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BALKAN CLINICAL LABORATORY FEDERATION

ifcc
International Federation of Clinical Chemistry and Laboratory Medicine

EFLM
EUROPEAN FEDERATION OF CLINICAL CHEMISTRY AND LABORATORY MEDICINE

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Neighbouring Countries:The Same Professional Aim

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In vitro diagnostics and evolving regulatory challenges in laboratory medicine

STRATEGIC PRIORITIES

Improvement of healthcare through laboratory medicine:

- Quality assurance standards,
- implementation of the criteria for harmonization of quality indicators for total testing process (TTP) and extra-analytical phases,
- biological variability,
- performance criteria,
- accreditation,
- education,
- evidenced base practise,
- standardization,
- harmonization,
- metrological traceability,
- commutability of reference materials,
- clinical and cost effectiveness with novel applications and multiplex diagnostic technologies,
- application of emerging and disruptive technologies to clinical laboratories,
- adapting to the digital health era efficiently using information technology/electronic communication tools,
- services and processes to deliver healthcare services;
- pursuing recognition of the importance and the clinical value of laboratory medicine, especially outside of the laboratory;

Total Quality Management (TQM)

Total Quality Management (TQM) consists of monitoring the following laboratory processes:

- **Internal Quality Assurance & External Quality Assura**nce (No patient results are released until internal & external laboratory quality controls are acceptable);
- **Validation and Notification of Test Results** (Highly developed software is useful to review the test results comparing the previous test results of the patients, especially in the laboratories with high work-load; Abnormal results require validation by clinical laboratory professionals);
- **Training and Competency Testing** of laboratory personnel;
- **Accreditation** of laboratories by governmental or other regulatory agencies.

In many countries, the requirements for Total Quality Management are being fulfilled and practiced, but a few countries still need support to achieve this aim.

Errors in Laboratory Medicine

Managing the extra-laboratory phase of the total testing cycle is a big challenge for laboratory medicine.

Several studies involving errors in clinical laboratories have focused, identified and quantified errors in laboratory testing.

The data from these studies have demonstrated that the highest incidence of errors occurs in the pre-pre-analytical phase of laboratory testing and post-post-analytical phase.

The risk is the least in the intra-analytical phase.

Ann Clin Biochem 2010; 47: 101–110

Table 4 Types and relative frequency of errors in the different phases of the TTP (data from reference[7])

Phase of the TTP	Type of error	Relative frequency (%)
Pre-pre-analytical	Inappropriate test request Order entry Patient/specimen misidentification Sample collected from infusion route Sample collection (haemolysis, clotting, insufficient volume, etc.) Inappropriate container Handling, storage and transportation	46–68.2%
Pre-analytical	Sorting and routing Pour-off Aliquoting, pipetting and labelling Centrifugation (time and/or speed)	3.0–5.3%
Analytical	Equipment malfunction Sample mix-ups Interference (endogenous or exogenous) Undetected failure in quality control	7.0–13%
Post-analytic	Erroneous validation of analytical data Failure in reporting/addressing the report Excessive turn-around-time Improper data entry and manual transcription error Failure/delay in reporting critical values	12.5–20%
Post-post-analytic	Delayed/missed reaction to laboratory reporting Incorrect interpretation Inappropriate/inadequate follow-up plan Failure to order appropriate consultation	25–45.5%

Errors in Laboratory Medicine

Methods such as **Lean** and **Six Sigma** improve the efficiency of the laboratories, but these techniques may have a minimal impact in improving the diagnostic process **if a wrong test has been ordered** or **a test result has been interpreted wrongly.**

Diagnostic algorithms & Reflex text protocols

Diagnostic algorithms providing guidance for test selection are abundant and are basis for the establishment of two types of reflex text protocols:

- one is the "**standard of care**" or "**universal**" reflex testing;
- the other is the "**local**" or "**institutional**" reflex testing.

Properly designed and applied reflex testing provides faster diagnosis at lower cost.

The hospital medical committee must approve the necessity and the value of the institutional reflex testing protocols.

Critical Results

Definition of critical results should be decided in agreement with clinicians.

Provision of a patient-specific interpretation and commentary associated with laboratory tests improves both the time and accuracy of diagnosis, decrease length of hospital stay and improve the clinical outcome.

Clinical laboratories play a greater role in reducing errors and improving patient safety and in managing and monitoring extra-analytical quality issues by building its quality management expertise on established standards of the related bodies:

- (ISO 15189; ISO TC212 and CEN TC140
- European Accreditation body (EA)
- the Joint Commission International (JCI)
- the College of American Pathologists (CAP) Laboratory Accreditation Program
- IFCC Working Group-Laboratory Errors and Patient Safety (WG-LEPS)
- EFLM Working Groups (WG-PRE, WG-POST and WG-TE)

Traceability in Laboratory Medicine

A high percentage of clinical decisions are based on data stemming from Laboratory Medicine (LM).

This responsibility requires delivery of a high-quality service.

Method calibration is a challenge.

In vitro Diagnostic (IVD) companies mostly produce their ‘own’ calibrators, resulting often in variability between methods for the same measurand.

Variability between methods may cause incorrect patient results leading to wrong diagnosis and treatment, and poor clinical outcome.

Traceability in Laboratory Medicine

Traceability requires both **(certified) reference materials** and **reference measurement procedures (methods)** in which they are used.

The Joint Committee for Traceability in Laboratory Medicine (**JCTLM**) was formed in 2002 by the **International Bureau of Weights and Measures (BIPM)**, **IFCC** and **International Laboratory Accreditation Cooperation (ILA**C) to enable a global response to the **IVD Directives.**

Corporate members / IVD Industry

IVD industries have broad scopes ranging from sophisticated technologies at the cutting edge of research to simple tests.

The overall IVD market will double over the next 10 years, driven by an aging population and an increase in non-communicable and chronic diseases in both mature and emerging markets despite changes and challenges, increasing pressures to prove medical value, and a more stringent regulatory environment.

The vital contribution of the IVD industry to achieve high quality in laboratory medicine is recognized.

IVD companies contribute to develop quality through educational grants, financial support for scientific and teaching projects presented by societies or individual members.

The collaboration between laboratory professionals and the IVD industry active in laboratory medicine and related fields **(e.g., in vitro diagnostics, pharmaceutical, IT, biotechnology, biotech networks, and commercial lab services)** must be enhanced pursuing projects of common interest.

In Vitro Diagnostics and Evolving Regulatory Challenges in Laboratory Medicine

The ***In Vitro* Medical Devices Directive (IVDD) 98/79/EC,** introduced in 1998 was not capable of regulating all new technical and medical developments.

Several weaknesses in the IVDD were identified:

- new developments regarding genetic testing and companion diagnostic devices that are not specifically addressed in the IVDD, the need to better align with international guidelines–including a risk-based classification system–and the lack of control over high risk “in-house” tests.

In Vitro Diagnostics and Evolving Regulatory Challenges in Laboratory Medicine

The new European ***In Vitro* Diagnostic Regulation (IVDR) EU/2017/746,** published in the Official Journal of the European Union on **May 5, 2017**, entered into force on **May 25, 2017.**

The official transition period to full implementation **is five years.**

The biggest change is the introduction of a **risk-based approach to classification** in combination with **increased Notified Body (NB) oversight**.

The new EU regulations create a new environment for IVD companies in terms of **product development, management of product lifecycle**, and **commercialization approach.**

In Vitro Diagnostics and Evolving Regulatory Challenges in Laboratory Medicine

IVD companies need to re-register their entire IVD portfolio under the new regulation by the end of the five-year transition period.

So, this will require additional efforts in terms of personnel and additional costs.

The IVDR is applicable to all devices sold or marketed within the **European Union (EU)**, with **no distinction** as to where they are marketed.

New Concepts for the IVDR which may lead to a new infrastructure for innovation in the field of IVDs in the European Union

- **CE** Marking requirements
- clinical and performance requirements
- post-market vigilance and surveillance
- new device identification system based on **Unique Device Identifiers (UDI)**
- European databank on medical devices (**EUDAMED**)
- IVD Manufacturers are required to develop **post-market surveillance reports** to monitor specific elements of safety, clinical performance, and risk/benefit ratios

MedTech Europe Code of Ethical Business Practice

entered into force as of **1st January 2017**, is applicable to **all third-party educational events** held in **Europe** or **anywhere in the world if the delegates are from two or more European countries.**

"EthicalMedTech" hosts a platform referred to as the "**Conference Vetting System**" that **enables third party educational event organizers to ensure compliance** with the MedTech Europe Code of Ethical Business Practice.

MedTech Europe Code of Ethical Business Practice

It appears that, IVD industry will curtail funds spent on registration fees in support of delegates to attend meetings.

Meetings organisation constitutes a major source of income.

An immediate action must be taken in order to fully understand the scale and the consequences of such a decision.

New consultations with IVD industry representatives must be initiated.

Evidence Based Medicine

Laboratory Medicine contributes positively to the quality of healthcare

- providing high quality laboratory test results,
- ensuring optimal test accuracy and precision,
- delivering test results in a timely manner,
- providing expert consultation to healthcare professionals for evidence-based clinical decisions.

Evidence Based Medicine

Laboratory Medicine applies ***in vitro*** **diagnostics** to provide **objective information** supporting "**Evidence Based Medicine"**

- Constituting the basis for accurate and fast diagnosis,
- leading to appropriate and effective therapy,
- targeting drug treatments according to patient's response,
- causing reduction of morbidity,
- providing risk prediction and reduction,
- allowing improved compliance,
- monitoring recovery from disease and effects of treatment.
- All this allows reassessment and updating of therapy, shortens length of hospital stay, lowers risk of hospital infections, improves the quality of life of patients, and decreases the total cost of health expenditure.

Financial constraints, Laboratory Organisation and Staffing

Clinical laboratory funding and budget constraints negatively affect the function of the laboratories.

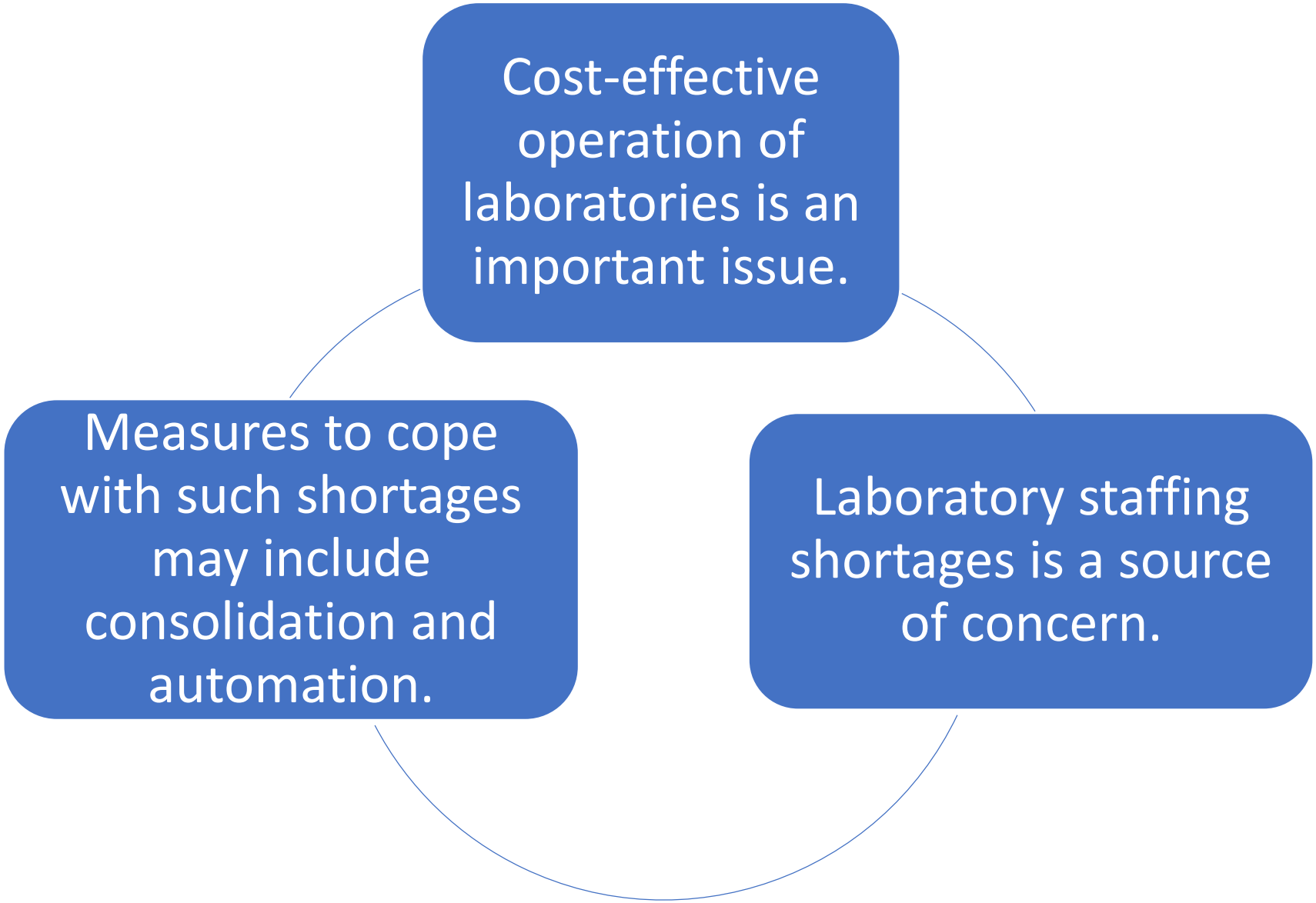
Clinicians and patients have the right to expect high standards of laboratory service.

Clinicians are under increasing pressure for better clinical outcomes.

Financial constraints, Laboratory Organisation and Staffing

IVDs, consisting of only very small amount of healthcare expenses, is a **clear and rational investment in healthcare**, which must be recognized by the clinicians, hospital administration, financial authorities/policy makers and financial controllers.

Financial constraints, Laboratory Organisation and Staffing



Financial constraints, Laboratory Organisation and Staffing

There is a trend to unify hospital laboratories and to give a central laboratory service to several hospitals and to consolidate specialty laboratories into a core laboratory model.

This trend might lead to lower costs in laboratory services by decreasing the number of laboratory personnel, equipment and space used.

The possibility to implement **outsourcing clinical laboratory services** for hospitals might have a negative impact on the **laboratory professionals** in laboratory medicine decreasing the need to employ them.

Point-of-Care Testing (POCT)

Healthcare system is undergoing tremendous change, focusing on improved population health, better patient outcomes, more patient engagement, all at affordable and reasonable costs.

The biggest advantage to Point-of-care testing (POCT) is that providing faster access to test results can expedite speed of diagnosis and subsequent treatment.

Point-of-Care Testing (POCT)

The next-generation of Point-of-Care (POC) platforms are expected to grow slightly faster than the central lab market.

The increased trend towards the **point-of-care testing (POCT)** and **home tests** offer several benefits, including **low cost, portability, simplicity, flexibility** and **built-in quality control**.

It is expected that point-of-care testing in near future will result in reducing the reliance on hospital central laboratories extensively.

Point-of-Care Testing (POCT)

Smartphones and wearable devices are a further step in this direction.

The FDA has provided regulatory guidance for the implementation of digital pathology and medical software.

Mobile technology and telehealth will play an important role in laboratory medicine in future, especially in low resource and remote regions.

POC testing

- Self-testing/smartphones (malaria)
- Glycation in finger nails as an alternative for diabetes diagnosis and follow-up
- HIV testing using portable bench-type PCR system
- INR self testing
- Serial measurements such as creatinine after renal transplantation

Problems associated with POCT connectivity

Regulatory compliance

(CLIA, FDA)

Device and connectivity solution limitations

Differences between POCT vs. core lab testing

Database requirements for POCT

Multitude of variant remote POCT devices

Problems associated with POCT connectivity

POCT operator certification

Device Tracking, QC & Calibration Verification

Verification of results before release

Systems for ordering, reporting, and storage of results

Automatic capture of billing information

POCT management systems available currently should enable

automatic electronic flow of data from the POCT devices to the LIS & patients' EHR

as well as

providing remote access to QC and

operator certification data.

Artificial intelligence: The next revolution in healthcare?

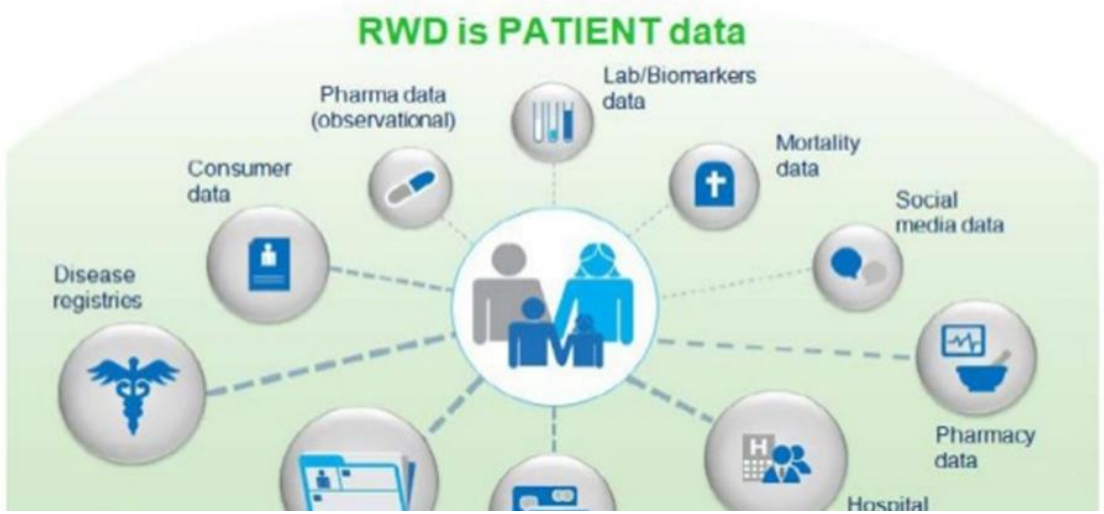
Old Model:

innovate-manufacture-sell business model.

New Model:

artificial intelligence (AI), robotics and big data

Real-World Data (RWD)



The question of how **artificial intelligence** and **robots** will affect jobs has been one of the darkest shadows looming over the 21st century.

Peter Sondergaard, head of research at Gartner, at the opening keynote of Gartner Symposium 2017, stated that by **2020 AI** will automate **1.8 million** people out of work, but it will create **2.3 million** jobs. So, AI will drive a net gain of 500,000 new jobs.

AI is going to play a complementary role to a lot of workers.

It will make them faster, more efficient, and more productive.

Tech talent is getting harder than ever, especially for

high-demand skills like

data science and **cybersecurity.**

Digitilization in Healtcare

Digitization in healthcare and automation such as

- pneumatic sample conveying systems
- robotics
- bi-directional Laboratory IT interface between the clinics and laboratories

are leading to decrease direct contact of the physicians and patients with the medical laboratories.

Digitalization in Healthcare

Digital Medicine will be a new challenge for Laboratory Medicine.

Handling the disruption of Laboratory Medicine in Digital Health must be met by re-assessing our **classical tasks** as well as **adopting new ones.**

Visibility of Laboratory Medicine

Diagnostics 4.0.
The End of Laboratory Medicine as we know it?

This was the title of the second EFLM Strategic Conference held recently.

It appears clearly that the increase in the number of measuring devices, their operation by non-professionals and the use of health apps cause an increased data volume, while decentralizing the flux of health data.

Visibility of Laboratory Medicine

Clinicians contact the lab only in the case of complex, and unclear test results for interpretation.

Laboratories will communicate not only with doctors, but also with patients, requiring Laboratory Medicine to develop new skills for interpreting and communicating results.

As a consequence of these developments, it is not easy for the medical laboratories to enter into the centre of the medical dialogue between the clinicians and patients.

This new development has to be designed into professional education and training programs.

Visibility of Laboratory Medicine

Patients today are much more informed due to the availability of information about diseases and diagnostic methods.

Better-informed patients are expected to access directly to the laboratory data providers for interpretation of test results.

Visibility of Laboratory Medicine

Laboratory Medicine should focus on **Advanced Diagnostics** and **organize meeting with clinicians to introduce new methodologies** in order to increase its visibility beyond providing well-functioning technical service.

Every possible attempt should be performed to take part **in the centre of the medical dialogue** and to prevent to be considered **as a second healthcare provider.**

SCIENCE AND INNOVATION

Follow and facilitate the development and implementation of technical innovations to clinical laboratory professionals such as

- lab on a chip
- multiplex systems
- next-generation sequencing (NGS) and integrated data processing
- automated mass spectrometry
- omics
- liquid profiling (liquid biopsy) in different pathological and physiological states (cancer, transplantation, acute states, trauma, sepsis, intensive care, autoimmune diseases, pregnancy)
- microbiome profiling
- biosensors for real-time patient monitoring and digital health
- patient self-testing & point of care testing
- custom-tailored statistical analysis of biological data
- big data, and bioinformatic tools and technology to manage patients' healthcare and digital data efficiently expecting the healthcare data reaching 2,314 exabytes by 2020.

Science and Innovation

Monitor pre-pre-analytical, pre-analytical, analytical, post-analytical, and post-post-analytical processes necessary for optimal clinical outcomes.

Harmonize, implement, and monitor quality indicators addressing all stages of TTP which includes establishing the objectives, methodology, interpretation, limits, action plan and duration of measurement.

The quality indicators must be periodically reviewed, to ensure their continued appropriateness.

Increase focus on harmonisation and standardisation in laboratory medicine.

Science and Innovation

Introduce new technologies and novel biomarkers in clinical laboratory practice.

Prepare Laboratory Practice Guidelines and provide solutions and guidelines for scientific and technological problems.

Establish networks of Reference Laboratories.

Support biomedical research policy in Laboratory Medicine favouring joint research projects.

EDUCATION AND TRAINING

Recommend strategies and procedures to prevent errors in laboratory medicine and to improve patient safety.

Encourage EFLM member societies to adopt equivalent standard of education/curriculum and EC4/EFLM registration, to obtain the title of **"European Specialist in Laboratory Medicine" (EuSpLM)** with a further aim to achieve recognition of professional qualifications under European Union legislation.

Promote professional development and continuous education of clinical laboratory scientists at all levels and identify and meet expectations and professional needs of the EFLM members recognizing the needs of both developed and developing countries.

EDUCATION AND TRAINING

Develop and deliver further educational programmes to foster expert laboratory medicine professionals.

Expand educational and training opportunities through innovative e-learning and distance learning programmes, support on-line training and continuing education and professional development activities, facilitate proficiency testing schemes.

Provide training on Lean Tools, Management & Implementation.

YOUNG SCIENTISTS AND GENDER

Offer programs for young scientists to develop their careers including use of social media for networking and skills development, increase the availability of scholarships for attendance at international congresses, courses, workshops.

Support young scientists in laboratory medicine by connecting them to experienced people as their Mentors from the laboratory medicine community.

ETHICS

Increase awareness of the Laboratory Medicine Professionals on ethical issues and encourage the practice of Laboratory Medicine to the highest ethical standards and public interest.

Apply strict patient confidentiality regulations for test results; take precautions to protect the patients' personal health data in the "BIG DATA" age.

Educate individual members to improve compliance with Ethics in Science and Laboratory Medicine at its broadest level, encompassing research ethics, medical ethics, publication ethics, conflicts of interest, ethical responsibilities as educator, clinical laboratory scientist, patient rights and many other areas.