Eighth Eurosurveillance Scientific Seminar

Infectious Disease POC Testing:
Ready or Not, Here It Comes

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University of Toronto, Toronto, Canada

November 27, 2019

Industry Disclosures 2014-2019

- **Advisory Board/Consultant**
  - Merck
  - Verity
  - Cipher
  - Paladin Labs
- **Research Support**
  - Accelerate Diagnostics
  - bioMérieux
  - Bio-Rad
- **Honorarium**
  - Merck
- **Travel Reimbursement**
  - Merck
  - Copan

None of these industry disclosures relate to point-of-care devices

Objectives

By the end of this session, you should be able to:

1. Describe the **role of infectious disease POC testing** along with predicted benefits
2. Illustrate **quality and ethical challenges** regarding the use of infectious disease POC tests
3. List **guidance documents** regarding the use of infectious disease POC to assure quality results

in Microbiology

NEW TECHNOLOGIES

1. Automation and Smart Incubation
2. Rapid Microbial Identification
3. Rapid Antimicrobial Susceptibility Testing
4. Automated Random Access Syndromic Assays
5. Point-of-Care Testing

in Microbiology

BEFORE: 8-4pm LAB

NOW: 24/7 LAB

NOW/FUTURE: 24/7 LAB & POC

POC Testing Definition

1. Medical diagnostic testing at or near the **point of care**—that is, **at the time and place of patient care.**
2. **POC laboratories** set up in remote regions to facilitate access to testing.

POC Testing – Current State

- Previously lateral flow immunoassay based
- Now nucleic acid amplification based assays
- Many available but primarily target:

  1. GAS 2. Influenza 3. HIV 4. Hepatitis C
- Performed in clinics, emergency departments, ICUs, some pharmacies
- Primarily performed by physicians as well as pharmacists, nurses

TABLE 1 Examples of CLIA-waived tests for infectious diseases[a]

Disease or pathogen	Principle	Measurand	No. of tests[b]
Group A *Streptococcus* (GAS)	LFIA	GAS antigen	79
	Molecular	Bacterial DNA	2
Infectious mononucleosis	LFIA	Heterophile antibodies	44
Helicobacter pylori	LFIA	IgG antibodies to *H. pylori*	35
	Biochemical[c]	Urease enzyme activity	7
	LFIA	*H. pylori* antigen	1
Influenza types A and B	LFIA	Influenza type A and B antigens	12
	Molecular	Viral RNA	2
	Biochemical	Neuraminidase enzyme activity	1
Respiratory syncytial virus	LFIA	Respiratory syncytial virus antigen	9
HIV-1 and HIV-2	LFIA	Antibodies to HIV-1/2	4
	LFIA	HIV-1 antigen, antibodies to HIV-1/2	1
HIV-1	LFIA	Antibodies to HIV-1	4
Influenza type A	LFIA	Influenza type A antigen	4
Influenza type B	LFIA	Influenza type B antigen	4
Urinary tract infections[d]	Biochemical	Catalase enzyme activity	2
Influenza A/B and RSV	Molecular	Viral RNA	2
Trichomonas vaginalis	LFIA	*T. vaginalis* antigen	2
Adenovirus	LFIA	Adenoviral antigen	2
Borrelia burgdorferi (Lyme disease)	LFIA	IgG and IgM antibodies to *B. burgdorferi*	1
Treponema pallidum (syphilis)	LFIA	Antibodies to *T. pallidum*	1
Hepatitis C virus	LFIA	Antibodies to hepatitis C virus	1
Gardnerella vaginalis, *Bacteroides* spp., *Prevotella* spp., and *Mobiluncus* spp.	Biochemical	Sialidase enzyme activity	1

Kozel et al. JCM 2017;(8):2313-20.

POC Testing Regulations

- **US FDA:**
  - Categorizes in vitro diagnostics (IVD) tests by their complexity
    - CLIA-Waived*
    - Moderate complexity
    - High complexity

* insignificant risk of an erroneous result:
  - Methods so simple & accurate that chance of erroneous result negligible
  - No unreasonable risk of harm to the patient if performed incorrectly

@POINT of CARE™

Lateral Flow Immunoassay with optical reader (results in 5 min)

Lateral Flow Immunoassay (results in 20 min)

OraQuick ADVANCE® Rapid Antibody Test HIV-1/2

OraQuick® Rapid Antibody Test HCV

NEAR* based

(results in <15 min)

(*Nicking Enzyme Amplification Reaction)

Alere i, Abbott

PCR based

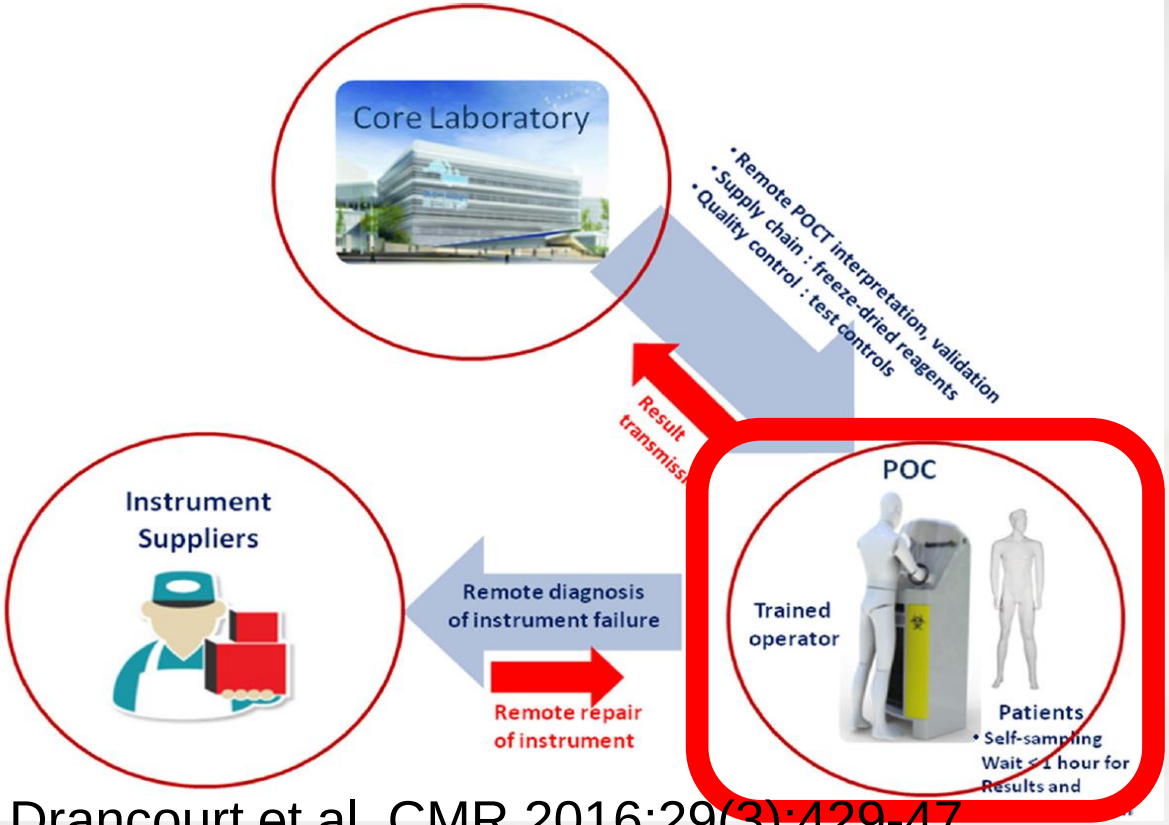
(results in ~20 min)

cobas Liat System, Roche

POC Testing – Future State

1. **Increased menu to include more targets**
   - NAAT based technologies
   - Novel methodologies
2. **Focus on syndromic testing**
   - Performed in increasing numbers of clinics, emergency departments, ICUs, pharmacies
   - Performed by physicians, pharmacists, nurses, other health care providers, patients

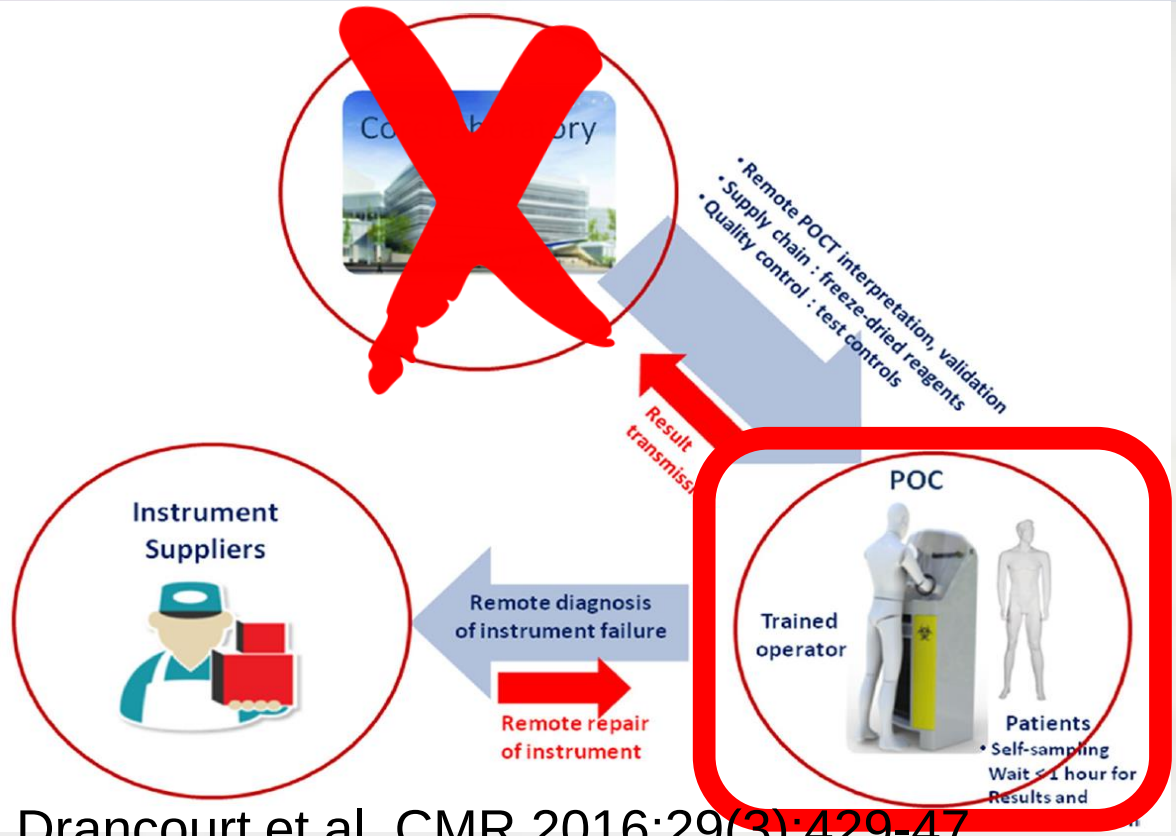
POC Testing – Future State



- Increasing use of POC

Drancourt et al. CMR 2016;29(3):429-47

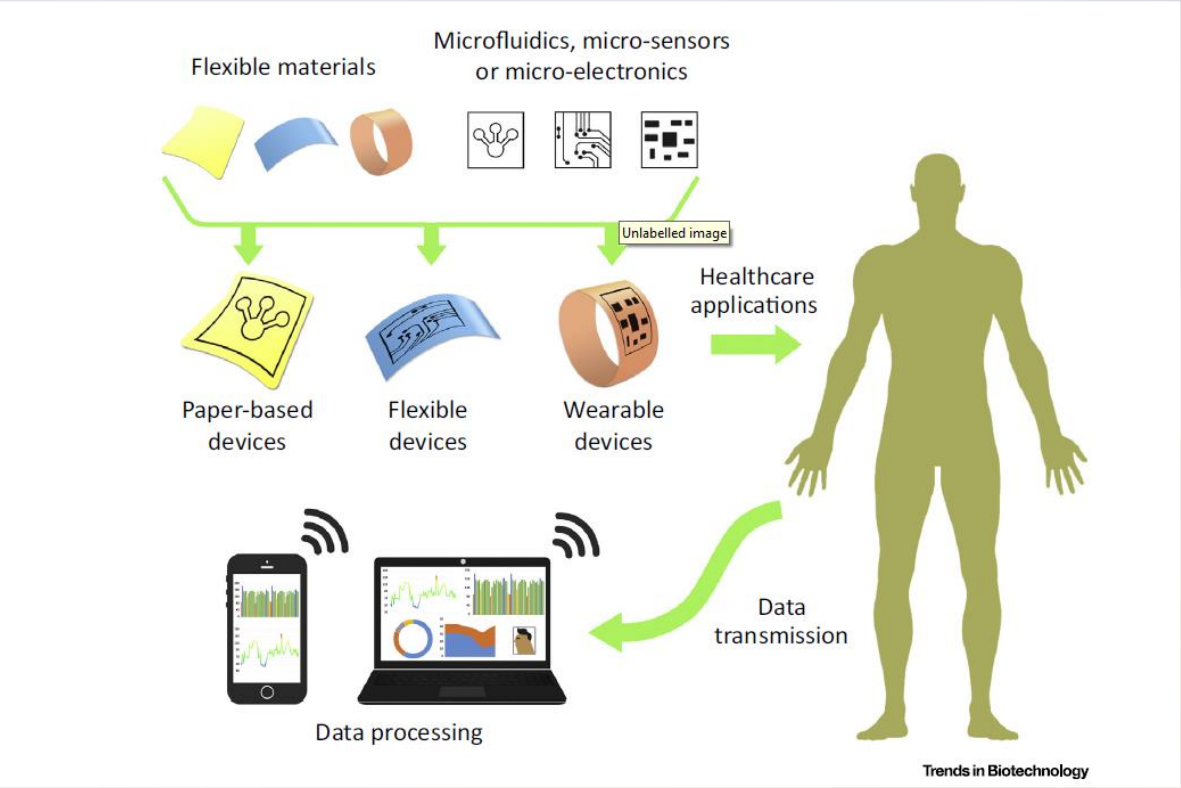
POC Testing – Future State



- Increasing use of POC
- Reducing role of laboratory “proper’

Drancourt et al. CMR 2016;29(3):429-47

POC Testing – Future State



- Increasing use of wearable POC with real-time data analysis & artificial intelligence

Wang et al. Trends in Biotechnology 2016;34(11):909-921

Motivators – Predicted Benefits

- Reduced turn-around-times
- Accessibility
- Presumed improved outcomes

Motivators – Predicted Benefits

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Clinical Impact of Rapid Point-of-Care PCR Influenza Testing in an Urgent Care Setting: a Single-Center Study

Robert C. Benirschke,[a,b] Erin McElvania,[a] Richard B. Thomson, Jr.,[a,b] Karen L. Kaul,[a,b] Sanchita Das[a,b]

- POC flu A/B 20min POC (Liat) was associated with:
  - ↑ antiviral use for those with influenza (92 vs 70%) (P<0.05)
  - ↓ antiviral use in those without influenza (2 vs 25%) (P<0.005)

Benirschke et al. JCM 2019:57(3):e01281-18

Challenges – Quality Management

- Device Selection
- Facilities
- Purchasing/Inventory
- Test Verification
- Operators
- Training
- Competency
- Documentation
- Quality Assurance
- Biosafety
- Critical Result Reporting
- **Public Health Reporting**
  - ➢Enforcement
  - ➢Oversight

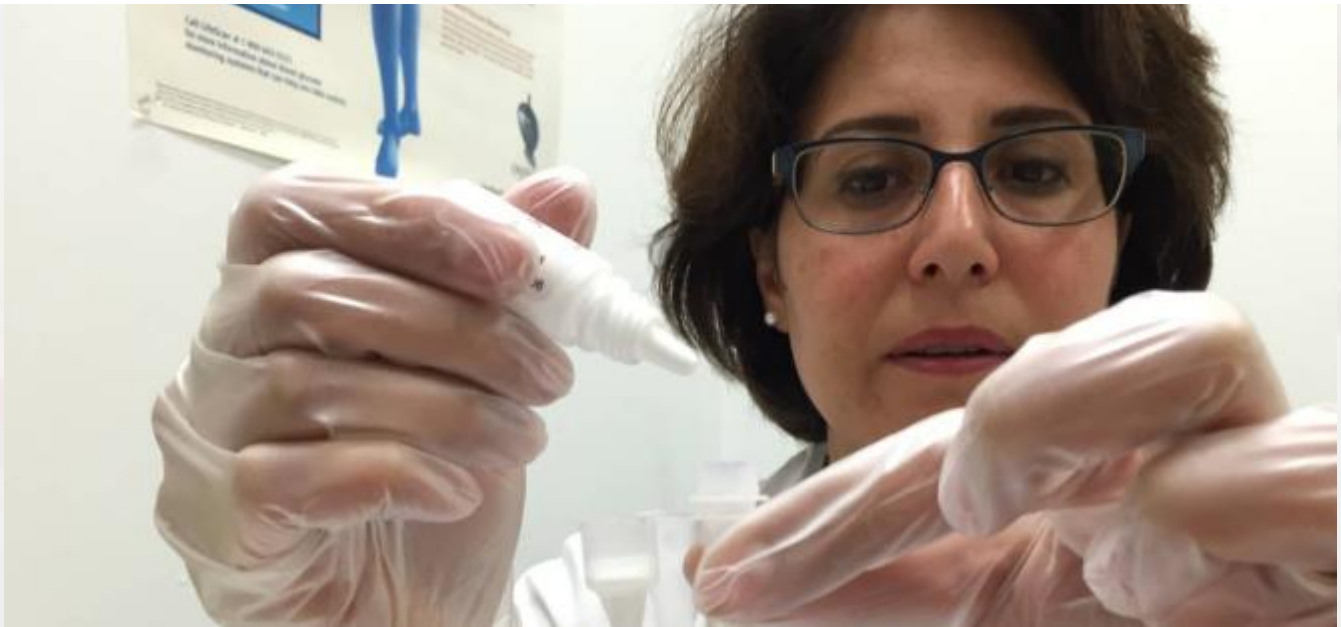
Challenges – Ethics

- Ethics – potential for for-profit motivation (pharmacists, physicians)

news · Posted: Aug 15, 2016 5:00 AM MT | Last Updated: August 15, 2016

On-the-spot strep throat tests offered at some Shoppers Drug Mart pharmacies

Some experts worry about accuracy of swabs, available in Alberta, B.C. and Nova Scotia



Health

Pharmacies want to give $15 strep throat tests – but pediatricians say they're not accurate enough for kids

Medical guidelines say rapid point-of-care tests shouldn't be used to rule out strep in children

November 13, 2018

AMERICAN SOCIETY FOR MICROBIOLOGY | Journal of Clinical Microbiology®

Comparison of the Alere i Strep A Test and the BD Veritor System in the Detection of Group A *Streptococcus* and the Hypothetical Impact of Results on Antibiotic Utilization

Gregory J. Berry,[a]* Catherine R. Miller,[a] Mariana Moreno Prats,[a] Christopher Marquez,[a] Olajumoke O. Oladipo,[a]* Michael J. Loeffelholz,[a] John R. Petersen[a]

[a]Department of Pathology, University of Texas Medical Branch, Galveston, Texas, USA

- **BD Veritor System (lateral flow immunoassay):**

  Sn = 76.2%; Sp = 93.6%

Berry et al. J. Clin Micro 2018;56(3): e01310-17

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[a]Department of Pathology, University of Texas Medical Branch, Galveston, Texas, USA

- **BD Veritor System (lateral flow immunoassay):**

  Sn = 76.2%; Sp = 93.6%

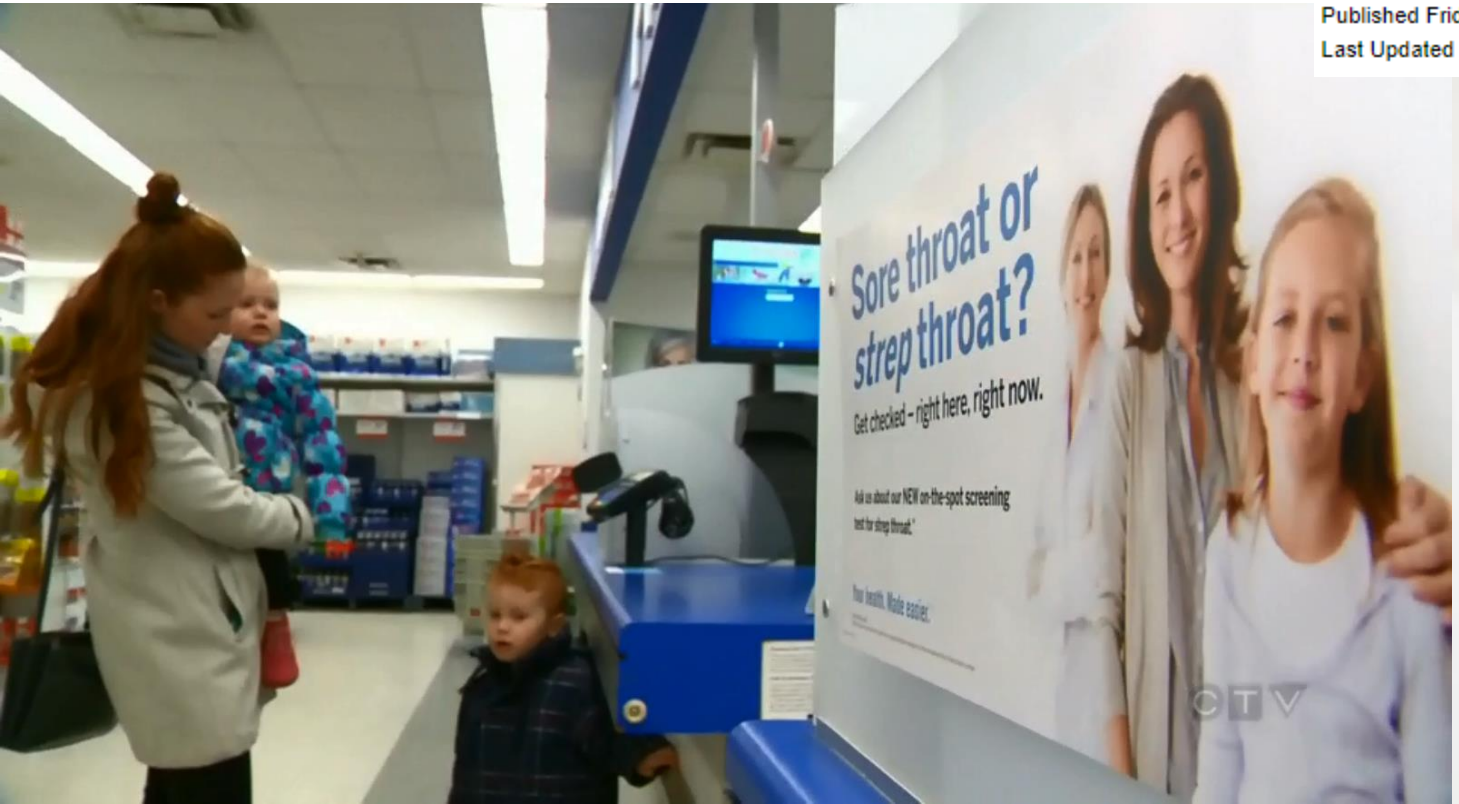
- **Alere i Strep A Test (NEAR):**

  Sn = 100 %; Sp = 91.3%

Berry et al. J. Clin Micro 2018;56(3): e01310-17

Convenience, at a cost? Pharmacies offering tests and treatment for strep, flu

CTVNews.ca Staff
Published Friday, December 2, 2016 10:00PM EST
Last Updated Monday, December 5, 2016 10:07AM EST



Convenience, at a cost? Pharmacies offering tests and treatment for strep, flu

Convenience, at a cost? Pharmacies offering tests and treatment for strep, flu

Chapter 3

Section
3.07

Ministry of Health and Long-Term Care

Laboratory Services in the Health Sector

Auditor General Report, Ontario, Dec 2017

Multiple Concerns Noted Based on 2015/2016 Data:

1. **Limited Investigation of Large In-Office Lab Test Volumes and Billings by MDs**
   - POC tests make up 4% of all laboratory testing
   - 50% of POC tests are ordered by <1% physicians
   - 15 highest billers billed $600,000 to $1.4 million CDN on 75,000 to 182,000 tests
     (average physician billed $4,700 CDN for 600 tests)

Auditor General Report, Ontario, Dec 2017

Multiple Concerns Noted Based on 2015/2016 Data:

2. No Licensing and Quality Management of Physicians' In-Office Lab Testing

- Noted in previous audits in 1995 and 2005 but the government has not taken action

Auditor General Report, Ontario, Dec 2017

POC Accreditation Requirements

IQMH ISO15189 Plus POC Testing Accreditation Requirements (2017)

POC Guidance

MINISTRY OF HEALTH AND LONG-TERM CARE

Point-of-Care Testing Policy

The policy applies to:

1. hospitals with a licensed laboratory,
2. hospitals without a licensed laboratory,
3. long-term care homes.

The policy is supplemented by a **POCT Guidance Document** specific to each type of facility.

Oversight must be completed by laboratory personnel.

MOHLTC POC Testing Policy, 2007

POC Guidance

Contents lists available at ScienceDirect

Clinical Biochemistry

journal homepage: www.elsevier.com/locate/clinbiochem

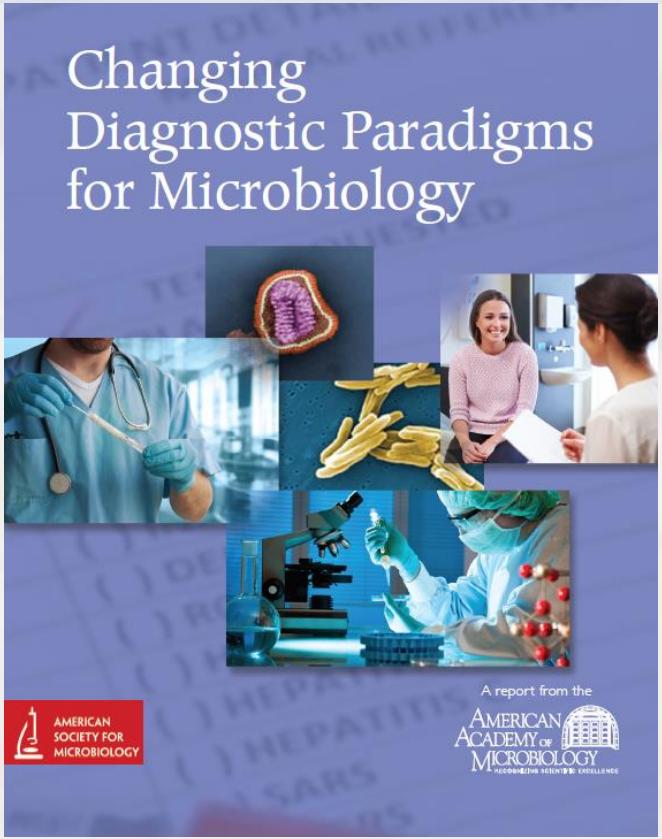
Review

Point-of-care testing: A position statement from the Canadian Society of Clinical Chemists

P.M. Yip[a], A.A. Venner[b], J. Shea[c], A. Fuezery[d], Y. Huang[e], L. Massicotte[f], N. Tetreault[g], C. Tomalty[h], J.L.V. Shaw[i,*]

Yip et al. Clin Biochemistry 2018;53:156-9.

POC Guidance



American Academy of Microbiology Report on POC Microbiology, 2017

POC Guidance

CM

OS147 **11:30 – 12:30** **Hall R**

1-Hour Oral Session

Workflow optimization: methodologies and applications

Chairs *Harald Seifert (Cologne, Germany),*
François Vandenesch (Lyon, France)

O0731 **11:30** **National guidelines for implementation of point of care testing for infectious diseases in Denmark**

G. Lisby (Hvidovre, Denmark)*

ECCMID 2018, Gorm Lisby O0731

Challenges with Enforcement

- Guidelines must be enforced in order to assure quality POC testing
- Must reach all healthcare personnel who may be interested in using POC
- Cannot be done through the laboratory

Expert Consensus Statement for Microbiology Point of Care Testing

1. ENFORCEMENT & REGULATION
2. LABORATORY OVERSIGHT
3. DEVICE SELECTION
4. FACILITIES
5. PURCHASING/INVENTORY AND EQUIPMENT
6. TEST VERIFICATION
7. TEST OPERATORS
8. TRAINING
9. INFORMATION MANAGEMENT AND DOCUMENTATION
10. QUALITY ASSURANCE
11. INFECTION PREVENTION AND CONTROL/BIOSAFETY AND BIOSECURITY
12. CRITICAL RESULTS REPORTING AND NOTIFIABLE DISEASES
13. ETHICS AND PROFESSIONAL CONDUCTS

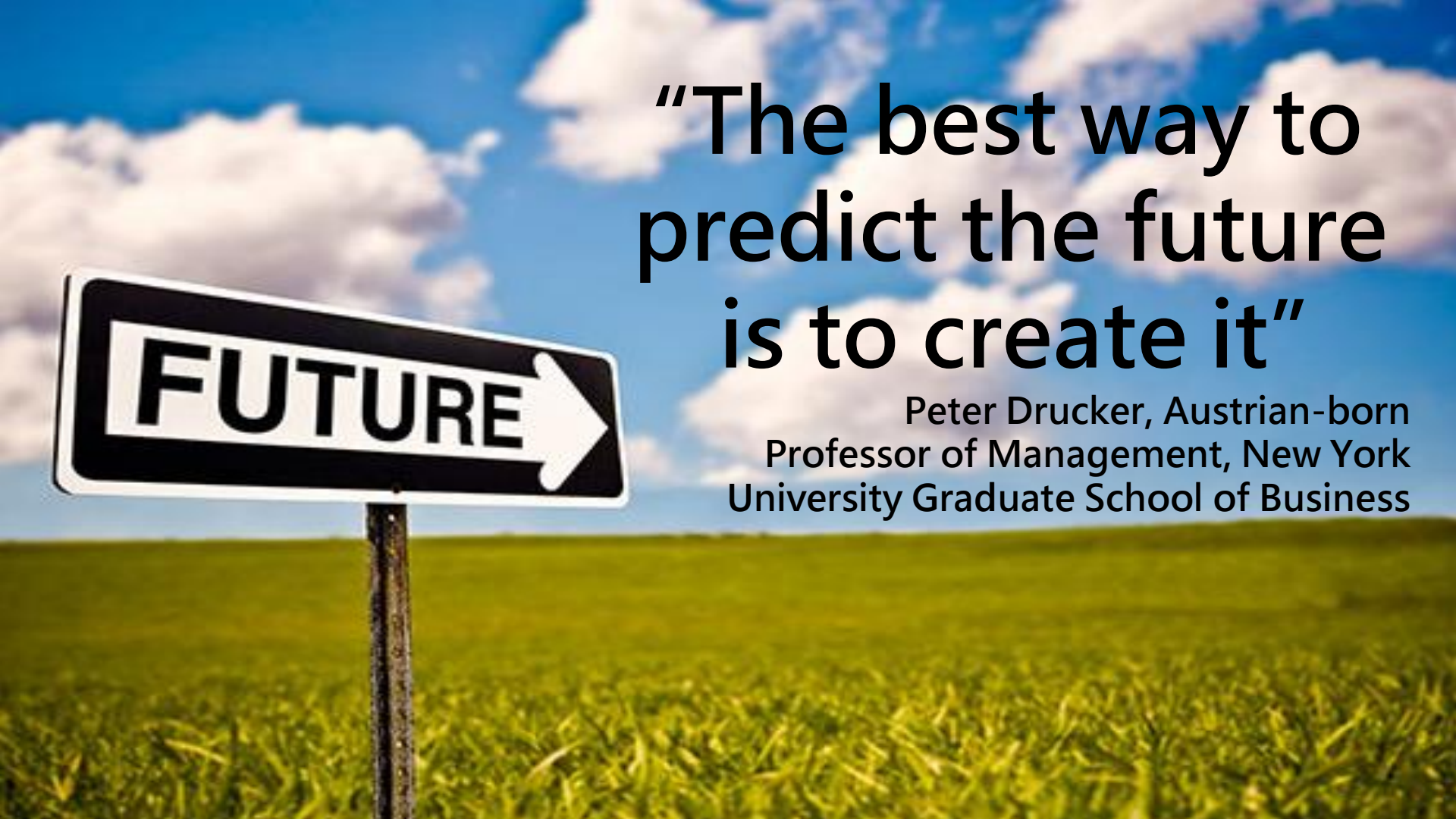
AMMI Canada Initiative

AMMI Canada

Preventing and treating infectious diseases
Prévenir et traiter les infections

Possible Solution

- **Consensus document** provided to local professional licensing bodies and hospitals
- Healthcare professional recertification and reappointments require:
  1. Documentation of use of POC tests
  2. Documentation of laboratory or expert oversight or relevant updated certified training



“The best way to predict the future is to create it”

Peter Drucker, Austrian-born Professor of Management, New York University Graduate School of Business

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