IFCC SYMPOSIUM 3 - Unraveling the Role of Machine Learning in Clinical Chemistry: Bridging the Gap between Potential and Practicality

UNRAVELING THE ROLE OF MACHINE LEARNING IN CLINICAL CHEMISTRY: BRIDGING THE GAP BETWEEN POTENTIAL AND PRACTICALITY

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Over the past years, many machine learning models have been developed in Pathology and Laboratory Medicine, such as identifying pre-analytical errors, improving test utilization, and predicting onset of diseases. Machine learning has shown tremendous potential to enhance diagnostic accuracy and improve laboratory workflow efficiency. However, many laboratory professionals are unfamiliar with the roadmap of ML model implementation in clinical workflows. There are three main phases in the pipeline: pre-implementation, peri-implementation, and post-implementation. Key modules of each phase affect the overall outcome of the entire ML solution. So far, there is a lack of expert consensus on how to assess ML models' performance before implementing it in the EHR/LIS and how to monitor its performance after implementation. It is unclear what information should be provided by vendor or third-party who develops a ML model for laboratory use. Validation strategies may be different for ML models approved by a regulatory agency, such as FDA, and the non-approved ones. Our IFCC AI Working Group has conducted a survey to gather expert opinions on the key questions about ML implementation in clinical laboratories. A detailed analysis of the survey results will be provided in this presentation.

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BIOMARKERS VS. MACHINE: THE RACE TO PREDICT ACUTE KIDNEY INJURY

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Acute kidney injury (AKI) is a serious complication affecting up to 15% of hospitalized patients. Early diagnosis is critical to prevent irreversible kidney damage that could otherwise lead to significant morbidity and mortality. However, AKI is a clinically silent syndrome, and current detection primarily relies on measuring a rise in serum creatinine, an imperfect marker that can be slow to react to developing AKI. Over the past decade, new innovations have emerged in the form of biomarkers and artificial intelligence tools to aid in the early diagnosis and prediction of imminent AKI. This session summarizes and critically evaluates the latest developments in AKI detection and prediction by emerging biomarkers and artificial intelligence. Main guidelines and studies discussed include those evaluating clinical utility of alternate filtration markers such as cystatin C and structural injury markers such as neutrophil gelatinase-associated lipocalin and tissue inhibitor of metalloprotease 2 with insulin-like growth factor binding protein 7 and machine learning algorithms for the detection and prediction of AKI in adult and pediatric populations. Recommendations for clinical practices considering the adoption of these new tools are also provided.

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DOING MORE WITH PATIENT DATA: DETECTION OF ANALYTICAL ERROR THROUGH PATIENT-BASED QUALITY CONTROL

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Traditional internal quality control (QC) can only provide a brief "snap-shot" of assay performance, and does not predict the accuracy of future test results. This gap between QC events can be quite large and can affect hundreds of patient samples. Patient-based real-time QC (PBRTQC) can bridge that gap and provide an assessment of result accuracy with each new sample tested. In this session we will discuss the basics of PBRTQC, the current status of its use in the clinical chemistry laboratory, the potential future directions that PBRTQC can lead, and will also include a discussion on the strengths and weaknesses of available PBRTQC strategies, as well as the challenges for wider adoption of this important tool that can improve detection of laboratory error.

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HARNESSING THE POWER OF MODERN TOOLS AND MACHINE LEARNING TO REDUCE PRE-ANALYTICAL ERROR

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Errors during the pre-analytical phase of testing, prior to a specimen being loaded onto an analytical instrument, are the most common type of laboratory error. Most published studies have found that pre-analytical phase errors account for ~43 – 75% of the captured errors. In the analytical phase of testing, an array of new techniques and tools such as moving averages and novel software have been implemented to detect error. However, there have been minimal new tools available to laboratorians that detect pre-analytical error. This session will assess novel approaches and tools for detecting pre-analytical error during phlebotomy, from intravenous fluid contamination, and from incorrect tube types. There will be an emphasis on the application of machine learning and the use of large datasets that are readily available within the laboratory information system. The application of these tools and how they may be interfaced into laboratory information systems and current workflows will be addressed. The goal of this session is to prepare laboratorians for a future state in which machine learning algorithms and advanced tools are implemented to reduce error and improve patient care.