

# Clinical and Forensic Toxicology Laboratories: Opportunities and Challenges

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# Introduction

## Clinical Toxicology Labs

- The main role of the clinical toxicology laboratory is the detection, identification and often also the measurement of drugs and poisons in biological and related specimens to help in the diagnosis, treatment, prognosis, and prevention of poisoning.

## Forensic Toxicology Labs

- Determines the absence or presence of drugs, poisons and chemicals in biological and non-biological samples, and evaluates their role as a determinant or contributory factor in the cause and manner of death, modifying human performance or behavior.

# Main Differences between CTLs and FTLs

## Clinical Toxicology Labs

- **Aim:**
- Medical diagnosis and therapeutic
- **Stakeholders:**  
Health care practitioners
- **Documented Chain of Custody:**  
Optional
- **Type of Samples**  
Patients bio-samples

## Forensic Toxicology labs

- **Aim:**
- Medico-legal purpose
- **Stakeholders:**  
Legal authorities
- **Documented Chain of Custody:**  
Mandatory
- **Type of Samples**  
Patients and corpse bio-samples

# Similarities between CTLs and FTLs

- **Current Topics and Areas**
- Occupational Toxicology
- Environmental Toxicology
- Chemical Incidents/Disasters/Terrorism
- Drug/Substance Abuse Screening
- Herbal/Ethnic Remedies Analysis
- Mass Poisoning

- **Analytical Methodology**

- **Chemical/Color/Spot tests**

- **Immunoassay techniques**

Immunochemistry, ELISA, EMIT, FPIA

- **Chromatographic techniques**

TLC, GC-FID, GC-MS, HPLC-DAD, LC-MS-MS

- **Spectrophotometry and spectroscopic techniques**

UV-VIS, FT-IR, AAS

- **Polarography techniques**

ASV, CSV

# Iranian Legal Medicine Organization (LMO )Laboratories

- **Forensic Toxicology Laboratory**
- **Forensic Pathology Laboratory**
- **Forensic Genetic Laboratory**
- **Forensic Serology Laboratory**



# Classification of the LMO Forensic Toxicology Laboratories

-Currently, 31 state laboratories participate in the Iranian Forensic Medicine Laboratories Network (IFMLN).

- Classification of the forensic toxicology labs at the Levels 1 -3 for specialized servicing in the state, regional and national levels.



# Level 1 Forensic Toxicology Laboratories of LMO

- **Two** laboratories located in **Tehran** and **Shiraz** are in **Level 1**, and these laboratories considered as reference forensic toxicology laboratory in national level.

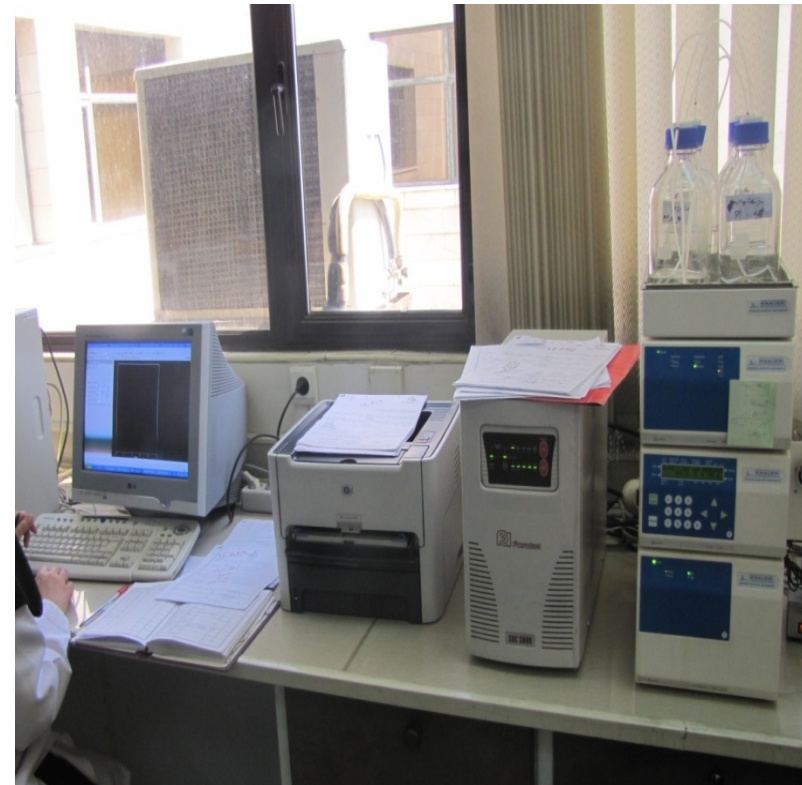




## Level 2 Forensic Toxicology Laboratories

- **Nine (9)** forensic toxicology labs incorporated in **Level 2**; they have sophisticated facilities to detect many of drugs and toxic chemical agents.
- Also, they are consider as **Forensic Toxicology Regional Laboratories**.

*They are located in Kerman, Kermanshah, Guilan, Khozestan, East Azarbaijan, Hamedan, Razavi Khorasan, Isfahan, Mazandran Provinces.*



## Level 3 of Forensic Toxicology Laboratories

- **Twenty (20)** laboratories in other provinces are designed in Level 3 for service at state level.





# Facilities of Forensic Toxicology Laboratories at a glance

- **No. of Technical Personnel:**

More than 230 persons

- **Academic degree and qualifications:**

PhD (Toxicology, Analytical Chemistry), PharmD, DLS, MSc (Toxicology, Chemistry), BS (Medical laboratory Sciences, Chemistry)

- **Analytical Instruments:**

UV-VIS, HPLC-DAD, HS-GC-FID, GC-NPD, GC-MS, LC-MS-MS, Polarograph, Breath Alcohol Analyzer

# Drugs and Poisons Testing

- **Drugs** (POM, OTC)
- **Abused Drugs** (Opioids, ATS)
- **Poisons** (Strychnine, Cyanide,...)
- **Alcohols** (Ethanol, Methanol, Isopropyl Alcohol, Ethylene glycol)
- **Pesticides** (OPs, Carbamates, OCs,...)
- **Toxic gases** (CO, H<sub>2</sub>S, PH<sub>3</sub>,...)
- **Heavy Metals** (As, Pb,...)

# Formula for Success in the LMO Forensic Toxicology Laboratory

- Standard Operating Protocols (SOPs)
- Safe and secure laboratories
- Trained Staff Personnel
- Quality control and quality assurance
- Continuous Educational Programs
- Research and Development (R&D)

# Clinical Toxicology Laboratories in Iran

- There are 5 dedicated Academic Clinical Toxicology Laboratories in Iran:
- *Tehran University of Medical Sciences*
- *Shahid Beheshti University of Medical Sciences*
- *Mashhad University of Medical Sciences*
- *Isfahan University of Medical Sciences*
- *Ilam University of Medical Sciences*

And there are many of drug abuse testing sections in private and governmental clinics and medical laboratories around the country.

# Analytical instruments in Academic Clinical Toxicology Laboratories in Iran

UV-VIS

HPLC-DAD, HPLC-UV

GC-FID

GC-MS

AAS

ELISA

FPIA



# Threats and Challenges

- Inappropriate geographical distribution
- Absence of National Reference laboratory in Clinical Toxicology
- Absence of national project plan for developing of the clinical toxicology laboratories
- Budget and financial support
- **Sanctions** and Toxicology Laboratories (Equipments, CRM, Reagents, Kits, Spare parts,....)

