PENGURUS PUSAT
PERKUMPULAN KESEMINATAN KIMIA KLINIK DAN LABORATORIUM INDONESIA
INDONESIAN ASSOCIATION FOR CLINICAL CHEMISTRY
Kramat Raya 150, Jakarta Pusat 10430, DKI Jakarta, Indonesia
secretariat@iacc.web.id

July 29th, 2025

No: 19/PP-IACC/EKS/VII/2025

Speaker's invitation for Symposium "Optimizing Blood Gas Analysis: Managing Risk and Quality with Intelligent Technology".

Dear Prof. Dr. dr. Pusparini, Sp.PK, Subsp.K.V.(K),

The purpose of this letter is to formally invite you to be the Speaker at the upcoming **IACC's Symposium "Optimizing Blood Gas Analysis: Managing Risk and Quality with Intelligent Technology"**.

The symposium conducted with the objectives: strengthen the understanding about blood gas analysis, the importance of quality management, and introduce the latest technology and systems in blood gas analysis. The participants for this symposium will be pathologists, medical technologies and other practitioner in clinical laboratory.

The symposium will be held at:
Date : Saturday, September 13th, 2025
Time : 08.00 – 12.05 UTC+07:00
Place : Mercure Hotel, Cikini, Jakarta

We hope you would be able to fit this event. The participants and organizers will benefit a lot from your expertise in the topic. Please kindly fill the Speaker Confirmation Statement attached to this letter. If you have any queries, please contact us at iacc-webinar@iacc.web.id

Thank you.
Respectfully,

dr. Dennis Jacobus, Sp.PK
Organizing Committee

PENGURUS PUSAT
PERKUMPULAN KESEMINATAN KIMIA KLINIK DAN LABORATORIUM INDONESIA
INDONESIAN ASSOCIATION FOR CLINICAL CHEMISTRY
Kramat Raya 150, Jakarta Pusat 10430, DKI Jakarta, Indonesia
secretariat@iacc.web.id

SYMPOSIUM SCHEDULE

"*Optimizing Blood Gas Analysis: Managing Risk and Quality with Intelligent Technology*"

Time UTC+07:00	Duration (Minute)	Agenda	Speaker
(1)	(2)	(4)	(5)
08.00 – 08.30	30	Registration (offline participants)	
08.30 – 08.45	15	Opening	
08.45 – 09.25	40	**Session 1:** "*Risk management in Blood Gas Analysis for improved Quality and Patient Safety*"	Pusparini
09.25 – 10.05	40	**Session 2:** "*Managing pre-analytic aspect in blood gas and its impact on analysis result*"	Tandry Meriyanti
10.05 – 10.20	15	Q&A	Moderator: Dennis Jacobus
10.20 – 10.25	5	Break	
10.25 – 11.00	35	**Session 3:** "*Meeting quality goals with intelligent technology – the future, is now?*"	Davide Colombo
11.00 – 11.35	35	**Session 4:** "*Intelligent system answering critical care demand*"	Davide Colombo
11.35 – 11.50	15	Q&A	Moderator: Dennis Jacobus
11.50 – 12.05	15	Closing	
12.05 – 13.05	60	Lunch	

PENGURUS PUSAT
PERKUMPULAN KESEMINATAN KIMIA KLINIK DAN LABORATORIUM INDONESIA
INDONESIAN ASSOCIATION FOR CLINICAL CHEMISTRY
Kramat Raya 150, Jakarta Pusat 10430, DKI Jakarta, Indonesia
secretariat@iacc.web.id

SPEAKER CONFIRMATION STATEMENT

I, the undersigned below:

Name : **Prof. Dr. dr. Pusparini, Sp.PK, Subsp.K.V.(K)**

Declare that I :

- ☐ **confirm**
- ☐ **decline**

to be a speaker at the **IACC's Symposium "Optimizing Blood Gas Analysis: Managing Risk and Quality with Intelligent Technology",**
which will be held on Saturday, September 13th, 2025.

I also declare that I give permission to the seminar committee to:

- ☐ record and publish my presentation through official IACC channels
- ☐ distributing my presentation materials in PDF format to seminar participants
- ☐ does not permit recording and distribution of material

_____, _____2025

Prof. Dr. dr. Pusparini, Sp.PK, Subsp.K.V.(K)

PENGURUS PUSAT
PERKUMPULAN KESEMINATAN KIMIA KLINIK DAN LABORATORIUM INDONESIA
INDONESIAN ASSOCIATION FOR CLINICAL CHEMISTRY
Kramat Raya 150, Jakarta Pusat 10430, DKI Jakarta, Indonesia
secretariat@iacc.web.id

SPEAKER CONFIRMATION STATEMENT

I, the undersigned below:

Name : **Prof. Dr. dr. Pusparini, Sp.PK, Subsp.K.V.(K)**

Declare that I :

- ☑ **confirm**
- ☐ **decline**

to be a speaker at the **IACC's Symposium "Optimizing Blood Gas Analysis: Managing Risk and Quality with Intelligent Technology",**
which will be held on Saturday, September 13th, 2025.

I also declare that I give permission to the seminar committee to:

- ☑ record and publish my presentation through official IACC channels
- ☑ distributing my presentation materials in PDF format to seminar participants
- ☐ does not permit recording and distribution of material

Jakarta, 4 Agustus 2025

Prof. Dr. dr. Pusparini, Sp.PK, Subsp.K.V.(K)

Kemenkes

IACC

LIVE WEBINAR

OPTIMIZING BLOOD GAS ANALYSIS:
Managing Risk and Quality with Intelligent Technology

Saturday, 13 September, 2025

Validasi di sini:

Start at 08:00 - 12:00

Register:
iacc.web.id

Prof. Dr. dr. Pusparini, Sp.PK, Subsp.K.V.(K)

Risk management in Blood Gas Analysis for improved Quality and Patient Safety

dr.Tandry Meriyanti, SpPK

Managing pre-analytic aspect in blood gas and its impact on analysis result

Davide Colombo

Intelligent system answering critical care demand
Meeting quality goals with intelligent technology – the future, is now?

dr. Dennis Jacobus, SpPK., FISQua

Moderator

In collaboration with: werfen emp

Prof. Dr.dr. Pusparini, Sp.PK, Subsp. K.V.(K)

Formal Education

2012	Doctorate of Medicine from Faculty of Medicine, University of Indonesia, Jakarta, Indonesia
2000	Clinical Pathologist from Faculty of Medicine, University of Indonesia, Jakarta, Indonesia
1991	Medical Doctor from Faculty of Medicine, Trisakti University, Indonesia

Organizations

2024 – now	Head of the Competency Development Sub-Division of the Clinical Pathology Collegium
2022 – now	Chairman of BP2KB Division of Indonesian Clinical Pathologist Association and Laboratory Medicine (PDS PatKLiN) Central Board
2019 – 2022	Head of Education & Scientific Division of the Central Board of PDSPatklin
2019 – 2022	Head of Education, Research & Community Service Division, PDSPatklin Jakarta Branch
2018 – now	Chairman of the Senate of Trisakti University

Professional Experience

2022 – now	Consultant of Clinical Laboratory at K-Lab Jakarta
2021 – now	Consultant of Clinical Laboratory at Abdi Waluyo Hospital
2017 – now	Professor of the Faculty of Medicine, Trisakti University
2016 – 2001	Consultant of Clinical Laboratory at Atma Jaya Hospital Jakarta
2012 – 2015	Secretary at Clinical Pathologist Programme in Faculty of Medicine University of Indonesia
2001 – now	Clinical Pathologist at Prodia Laboratory
2000 – now	Teaching staff of the Faculty of Medicine, Trisakti University

Risk Management in Blood Gas Analysis for Improved Quality and Patient Safety

Pusparini
Clinical Pathology Department
Trisakti University
Jakarta 2025

Topic

1. Overview of Blood Gas Analysis (BGA)
2. Risk Management BGA
    a. Pre analytic
    b. Analytic
    c. Post Analytic
3. Selecting BGA devices :

a. Centralization vs decentralization
b. Efficiency : actual vs hidden cost

Blood Gas Analysis

Purpose:

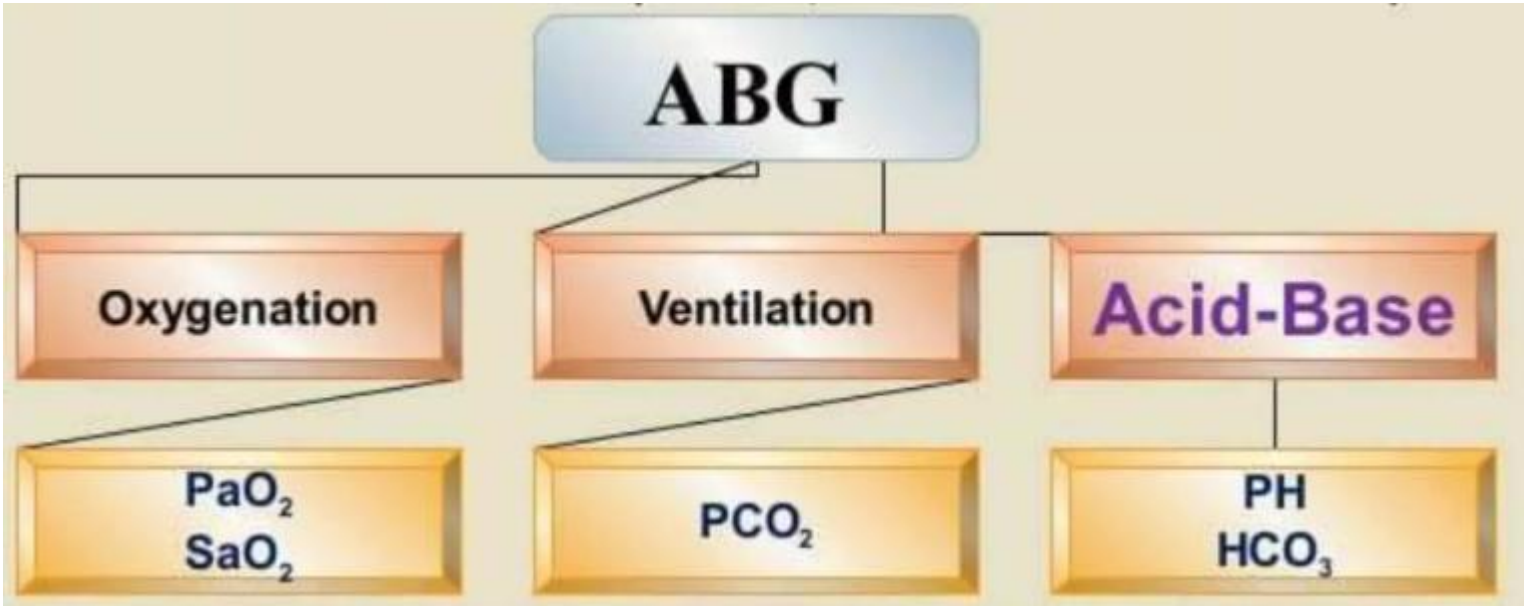
1. To determine the presence and type of acid-base balance
2. To check severe breathing problems and lungs diseases
3. Assessment of the responses to the therapeutic intervention such as mechanical ventilator

Indication :

- Respiratory failure
- Ventilated patient
- Cardiac failure
- Renal failure
- Sepsis and Burn
- Poisoning

What is the Blood Gas Analysis?

- BGA is an essential part for diagnosing and managing the patient's **oxygenation status, ventilation and acid-base balance**
- Drawn from arteries : a. radial, brachial, and femoral



Normal Values

pH	7.35-7.45
CO_2	35-45
pO_2	80-100
HCO_3	22-26
O_2 Sat.	95-100%

ACID BASE MNEMONIC (ROME)

R Respiratory

O Opposite

pH ↑ PCO_2 ↓ Alkalosis

pH ↓ PCO_2 ↑ Acidosis

M Metabolic

E Equal

pH ↑ HCO_3 ↑ Alkalosis

pH ↓ HCO_3 ↓ Acidosis

(I) Respiratory Acidosis

- It is defined as a pH less than 7.35 with a $PaCO_2$ greater than 45 mmHg.
- Acidosis is the accumulation of co_2 which combines with water in the body to produce **carbonic acid**, thus lowering the pH of the blood.

ABG	pH	$PaCO_2$	HCO_3
Respiratory Acidosis	↓	↑	normal

(II) Respiratory Alkalosis

- It is defined as a pH greater than 7.45 with a $PaCO_2$ lesser than 35 mmHg.
- Alkalosis is due to excessive **wash** of co_2 (**hyperventilation**), thus increasing the pH of the blood.

ABG	pH	PaCO2	HCO3
Respiratory Alkalosis	↑	↓	normal

(III) Metabolic Acidosis

- It is defined as a pH less than 7.35 with a HCO_3 less than 22 mEq/L.

- **Toxic Causes :** Any disorder that will lead to tissue hypoperfusion whatever the cause will lead eventually to increase in lactic acid production resulting in Metabolic Acidosis.

1) **Late salicylate**
2) **Methanol**
3) **Ethylene glycol**
4) **Iron**

ABG	pH	$PaCO_2$	HCO_3
Metabolic Acidosis	↓	normal	↓

(IV) Metabolic Alkalosis

- It is defined as a pH greater than 7.45 with HCO_3 greater than 28 mEq/L

- **Causes**

It is due to **excessive acid loss** (repeated vomiting and nasogastric suction) OR **bicarbonate retention** e.g. overuse of sodium bicarbonate .

ABG	pH	$PaCO_2$	HCO_3
Metabolic Alkalosis	↑	normal	↑

Risk management

Described as : the systematic application of management policies, procedures and practices to the tasks of analyzing, evaluating, controlling, and monitoring risk. (ISO 14971)

It is a process that involves:

1. Anticipating what could go wrong (errors)
2. Assessing the frequency of occurence of these errors
3. Assessing the severity of harm they cause
4. What can be done to reduce the risk of potential harm to an acceptable level

Risk Management

- The practice of risk management is one that is regularly employed in **aerospace** and **automotive industries**.
- **in vitro diagnostic device (IVD)** manufacturers follow risk management protocols to determine the best use of their devices and then outline the limitations and interferences that can affect the devices in package inserts or user manuals.
- For **clinical laboratories**, risk management is a new concept

Identified as building blocks for risk management

1. Risk prevention
2. Risk identification
3. Risk assessment
4. Corrective actions
5. Loss control

Risk Management for BGA

Pre analytic :

- Patient identification
- Sample collection
- Sample handling and transport
- Sample storage

Analytic :

- Instrument maintenance
- Calibration
- Quality control
- Troubleshooting and maintenance

Post-analytic :

- patient identification
- Result verification and interpretation
- Result reporting and documentation
- Monitoring and evaluation

Risk Management for BGA

PRA ANALYTIC

Patient Identification:

- Accurate patient identification : at least 2 identities
  - a. full name
  - b. age/ date of birth } avoid mislabelling/sample mix-ups

- For inpatients match with the patient's wristbrands or patient's family or nurse to help patient's identification

As a result of an error:

1. The Sample examined doesn't belong to the patient
2. Most fatal because it's difficult to trace
3. Wrong diagnosis
4. Wrong therapy
5. Endanger patient's to the point of life threatening

Risk Management for BGA

PRA ANALYTIC

Sampel Collection:

a. Proper sample collection techniques (collateral at the punction hand))
b. Appropiate site collection
c. Syringe preparation
d. air bubbles
e. clots
f. Improper anticoagulation
g. Ask about medication

result :

1. Hematoma
2. Result doesn't match patient's condition
3. Error at instrument

Table 1. Interfering Substances for Blood Gas/Electrolyte/Metabolite Systems

Substance	Blood Gases	Electrolytes	Glucose/Lactate
Ice (cooling)	0	+	0
Excessive heparin [4,a]	+	+	0
Sodium thiopental	pH	+	0
Benzalkonium chloride	pH	+	0
Ascorbic acid	0	0	±
Uric acid	0	0	±
Dopamine	0	0	±
Dobutamine	0	0	±
Flaxedil	0	0	+
Ethanol	0	0	+
Acetaminophen	0	0	±
Isoniazide	0	0	±
Thiocyanate	0	0	±
Hydroxyurea	0	0	±
Sodium fluoride	0	0	±
Potassium oxalate	0	0	±

± = Interference is concentration dependent and may vary with sensor design
0 = No effect
+ = Notable effect

H11-A4 Procedures for the Collection of Arterial Blood Specimens

Operating systems/QSE	Operating systems/QSE
1. Patient assessment	• Practice guideline implementation • Duplicate test ordering
2. Test request	• Ordering accuracy • Accuracy of order transmission • Verbal order evaluation
3. Specimen collection/labeling	• Wristband evaluation
4. Specimen transport	• Transit time • Stat transit time
5. Specimen receiving/processing	• Blood gas specimen acceptability • Chemistry specimen acceptability
6. QSE: Personnel	• Competence evaluation • Employee retention
7. QSE: Process control	• Safety
8. QSE: Occurrence management	• Incidents
9. QSE: Internal assessment	• On-site inspections/assessments • Self-inspections/assessments

QSE : quality specimen essential

Risk Management for BGA

PRA ANALYTIC

Sample Handling and Transport:

1. Timely transport sample to the analyzer (10-30 menit)
2. Maintaining appropiate temperature (room temperature < 30menit), if > 30 menit use coolant
3. Preventing exposure to air are essential to maintain sample integrity

result :

Test result doesn't match patient's condition

CLSI H11-A4, Procedures for the Collection of Arterial Blood Specimens
NCCLS. Procedures for the Collection of Arterial Blood Specimens; Approved Standard—Fourth Edition. NCCLS document H11-A4

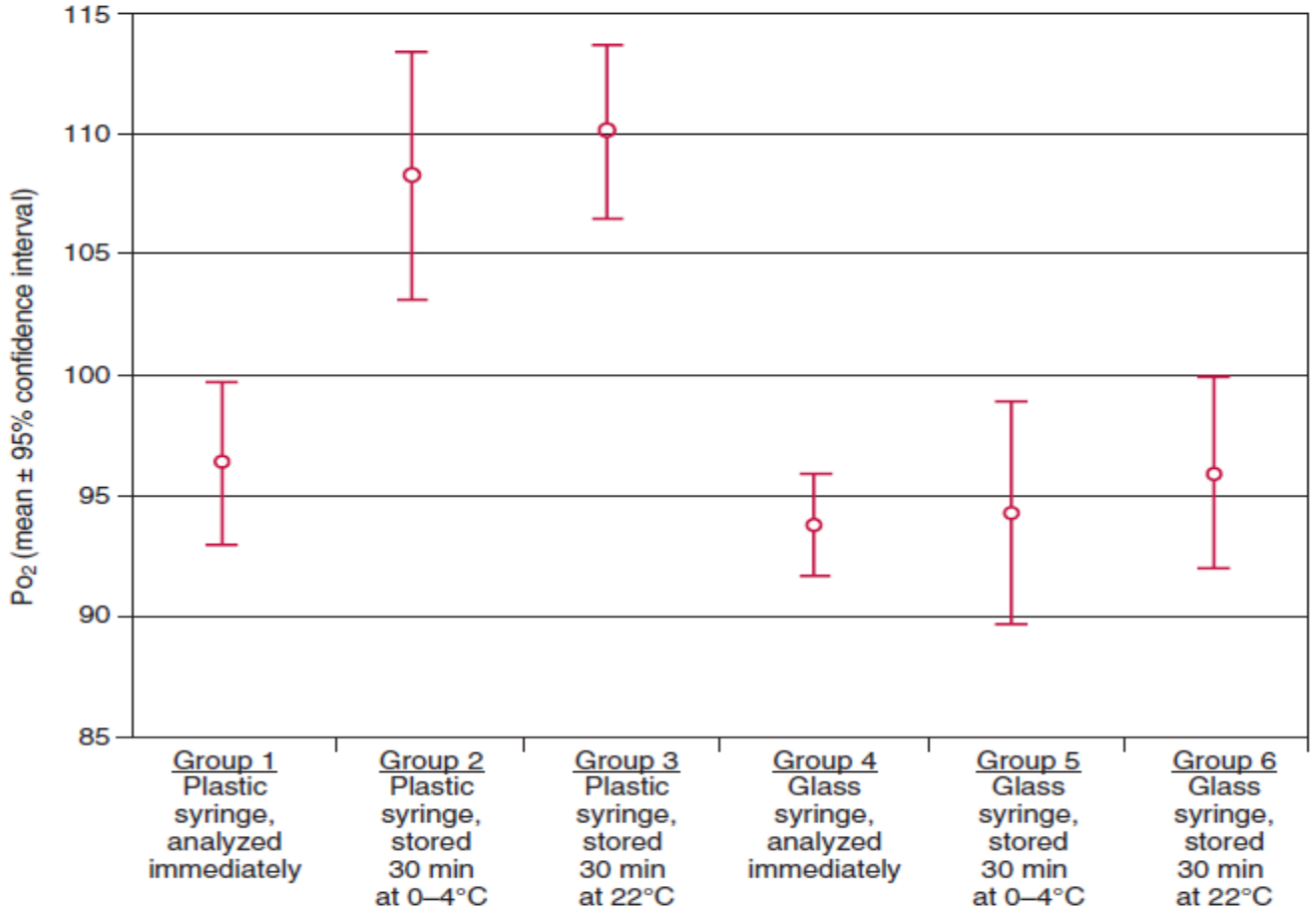


FIGURE 5.18 Plastic syringes should not be cooled because plastic molecules contract when cooled to 0 to 4 °C. Contraction of plastic molecules creates pores in the syringe wall, through which oxygen easily diffuses. If samples must be cooled, glass syringes should be used to avoid the exchange of oxygen through the syringe wall. This graph shows the differences in pO_2 values in arterial blood samples stored at different temperatures for different periods of time. (From Knowles TP, Mullin RA, Hunter JA, Douce FH. Effects of syringe material, sample storage time, and temperature on blood gases and oxygen saturation in arterialized human blood samples. *Respir Care* 2006;51:732–36, with permission by Dallas, Texas: Daedalus Enterprises for the American Association for Respiratory Therapy.)

Risk Management for BGA

ANALYTIC

Instrument Maintenance and Calibration:

- Regular maintenance
- Calibration
- quality control checks to ensure the accuracy and reliability of blood gas analyzers)

This includes performing regular calibration verification and running external quality assurance (EQA) samples.

- QC at least 2 levels every 24 hours; testing one level every 8 hour
- QC :
  a. Surrogate : tonometri, aqueous control, emulsion control
  b.alternative:electronic QC, automated control, automated internal checks
- This helps monitor instrument performance, identify potential issues, and ensure reliable results.

Risk Management for BGA

ANALYTIC

Troubleshooting and Maintenance

- Establish clear protocols for troubleshooting instrument errors
- Performing routine maintenance
- Document all maintenance and repairs to track instrument performance and identify potential problems

Risk Management for BGA

POST - ANALYTIC

Result Verification and Interpretation

- Results should be carefully verified against clinical data and interpreted by trained personnel.
- Clinicians should be educated on the interpretation of blood gas results, including acid-base disturbances and compensatory mechanisms

When we must retest/duplo?

- **result inconsistent with patient's condition before**
- **Result inconsistent internally (pO2 + p Co2 > 150 torr with the patient breathing room air)**
- **Value are at extremes of expected (pH <7,2 or > 7,6)**

Disturbing factors for pO2 :

Anesthetic gas : No, halothane, isoflurane (pO2 increase)

Risk Management for BGA

POST - ANALYTIC

Result Reporting and Documentation

- Ensure accurate and timely reporting of results
- Proper documentation in the patient's medical record
- Consider integrating blood gas analyzers with the Laboratory information system (LIS) and electronic medical record (EMR)

Risk Management for BGA

POST - ANALYTIC

Monitoring and Evaluation:

- Continuously monitor the entire blood gas analysis process to identify areas for improvement
- This includes :
  - tracking error rates
  - analyzing incident reports
  - implementing corrective actions.

Tools and Strategies for Risk Management

FMEA (Failure Mode and Effects Analysis):

- This proactive tool helps identify potential failure points in the blood gas analysis process
- develop preventative measures

Tools and Strategies for Risk Management

Quality Control (QC) Programs:

- Implementing both IQC and EQA programs is essential for monitoring instrument performance and ensuring reliable results

Tools and Strategies for Risk Management

Training and Competency Assessment:

- Provide comprehensive training to all personnel involved in BGA
- Regularly assess their competency to ensure they have the necessary skills and knowledge (certificate must be updated **once per year**)

Training staf

Analytical skills:

- Operation,calibration,and routine maintenance
- Understanding of any analytical limitation of the instrument or test system
- Recognize instrument malfunction and able to do simple troubleshooting techniques
- Principles, procedures and documentation of internal QC & External QA and patient results
- Cleaning,decontamination,and disposal procedures

Wood JF & Burnett D. Training and certification for point-of-care testing. In: Price CP, St John A, Hicks JM. Point-of-care testing. 2nd ed. AACC Press. 2004. p.122.

Tools and Strategies for Risk Management

Standard Operating Procedures (SOPs):

- Develop clear and concise SOPs for all aspects of blood gas analysis
- Ensuring consistency and adherence to best practices

Tools and Strategies for Risk Management

Technology Integration:

- Integrated blood gas analyzer with hospital information systems (HIS) and LIS to reduce errors and improve data management

By implementing these strategies, healthcare facilities can minimize the risks associated with blood gas analysis, improve the **quality of patient care**, and enhance overall **patient safety**

Tools and Strategies for Risk Management

Incident Reporting and Analysis:

- Establish a system for reporting and analyzing incidents, near misses, and adverse events to identify trends and implement corrective actions

Risk estimation

- Risk cannot be completely eliminated
- Identify unacceptable risks based on criticality
- Criticality = probability of harm x severity of potential harm

Probability of harm :

- Frequent : once a week
- Probable : once per month
- Occasional : once per year
- Remote : once every few year
- Improbable : once in the life of the measuring system

Severity of harm :

- Negligible : inconvenience/ temporary discomfort
- Minor : temporary injury/impairement not requiring proffesional medical intervention
- Serious : injury/impairement requiring proffesional medical intervention
- Critical : permanent impairement/life threatening injury
- Catastrophic : patient death

TABLE 3.3 Risk Matrix to Categorize Risk Criticality From a Combination of Severity and Occurrence

	1 Negligible	2 Minor	3 Serious	4 Critical	5 Catastrophic
5 Frequent	5 low	10 medium	15 high	20 very high	25 very high
4 Probable	4 low	8 medium	12 medium	16 high	20 very high
3 Occasional	3 low	6 low	9 medium	12 medium	15 high
2 Remote	2 low	4 low	6 low	8 medium	10 medium
1 Improbable	1 low	2 low	3 low	4 low	5 low

Legend for Risk Matrix

Scales

Occurrence Levels	Severity Levels
5 Frequent—once per week	5 Catastrophic—could result in patient death
4 Probable—once per month	4 Critical—could result in permanent or life-threatening injury
3 Occasional—once per year	3 Serious—could result in injury or impairment requiring professional medical intervention
2 Remote—once every few years	2 Minor—could result in temporary injury or impairment requiring professional medical intervention
1 Improbable—once in the lifetime of the measuring system	1 Negligible—could result in inconvenience or temporary discomfort

Risk Management Category	Example of Potential Response Matched to Risk Category if Incident Were to Occur
Very high—a dangerous level of risk that is required to be controlled immediately	Formal investigation and root cause analysis (RCA) with recommendations reported to board and externally
High—an unacceptable level of risk that should be controlled immediately	Formal investigation with recommendations reported to the Executive
Medium—manage by specific monitoring or audit procedures	Departmental investigation and improvement summarized in report to operations
Low—manage by routine procedures	Local monitoring and KPI

Examples of occurrence and severity are given below from ISO 14971.[21] There is also a CLSI standard on Risk EP23A.[22]

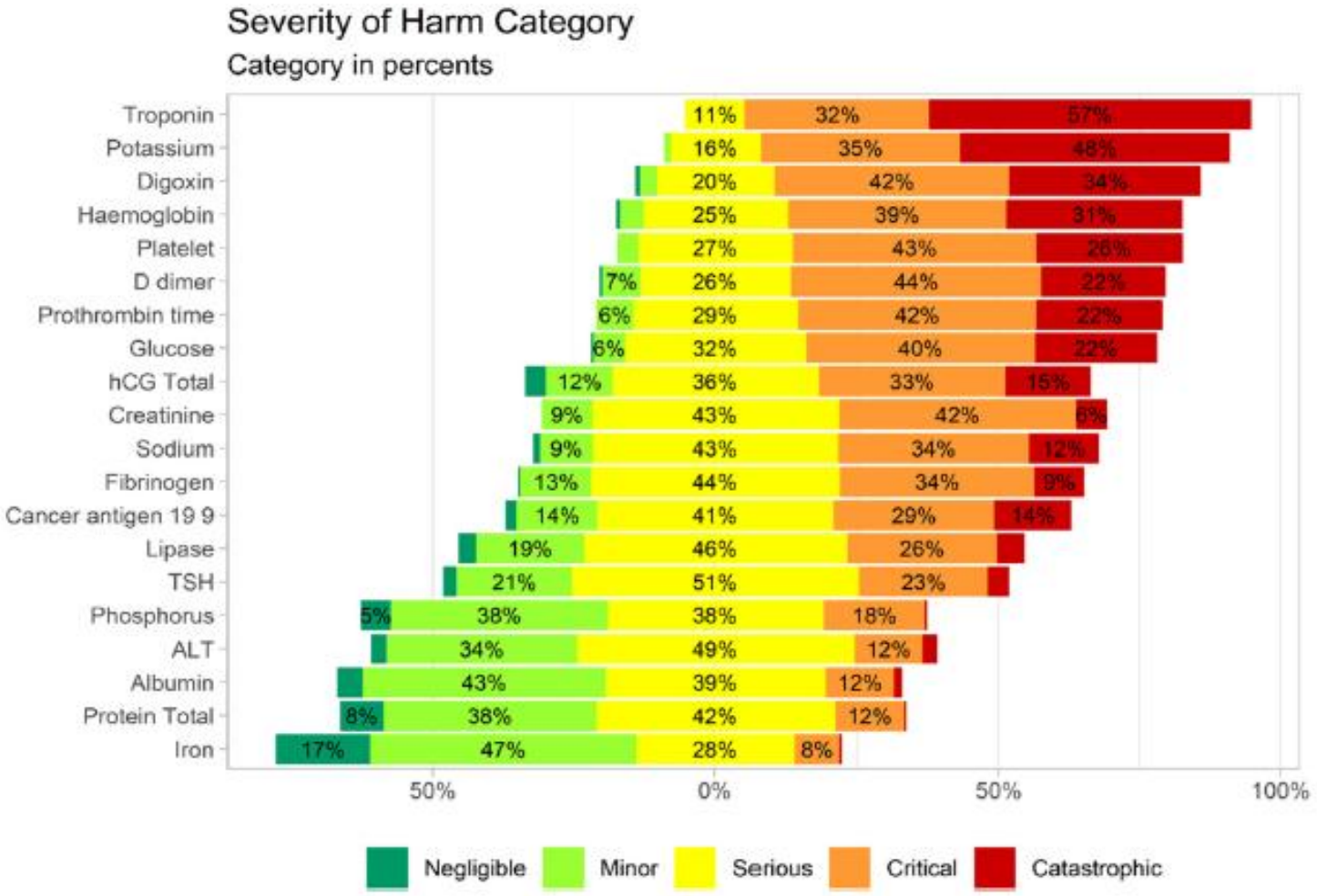
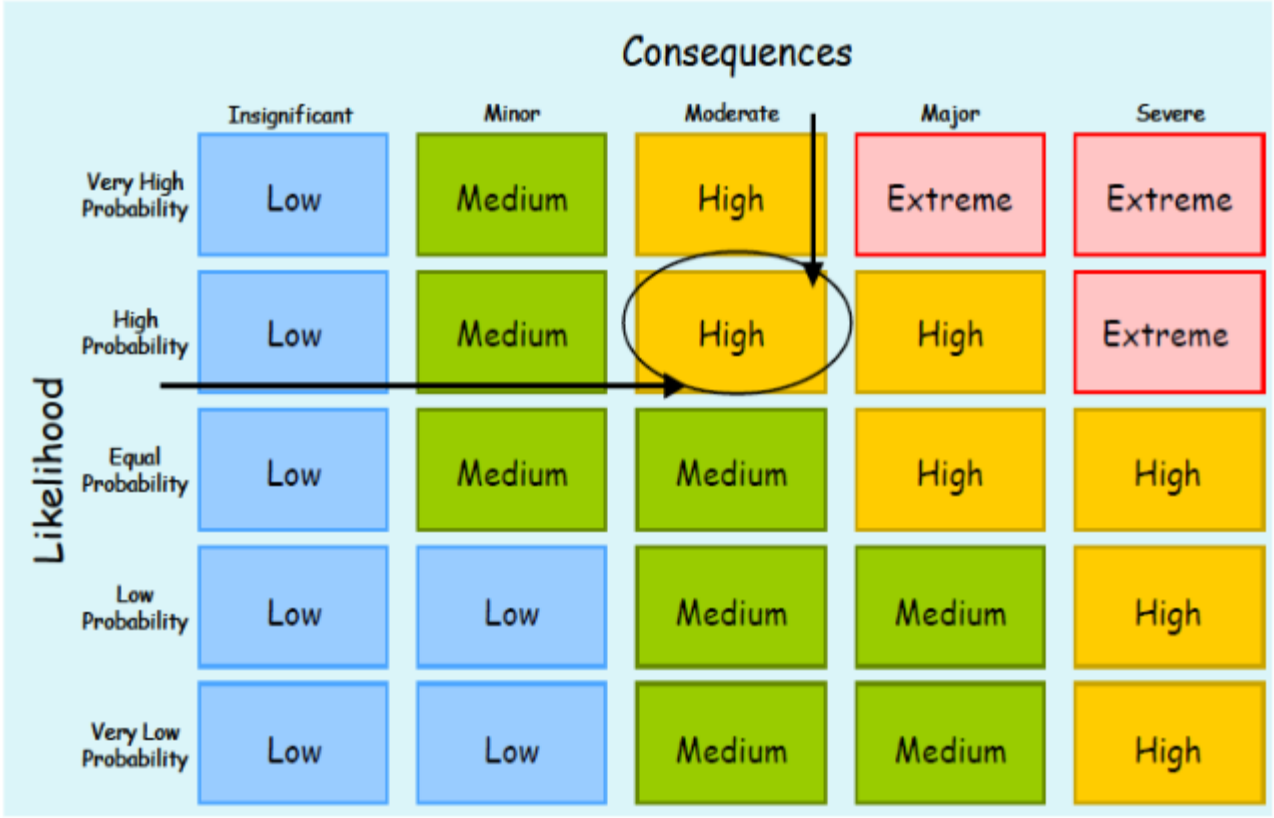


Figure 1: Likert plot representation of survey results of severity of harm categorization. The likert plot centered bars with splits the serious category. Analytes are ordered by the combined critical and catastrophic category. The "no answer" category was removed and not taking into account.

Table 3: Prevailing severity of harm category for the survey parameters.

Analyte	Prevailing severity of harm category
Potassium (serum/plasma)	Catastrophic
Troponin (serum/plasma)	Catastrophic
Creatinine (serum/plasma)	Critical
D-dimer (plasma)	Critical
Digoxin (serum/plasma)	Critical
Glucose (serum/plasma)	Critical
Haemoglobin (whole blood)	Critical
hCG total (serum/plasma)	Critical
Platelet (whole blood)	Critical
Prothrombin time (plasma)	Critical
Albumin (serum/plasma)	Serious
ALT (serum/plasma)	Serious
CA 19-9 (serum/plasma)	Serious
Fibrinogen (plasma)	Serious
Lipase (serum/plasma)	Serious
Phosphorus (serum/plasma)	Serious
Protein (total) (serum/plasma)	Serious
Sodium (serum/plasma)	Serious
TSH (serum/plasma)	Serious
Iron (serum/plasma)	Minor



Likelihood and consequence on the risk matrix to find the risk level

Warade J. Risk management in clinical laboratory 2022

Table 1 Example Risk Assessment: Blood Gas and Electrolyte POCT Analyzer

Example risk assessment for a generic unit-use POCT blood gas and electrolyte analyzer considering risks from samples, operator, reagents, device and the environment on the testing process

Hazard	Manufacturer Control Process	Laboratory Action	Risk Clinically Acceptable?
Physician order		Operator training	Yes
Anaerobic collection for blood gases		Operator training	Yes
Incorrect tube additive		Operator training	Yes
Clots, hemolysis (undermixing or over-mixing)	Clot and bubble detection	Operator training	Yes
Delays in analysis		Operator training	Yes
Operators trained/competent	Operator lock-out		Yes
Over-filling or under-filling	Sample detection		Yes
Incorrect operator procedure	Automated test analysis		Yes

James H. Nichols
Risk management for point-of-care testing *eJIFCC2014Vol25No2pp154-161*

Failure to document results	Wireless connectivity		Yes
Forgetting to clean device		Operator training	Yes
Exposure during cartridge shipment		Analyze liquid quality controls	Yes
Lot-to-lot variability		Analyze liquid quality controls	Yes
Cartridge degradation during storage		Monitor storage conditions Analyze liquid quality controls	Yes
Device failure – electrical, sensor, computational	Internal checks and internal QC	Monitor error codes	Yes
Environment temperature and humidity	Continuously monitored		Yes

James H. Nichols
Risk management for point-of-care testing eJIFCC2014Vol25No2pp154-161

Blood gas analysis device

Central Laboratory:

- **Electrochemical**
- **Detector: Ion selective electrode**

POCT:

- **dry chemistry or**
- **single use disposable cartridge sensor system**

Instrument BGA

Near Patient Testing

Defined as :

- Laboratory benchtop analyzer (traditionally)
- Placed in a central location
- Located on or close to critical care / surgical unit
- Retains functional requirements of lab. based system (e.g. maintenance, QC)
- Nurse must leave bed to perform test

Point Of Care Testing

Defined as :

- Portable hand held analyzers
- Testing performed at patient bedside
- Care giver performs rest & integrated into care process
- Results within 5” of sample draw
- Functional requirements (compared to lab. analyzers) minimized

Aspect that need to be considered?

Useful enough?	Saving or expence?	How to implement them in our institutions?
1. Analytical perfomance 2. Turn around time (TAT) *3. Clinical significance*	1. Analytical costs 2. Number of test 3. TQM needs a. QC b. EQA c. Workforce requirements (training & competency)	1. Organization 2. Defining what we need 3. Selecting the instrument/vendor 4. Implementation training & communication 5. evaluation

1. Analytical performance : do the current device provide the required sensitivity and accuracy?

2. Turn around time (TAT) :
   a. central lab : 30 minute - hours
   b. near patient testing : 5-15 minutes
   c. POCT : <5 minutes
3. *Clinical significance*

TTAT; therapeutic turn aroun time

Influences of true cost POCT

- Depending of a lot of factors :

1. POCT device usually more higher cost than central lab device
2. Excessive or inappropiate testing
3. Continuing request to the main lab
4. Poorquality and increased risk : **no analytical quality procedures, poor compliance with training --→ errors--→ harm to patients, wasted consumables**
5. Time out of clinical work perform test
6. Hiddden costs : supervision of POCT, user training, managing QC and EQA.

How to choose instrument BGA?

Benchtop	Cardtridge based	Single used /handheld
1. not portable 2. Amount of maintenance is progressively reducing 3. May be the most cost-effective system for medium to large test volumes	1. Semi portable 2. Little maintenance 3. May be cost-effective for medium to large test volumes	1. truly portable 2. Least maintenace 3. May be only cost effective for small to medium test volumes

How to choose BGA device?

BGA device :

1. Analytical performance
2. Feature
3. Easy to use
4. Training
5. After sales support

IT support :

1. Hardware
2. Software

Direct cost vs hidden cost

Direct cost :

- The direct cost is the price of the test, which can vary by location and facility
- The actual cost of the blood gas analysis test can fluctuate based on the healthcare provider, location (hospital, clinic, etc.), and the specific testing equipment used.

Hidden cost:

- include the time and resources used for preparation
- sample collection, analysis
- potential treatment adjustments based on the results.

How to choose BGA device?

- ☆ Long-life, maintenance free electrodes or disposable sensor packs
- ☆ Touch screens as the user interface
- ☆ Software that can demand user and patient identification
- ☆ Built-in barcode scanners
- ☆ Reduced sample sizes
- ☆ Clot detection within the detection chamber
- ☆ Sample detection to prevent short samples

- ☆ Liquid calibration systems instead of gas bottles
- ☆ Automated calibrations
- ☆ Automated QC sampling
- ☆ Sophisticated QC programs including interpretation of data
- ☆ Connectivity to information systems allowing remote monitoring and control

St. John A. Benchtop instruments for point-of-care testing. In: Price CP, St John A, Hicks JM. Point-of-care testing. 2nd ed. AACC Press, 2004. p.33.

Take home message

- Risk management is a system to detect the possibility of errors occurring in BGA process
- It is necessary to anticipate the possibility of errors occurring in pre-analytic, analytic dan post-analytic processess
- When selecting BGA devices, there are many things to consider depending on the number of test, direct costs and hidden costs

References

- Warade J (2015). Risk Management in clinical laboratory
- H11- A4 Procedures for the Collection of Arterial Blood Specimens. CLSI
- H4-A6, Procedures and Devices for the Collection of Diagnostic Capillary Blood Specimens. CLSI
- C46-A2, Blood Gas and pH Analysis and Related Measurements. CLSI

Terima kasih

Kemenkes

Pengembangan Keprofesian Berkelanjutan

Nomor: KT.03.02/F/2132257/SER/2025

Diberikan kepada

DR.PUSPARINI

Telah mengikuti

Seminar Nasional Optimizing Blood Gas Analysis: Managing Risk and Quality with Intelligent Technology Angkatan 1

diselenggarakan oleh Lembaga Pendidikan Pelatihan Profesi Laboratorium Medik Utama

Pada 13-09-2025 s/d 13-09-2025

Sebagai Fasilitator

Jumlah 3.5 Jam Pelajaran senilai 2 SKP

a.n Menteri Kesehatan
Direktur Jenderal Sumber Daya Manusia Kesehatan

dr. YULI FARIANTI, M.Epid