Diagnostics as a vital tool to enhance antibiotic stewardship

Omuse G.A.
Assistant Professor and Clinical Pathologist
Aga Khan University Hospital Nairobi

“Typhomalaria”

Short Report

Diagnostic utility of a single Widal test in the diagnosis of typhoid fever at Aga Khan University Hospital (AKUH), Nairobi, Kenya

Geoffrey Omuse MBChB
Ruchika Kohli MBChB
Gunturu Revathi MBBS MD

Division of Microbiology, Pathology Department, Aga Khan University Hospital, Nairobi, Kenya

Correspondence to: Dr Geoffrey Omuse, PO Box 47586-00100, Nairobi, Kenya
Email: g_omuse@yahoo.com

TROPICAL DOCTOR 2010; 40: 43–44
DOI: 10.1258/td.2009.090109

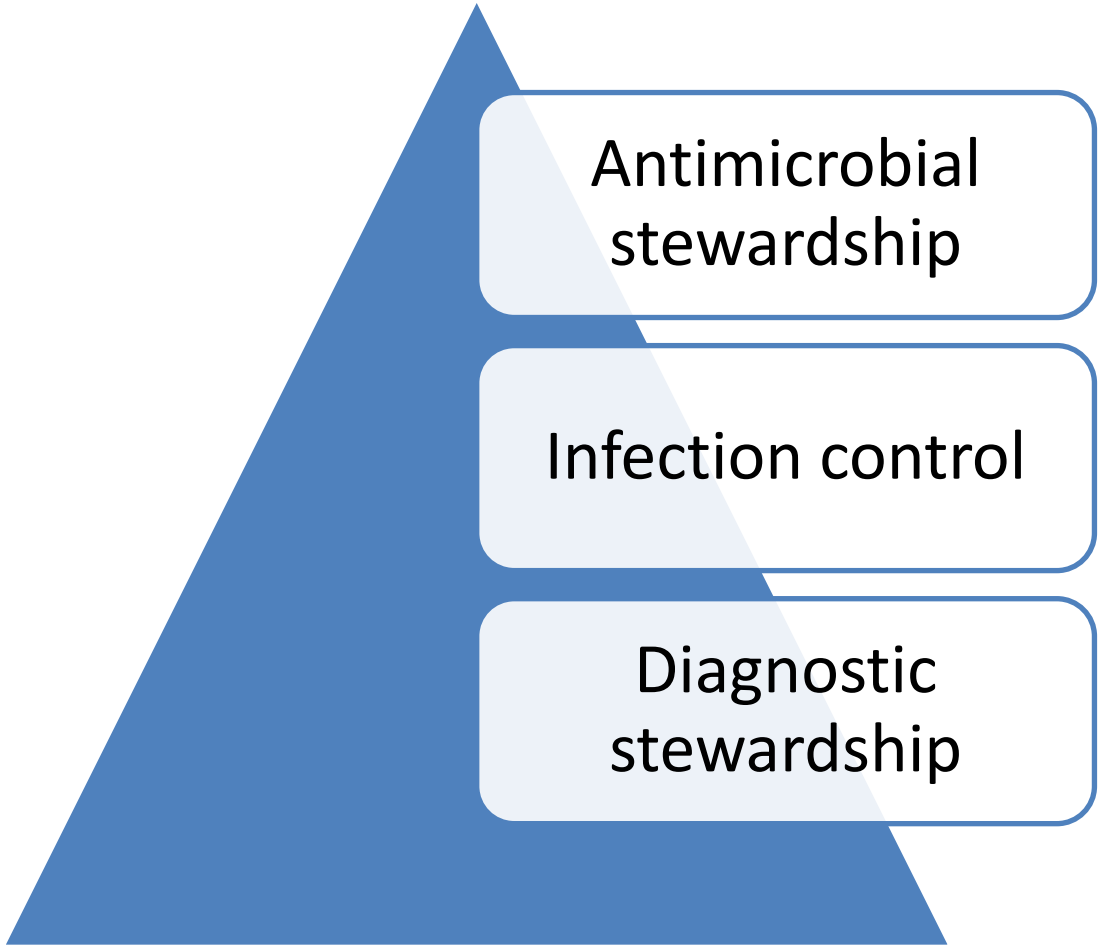
- Only 18 (26%) of our patients had diagnostic titres;
- 37 (53.6%) had O and H titres less than1:40

Outline

Diagnostic stewardship:

- Integrated model
- Scope
- Value add

Integrated model



Diagnostic stewardship

- Promoting the appropriate use of microbiology diagnostic methods

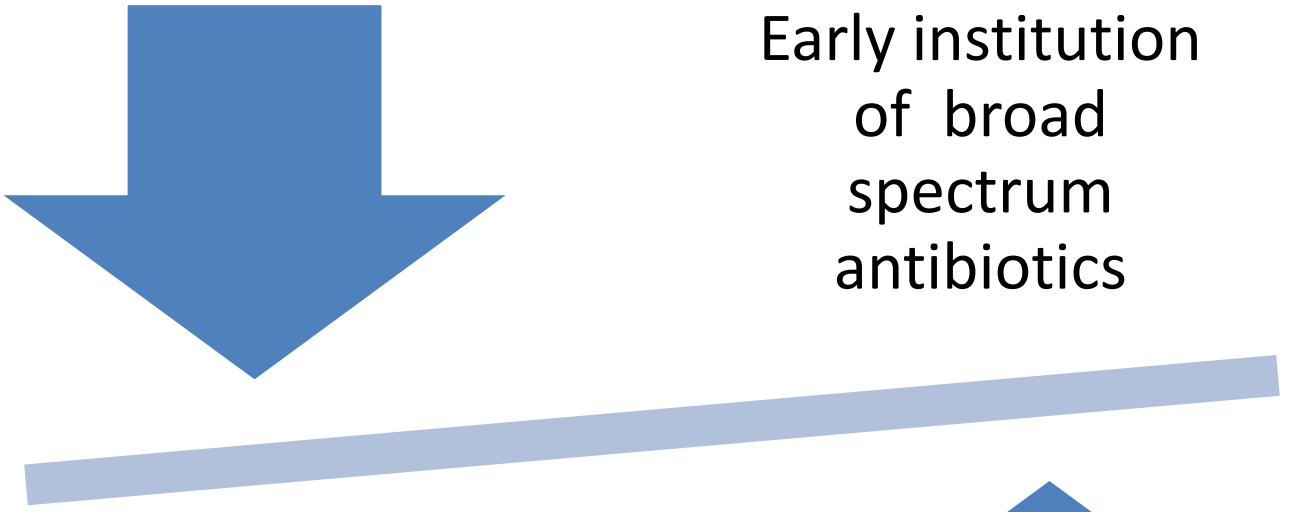
- Using microbiology diagnostic tests to improve the use of antibiotics

Scope

- Advice to clinicians regarding infection management
- Recommendations for appropriate microbiologic sampling
- Selection of the rapid diagnostic tests that are the most relevant in clinical practice
- Timely and accurate microbiology results
- Improved reporting of results to clinicians (e.g. selective reporting)
- Surveillance (epidemiological data) and generation of essential data that inform institutional treatment guidelines
- Advanced tests to establish molecular mechanisms underlying antimicrobial resistance and genotyping of pathogens

Advice to clinicians regarding infection management

Conundrum



Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock. *Crit Care Med* 2006, **34:**1589–1596.

Surviving sepsis guidelines 2016

We recommend that appropriate routine microbiologic cultures (including blood) be obtained before starting antimicrobial therapy in patients with suspected sepsis and septic shock if doing so results in no substantial delay in the start of antimicrobials.

- Remarks: Appropriate routine microbiologic cultures always include at least two sets of blood cultures (aerobic and anaerobic).

Blood culture positivity

- Fewer than one-half of the patients who have signs and symptoms of sepsis have positive blood culture (BC) results or other microbiological proof of an infectious focus

Intensive Care Med. 33:606–618
JAMA 278:234 –240
Intensive Care Med. 30:580 –588

Recommendations for appropriate microbiologic sampling

Some tips

- Blood cultures
  - 70% Isopropyl alcohol then chlorhexidine
  - 2 sets: volume is key
  - CR-BSI: peripheral site and through catheter (Ideally 2 hrs)
  - Skin organisms: Same organism identified twice
- Wounds / Abscess
  - Avoid superficial swabs of chronic wounds and sinuses
  - Aspirate when possible
- Sputum
  - Rinse mouth
  - Criteria for rejection (>10 SEC/LPF)
- Urine
  - No urinary catheters for UTI
  - MSSU
  - Catheterize

Selection of the rapid diagnostic tests that are the most relevant in clinical practice

Hour-1 Bundle

Surviving Sepsis Campaign®

Initial Resuscitation for Sepsis and Septic Shock (begin immediately):

Time Zero/Time Presentation

*"Time zero" or "time of presentation" is defined as the time of triage in the Emergency Department or, if presenting from another care venue, from the earliest chart annotation consistent with all elements of sepsis (formerly severe sepsis) or septic shock ascertained through chart review.

1 Measure lactate level.

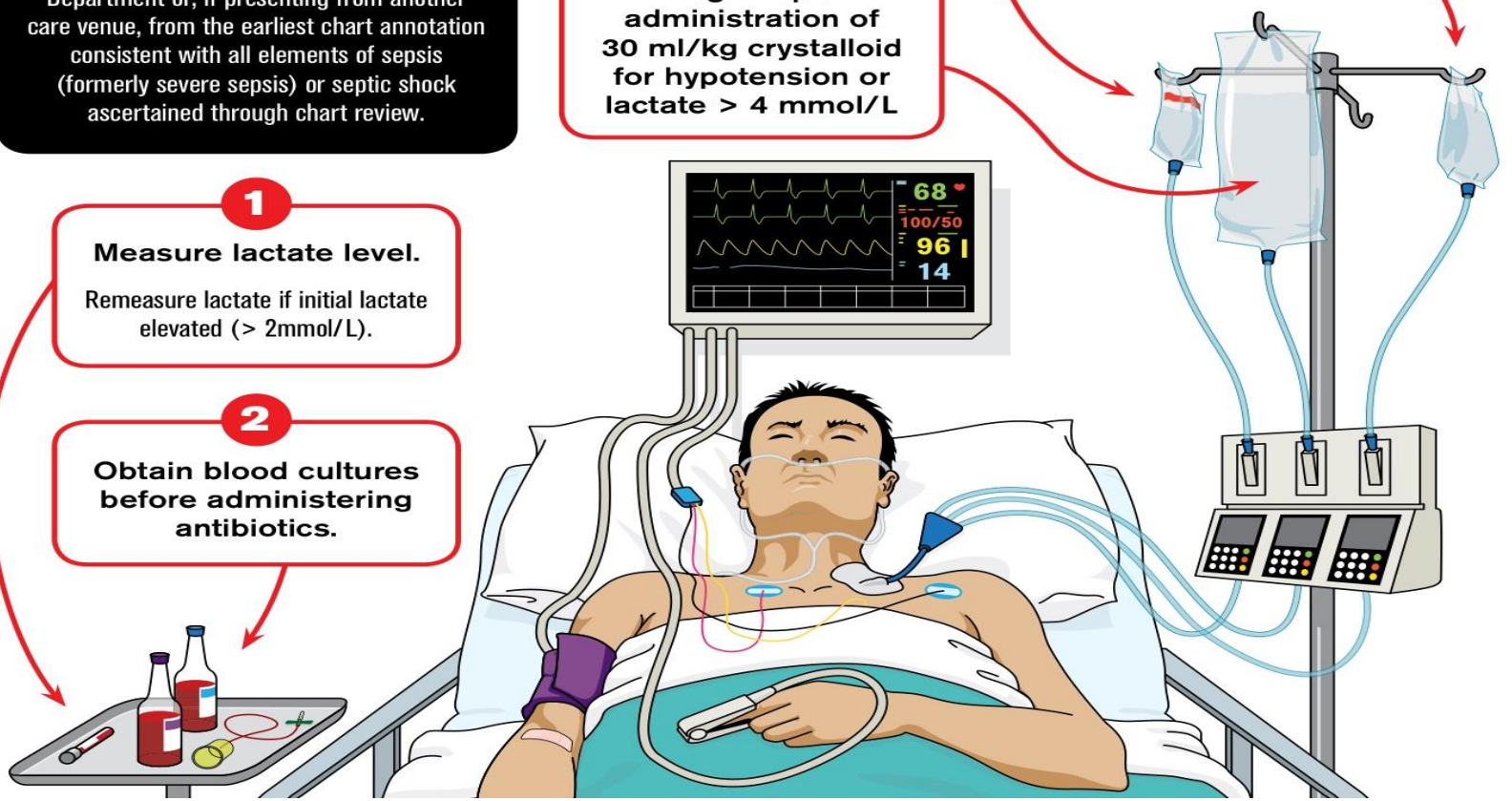
Remeasure lactate if initial lactate elevated (> 2mmol/L).

2 Obtain blood cultures before administering antibiotics.

3 Administer broad-spectrum antibiotics.

4 Begin rapid administration of 30 ml/kg crystalloid for hypotension or lactate > 4 mmol/L

5 Apply vasopressors if hypotensive during or after fluid resuscitation to maintain a mean arterial pressure ≥ 65 mm Hg.



Rapid tests

- Rotavirus / Adenovirus / Norovirus
- H.pylori
- Influenza A
- Group B strep
- Giardia lamblia
- Schistosomiasis

Improved reporting of results to clinicians

Not always easy

- Colonization vs infection
- Not always relevant to report all tested antibiotics
- Bactericidal vs bacteriostatic
- Significant growth or not

AST guidelines: CLSI vs EUCAST

Kassim et al. Ann Clin Microbiol Antimicrob (2016) 15:21
DOI 10.1186/s12941-016-0135-3

Annals of Clinical Microbiology and Antimicrobials

RESEARCH Open Access

Comparison of Clinical Laboratory Standards Institute and European Committee on Antimicrobial Susceptibility Testing guidelines for the interpretation of antibiotic susceptibility at a University teaching hospital in Nairobi, Kenya: a cross-sectional study

Ali Kassim*, Geoffrey Omuse, Zul Premji and Gunturu Revathi

MRSA isolate from blood

- Cefoxitin – R
- Amoxicillin - R
- Ceftriaxone -S
- Amoxicillin / clavulanic acid - S
- Meropenem – S
- Vancomycin – S
- Linezolid –S

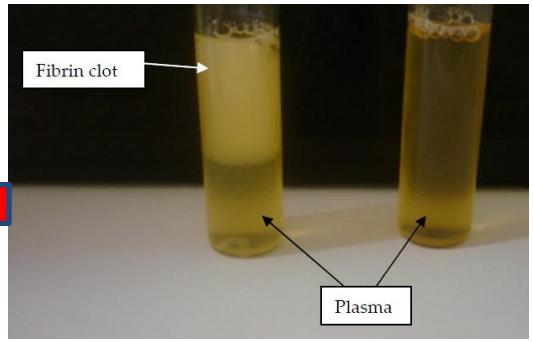
A. Comment on the AST result
B. Which antibiotic would you choose and why?

P.aeroginosa from urine

- Amoxicillin – R
- Cefuroxime – R
- Ciprofloxacin – R
- Meropenem – R
- Gentamicin – R
- Nitrofurantoin – R
- Colistin - R

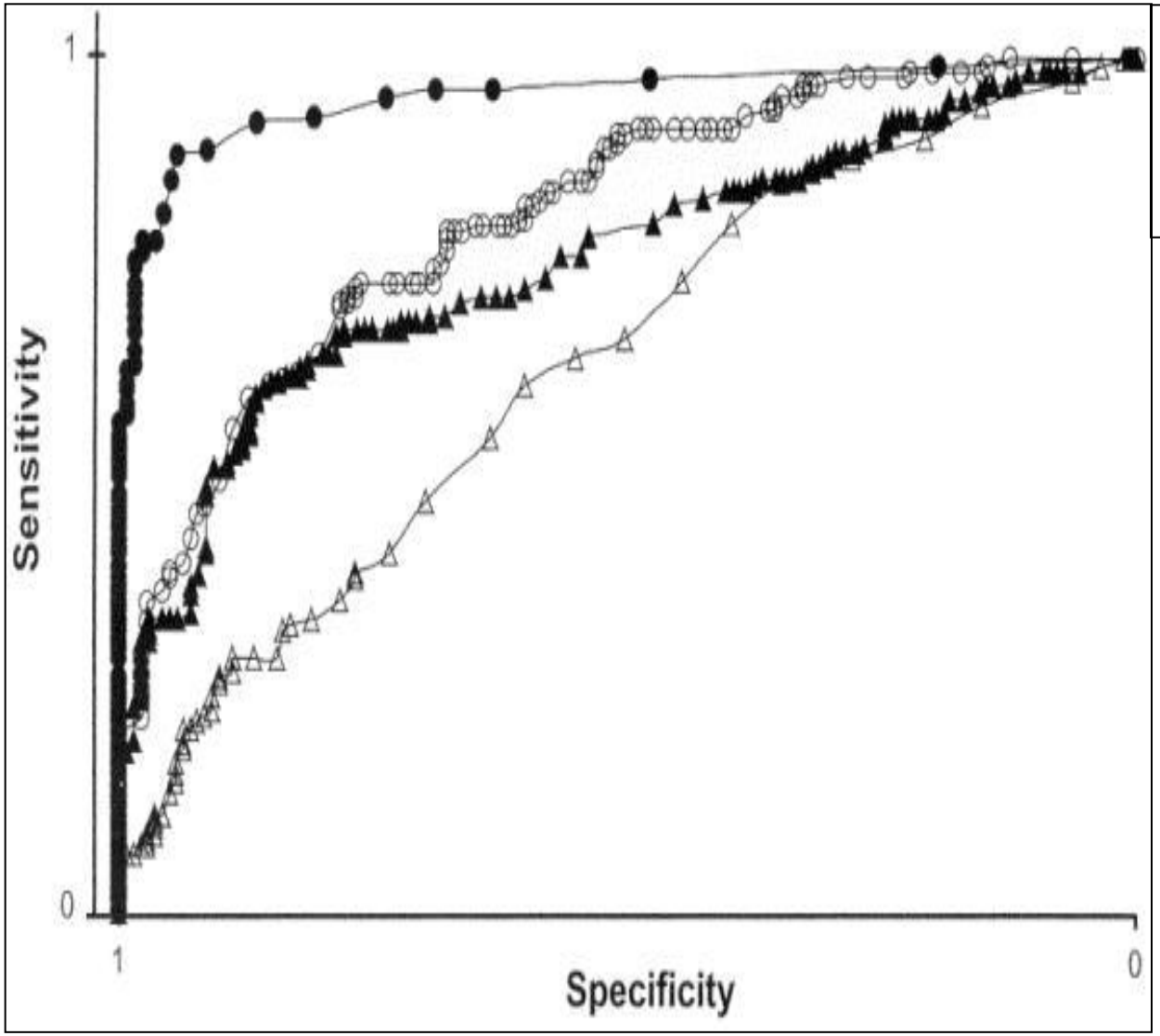
- Comment on the AST results

Timely and accurate microbiology results


Fibrin clot
Plasma


Vitek 2

Figure 3



Calcitonin precursors are reliable markers of sepsis in a medical intensive care unit.
Muller, Beat; Becker, Kenneth; MD, PhD; Schachinger, Hartmut; Rickenbacher, Peter; Huber, Peter; Zimmerli, Werner; Ritz, Rudolf

Critical Care Medicine. 28(4):977-983, April 2000.

Figure 3 . Receiver-operating-curve analysis of serum calcitonin precursors (solid circles) vs. interleukin-6 (solid triangles), C-reactive protein (open circles), and lactate (open trianlgles) concentrations. Values are shown for all time points (n = 272; 101 values at admission, 74 values on day 2, and 97 values on day of discharge or death) for the diagnoses of sepsis, severe sepsis, or septic shock.

Surviving Sepsis guidelines 2012

The utility of procalcitonin levels or other biomarkers (such as C-reactive protein) to discriminate the acute inflammatory pattern of sepsis from other causes of generalized inflammation (eg, postoperative, other forms of shock) has not been demonstrated

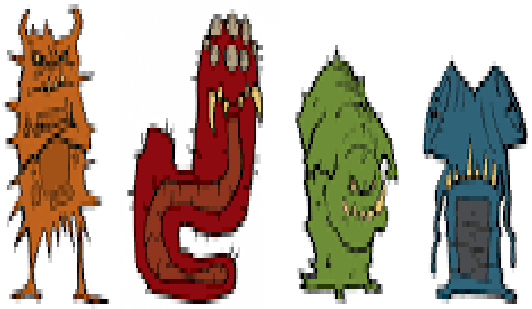
Surviving Sepsis Campaign: International Guidelines for Management of Severe Sepsis and Septic Shock: 2012 Critical Care Medicine February 2013 • Volume 41 • Number 2

Procalcitonin to initiate or discontinue antibiotics in acute respiratory tract infections (Review)

- 6708 participants from 26 trials in 12 countries.
- Mortality at 30 days was significantly lower in procalcitonin-guided participants compared to control participants 8.6% versus 10.0%
- No significant difference with regard to treatment failures
- Procalcitonin-guided group had a 2.4-day reduction in antibiotic exposure and a reduction in antibiotic-related side effects (16.3% versus 22.1%)

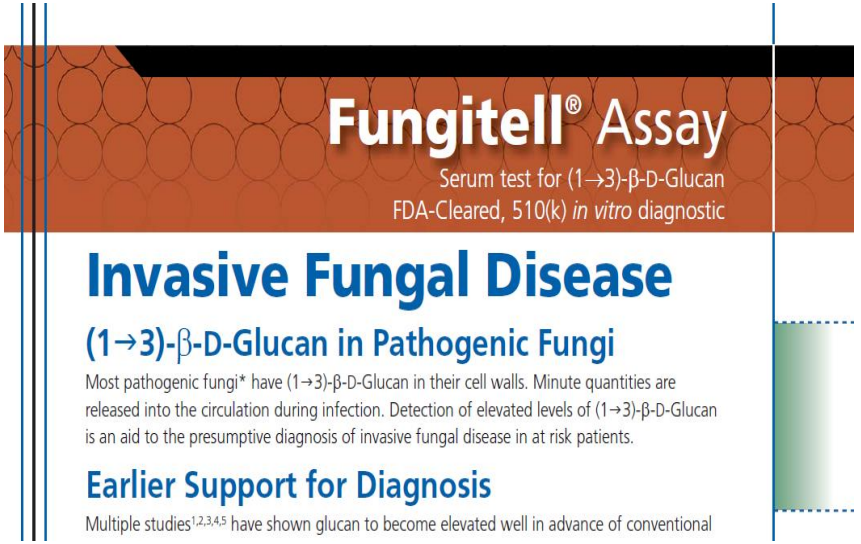
Cochrane Database of Systematic Reviews 2017, Issue 10. Art. No.: CD007498.

Multiplex pcr



BIOFIRE® | FilmArray® BIOMÉRIEUX

Fungal antigen assays



Surveillance (epidemiological data)

Empiric treatment vs local data

- Antibiotic guidelines should be guided by local data
  - Paucity of data including seroprevalence
  - Validity of findings

- Need to understand molecular epidemiology
  - Resistance genes
  - phenotyping

Year	Setting	Sample types	*S.aureus* isolates	No. of MRSA isolates (%)	Reference
1991-1995 **Omari *et al***	KNH	• Mixed	985	393 (39.8%)	East Afr Med J. 1997 Mar;74(3):134-7
1996-1997 **Kesah *et al***	KNH	• Mixed	137	38 (27.7%)	CMI 2003;9:153-156
2003-2008 **Kohli *et al***	AKUHN	• Blood	364	76 (21%)	East African Medical Journal Vol. 87. No. 2 February 2010
2005-2007 **Maina *et al***	5 public & private hospitals in Nairobi	• SSTI	82	69 (84.1%)	International journal of infectious diseases 17 (2013) e115-e119
2008-2009 **Dinda *et al***	AKUHN	• Surgical site infections	10	1 (10%)	Ethiop J Health Sci. 2013 Jul; 23(2): 141–149
Ouko *et al*	2 childrens homes in NBI, MDH, Alupe	• Mixed	118	31 (26.3%)	East African Medical Journal Vol. 87. No. 5 May 2010
2010 **Omuse et al**	AKUHN	• Nasal swab	45	0 (0%)	J Hosp Infect. 2012 Jan;80(1):71-3
2011 **Aiken *et al***	TDH	• Nasal and axillary swabs	86	6 (7%)	Antimicrob Resist Infect Control. 2014; 3: 22
2011-2013 **Omuse *et al***	AKUHN GCH	• Mixed	731	27 (3.7%)	BMC Infect Dis. 2014 Dec 14;14:669
2014-2016 Gitau et al	KNH	• Mixed	944	262 (27.8%)	*BMC Res Notes (2018) 11:226*
2014-2016 Wangai et al	KNH	• Mixed	187	100 (53.4%)	BMC Infect Dis. 2019; 19: 596

RESEARCH Open Access

Molecular characterization of *Staphylococcus aureus* isolates from various healthcare institutions in Nairobi, Kenya: a cross sectional study

Geoffrey Omuse[1*], Kristien Nel Van Zyl[2], Kim Hoek[2], Shima Abdulgader[3], Samuel Kariuki[4], Andrew Whitelaw[2] and Gunturu Revathi[1]

The predominant MRSA *spa* type was t037, MLST ST 241, clonal complex 5 **"Brazilian/Hungarian clone"**

AAC
Journals.ASM.org

Ceftriaxone-Resistant *Salmonella enterica* Serotype Typhimurium Sequence Type 313 from Kenyan Patients Is Associated with the $bla_{CTX\text{-}M\text{-}15}$ Gene on a Novel IncHI2 Plasmid

Samuel Kariuki,[a,c] Chinyere Okoro,[c] John Kiiru,[a] Samuel Njoroge,[a] Geoffrey Omuse,[b] Gemma Langridge,[c] Robert A. Kingsley,[c] Gordon Dougan,[c] Gunturu Revathi[b]

- These *Salmonella enterica* serotype Typhimurium isolates were resistant to ampicillin, chloramphenicol, cefuroxime, ceftriaxone, aztreonam, cefepime, sulfamethoxazole-trimethoprim, and cefpodoxime.

Antimicrobial Agents and Chemotherapy

Detection of NDM-1-Producing *Klebsiella pneumoniae* in Kenya

Laurent Poirel, Gunturu Revathi, Sandrine Bernabeu and Patrice Nordmann
Antimicrob. Agents Chemother. 2011, 55(2):934. DOI: 10.1128/AAC.01247-10.
Published Ahead of Print 29 November 2010.

- First report of NDM 1 producer from Africa
- Isolates collected from 2007-2009

International Journal of Infectious Diseases 85 (2019) 182–187

Contents lists available at ScienceDirect

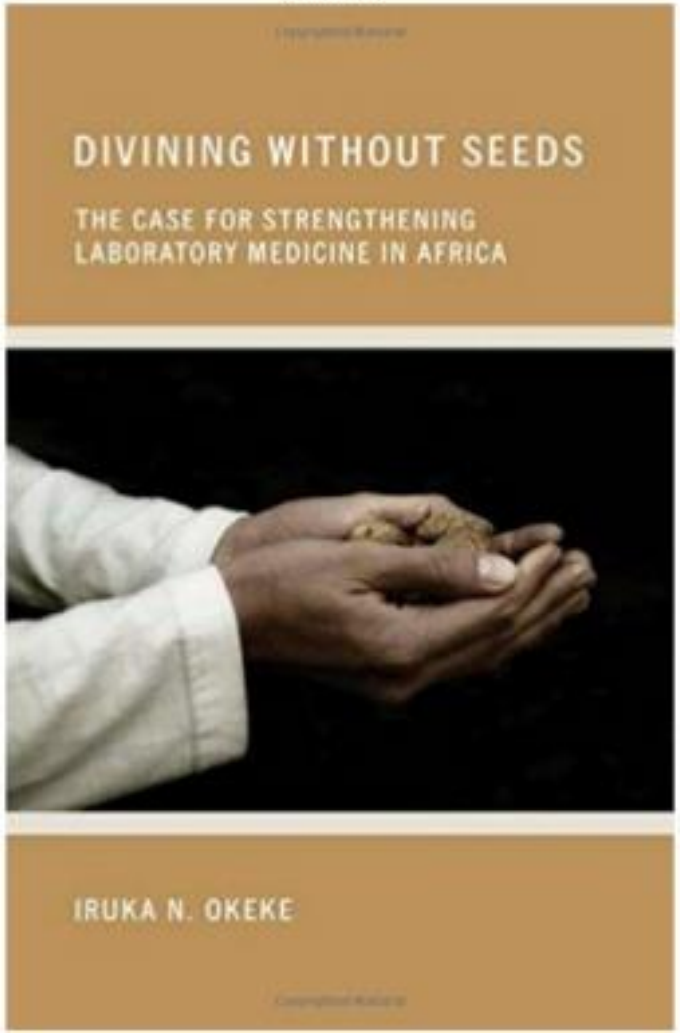
International Journal of Infectious Diseases

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

Analysis of *Candida auris* fungemia at a single facility in Kenya

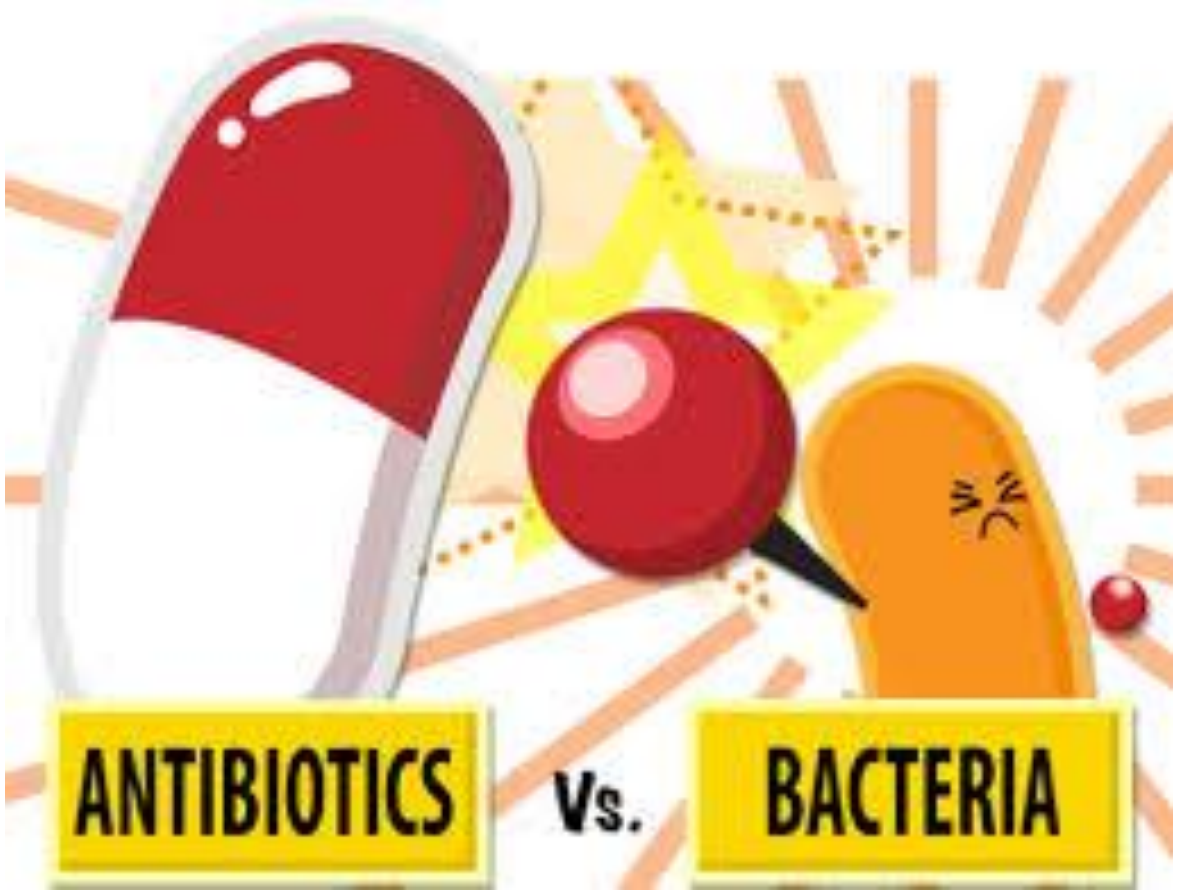
Rodney D. Adam[a,*], Gunturu Revathi[b], Nancy Okinda[b], Melanie Fontaine[b], Jasmit Shah[c], Elizabeth Kagotho[b], Mariana Castanheira[d], Michael A. Pfaller[d], Daniel Maina[b]

- Identified by vitek 2 as *C.haemulonii*
- *C. auris* patients had been hospitalized longer (mean 32 days vs. 13 days; p < 0.001)
- More likely to have central lines preceding candidemia than *C. albicans* patients (84% vs. 54%; p = < 0.001)
- More commonly been treated with carbapenems (83% vs 61% for *C. albicans* [p = 0.01])
- The crude mortality was 29%, compared to 36% for *C. albicans*



No Human is Limited

No Bacteria is Limited



- END