Understanding laboratory medicine

International Federation of Clinical Chemistry & Laboratory Medicine
Committee on Public Relations
Laboratory medicine results:
A hidden treasure in health care, providing

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Description</th>
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<tbody>
<tr>
<td>94%</td>
<td>Of objective data in medical records (1)</td>
</tr>
<tr>
<td>90%</td>
<td>Of clinical decisions influenced by critical value reporting (2)</td>
</tr>
<tr>
<td>23%</td>
<td>Of practice guidelines (3)</td>
</tr>
<tr>
<td>23%</td>
<td>Of companion diagnostics results and constantly growing (4)</td>
</tr>
</tbody>
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Why is laboratory medicine important?

- Laboratory Medicine is essential in screening, diagnosis, monitoring and prognosis of diseases
- Laboratory Medicine plays a critical role in monitoring health status and prevention of diseases

How does it achieve its role?

- Directs evidence-based clinical decision making
- Provides high quality laboratory test results
- Ensures optimal test accuracy and precision
- Delivers test results in a timely manner
- Provides expert consultation to healthcare professionals
What happens to my sample?

**Symptoms**
Unwell patient

**Test request**
Patient sample collected and sent to the laboratory

**Laboratory**
Laboratory analyses the patient sample

**Diagnosis**
Pathology results reported to requesting doctor

**Examination**
Physical examination

**Treatment**
Appropriate medical treatment given

**Diagnosis & monitoring cycle**
Who can look at my results?

**Laboratory staff**
- Strict patient confidentiality regulations apply to test results
- Laboratory staff release results to requesting doctor

**Requesting doctor**
- Receives paper or electronic copy of test results
- Doctor discusses results with patient

**Patient**
- May have direct access to test results
- Results are stored in medical record

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Are my results accurate?

**Laboratory quality control**
- No patient results are released until internal laboratory quality control is acceptable
- Laboratories are regularly monitored by both internal and external quality assurance programs

**Validation and notification**
- Highly developed software used to review test results
- Abnormal results require validation by clinical laboratory professionals

**Total Quality Management**
- Monitoring of all internal laboratory processes
- External quality assurance programs
- Strict staff training and competency testing
- Accreditation of laboratory by governmental or other regulatory agencies
Specialties in laboratory medicine

Biochemistry
- Blood & Urine
- Hormones
- Glucose
- Lipids
- Liver/ Kidney function

Hematology
- Blood cells
- Blood type
- Clotting disorder
- Blood products

Microbiology
- Biological fluids
- Infections
- Bacteria
- Viruses
- Resistance

Pathology
- Tissues
- Cell structure
- Abnormalities

Molecular Diagnostics
- DNA
- Genetic traits
- Inheritance
Laboratory medicine professionals

**Pathologists**
- Medical qualification
- Pathology specialist training
- Interpret pathology results

**Clinical Lab Scientists**
- Scientific qualification
- Performs test analysis
- Verify results
- Interpret results

**Technicians/ Technologists**
- Certification in lab testing
- Assist scientists in laboratory testing

**Phlebotomists**
- Blood collection certificate
- Collect blood, urine and other samples from patient

**Specimen Receptionists**
- Specimen handling & identification
- Patient data entry

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A few practical examples
Have I had a heart attack?

55 year old male with severe chest pain arrives at Emergency

Examination by Doctor
ECG Trace
Blood collected

Monitor recovery

Cardiac surgeon performs angiogram and inserts stent to re-open artery

Lab results confirm heart attack

Lab tests for cardiac biomarkers (Troponin, CK)

Biochemistry

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Does my blood show I am healthy?

Patient will be treated and monitored to increase life expectancy (48 years).

Parents are both ‘carriers’ of abnormal haemoglobin gene (HbS).

Infant blood collected: Blood smear analyzed. Sickle cells detected.

7 month African American female with abdominal & chest pain present for 3 weeks.

All family members blood analyzed: ‘Sickle cells’ detected in 1:4 children in family.
Do I have an infection?

Patient urine sample collected

Urine sent to lab for urine culture and sensitivity testing - UTI confirmed

Urine “dipstick” in general practitioner office shows white cells in urine

Monitor recovery

Antibiotics prescribed, based on sensitivity of microorganism cultured

25 years old female with fever, pain on urination visits general practitioner

Microbiology
Do I have skin cancer?

42 year old male visits general practitioner for mole check

Mole considered ‘suspicious’ and removed

Clinical Monitoring

Tissue viewed under the microscope - Melanoma confirmed Treatment started

Tissue fixed and embedded Thin sections of tissue cut and stained

Further surgery to remove nodal lump from underarm. Specimens sent to lab
Is my unborn child healthy?

37 year old female G₃P₀ considered high risk of abnormal pregnancy.

Chromosome number checked for major abnormalities (FISH): Normal pregnancy.

Mother’s blood screened for markers of Down syndrome: Abnormality found.

Placental sample collected using a fine needle (CVS).

Placental sample put into sterile culture media – to lab.
Patient Self-Testing & Point of Care Testing

Common, simple PoCT
- Urine pregnancy test
- Detects β–HCG elevated in pregnancy

Diabetes management at home
- Blood collected by fingerprick
- Blood glucose result in 2-3 minutes

Point of care testing in general practitioner clinic
- Lipid evaluation – cholesterol, triglyceride
- INR (blood clotting time) for patients on anticoagulant therapy
- Ward-based testing (blood gases)
...Lab of the future?

- Lab on a Chip
- Multiplex systems
- Automated Mass Spectrometry
- Biosensors for real-time patient monitoring
What is being done now?  The IFCC

45,000 Laboratory specialists
What does the IFCC do?

**Scientific Activities**
- Develops best practice laboratory guidelines
- Develops reference materials
- Encourages innovation and excellence

**Education**
- Transfers knowledge to laboratories in developing countries
- Encourages global information exchange
- Develops unique education programs

**Public Relations/Communications**
- Promotes profession
- Publishes scientific documents & papers
- Holds international scientific meetings
How can I learn more?

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