	29		853

FIVE IMPROVEMENT SUGGESTIONS

Do Not Reject Hemolyzed Specimens

Develop Interdepartmental Team(s)

Choose Instruments That Quantitate Hemolysis

Monitor & Share Successes With Administration

Select Aids For Improvement

CONCLUSIONS

- Definition & Significance Of Hemolysis
- Discussed Clinical Laboratory Practice Patterns
- Established Causes
- Provided Suggestions For Improvements