



UNIVERSITY *of* TORONTO

**SickKids**<sup>®</sup>  
THE HOSPITAL FOR  
SICK CHILDREN

# *Electronic Apps and Medical Diagnostics Data Management*

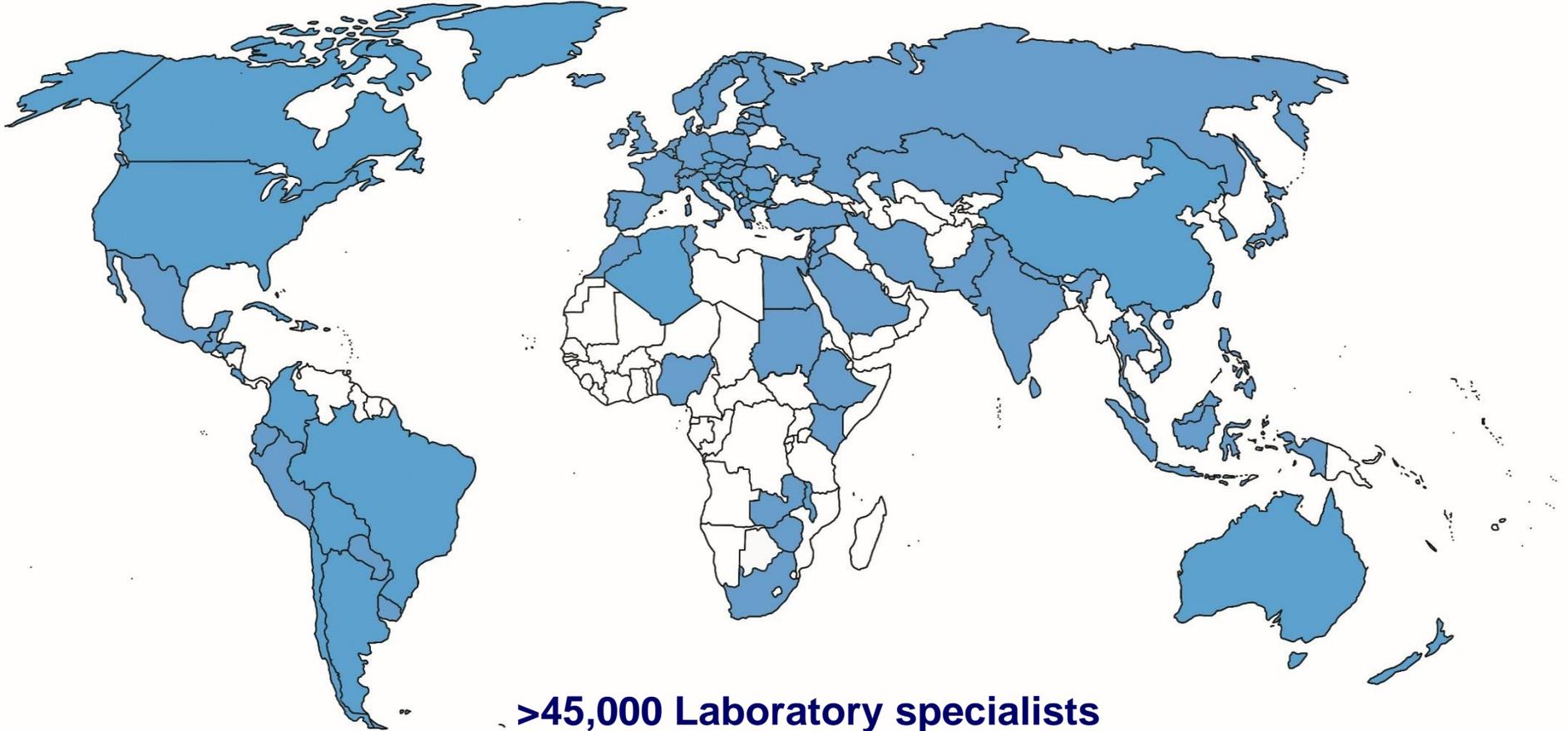
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Head, Clinical Biochemistry,  
The Hospital for Sick Children  
University of Toronto

IFCC President-Elect (2020-2023)  
Past Chair, IFCC Communications &  
Publications Committee (CPD)



# Advancing excellence in laboratory medicine for better healthcare worldwide



**>45,000 Laboratory specialists**  
**93 Full members & 11 Affiliates**

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## Communications and Publications

[CPD Committees](#)

[CPD Working Groups](#)

[IFCC Publications/Documents](#)

[News and Document Archive](#)

[CPD Minutes](#)

## IFCC - Communications and Publications Division (CPD)



**CDP - Executive Committee**

From left to right: **Eduardo Freggiaro**, CPD EC Secretary, Publication Coordinator; **Tahir Pillay**, CPD Chair; **Edgard Delvin**, Past C-PR Chair; **János Kappelmayer**, eJIFCC Editor; **Khosrow Adeli**, past CPD Chair; **Tricia Ravalico**, Corporate Representative; **Howard Morris**, IFCC President.

# CPD Publications & Media

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- IFCC **eNewsletter** Editor, Katherina Psarra (GR)
- IFCC **eJournal** Editor, János Kappelmayer (HU)
- IFCC **Website** Web-Editor, Janine Grant (AU)
- IFCC **App** Coordinator, Janine Grant (AU)
- IFCC **eAcademy** (CPD & EMD)
- IFCC **eNews Flash** Editor, Katherina Psarra (GR)
- **DiV** Editor, Maria del Carmen Pasquel (EC)
- IFCC **Social Media** Coordinator, Rojeet Shrestha (NP)



LinkedIn

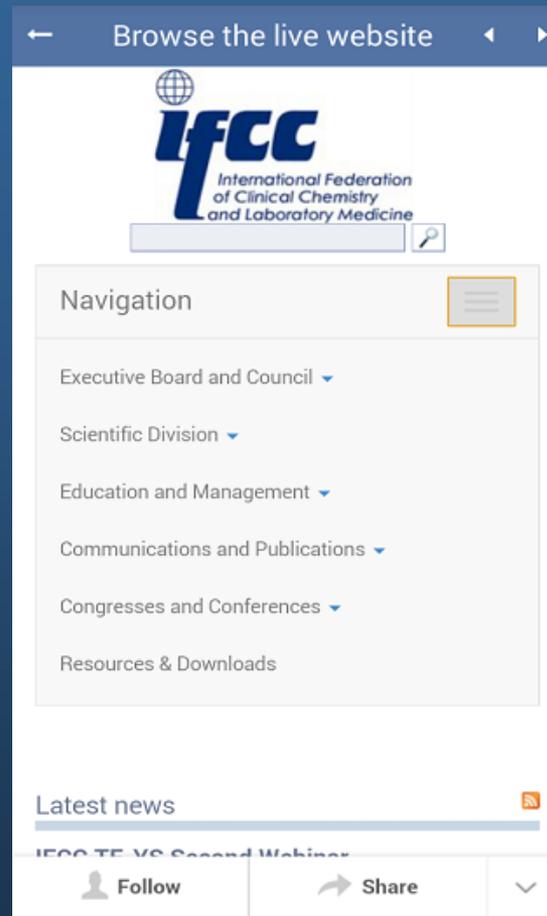


FaceBook



Twitter

# IFCC App



- Offers direct communication of IFCC news and projects
- Plans to release an improved and more interactive version in year 2019/2020



**IFCC**

International Federation  
of Clinical Chemistry  
and Laboratory Medicine

# Communication Strategies within and across the World of Laboratory Medicine



**A New Era of Medical Laboratory Diagnostics**

**Effectively Communicating Laboratory Patient Data**

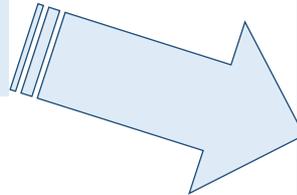
***Innovations in eCommunication Tools***

# New Vision for Laboratory Medicine

## *Changing Role in Delivery of Care*

### From:

- Specimen-centred Clinical testing
- Laboratory performance
- Provider of results

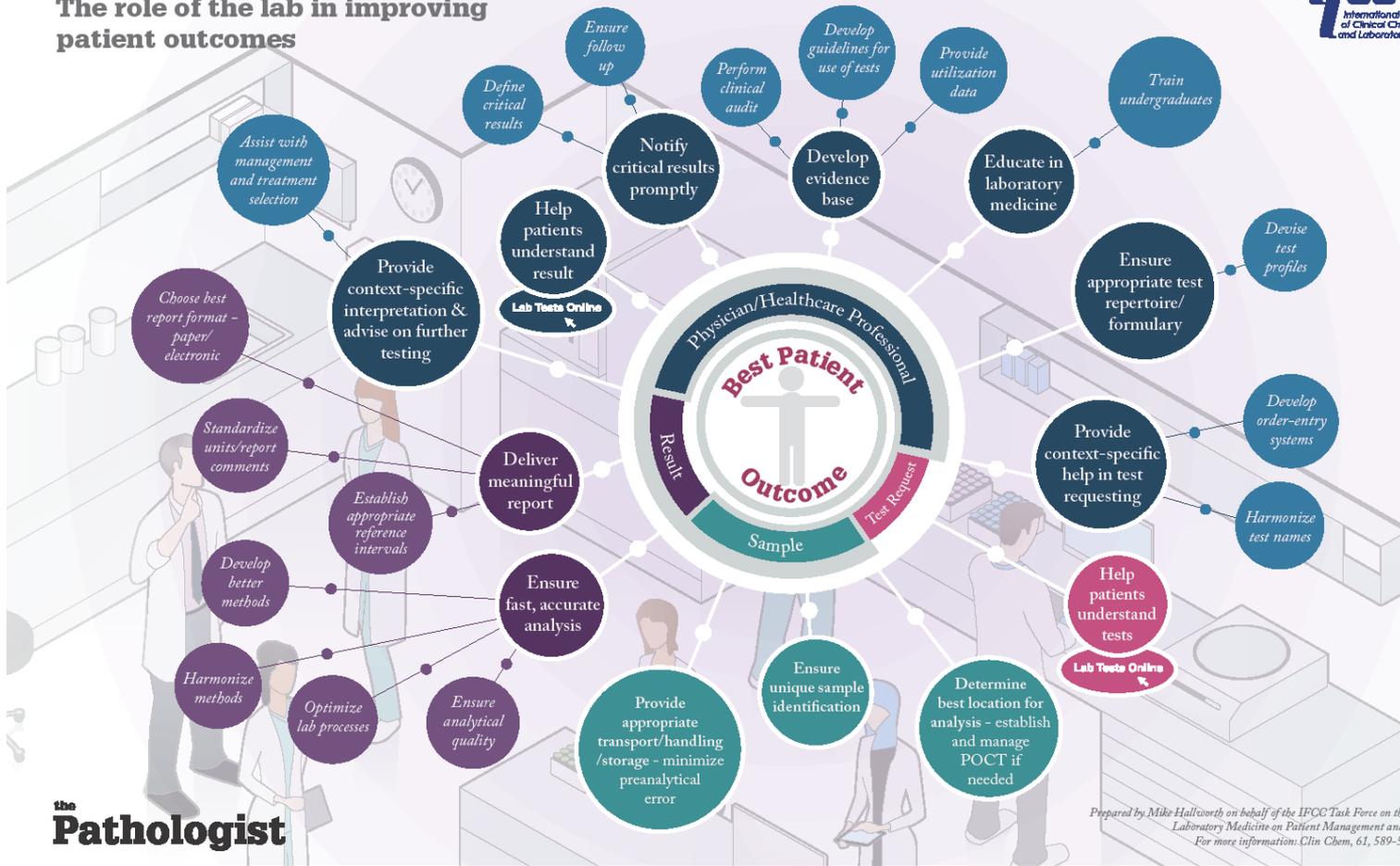


### To:

- Patient-centred clinical decision-making
- Patient outcomes
- Partner in care

# Patient-Centered Laboratory Medicine

## The role of the lab in improving patient outcomes



the **Pathologist**

Prepared by Mike Hallworth on behalf of the IFCC Task Force on the Impact of Laboratory Medicine on Patient Management and Outcomes. For more information: Clin Chem, 61, 589-599 (2015).

# Communication is Key!

## *CLSI Standard for Electronic Exchange of Data*

- The most important role of the clinical laboratory is to:
  - ❖ accurately perform diagnostic tests
  - ❖ generate reports of test results
  - ❖ communicate them clearly and quickly to clinical decision makers
- As the clinical laboratory becomes more highly automated, the process of ensuring communication **increases in complexity** and poses **more of a challenge**
- *Clinical and Laboratory Standards Institute (CLSI)* published a document titled:

*Laboratory Automation: Communications With Automated Clinical Laboratory Systems, Instruments, Devices, and Information Systems; Approved Standard—Second Edition (AUTO03-A2)*

# Communication is Key!

## *Digital Communication & Medical Dx Data Management*

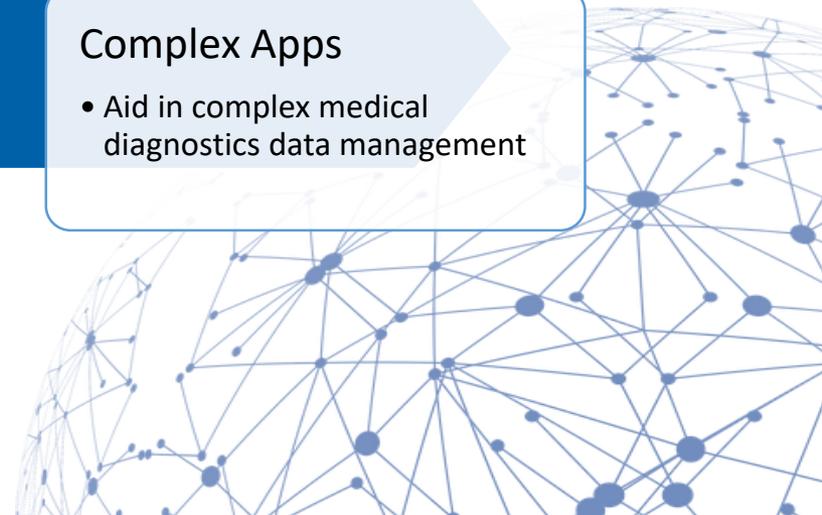
- Indeed, *laboratory medicine is a domain which offers a unique opportunity to analyze extremely large, rich and complex datasets of information concerning medical laboratory test results*
- In recent years, an increasing number of web-based and mobile applications has been developed to improve access to laboratory test information and test result interpretation – **Increasingly AI Powered**

### Simple Apps

- Provide reference lab value information

### Complex Apps

- Aid in complex medical diagnostics data management



# eApps for Medical Data Management



UpToDate



mobile  
MedRecords



Figure 1



AirStrip  
ONE



Hepaxpert



PEPID



Anesthesia  
Central



MD Series:  
Anemia



VisualDx  
(image recognition)



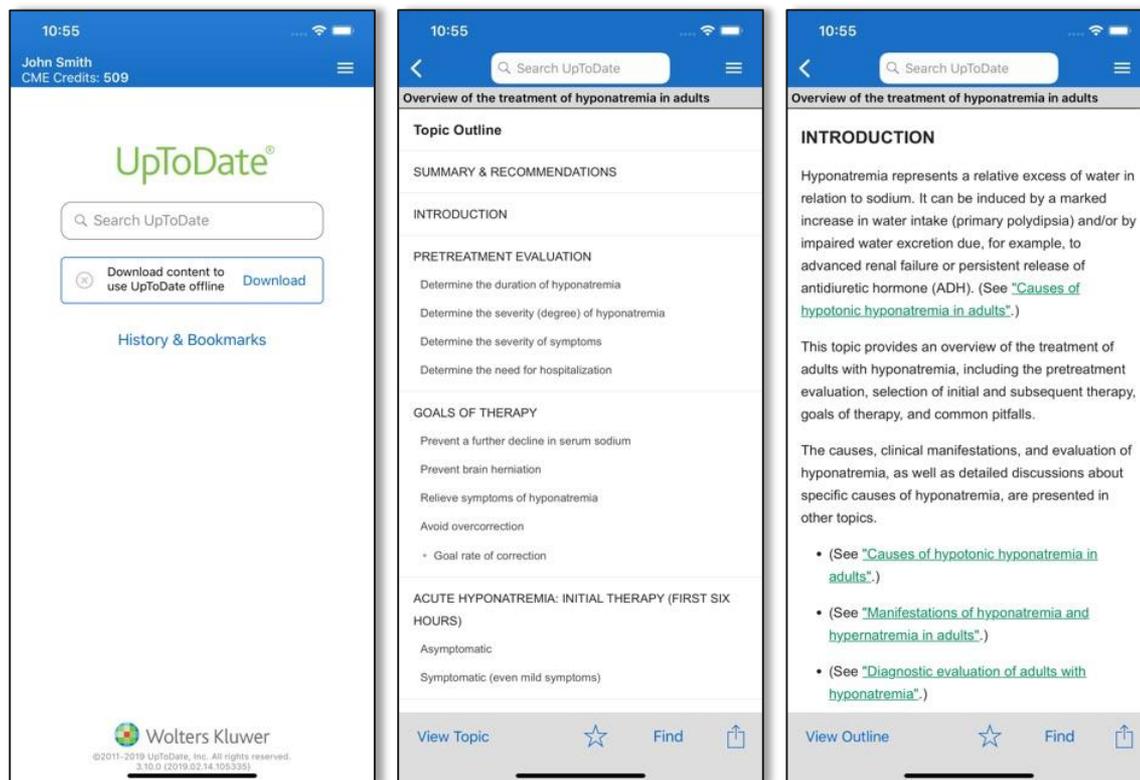
eGFR  
Calculator



MD Series:  
AKI  
(acute kidney injury)

# UpToDate Clinical Support Resource

- UpToDate is the leading clinical decision support resource with evidence-based clinical information – including drug topics and recommendations that clinicians rely on at the point of care.
- Over **80 research studies** suggesting that widespread usage of UpToDate is associated with improved patient care and hospital performance



# *UpToDate Clinical Support Resource*

- More than **37,800 hospitals and institutions** worldwide use UpToDate
- In 2011, researchers at Harvard University published a study which concluded that the use of UpToDate over a three year period was associated with:
  - ❖ Improved quality of every condition on the Hospital Quality Alliance Metrics
  - ❖ Shorter lengths of stay (372,000 hospital days saved per year)
  - ❖ Lower mortality rates (saving 11,500 lives per three year period)



# MedRecords

- mobile-MedRecords(mMR) manages, stores and displays entire clinical information of patients in real time at the point of care.
- mMR helps enhance patient care process with point-of-care access to end-to-end patient records – from a variety of backend data sources.

My Patients

Search
Refresh
Sort By Ward
My Patients
My Favorite
Logout
<b>A</b>
<b>Anil Garg (Male)48</b> IHDH12I14007 Private Ward : PW1/13 A known case of DM with Hypertension with Right thalamic Bleed
<b>Anoop Bhandarkar (Male)42</b> IHDH12I14002 Private Ward : PW1/8 A case of Osteoarthritis right hip joint secondary to AVN of femoral head with 2 cm
<b>P</b>
<b>Pooja Shrivastava (Female)25</b> IHDH12H29001 Private Ward : PW1/10
<b>Priya Rao (Female)26</b> IHDH12H29003 May 20 2012 11:20 Private Ward : PW1/7 A known case of limited cutaneous systemic sclerosis.

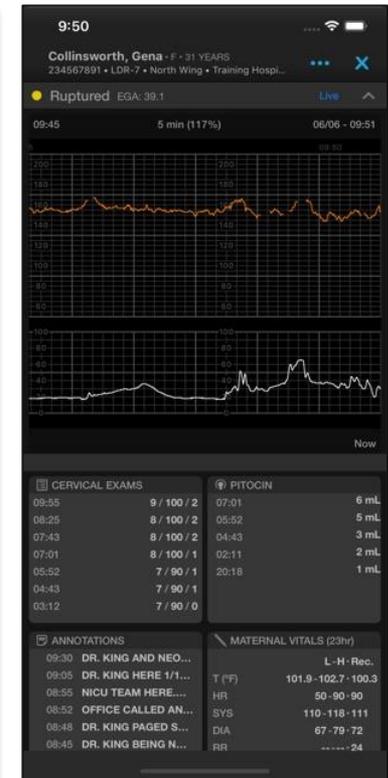
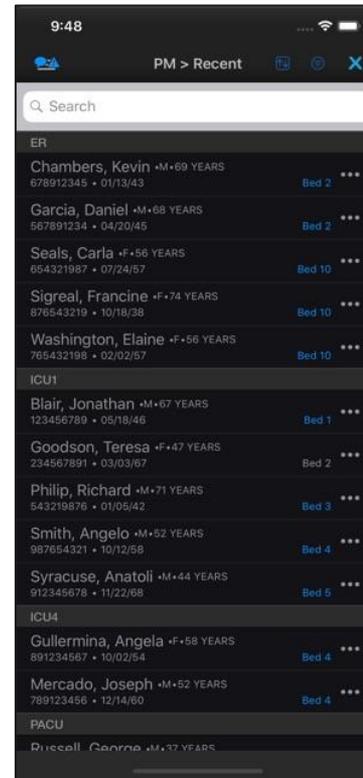
mMR - Anil Garg Laboratory Test Result

Test Name	Value	Normal Range	Units	Status
BASOPHILS	1	00-01	%	NORMAL
BASOPHILS	11	00-01	%	ABNORMAL
EOSINOPHILS	05	01-06	%	NORMAL
EOSINOPHILS	7	01-06	%	ABNORMAL
HAEMOGLOBIN	12	12-16	g/dl	NORMAL
HAEMOGLOBIN	23	12-16	g/dl	ABNORMAL
LYMPHOCYTES	10	20-45	%	ABNORMAL
LYMPHOCYTES	20	20-45	%	NORMAL
M.C.H	24	27-32	pg	ABNORMAL

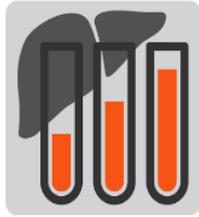


# AirStrip ONE

- AirStrip ONE shatters barriers between disparate data sources from multiple vendors, bringing all live relevant data to the clinician's mobile device to provide a more **complete picture of patient health**
- Customizes the user experience to each clinician's specialty, usage patterns, workflows, and visual preferences,
- Safeguards privacy with secure transfer and presentation of patient data, removing uncertainty around security and regulatory compliance



*Cleared to use as a diagnostic aid!*



# Hepaxpert

- It is a quick and easy way to get interpretive texts for hepatitis A, B, and C serology test results
- A total of **61.520 hepatitis test result** combinations are possible (most of them for hepatitis B)
- Hepaxpert's automatically generated interpretive reports include a detailed analysis with regard to virus exposure, immunity, stage of illness, prognosis, and infectiousness.

11:10 Hepaxpert

Hepatitis A Serology

anti-HAV	POS	NEG	BDL	N/A
IgM anti-HAV	POS	NEG	BDL	N/A
HAV-RNA	POS	NEG	BDL	N/A

Hepatitis B Serology

HBsAg	POS	NEG	BDL	N/A
anti-HBs	POS	NEG	BDL	N/A
anti-HBc	POS	NEG	BDL	N/A
IgM anti-HBc	POS	NEG	BDL	N/A
HBeAg	POS	NEG	BDL	N/A

Interpretation

11:10 Results

Disclaimer of Liability

Hepatitis A Serology

anti-HAV IgM anti-HAV HAV-RNA

Positive evidence of IgM anti-HAV antibodies indicates a recent hepatitis A virus infection. Its picture may be that of acute icteric or anicteric hepatitis A or of a subclinical disease. As the IgM antibodies can persist up to a period of about 8 months, the patient could also be in a stage of convalescence from acute hepatitis A.

Hepatitis B Serology

HBsAg anti-HBs anti-HBc IgM anti-HBc

HBeAg anti-HBe anti-HBs titre

The positive result for anti-HBc antibody indicates that there has been contact with the hepatitis virus B. If the results for HBs-antigen are negative, one of the following three possibilities may apply: (a) naturally acquired immunity to the hepatitis virus B, (b) the so-called 's-window', that is the stage of HBs-seroconversion in the course of acute hepatitis B, or

Back New Input

*Find suggestions for further testing!*

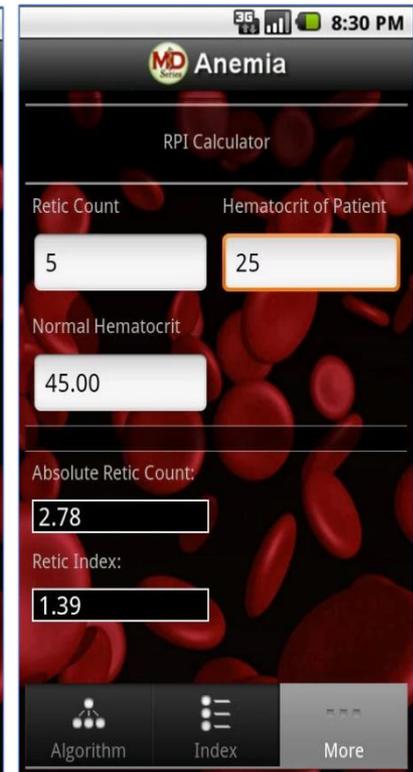
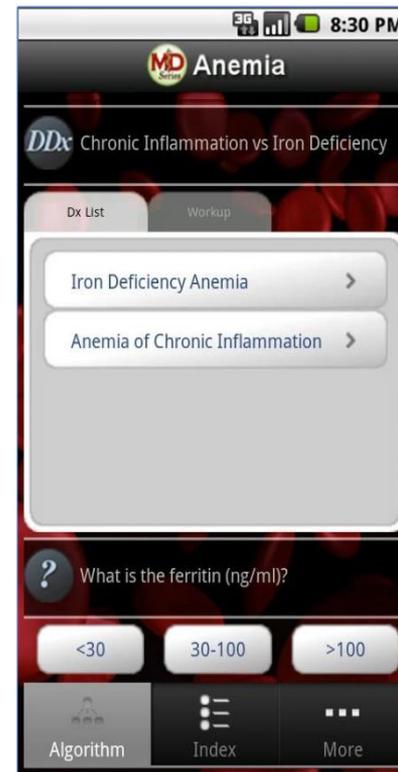


# MD Series Anemia

Allows the user to approach anemia, one of the most common hospital diagnoses through point of view of a hematologist

Effectively start the anemia workup before a hematology consult

- *Algorithm delineating over 35 causes of anemia*
- Index, both alphabetical and by red cell morphology
- Reticulocyte Production Index (RPI) Calculator
- Unique RPI Estimate for rapid use of the algorithm
- Descriptions of corresponding peripheral blood smears

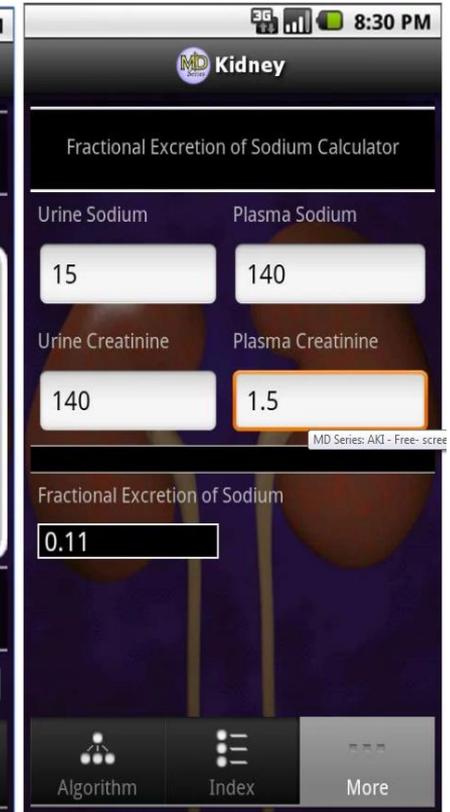
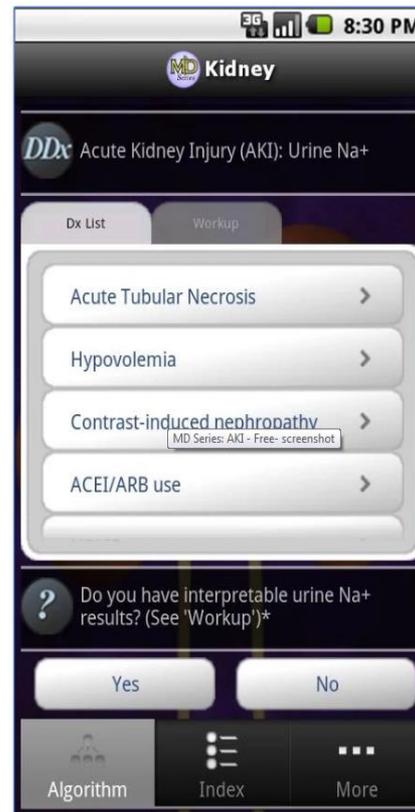




# MD Series: AKI

(acute kidney injury)

- Allows the user to approach AKI, one of the most common hospital diagnoses, through the point-of-view of a nephrologist  
*Effectively start the AKI workup prior to ordering a nephrology consult*
- Algorithm delineating over 40 causes of AKI
- Index, both alphabetical and by area of damage
- Fractional Excretion of Sodium (FENa) Calculator
- Descriptions of urine microscopy<sup>[SEP]</sup> corresponding to the many diagnoses
- Examples of typical patients encountered



# Artificial Intelligence

## *AI Powered Diagnostic Tools*

- AI methods show promise for **multiple roles** in healthcare.
- AI-powered diagnostic apps are being rapidly developed to improve diagnostic power
- Potential to **infer and alert patients** and their physicians about hidden risks of potential adverse outcomes, selectively guiding attention, care, and interventional programs and reducing errors in hospitals
- Basic diagnosis of common ailments will **profoundly relieve pressure** on healthcare services for more common problems.

***“Sleeping Giant in Healthcare”***

*(Eric Horvitz, PhD, Director of Microsoft Research Labs)*

# Artificial Intelligence

## *AI Powered Diagnostic Tools*

- **WebMD:** one of the most famous symptom-checkers on the net. It is used by millions of people every day and now has an app to further extend its reach.
- **ADA the AI Doctor:** ADA is an AI-powered doctor application that has been in the making for over 6 years. It was developed by a London and Berlin-based health care startup that hopes relieve pressure on healthcare professionals.
- **Babylon Health App:** Babylon Health is another virtual AI-powered Doctor app. This and similar apps are beginning to make waves in the healthcare industry.

The logo for WebMD, featuring the word "Web" in a blue script font and "MD" in a bold, black sans-serif font.

Hi, I'm Ada.  
I can help if you're  
feeling unwell.



# eApps for Laboratory Diagnostics



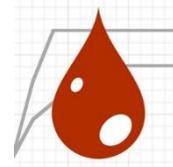
Davis's Lab &  
Diagnostic Tests



MolPath



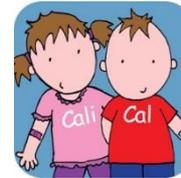
OPKO Lab Mobile



BiliApp



Lab Values+



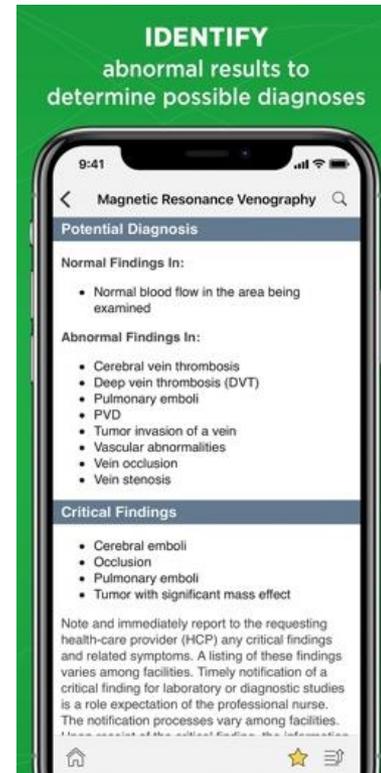
CALIPER App

...and many more!



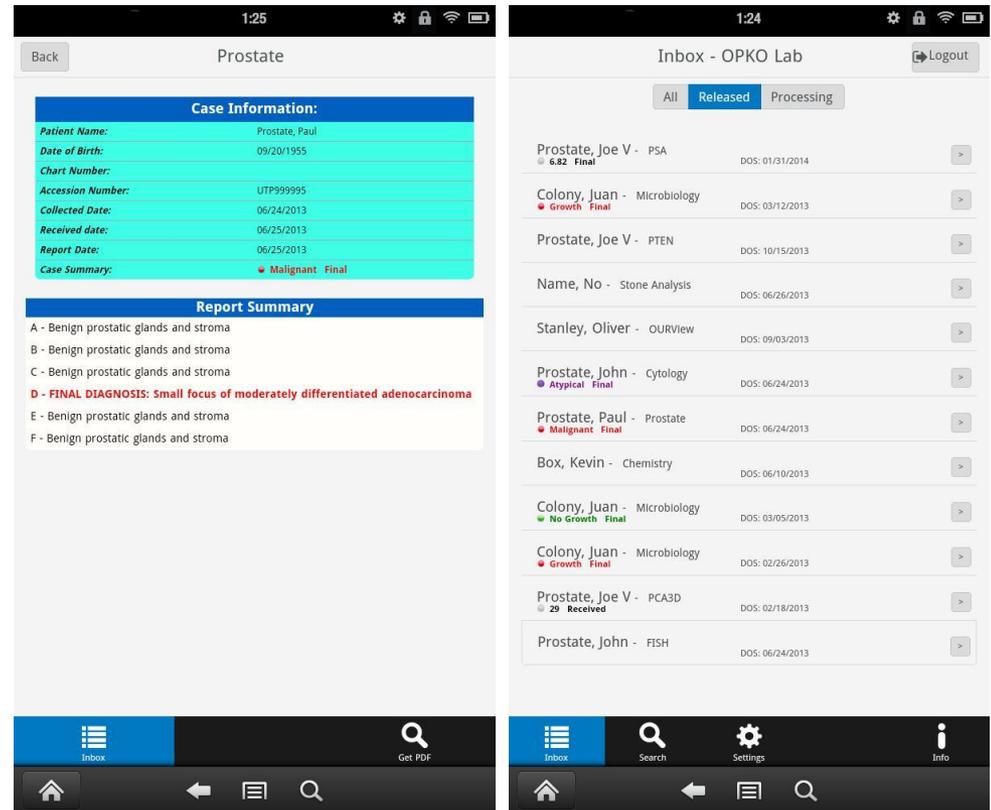
# Davis's Lab & Diagnostic Tests

- Contains **100s** of diagnostic test descriptions to help understand and implement critical test procedures
- Each entry delivers details on test function, accurately interpreting normal and abnormal results, and preparing your patients
- Includes recommendations on pretest requirements, intratest procedures, and post-test care



# OPKO Lab Mobile

- OPKO Lab Mobile lets clinicians securely review pathology & laboratory reports anywhere, anytime.
- OPKO Lab Mobile checks for new reports and makes them available on their Android phones and tablets for viewing.
- OPKO Lab Mobile also displays a list of pending laboratory tests.





# MolPath Lab Mobile

- Designed to improve patient care by increasing the ease and speed of clinical molecular tests including RAS, BRAF, ALK, EGFR, HER2 etc.
- MolPath saves time and is convenient for oncologists, pathologists etc.
- Tests can be requested from any location

New Request

Patient Initials

← Scan or Enter MRN

Test

Site

Diagnosis

← Scan or Enter Pathology

Lab (to receive request)

Comment

NHS request

CANCEL SAVE

Tests

ALK

BRAF

C-KIT

EGFR

Her2

MMR and MSI  
MMR and MSI (irrespective of MMR...)

MMR or MSI

MolPath - screens

# Medical Apps for Reference Lab Values

❖ MEDREF

❖ LAB TESTS

❖ POCKET LAB VALUES

❖ NORMAL LAB VALUES

❖ CALIPER WEB APP

❖ CALIPER MOBILE APP

# eApps & Medical Diagnostics

## Data Management

The “eLab” developed by Tru-Solutions Inc. is a comprehensive medical diagnostic center and lab management software that provides a user friendly interface and access control.

- Linked iMedDx.com to allow flexible patient search and selection
- Includes an eLab Dashboard on mobile/tablet, allowing patients and labs/hospitals access their reports online.

The Davis’s Laboratory & Diagnostic Tests medical app provides another useful app with a wide-breadth of tests, as well as guidance on how to counsel and collect tests.

- Geared towards those responsible for obtaining laboratory tests
- Available on multiple platforms including the iPhone/iPad, Android and Blackberry.

The “LabGear” is another medical lab reference app providing a pocket tool for medical laboratory test

- Integrated with MedCalc with normal lab value reference information.
- Over 200+ lab tests

# CALIPER Web App

The CALIPER App has been developed for laboratory specialists, paediatricians, family physicians, other healthcare workers

*www.caliperdatabase.ca*

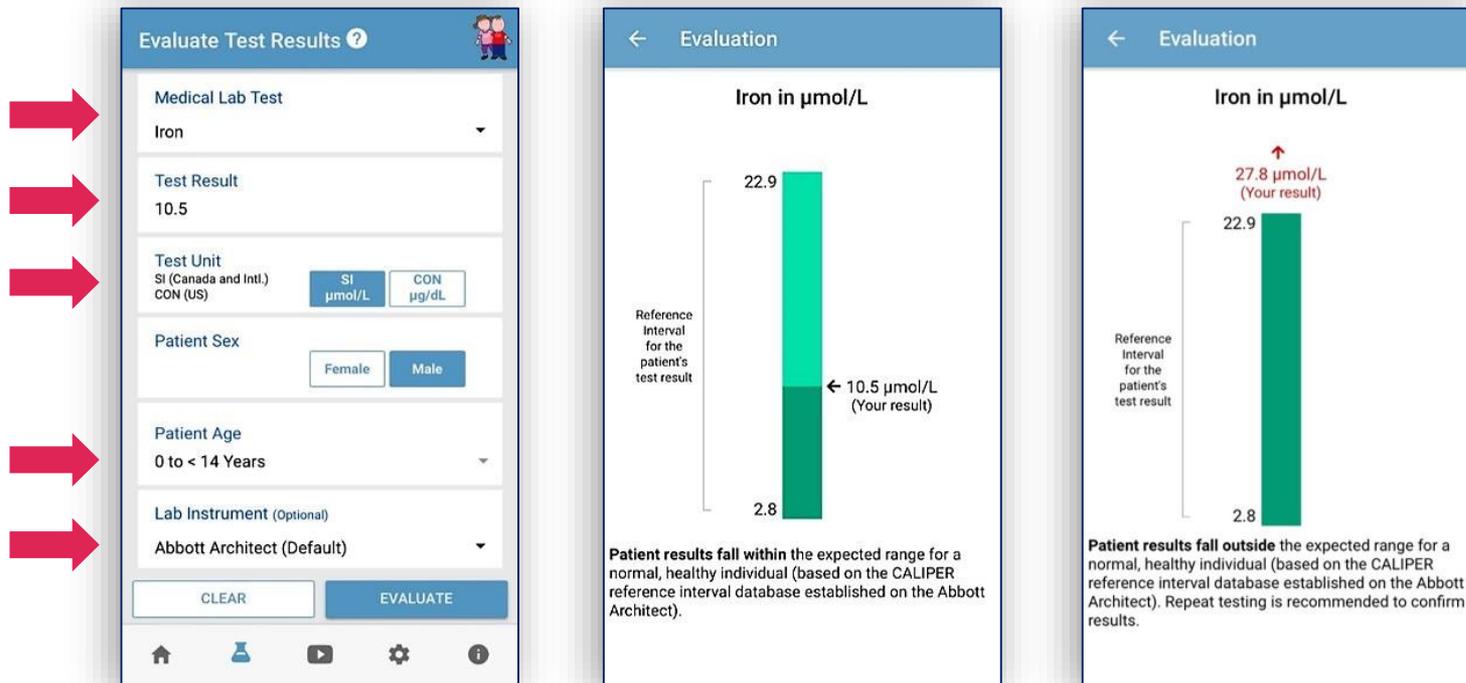
A user friendly and easy tool to view latest reference value database developed based on thousands of healthy children and adolescents.



Full Tables of Age- and Gender-Specific Reference Intervals

# CALIPER Mobile App

Available on Apple Store and Google Play



Targeted to community pediatricians and healthcare workers to facilitate easy access to CALIPER database

# Regulatory & Safety Considerations

## The regulation of mobile medical applications

Ali Kemal Yetisen,<sup>\*a</sup> J. L. Martinez-Hurtado,<sup>a</sup> Fernando da Cruz Vasconcelos,<sup>a</sup>  
M. C. Emre Simsekler,<sup>b</sup> Muhammad Safwan Akram<sup>a</sup> and Christopher R. Lowe<sup>a</sup>



Clinical Decision Support  
in the Era of Artificial Intelligence



mHealth and Mobile Medical Apps: A Framework to Assess Risk  
and Promote Safer Use

Health-related smartphone apps:  
regulations, safety, privacy and  
quality



FDA Regulation of Mobile Medical Apps

Smartphone apps in microbiology—is  
better regulation required?

COMMENTARY

Open Access

'Trust but verify' – five approaches to  
ensure safe medical apps



# The Future is Here!

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*An explosion of new Web-based and Mobile eApps* allow communication of laboratory diagnostic data to healthcare professionals and patients

Allow *ready integration of laboratory data with other medical data records* to increase clinical effectiveness and improve diagnostic speed and accuracy

*Unlimited applications in delivery of laboratory medicine* and clinical laboratory diagnostics

спасибо  
danke 謝謝  
ngiyabonga  
teşekkür ederim  
dank je  
gracias  
tapadh leat  
bedankt  
hvala  
mauruuru  
thank you  
mochchakkeram  
dziękuje  
sagolun  
sukriya  
kop khun krap  
go raibh maith agat  
arigatō  
takk  
dakujem  
merci  
obrigado  
terima kasih  
ευχαριστώ  
merci  
감사합니다