Dr. Daniel Gregson

@IDMedMicroMD

Associate Professor

Pathology & Laboratory Medicine and Medicine

University of Calgary

Clinical Section Chief, Medical Microbiology

Calgary Zone

Member, Division of Infectious Diseases

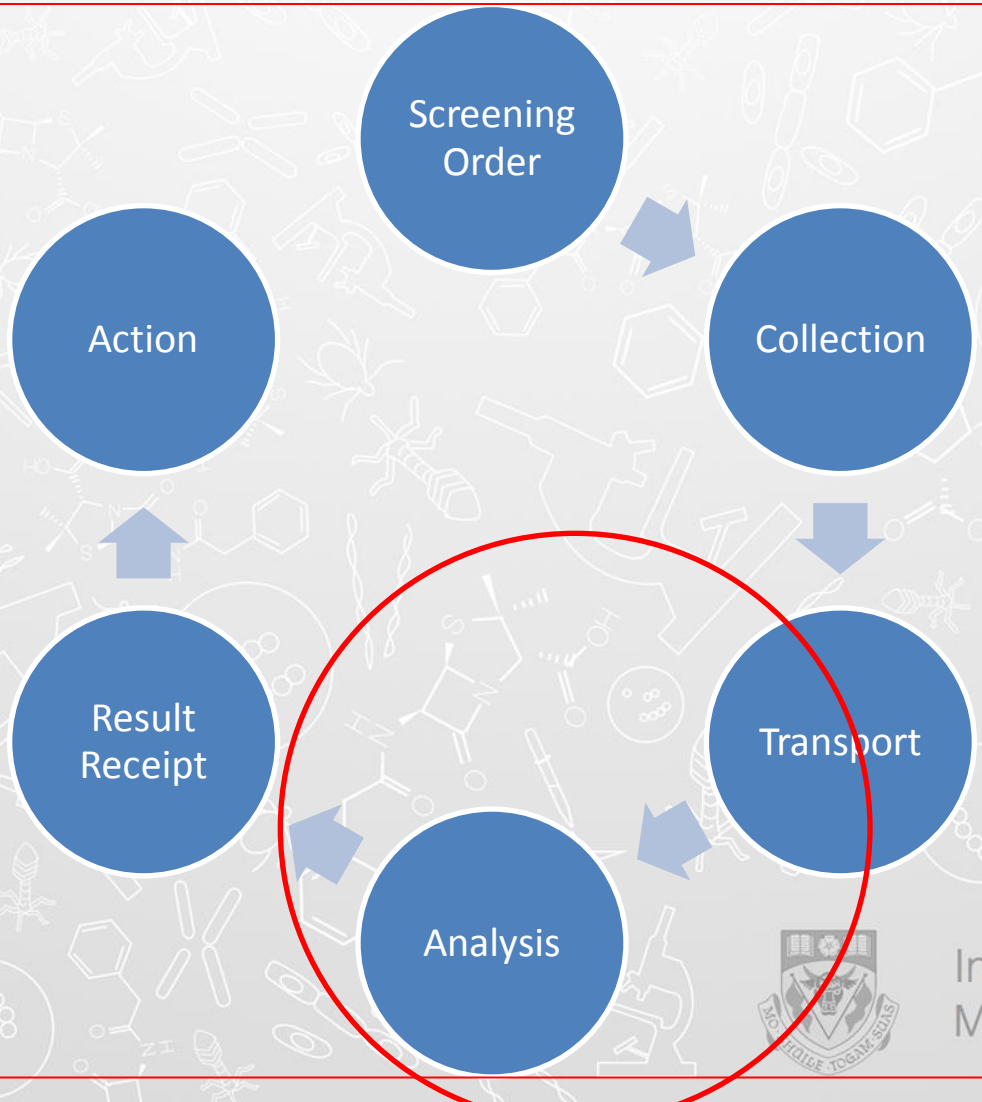
Calgary Zone

Infectious Diseases
Medical Microbiology

Disclosures

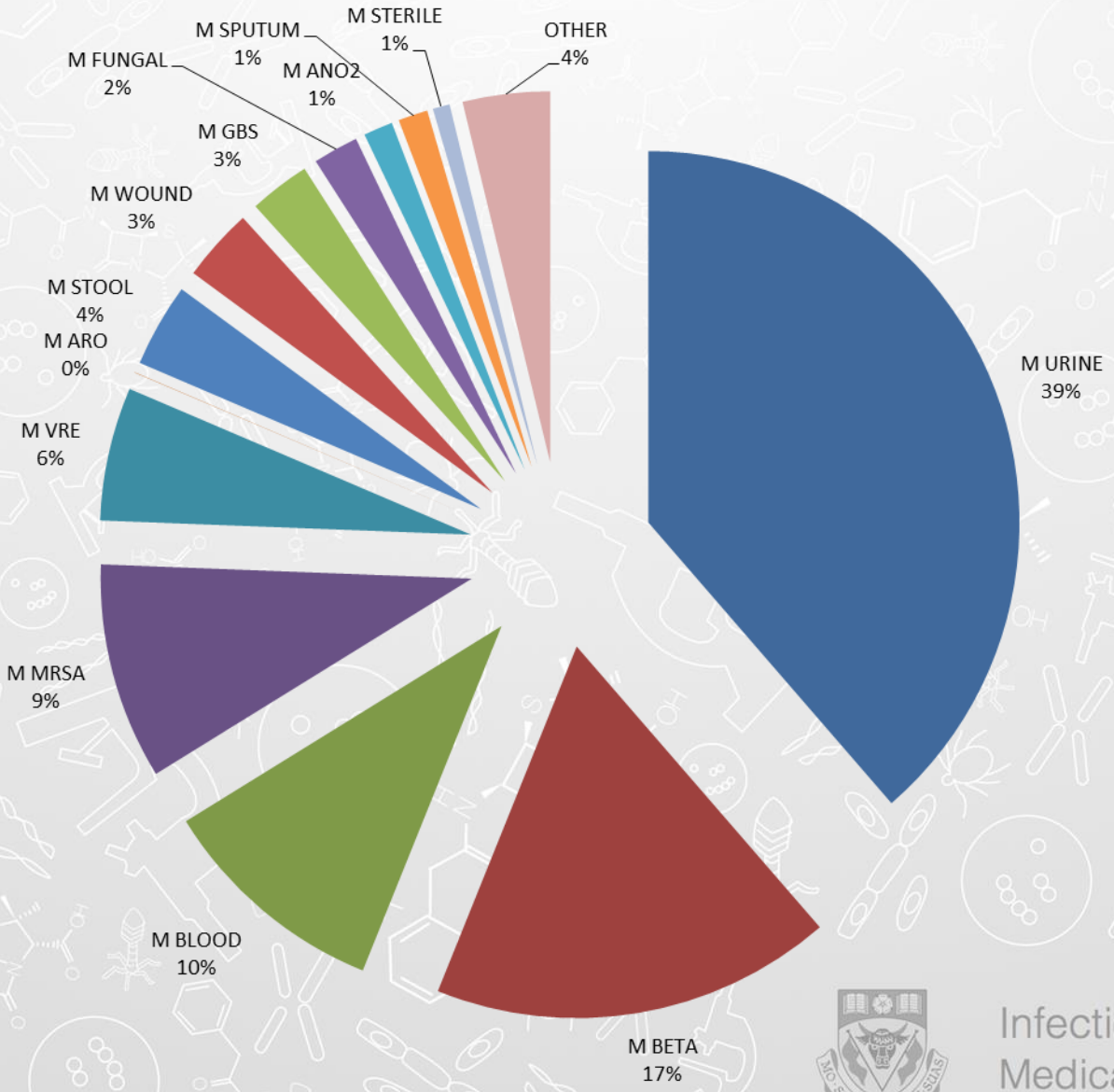
- Industry Funded Therapeutic Trials
  - Jansen, Roche, Merk, Astra Zeneca
- Industry Funded Diagnostic Trials
  - GeneOhm Sciences, Becton-Dickinson,
  - Abbott Diagnostics
- Executive Council Member: Association of Medical Microbiology and Infectious Diseases (AMMI Canada)
- Member - CPSA Advisory Committee on Laboratory Medicine

Laboratory Diagnostic Cycle Time



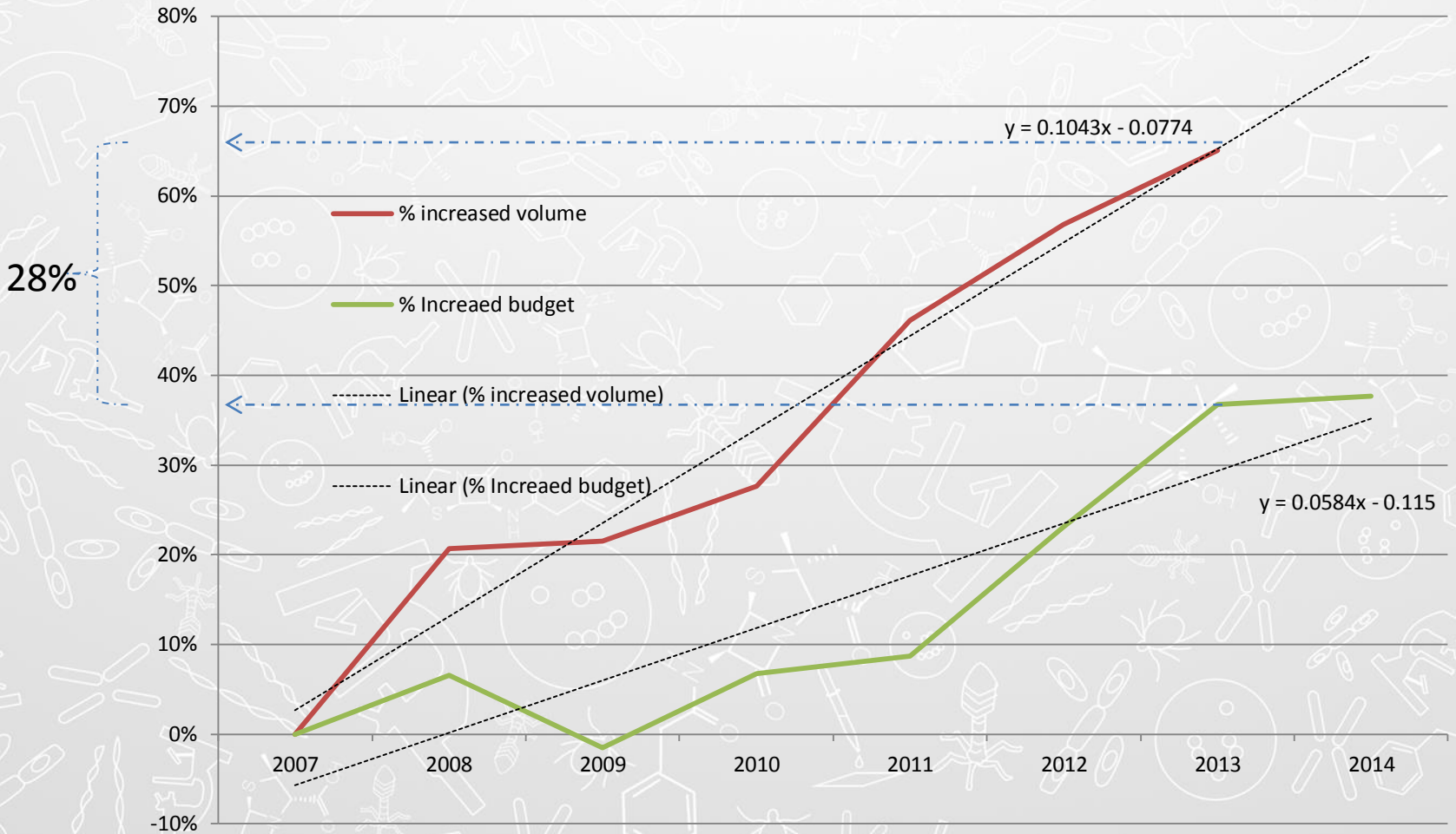
Infectious Diseases
Medical Microbiology

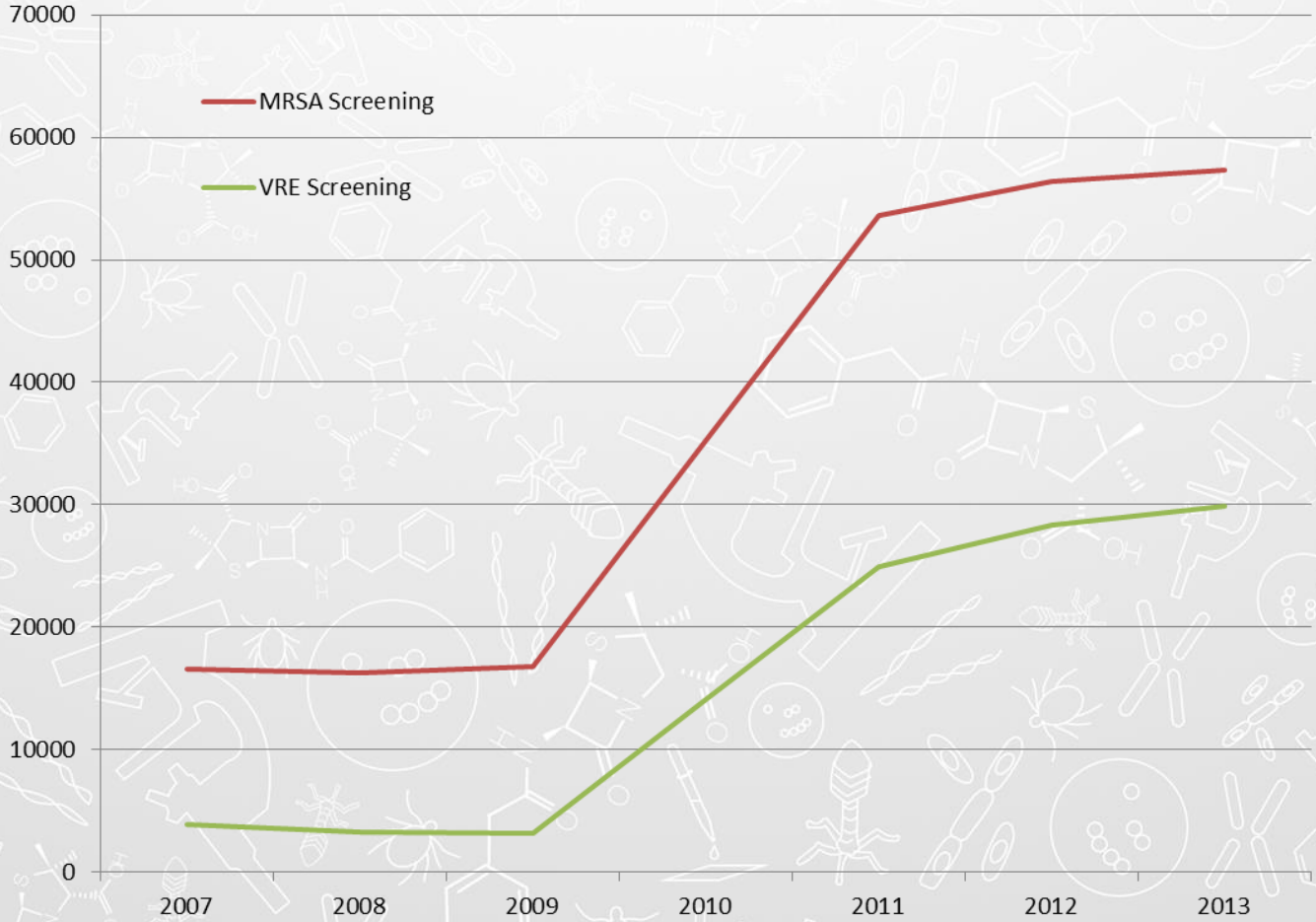
The Burden of Testing CLS 2013.



Infectious Diseases
Medical Microbiology

CLS Microbiology Laboratory Volume and Resources




70000
60000
50000
40000
30000
20000
10000
0
MRSA Screening
VRE Screening
2007
2008
2009
2010
2011
2012
2013

ARO Screening: Lab Issues

- Which ARO are you looking for?
- What sensitivity do you need?
- How fast do you need the results?
  - Transport/batching
- How many samples are you sending?
- How much capital funding is available?

Relative Effect of Differing Processes

Procedure	TAT	Sensitivity	Cost
Single Sample/Pt	Base	Base	Base
Multiple Samples/Pt	+/-	++	Increased X N
Batching	+	-	-
Broth Pre-incuabation	++	+++	+
Pooled samples	+/-	++-	-
NAT Methods	-----	+++	+++++

Asir K et al. Letters in Applied Microbiology 48 (2009) 230–233

Table 1 Number of strains isolated on each medium pre- and postenrichment after incubation of agar plates for 20–22 h and 48 h incubation

	No. strains recovered (No. forming coloured colonies)					
	AES VRE Agar		bioMérieux chromID VRE		Oxoid VRE Agar	
	22 h	48 h	22 h	48 h	22 h	48 h
Pre-enrichment						
Vancomycin-resistant enterococci						
Enterococcus faecium	12(10)	12 (12)	10(9)	14 (14)	6(6)	9 (8)
Enterococcus casseliflavus	4(4)	8 (8)	0	0	0	0
Enterococcus gallinarum	18(16)	29 (27)	0	0	0	2(1)
Vancomycin susceptible enterococci						
Ent. faecium	0	1 (1)	1(1)	0	1(1)	0
Enterococcus faecalis	0	0	0	1 (0)	0	0
Other Gram-positive cocci	6(2)	9 (3)	0	3 (1)	1(0)	4 (3)
Lactobacillus sp.	19(10)	91 (37)	0	1 (1)	25(13)	126 (99)
Yeasts	1(0)	16 (3)	25(10)	117 (74)	68(10)	123 (15)
Enterobacteriacae	0	8 (3)	21(19)	24 (14)	1(0)	2 (1)
Pseudomonas/Stenotrophomonas	0	0	2(1)	8 (2)	8(2)	18 (6)
No growth	230	142	231	151	184	90
	Sensitivity for detection of vancomycin-resistant *Ent. faecium* (%)					
	55·6	66·7	50·0	77·8	33·3	44·4
Postenrichment						
Vancomycin-resistant enterococci						
Ent. faecium	10(10)	12(12)	15(15)	15 (15)	14(13)	15 (14)
Ent. casseliflavus	4(4)	4 (4)	0	0	0	0
Ent. gallinarum	19(16)	20 (20)	0	2 (1)	3(3)	3 (3)
Vancomycin susceptible enterococci.						
Ent. faecalis	0	0	3(3)	3 (3)	0	1 (1)
Other Gram-positive cocci	0	17 (6)	0	1 (1)	9(7)	11 (7)
Lactobacillus sp.	34(21)	105 (50)	1(1)	5 (4)	56(25)	132 (111)
Yeasts	0	2 (0)	17(8)	43 (20)	40(6)	49 (7)
Enterobacteriacae	16(5)	37 (15)	94(80)	110 (81)	1(0)	8 (5)
Pseudomonas/Stenotrophomonas	5(0)	9 (2)	31(15)	54 (15)	27(8)	49 (21)
No growth	192	119	146	116	149	90
	Sensitivity for detection of vancomycin-resistant *Ent. faecium* (%)					
	55·6	66·7	83·3	83·3	72·2	77·8

E.S. Marner et al. / Diagnostic Microbiology and Infectious Disease 69 (2011) 382–389

Table 2
Comparison of GeneXpert *vanA/B* versus direct agar culture, broth-enriched culture, and a combined reference standard that includes chart review for VRE colonization 1 month before testing

	Direct culture		Broth-enriched culture		Comb. Ref. Std.	
	Pos	Neg	Pos	Neg	Pos	Neg
Xpert positive	68	19	70	17	81	7
Xpert negative	3	94	3	94	3	93
Sensitivity	95.8% (86.2–98.2)		95.9% (88.1–99.1)		96.4% (89.6–99.2)	
Specificity	83.2% (75.1–89.0)		84.7% (76.7–90.3)		93.0% (86.0–96.8)	
PPV	78.2% (68.3–85.6)		80.5% (70.8–87.5)		92.0% (84.2–96.3)	
NPV	96.9% (86.5–99.4)		96.9% (86.5–99.4)		96.9% (86.5–99.4)	
Total agreement	88.0% (82.5–92.0)		89.1% (83.7–92.9)		94.6% (90.0–97.1)	

Raw data are depicted as well as performance parameters for sensitivity, specificity, PPV, NPV, and total agreement, each depicted with corresponding 95% confidence intervals.

Senn et al, Clin Microbiol Infect 2012; 18: E31–E33

TABLE 1. Sensitivity of different screening sites and combinations for detection of methicillin-resistant *Staphylococcus aureus* (MRSA) by culture and by PCR rapid test (Xpert MRSA)

	Culture[a]		PCR rapid test[b]	
Screening sites	**No. of positive samples**	**Sensitivity, % (95% CI)**	**No. of positive samples**	**Sensitivity, % (95% CI)**
Single sites				
Nose	1509	48 (46–50)	193	62 (56–67)
Groin	1984	63 (62–65)	213	68 (63–73)
Throat	1923	61 (60–63)	134	43 (37–49)
Combinations of sites				
Nose and groin	2475	79 (77–80)	288	92 (89–95)
Nose and throat	2377	76 (74–77)	230	74 (68–78)
Groin and throat	2799	89 (88–90)	258	83 (78–87)
Nose, groin, and throat	3002	96 (95–96)	309	99 (97–100)
Nose, groin, throat, and wounds	3113	99 (99–99)	310	99 (97–100)
Nose, groin, throat, wounds, and others	3137	100	312	100

[a]Period, 2006–2009; positive screenings (≥1 positive site), 3137.
[b]Period, 2009; positive screenings (≥1 positive site), 312.

broth enhanced cultures onto chromogenic media

Eur J Clin Microbiol Infect Dis. 2013 Apr;32(4):565-8. doi: 10.1007/s10096-012-1775-7. Epub 2012 Nov 10.

MRSA screening by the Xpert MRSA PCR assay: pooling samples of the nose, throat, and groin increases the sensitivity of detection without increasing the laboratory costs.

Table 1 Number of positive results and sensitivity of the Xpert MRSA assay compared to culture on pooled or nonpooled samples of the nose, groin, and throat among 50 known methicillin-resistant *Staphylococcus aureus* (MRSA) carriers

	No. of positives by Xpert MRSA	No. of positives by culture	Sensitivity (95 % CI)
Nose	26 (52 %)	27 (54 %)	0.89 (0.70–0.97)
Throat	21 (42 %)	27 (54 %)	0.78 (0.57–0.90)
Groin	31 (62 %)	34 (68 %)	0.88 (0.72–0.96)
Pooled results from separated analysis of the three sites[a]	38 (76 %)	39 (78 %)	0.92 (0.78–0.98)
Pooled from three separated eSwabs by lab technicians	35 (70 %)	36 (72 %)	0.86 (0.70–0.95)
Swabs pooled within one eSwab tube by nurses	34 (68 %)	36 (72 %)	0.86 (0.70–0.95)

[a] If one or more sites were positive, the pooled result was considered to be positive. It was considered to be negative only when the three sites were all negative

ORIGINAL ARTICLE

Clinical Microbiology Costs for Methods of Active Surveillance for *Klebsiella pneumoniae* Carbapenemase–Producing Enterobacteriaceae

Amy J. Mathers, MD;[1,2] Melinda Poulter, PhD;[2] Dawn Dirks, MS;[2] Joanne Carroll, BS;[2]
Costi D. Sifri, MD;[1] Kevin C. Hazen, PhD[2,a]

OBJECTIVE. To compare direct laboratory costs of different methods for perirectal screening for carbapenemase-producing Enterobacteriaceae (CPE) colonization.

DESIGN. Cost-benefit analysis.

SETTING. A university hospital and affiliated long-term acute care hospital (LTACH).

PARTICIPANTS. Inpatients from the hospital or LTACH.

METHODS. Perirectal samples were collected from inpatients at risk for exposure to CPE. In 2009, we compared the accuracy of the Centers for Disease Control and Prevention (CDC)–recommended CPE screening method with similar methods incorporating a chromogenic agar (CA). We then performed a cost projection analysis using 2012 screening results for the CA method, the CDC method, and a molecular assay with wholesale pricing based on the 2009 analysis. Comparisons of turnaround and personnel time were also performed.

RESULTS. A total of 185 (2.7%) of 6,860 samples were confirmed as CPE positive during 2012. We previously found that the CDC protocol had a lower sensitivity than the CA method and predicted that the CDC protocol would have missed 92 of the CPE-positive screening results, whereas the modified protocol using CA would have missed 26, assuming similar prevalence and performance. Turnaround time was 3 days using the CDC and CA-modified protocols compared with 1 day for molecular testing. The estimated annual total program cost and total technologist's hours would be the following: CA-modified protocol, $37,441 and 376 hours; CDC protocol, $22,818 and 482 hours; and molecular testing, $224,596 and 343 hours.

CONCLUSIONS. The CDC screening protocol appeared to be the least expensive perirectal screening method. However, expense must be weighed against a lower sensitivity and extra labor needed for additional work-up of non-CPE isolates. The molecular test has the shortest turnaround time but the greatest expense.

Infect Control Hosp Epidemiol 2014;35(4):350-355

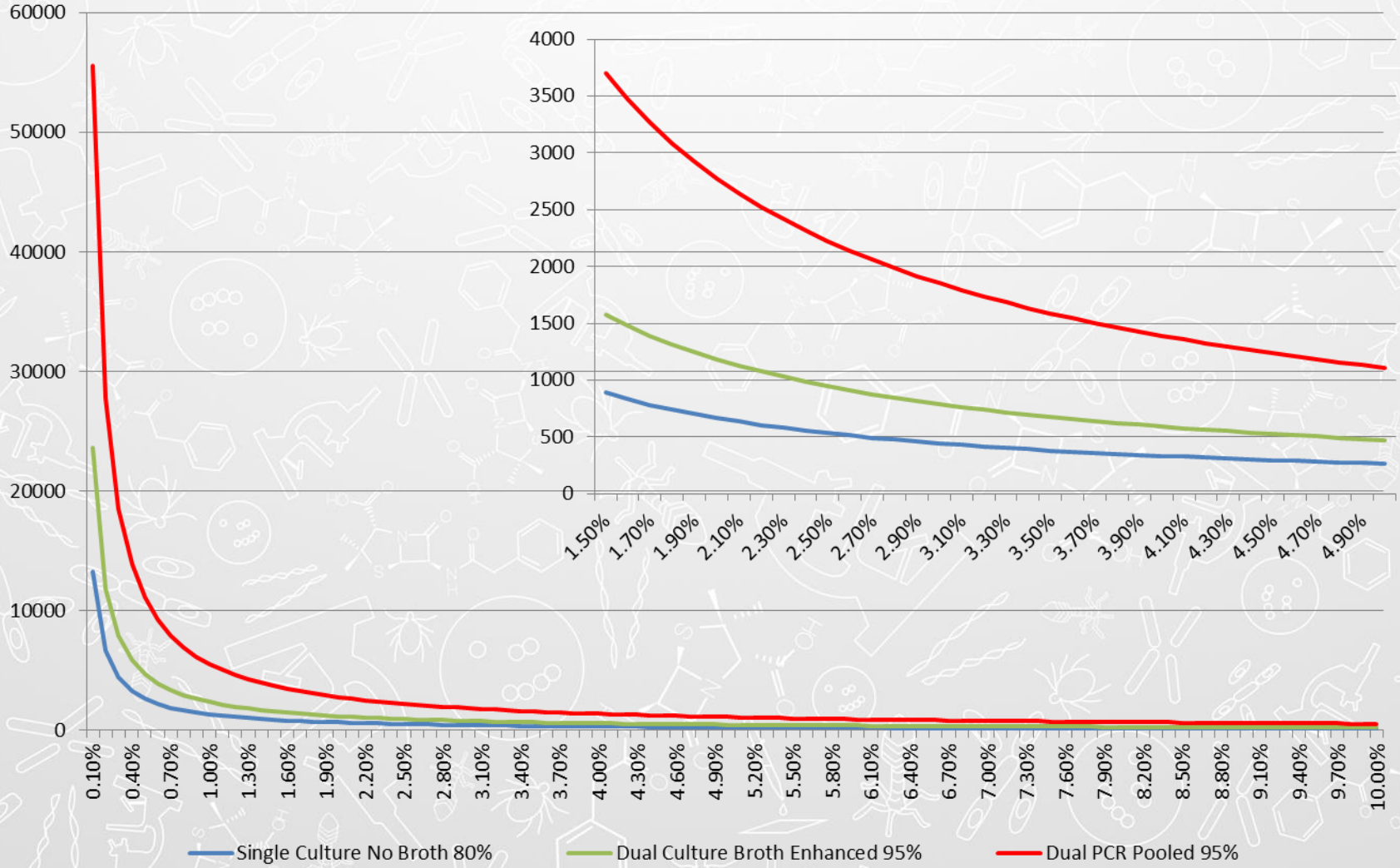
TABLE 1. Cost of Each Individual Component of Our Current Chromogenic Agar (CA) Indirect Carbapenemase Test (ICT) Protocol, the Centers for Disease Control and Prevention MacConkey Agar (MAC) ICT Protocol, and Molecular Protocols

Protocol component	US$	CA-ICT positive (n = 185)	CA-ICT additional work-up (n = 58)	CA-ICT negative (n = 6,617)	MAC-ICT positive (n = 119)	MAC-ICT additional work-up (n = 1,459)	MAC-ICT negative (n = 5,282)	Molecular (n = 6,860)
Tryptic soy broth	0.68	+	+	+	+	+	+	...
Ertapenem 10-μg disk	0.13	+	+	+	+	+	+	...
RambaChrom agar	3.00	+	+	+	...	...	...	...
Blood agar plate	0.26	+	...	...	+	...	...	...
Mueller Hinton	0.50	+	+	...	+	+	...	...
Tris-EDTA disk	0.45	+	+	...	+	+	...	...
Imipenem 10-μg disk	0.05	+	+	...	+	+	...	...
VTK GN ID card	3.50	+	...	...	+	...	...	...
MA	0.28	...	...	...	+	+	+	...
Supply total		8.57	4.81	3.81	5.85	2.09	1.09	31.36[a]
Technologist time[b]	0.46	5.52	3.68	1.38	5.52	3.68	1.38	1.38
Time to perform, min		12	8	3	12	8	3	3
Total cost		14.09	8.49	5.19	11.37	5.7	2.47	32.74
Total cost 2012		2,606.65	492.42	34,342.23	1,353.03	8,418.43	13,046.54	224,596.4
Total min		2,220	464	19,851	1,428	11,672	15,846	20,580

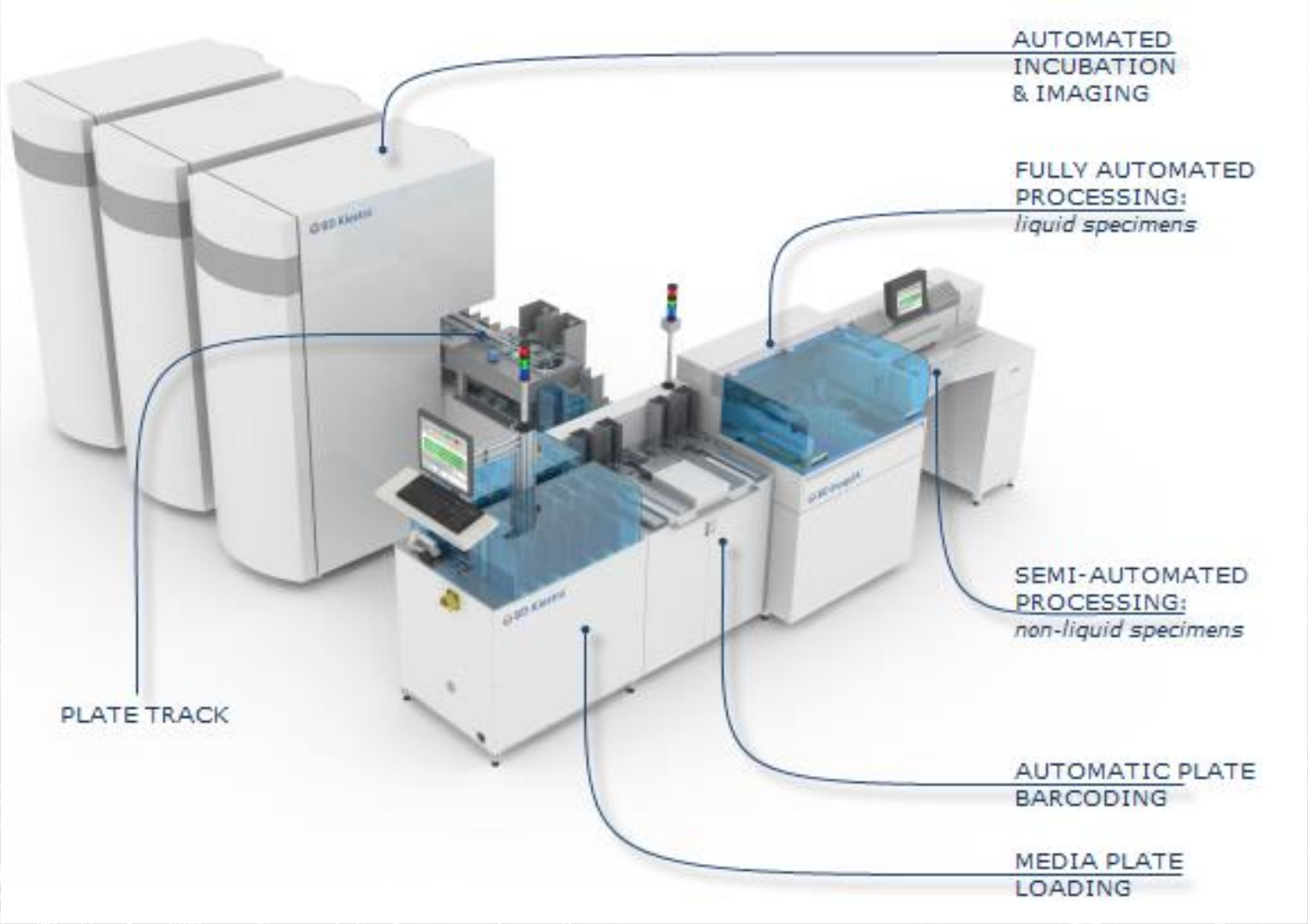
- No benefits/ overhead / support / capital costs included
- Technologists wages in US less than Canada

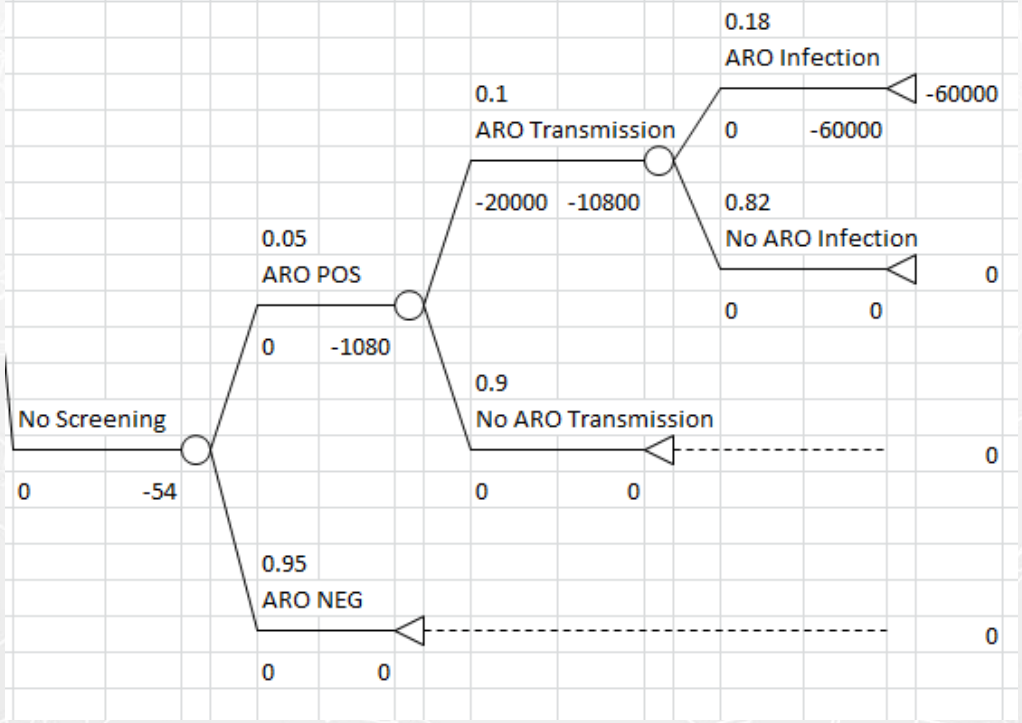
Infectious Diseases
Medical Microbiology

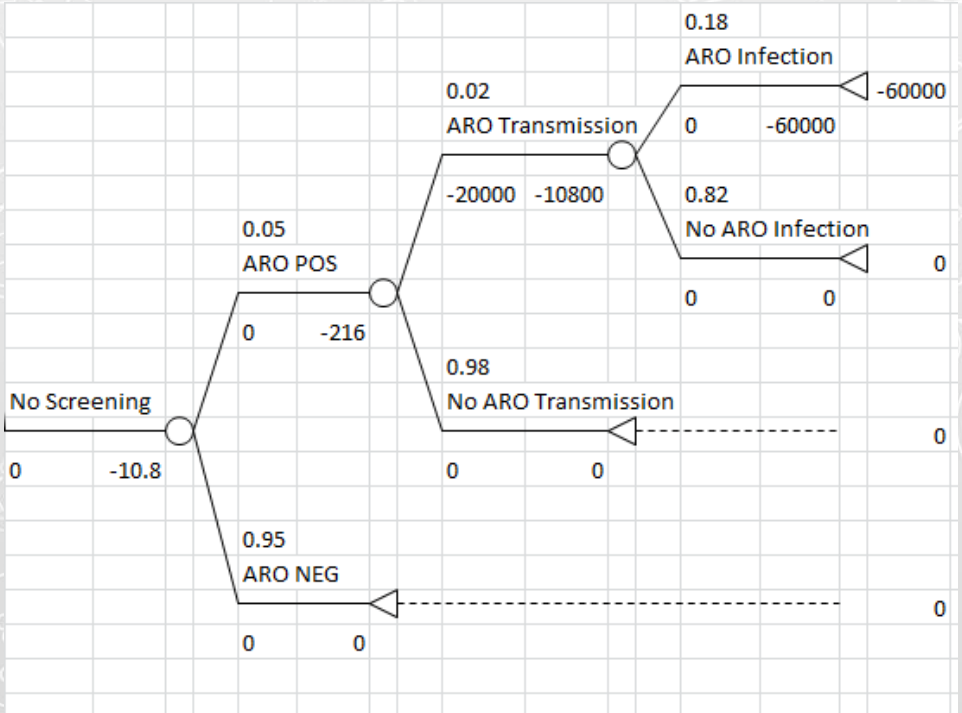
Cost per Positive Screening Test: MRSA based methods CLS




Calgary Transit
2246


AUTOMATED
INCUBATION
& IMAGING
FULLY AUTOMATED
PROCESSING:
liquid specimens
SEMI-AUTOMATED
PROCESSING:
non-liquid specimens
PLATE TRACK
AUTOMATIC PLATE
BARCODING
MEDIA PLATE
LOADING





Infectious Diseases
Medical Microbiology

Choosing Wisely Canada

In partnership with the Canadian Medical Association