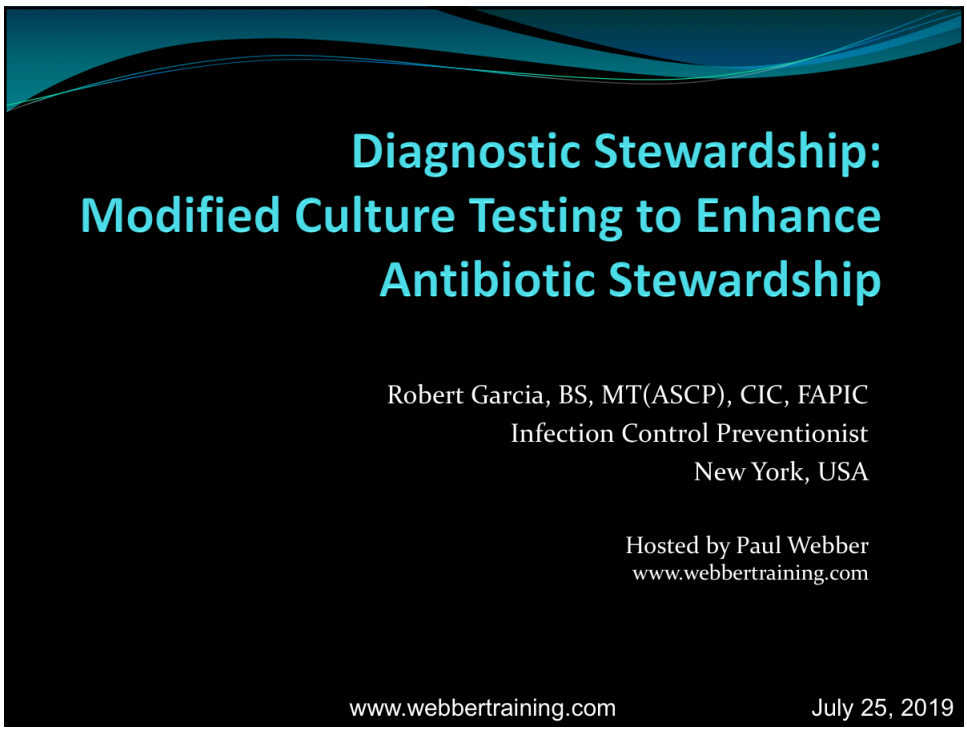
Diagnostic Stewardship: Modified Culture Testing to Enhance Antibiotic Stewardship
Robert Garcia, BS, MT(ASCP), CIC, FAPIC
Infection Control Preventionist
New York, USA
Hosted by Paul Webber
www.webbertraining.com
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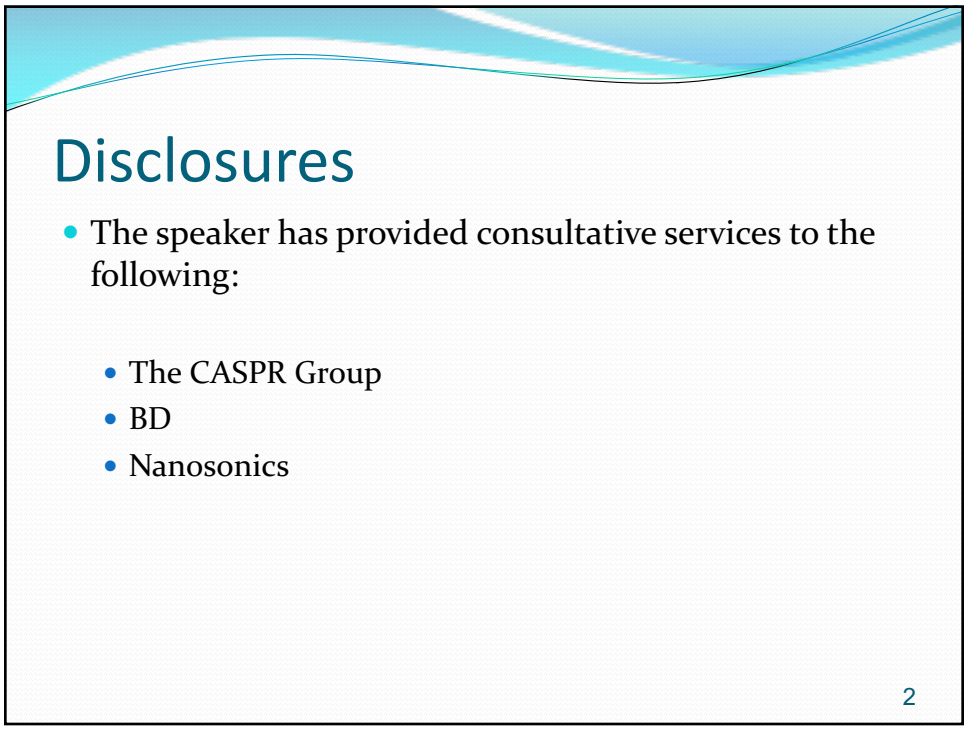
July 25, 2019


Disclosures
The speaker has provided consultative services to the following:
The CASPR Group
BD
Nanosonics
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Lecture Objectives

- Describe the impacts of blood and urine cultures have on healthcare outcomes
- Describe the potential entry points for contaminant organisms in current collection and handling practices
- Review studies that indicate control of urine and blood cultures leads to reduced antibiotic use and negative outcomes

3

The Effects on Healthcare When Proper Culture Management is Not Implemented

Systematic review on costs (BC Contamination):
- **Pharmacy:**
  - **$210-$12,611**
- **Labs:**
  - **$2397-$11,151**
- **Hospital costs:**
  - **$16,200-$111,627**
- **LOS: 1-22 days**

Dempsey C, et al. Economic health care costs of BC contamination, AJIC 2018

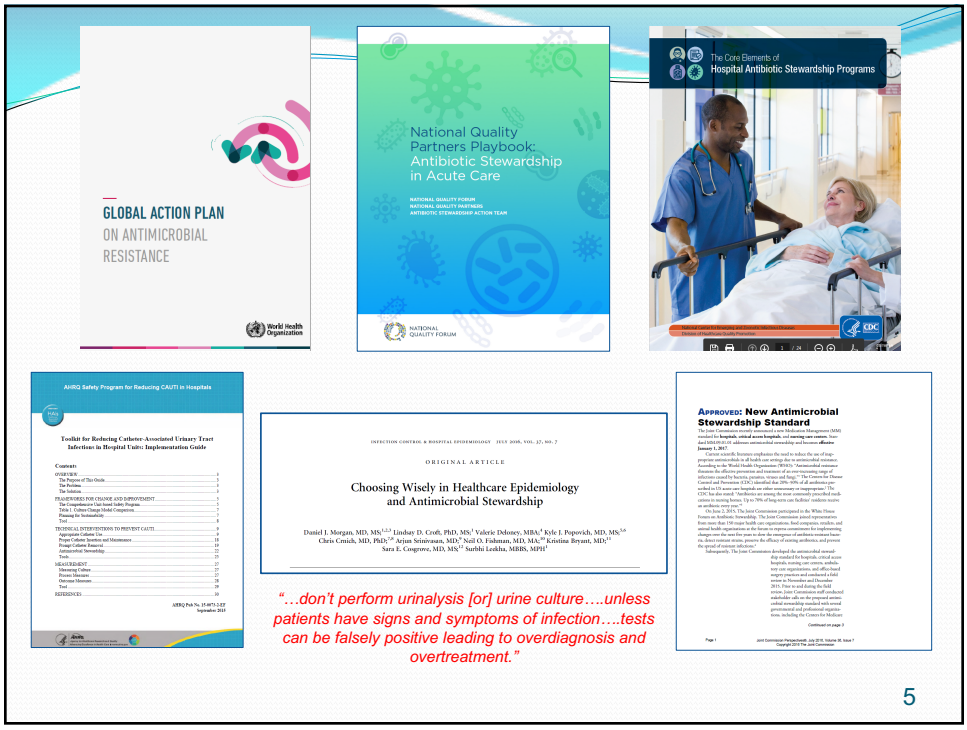
Clinician	Improper ordering
Nursing	Improper collection
Laboratory	False-positive results, workloads
Pharmacy	Increased costs
ID	Ineffective antibiotic stewardship
IP	Inaccurate analysis
Finance	Increased costs
Patient	Adverse effects including *C. difficile*

4

Diagnostic Stewardship: Modified Culture Testing to Enhance Antibiotic Stewardship

Robert Garcia, Stoney Brook Medicine, New York, NY

A Webber Training Teleclass



"…don't perform urinalysis [or] urine culture….unless patients have signs and symptoms of infection….tests can be falsely positive leading to overdiagnosis and overtreatment."

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An Integrated Stewardship Model

PERSPECTIVE

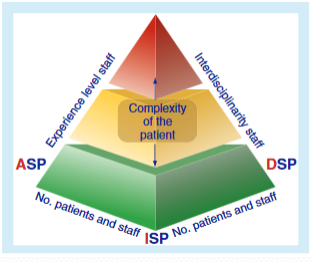
For reprint orders, please contact: reprints@futuremedicine.com

Future MICROBIOLOGY

An integrated stewardship model: antimicrobial, infection prevention and diagnostic (AID)

Jan-Willem H Dik[1], Randy Poelman[2], Alexander W Friedrich[*,3], Prashant Nannan Panday[4], Jerome R Lo-Ten-Foe[1], Sander van Assen[5], Julia EWC van Gemert-Pijnen[6], Hubert GM Niesters[2], Ron Hendrix[1,7] & Bhanu Sinha[1]

2015



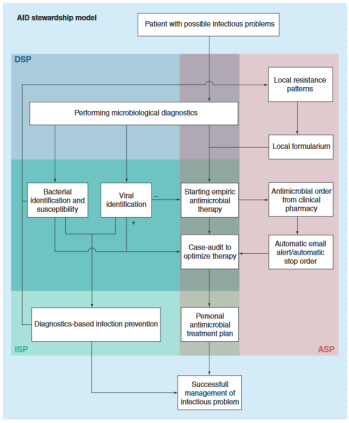


Figure 2. Master scheme antimicrobial, infection prevention and diagnostic stewardship model. Flow chart that depicts the path of care of a patient from top to bottom, surrounded by (several of) the building blocks of the three different, but supplemental, stewardship programs and how they are intertwined. Notice the overlap, thereby showing the necessity of all three stewardship programs and integrative nature of the model.
AID: Antimicrobial, infection prevention and diagnostic; ASP: Antimicrobial Stewardship Program; DSP: Diagnostic Stewardship Program; ISP: Infection Prevention Stewardship Program.

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Hosted by Paul Webber paul@webbertraining.com
www.webbertraining.com

Antibiotic Stewardship & IP Facts

American Journal of Infection Control 46 (2018) 364-8

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

APIC/SHEA/SIDP Antimicrobial Stewardship Position Paper

Antimicrobial stewardship and infection prevention—leveraging the synergy: A position paper update

Mary Lou Manning PhD, CRNP, CIC, FSHEA, FAPIC [a,*], Edward J. Septimus MD, FIDSA, FACP, FSHEA [b], Elizabeth S. Dodds Ashley PharmD, MHS, BCPS [c], Sara E. Cosgrove MD, MS, FSHEA [d], Mohamad G. Fakih MD, MPH, FIDSA, FSHEA [e], Steve J. Schweon MPH, MSN, RN, CIC, HEM, FSHEA, FAPIC [f], Frank E. Myers MA, CIC, FAPIC [g], Julia A. Moody SM-ASCP [h]

- AS and IP are bound by a common goal: *to keep patients safe and improve outcomes, regardless of where care is rendered*
- A significant world-wide concern are the development of MDROs
- Clinicians often order tests for patients *without* symptoms specific for the disease process, e.g., urine cultures among patients without symptoms of a UTI
- AS programs along with IP interventions such as hand hygiene are more effective than AS alone

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Goals of AS & IP Programs

- **Antimicrobial stewardship** refers to a collaborative, multidisciplinary program designed to improve (*conserve*) antimicrobial prescribing to optimize clinical outcomes while minimizing unintended consequences of antimicrobial use

- **Infection Prevention** programs aim to identify significant pathogens, reduce the transmission of organisms and MDROs by emphasizing aseptic technique, hand hygiene, environmental decontamination, and establishing prevention bundles to reduce the occurrence of HAIs

Antimicrobial Resistance: An antimicrobial/diagnostic stewardship and infection prevention approach. Med Clin N Am 2018;102:819-29.

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What is Diagnostic Stewardship?

- ***Diagnostic Stewardship*** is a coordinated system or user-based interventions designed to promote evidence-based utilization of diagnostic tests, with the primary goals of improving value and care quality and safely reducing costs
- DS involves modifying the process of ordering, performing, and reporting diagnostic tests in order to direct appropriate antimicrobial therapy
- The Microbiology laboratory provides information that identifies if a patient is infected, what the pathogen is, and which antibiotics may be effective in treatment of true infection

Septimus EL. Antimicrobial Resistance: An antimicrobial/diagnostic stewardship and infection prevention approach. Med Clin N Am 2018;102:819-29.
Morgan DJ, et al. Diagnostic Stewardship – Leveraging the laboratory to improve antimicrobial use. JAMA 2017;318:607-8.

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Key Considerations

DS

Goal	Key question	Key considerations and potential strategies
Right test	Is the test appropriate for the clinical setting?	Sensitivity and specificity Predictive values Testing volumes Diagnostic yield Laboratory feasibility Cost Clinical impact
Right patient	Will the clinical care of the patient be affected by the test result?	Laboratory test utilization committee Automatic laboratory reflex CPOE decision support Appropriate use criteria Indication selection Prior authorization Benchmarking Specimen rejection
Right time	Will the result be available in time to optimally affect care?	Time to specimen receipt Centralized vs point-of-care testing On-demand vs batched testing Specimen preparation time Run time Result reporting time

AS

Goal	Key question	Key considerations and potential strategies[a]
Right interpretation	Will the clinician understand the test result?	Result report language Selective reporting of relevant results AS prospective audit and feedback AS real-time decision support
Right antimicrobial	Will the clinician appropriately modify antimicrobials based on the test result?	Clinical practice guidelines EMR-based decision support with result reporting AS prospective audit and feedback AS real-time decision support
Right time	Will the clinician act upon the test result promptly?	EMR reporting Results called with readback reporting AS prospective audit and feedback AS real-time decision support

[a]AS, antimicrobial stewardship.

Messacar K, et al. Implementation of rapid molecular infectious disease diagnostics: the role of diagnostic and antimicrobial stewardship. J Clin Micro 2017;55:715-23.

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The 4 Moments for Improving Antibiotic Use

- Moment 1: "Does the patient have an infection that requires infection?"
- Moment 2: "Have I ordered appropriate cultures before starting antibiotics? What empirical antibiotic therapy should I initiate?"
- Moment 3: "A day or more has passed. Can I stop antibiotics? Can I narrow therapy? Can I change from intravenous to oral therapy?"
- Moment 4: "What duration of antibiotic therapy is needed for this patient's diagnosis?"

Tamma PD, et al. Rethinking how antibiotics are prescribed incorporating the 4 moments of antibiotic decision making into clinical practice. JAMA 2018;12/27/18.

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Diagnostic Stewardship

- DS practices are increasingly common among hospitals, often classified as quality improvement or under the umbrella of AS
- DS has a potentially important role in HAI surveillance: HAI surveillance based on current surveillance definitions may over-diagnose HAIs (e.g., CAUTI, CLABSI) by including colonized rather than clinically infected patients or by including organisms that are contaminants rather than true pathogens.
- Within the Micro community, the three stages of DS include:
  - Pre-analytic – test-related decision making and specimen collection
  - Analytic – relating to lab practices including reflex test algorithms
  - Post-analytic – includes selective reporting of results

Madden GR, et al. Diagnostic Stewardship for healthcare-associated infections opportunities and challenges to safely reduce test use. ICHE 2018;39:214-18.

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Examples of HAI-Related DS Strategies

TABLE 1. Examples of HAI-related Diagnostic Stewardship Strategies

			Diagnostic Stewardship Strategies		
HAI	Guidelines	Guidance to Support Stewardship Approach	Preanalytic	Analytic	Postanalytic
CAUTI	ACCCM/ IDSA guidelines for evaluation of new fever in critically ill patients[19]	Urine culture should only be obtained in febrile catheterized patients when urinary tract is suspected as a source or if urinary obstruction, neutropenia, or recent surgery is present. Urine dipstick is not recommended for catheterized patients.	Multifaceted approach in an ICU setting including "stewardship of culturing," reduced CAUTI rates by a third.[18] BPA discouraging dipsticks for catheterized patients.	Reflex urine culture protocol instituted for immunocompetent ICU patients associated with lower CAUTI rates. The lab performed urine culture only if pyuria was present on urinalysis.[20]	Clear interpretative language (eg, "likely contaminant") attached to result.
HABSI/ CLABSI	IDSA clinical practice guidelines for intravascular catheter-related infection[6]	Blood cultures should be obtained by a specialized phlebotomist. Catheter-drawn cultures to be done only when catheter-related BSI is suspected, along with a peripheral sample. Meta-analysis shows catheter-obtained specimens more likely to be contaminated versus	Policy discouraging routine blood culture samples drawn from central lines plus reeducation of phlebotomists reduced blood culture contamination and CLABSIs related to contamination.[9]	Use of molecular microarray for gram-positive blood cultures shortens time to pathogen identification and appropriate antimicrobial therapy for patients with VRE bacteremia.[27]	Rapid microarray results coupled with mandatory infectious diseases consultation for positive gram-positive cultures reduced mortality due to *S. aureus* bacteremia.[28]

Madden GR, et al. Diagnostic Stewardship for healthcare-associated infections opportunities and challenges to safely reduce test use. ICHE 2018;39:214-18.

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Examples of HAI-Related DS Strategies

Table. Steps at Which Diagnostic Stewardship May Improve Testing for Common Infectious Disease Tests

	Ordering (Preanalytic)	Collection (Preanalytic)	Processing (Analytic)	Reporting (Postanalytic)
General principles	Test only if clinical presentation is consistent with the infectious etiology (high pretest probability)	Pay attention to sample collection and transport, to optimize yield and reduce contamination	Use adjunctive laboratory tests to distinguish colonization from infection	Report results in a format that guides appropriate practice
Urine cultures	Test only when symptoms suggest urinary tract infection or, if asymptomatic, concordant with guidelines (eg, urologic surgery, pregnancy)	Use aseptic technique—midstream clean catch after periurethral cleansing Obtain catheter sample from collection port (not bag), prefer newly inserted catheter	Only perform urine culture if pyuria present	Text interpreting result, eg, "multiple organisms indicating likely contamination"; "no pyuria, culture not performed" Selective reporting of antibiotic susceptibilities—display preferred antibiotics only
Blood cultures	Test only when symptoms of infection present (fever) Avoid repeat cultures unless concern for persistent or endovascular infection	Use aseptic technique—prefer peripheral samples obtained by trained phlebotomists Avoid catheter draws	Consider rapid testing on initial positive results, eg, polymerase chain reaction, PNA-FISH, MALDI-TOF	Text interpreting result, eg, "likely skin contaminant"; "*Staphylococcus aureus*, likely pathogen consider infectious diseases consult" Selective reporting of antibiotic susceptibilities
***Clostridium difficile* testing**	Test only when disease likely (eg, recent antibiotic exposure, >3 loose stools/d, duration >24 h, and no recent laxative use) Avoid tests of cure	Only collect and send loose stool (ie, that conforms to the container)	Consider use of a testing algorithm that includes toxin immunoassay	Text interpreting result, eg, "toxin−/PCR+ indicating possible colonization rather than disease"
Molecular detection panels (ie, "syndromic testing")	Test only when pretest probability moderate to high for ≥2 targets on the panel, and when results will influence management	Use recommended collection and transport conditions to reduce contamination and optimize yield	Follow stringent contamination prevention guidance in the laboratory to avoid false-positive results	Selective suppression of results for tests on panel if other testing approach used in the laboratory (eg, *C difficile* testing on stool pathogen panel) Text interpreting results discussing colonization
Forms of automation	Clinical decision support requiring documentation of symptoms Hard stops for contraindications—eg, laxative use within 48 h of *C difficile* test)	Recording site and method of collection Orders requiring supplementary tests—eg, urinalysis before urine culture	Laboratory support systems performing cascades of tests	Prepopulated reports that can be reviewed and modified by laboratory personnel
Clinician education	Yes	No	No	Yes

Abbreviations: PNA-FISH, peptide nucleic acid–fluorescence in situ hybridization; MALDI-TOF, matrix-assisted laser desorption/ionization time-of-flight.

Morgan DJ, et al. Diagnostic Stewardship – Leveraging the laboratory to improve antimicrobial use. JAMA 2017;318:607-8.

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Review Article on Blood Culture Collection and Handling

American Journal of Infection Control 43 (2015) 1222-37

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major article

Multidisciplinary team review of best practices for collection and handling of blood cultures to determine effective interventions for increasing the yield of true-positive bacteremias, reducing contamination, and eliminating false-positive central line–associated bloodstream infections

Robert A. Garcia BS, MT(ASCP), CIC[a,*], Eric D. Spitzer MD, PhD[b], Josephine Beaudry RN, BS, MS, CNS-A, CNS-N, ANP-c[c], Cindy Beck BSN, RN[d], Regina Diblasi BSN, RN, OCN[e], Michelle Gilleeny-Blabac BS, MT(ASCP), SLS[f], Carol Haugaard RN, MSN, ANP[g], Stacy Heuschneider DNP, NP-C, ACNS-BC, CCRN[h], Barbara P. Kranz CIC[a], Karen McLean RN[i], Katherine L. Morales RN, CCRN, MSFN[j], Susan Owens RN, BS[k], Mary E. Paciella RN, MS, CCRN, ANP, ACNS-BC, PCCN[l], Edwin Torregrosa RN, BSN[m]

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Reasons for Optimizing Blood Culture Collection & Handling

- Identifying true pathogens
- Avoidance of blood culture contamination
- Avoiding false positive CLABSIs

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Need for Maximizing True Pathogens

- Septicemia is the 11th leading cause of death in the U.S. accounting for more than 41,000+ lives per year
- Sepsis is currently the most expensive hospital condition ($23.6 billion) among inpatients
- ….has accounted for a 32 percent increase in hospitalizations in recent years
- …and is the leading cause of admission to a hospital for adults aged 45 to 84 years after an Emergency Department (ED) visit
- Guidelines recommend blood cultures to be obtained within three hours of presentation and prior to administration of antibiotics

CDC, Leading causes of death, US, 2016. available at: https://www.cdc.gov/nchs/data/nvsr/nvsr67/nvsr67_05.pdf
Agency for Healthcare Research and Quality. Healthcare Cost and Utilization Project. Statistical Brief #204. National Inpatient Hospital Costs: The Most Expensive Conditions by Payer, 2013. Available at: https://hcup-us.ahrq.gov/reports/statbriefs/sb204-Most-Expensive-Hospital-Conditions.jsp.
Agency for Healthcare Research and Quality. Healthcare Cost and Utilization Project. Statistical Brief #161. Trends in Septicemia Hospitalizations in Selected HCUP States, 2005 1nd 2010. Available at: http://www.hcup-us.ahrq.gov/reports/statbriefs/sb161.pdf.
Agency for Healthcare Research and Quality. Healthcare Cost and Utilization Project. Statistical Brief #174. Overview of Emergency Department Visits in the United States, 2011. Available at: http://www.hcup-us.ahrq.gov/reports/statbriefs/sb174-Emergency-Department-Visits-Overview.pdf.
Surviving Sepsis Campaign. Updated Bundles in Response to New Evidence. Available at: http://www.survivingsepsis.org/SiteCollectionDocuments/SSC_Bundle.pdf

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Blood Culture Collection Methods

"Drawing blood for culture may be performed by obtaining the blood peripherally of from an existing intravascular device…..however, both methods have substantial risk of introducing microorganisms that are not present in the blood into the blood specimen"

Hughes, JA, et al. The effectiveness of interventions to reduce peripheral blood culture contamination in acute care: a systematic review protocol. Systematic Rev 2018;7:126.

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Blood Culture Contamination

- Contaminated BCs are associated with severe financial and clinical consequences
- Landmark study by the College of American Pathologists (CAP) of 497,134 BCs obtained in 640 hospitals reported *mean contamination rate of 2.5%* among all BCs drawn
- Approximately **50%** of *positive* BCs represent contamination
- Most U.S. hospitals use a BCC benchmark of ≤3.0% as derived from CAP Q-Tracks Monitor data, although this is not a validated benchmark
- BCs are considered contaminated if one or more of the following organisms are found in *only one bottle in a series of BC sets* (e.g., 1 of 1; 1 of 2, etc.):
  - CoNS, *Micrococcus*, alpha-hemolytic viridens strep, *Propionibacterium acnes*, *Corynebacterium* sp., *Bacillus* sp.

Bates DW, Goldman L, Lee TH. Contaminant blood cultures and resource utilization: the true consequences of false-positive results. JAMA 1991;265(3):365-69.
Schifman RB, Strand CL, Meier FA, Howanitz PJ. Blood culture contamination: a College of American Pathologists Q-Probes study involving 640 institutions and 497,134 specimens from adult patients. Arch Pathol Lab Med 1998;122:216-21.
Bekeris LG, Tworek JA, Walsh MK, Valenstein PN. Trends in blood culture contamination: a College of American Pathologists Q-Tracks Study of 356 institutions. Arch Pathol Lab Med 2005;129:1222-25.

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BC Utilization Study

- Study intended to describe pattern of BC utilization in an academic medical center
- In total 38,939 BC sets were drawn over a one-year period (diversion discard tube used)
  - No growth – 35,823 (92.0%)
  - Pathogens – 2755 (7.1%)
  - Contamination – 358 (0.91%)
- In 2.5% of BC draws, catheter-related infections were principle diagnosis

Chen AI, et al. Blood culture utilization at an academic hospital: addressing a gap in benchmarking. ICHE 2018:39:1353-59.

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Define & Measure (Surveillance): NHSN CLABSI Definitions, 2019

NHSN Footnote: Blood Specimen Collection
In LCBI criteria 2 and 3, the phrase **"two or more blood specimens drawn on separate occasions"** means:

a. blood from at least two separate blood draws was collected on the same or consecutive calendar days, and
b. two separate site preparations (decontamination steps) were performed during specimen collection.
This will reduce misidentification of **contaminated** blood specimens as LCBIs. For example, aseptic technique indicates that separate site decontaminations would be performed for blood specimens drawn from different sites (in other words; different venipunctures, a combination of venipuncture and lumen withdrawal, or different lumens of the same central line), or at different times. Specimens collected in this manner would therefore be considered "separate occasions".
Specimen Collection Considerations: Blood specimens drawn through central lines can have a higher rate of **contamination** than blood specimens collected through peripheral venipuncture. 3, 4 However, all positive blood specimens, regardless of the site from which they are drawn or the purpose for which they are collected, must be included when conducting in-plan CLABSI surveillance (for example, weekly blood cultures performed in hematology and oncology locations).

NHSN, Bloodstream Infection Event (Central Line-Associated Bloodstream Infection and Non-central line-associated Bloodstream Infection), available at: http://www.cdc.gov/nhsn/PDFs/pscManual/4PSC_CLABScurrent.pdf

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BCC Effect on CLABSIs

- LCBI 1: so called NHSN *"recognized pathogens"* such as *S. aureus* or *Enterococcus* have been identified as contaminants (6.4% and 16.1% respectively) in major study; when a "pathogen" is not related to an infection at another site, as occurs when a contaminant is identified, then the event is a CLABSI
- LCBI 2: clinical situations, e.g., patient's venous condition, limited CVAD lumen access, clinician's workload may restrict "ideal" blood draws from separate sites or at different times.
- There exists no "gold standard" for determining true infection vs. contamination of BCs….this limitation may impact the variability in identifying reportable CLABIs

Freeman JT, et al. Blood culture contamination with Enterococci and skin organisms: implications for surveillance definitions of primary blood stream infections. Am J Infect Control 2011;39:436-48.
Steinberg JP, et al. Distribution of pathogens in central line-associated bloodstream infections among patients with or without neutropenia following chemotherapy: evidence for a proposed modification to the current surveillance definition. Infect Control Hosp Epidemiol 2013;34:171-75.
Backman LA, et al. Validation of the surveillance and reporting of central line-associated bloodstream infection data to a state health department. Am J Infect Control 2010;38:832-38.

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BC Issues Affecting Optimal Outcome

- Clinical indications
- Site draws: venipuncture vs. intravascular lines
- Handling of needleless connectors
- Use of pre-packaged kits for BC Drawing
- Use of sterile gloves
- Use of masks
- Skin antisepsis
- Disinfection of BC bottle septums
- Discarding of initial volume of blood
- Recommended volumes of blood
- Order of draw
- Inoculation of aerobic and anaerobic bottles
- Labeling (site of draw)
- Transport

Garcia R, Spitzer E. **Multidisciplinary team review of best practices for collection and handling of blood cultures to determine effective interventions for increasing the yield of true-positive bacteremias, reducing contamination, and eliminating false-positive central line-associated bloodstream infections. AJIC 2015;43:1222-37.**

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Review Article on Urine Culture Collection and Handling

American Journal of Infection Control 45 (2017) 1143-53

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

State of the Science Review

Promoting appropriate urine culture management to improve health care outcomes and the accuracy of catheter-associated urinary tract infections

Robert Garcia BS, MT(ASCP), CIC, FAPIC [a,*], Eric D. Spitzer MD, PhD [b]

[a] Healthcare Epidemiology Department, Stony Brook University Hospital, Stony Brook, NY
[b] Department of Pathology, Stony Brook University Hospital, Stony Brook, NY

Key Words:
Urinalysis
Urine culture
Asymptomatic bacteriuria
Antimicrobial stewardship
Reflex testing
Contamination

Published literature indicates that the unjustified ordering or improper collection of urine for urinalysis or culture from either catheterized patients or those without indwelling devices, or misinterpretation of positive results, often leads to adverse health care events, including increased financial burdens, over-reporting of mandated catheter-associated urinary tract infection events, overtreatment of patients with antimicrobial agents, selection of multidrug-resistant organisms, and *Clostridium difficile* infection. Moreover, national guidelines that provide evidence-based direction on core processes that form the basis for subsequent clinical therapy decisions or surveillance interpretations; that is, the appropriate ordering and collection of urine for laboratory testing and the treatment of patients with symptomatic urinary tract infection, are not widely known or lack adherence. This article provides published evidence on the influence of inappropriate ordering of urine specimens and subsequent treatment of asymptomatic bacteriuria and associated adverse effects; reviews research on bacterial contamination and preservation; and delineates best practices in the collection, handling, and testing of urine specimens for culture or for biochemical analysis in both catheterized and noncatheterized patients. The goal is to provide infection preventionists (IPs) with a cohesive evidence-based framework that will assist them in facilitating the implementation of a urine culture management program that reduces patient harms, enhances the accuracy of catheter-associated urinary tract infection surveillance, improves antibiotic stewardship, and reduces costs.

4.0 mL, Boric Acid, Sodium Formate and Sodium Borate Preservative

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Effects of UC on Admission

INFECTION CONTROL & HOSPITAL EPIDEMIOLOGY MAY 2018, VOL. 39, NO. 5

ORIGINAL ARTICLE

Urine Culture on Admission Impacts Antibiotic Use and Length of Stay: A Retrospective Cohort Study

Molly J. Horstman, MD;[1,2,4] Andrew M. Spiegelman, PhD;[3] Aanand D. Naik, MD;[1,2,4] Barbara W. Trautner, MD, PhD[1,2,5]

OBJECTIVE. To examine the impact of urine culture testing on day 1 of admission on inpatient antibiotic use and hospital length of stay (LOS).

DESIGN. We performed a retrospective cohort study using a national dataset from 2009 to 2014.

SETTING. The study used data from 230 hospitals in the United States.

PARTICIPANTS. Admissions for adults 18 years and older were included in this study. Hospitalizations were matched with coarsened exact matching by facility, patient age, gender, Medicare severity-diagnosis related group (MS-DRG), and 3 measures of disease severity.

METHODS. A multilevel Poisson model and a multilevel linear regression model were used to determine the impact of an admission urine culture on inpatient antibiotic use and LOS.

RESULTS. Matching produced a cohort of 88,481 patients (n = 41,070 with a culture on day 1, n = 47,411 without a culture). A urine culture on admission led to an increase in days of inpatient antibiotic use (incidence rate ratio, 1.26; $P < .001$) and resulted in an additional 36,607 days of inpatient antibiotic treatment. Urine culture on admission resulted in a 2.1% increase in LOS ($P = .004$). The predicted difference in bed days of care between admissions with and without a urine culture resulted in 6,071 additional bed days of care. The impact of urine culture testing varied by admitting diagnosis.

CONCLUSIONS. Patients with a urine culture sent on day 1 of hospital admission receive more days of antibiotics and have a longer hospital stay than patients who do not have a urine culture. Targeted interventions may reduce the potential harms associated with low-yield urine cultures on day 1.

Infect Control Hosp Epidemiol 2018;39:547–554

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Reasons for Inappropriate UC and UA Ordering

- Multi-hospital survey of internal medicine resident physicians designed by 6 board-certified ID physicians
- 100 total responses, *overall knowledge 48%*

Table 2
Summary of clinical vignettes presented to 100 respondents and knowledge domain assessed, with the corresponding proportion of correct responses

Summary of vignette, and question	Knowledge domain assessed	Correct responses/total responses (% correct)
Man with dementia aged 80 y, 1 day after being admitted with lethargy and confusion, but no urinary symptoms. Exam and laboratory results were consistent with dehydration. He is now alert and interactive, and with improvement in laboratory studies after rehydration. UA with pyuria, UC with growth of a gram-negative bacillus. Should antimicrobials be started?	Differentiating UTI from ASB	18/95 (19)
Same patient, 1 d later. Visiting family indicates he is at his baseline. UC with *Pseudomonas aeruginosa* , susceptible only to gentamicin and imipenem/cilastatin. Should antimicrobials be started?	Differentiating UTI from ASB	22/95 (23)
Asymptomatic woman aged 70 y seen preoperatively before hip arthroplasty. A preoperative UC grew 70,000 cfu/mL of a gram-negative bacillus. Should further work-up or treatment be pursued?	Necessity for further testing	56/95 (59)
The same patient's surgeon calls with results of a repeat UC, which grew >100,000 cfu/mL of a cefazolin-resistant *Escherichia coli* . Should antimicrobials be started, or prophylaxis (cefazolin) be altered? View full size	Differentiating UTI from ASB	50/94 (53)
A thoracic surgeon requests that all preoperative evaluations include a preoperative UC, with treatment of any positive results. What procedure should be implemented?	Clinical significance of ASB	51/94 (54)
Man aged 58 y about to undergo transurethral resection of the prostate has a preoperative UC with >100,000 cfu/mL of an *E coli* susceptible only to gentamicin and imipenem/cilastatin. What should be done in response to this UC result?	Management of ASB before urologic procedure	78/92 (85)
Patient with long-standing paraplegia and a grossly infected sacral decubitus ulcer has cloudy urine in the collection bag of his indwelling catheter. Should a UC be obtained?	Differentiating UTI from ASB	21/92 (23)
Man aged 60 y with fever and dysuria presents to clinic. UA shows pyuria, UC is pending. How should he be treated?	Male UTI management	74/92 (80)
Asymptomatic man aged 65 y seen for his annual physical exam, which was normal. Routine UA showed pyuria; UC grew >100,000 cfu/mL of a susceptible *Klebsiella* species. Should further work-up or treatment be pursued?	Necessity for further testing	35/90 (39)

ASB , asymptomatic bacteriuria; *UA* , urinalysis; *UC* , urine culture; *UTI* , urinary tract infection.

Drekonja DM, Abbo LM, Kuskowski MA, Gnadt C, Shulka MD, Johnson JR. A survey of resident physicians' knowledge regarding urine testing and subsequent antimicrobial treatment. Am J Infect Control 2013;41:892-6.

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Reasons for Inappropriate UC and UA Ordering

- Survey of 354 nurses at 5 hospitals
- Sample of incorrect responses: *58.4% observed others compliant with not obtaining specimen for culture from drainage bag; 78.4% would obtain sample in patients with chronic urinary catheter on admission; 3.1%-24.7% agreed with taking culture when patient has pyuria*

Table 1
When nurses obtain urine cultures in catheterized patients (I anticipate collecting a urine sample for culture if my patient with an indwelling urinary catheter has...)

Statement		Answered true	Answered false	Answered do not know	Statement is
1	Foul-smelling urine	378/391 (96.7)	9/391 (2.3)	4/391 (1)	Incorrect
2	Hematuria	268/384 (69.8)	91/384 (23.7)	25/384 (6.5)	Controversial
3	Cloudy urine	376/391 (96.2)	13/391 (3.3)	2/391 (0.5)	Incorrect
4	Urine sediment	330/389 (84.8)	42/389 (10.8)	17/389 (4.4)	Incorrect
5	Urine color becoming darker in color View full size	207/382 (54.2)	140/382 (36.6)	35/382 (9.2)	Incorrect
6	Urgency (sensation to urinate)	289/385 (75.1)	80/385 (20.8)	16/385 (4.2)	Correct
7	Catheter insertion routinely	174/378 (46)	176/378 (46.6)	28/378 (7.4)	Incorrect
8	Catheter present for >3 days	176/384 (45.8)	166/384 (43.2)	42/384 (10.9)	Incorrect
9	Chronic urinary catheter on admission	305/389 (78.4)	58/389 (14.9)	26/389 (6.7)	Incorrect
10	New onset lower abdominal pain	297/385 (77.1)	54/385 (14)	34/385 (8.8)	Correct
11	New onset confusion in an elderly patient (>65 y old)	361/391 (92.3)	23/391 (5.9)	7/391 (1.8)	Correct
12	Patient going for bladder tumor resection	194/386 (50.3)	84/386 (21.8)	108/386 (28)	Correct
13	Patient going for colon surgery	119/381 (31.2)	139/381 (36.5)	123/381 (32.3)	Incorrect
14	Temperature of 38°C (100.4°F) with stable blood pressure and heart rate without clear source	287/386 (74.4)	69/386 (17.9)	30/386 (7.8)	Controversial
15	Temperature of 38°C (100.4°F) with hypotension without clear source	323/388 (83.2)	27/388 (7)	38/388 (9.8)	Correct
16	Temperature of 38°C (100.4°F) with hypotension in a patient with pneumonia	185/383 (48.3)	134/383 (35)	64/383 (16.7)	Incorrect
17	A urine WBC (unspun) of 25 cells	135/376 (35.9)	93/376 (24.7)	148/376 (39.4)	Incorrect
18	A urine WBC (unspun) of 100 cells	226/378 (59.8)	22/378 (5.8)	130/378 (34.4)	Incorrect
19	A urine WBC (unspun) of 500 cells	265/384 (69)	12/384 (3.1)	107/384 (27.9)	Incorrect

NOTE. Values are n/N (%) or as otherwise indicated.

Jones K, Sibai J, Battjes R, Fakih MG. How and when nurses collect urine cultures on catheterized patients: a survey of 5 hospitals. Am J Infect Control 2016; 44:173-6.

27

Evidence for Inappropriate Ordering of UC/UA Testing

- Randomized study of 208 newly admitted patients over 1 year at the University of Michigan Health System
  - *120 (57.7%) did not meet guideline-based criteria for a urine culture*
  - *Of these, 75 patients (62.5%) had a reason documented that was inconsistent with current guidelines, including for bacteriuria before an orthopedic procedure and altered mental status*
  - *No documented reason for ordering a UC was found in 37.5% of patients*
  - *Fever was the sole indication for obtaining a UC in nearly three-quarters*

Hartley S, Valley S, Kuhn L, Washer LL, Gandhi T, Meddings J, et al. Inappropriate testing for urinary tract infection in hospitalized patients: an opportunity for improvement. Infect Control Hosp Epidemiol 2013;34:1204-7.

28

Asymptomatic Bacteriuria

- IDSA defines ASB as *"isolation of a specified quantitative count of bacteria in an appropriately collected urine specimen obtained from a person without symptoms or signs referable to urinary infection"*
- ASB occurs in more than 30% of nursing home patients and 100% of those who are chronically catheterized
- 23% to 50% of antibiotic days for UTI are unnecessary treatment of ASB
- ASB is a benign condition that generally does not require treatment
- When patient symptoms are not considered or when non-urinary symptoms are attributed to bacteriuria, *"...unwarranted events may occur including unnecessary urine testing....leading to false-positive results...followed by over-treatment with antibiotics"*

Nicole LE, et al. Infectious Diseases Society of America. Guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults. Clin Infect Dis 2005;40:643-54.
Lin K. Screening for asymptomatic bacteriuria in adults: evidence for the U.S. Preventive Services Task Force reaffirmation recommendation statement. Ann Intern Med 2008;149:W20-4.
Trautner BW. Asymptomatic bacteriuria: when the treatment is worse than the disease. Not Rev Urol 2012;9:85-93
Garcia R, Spitzer E. Promoting appropriate urine culture management to improve health care outcomes and the accuracy of catheter-associated urinary tract infections. AJIC 2017 (pending publication)

29

Inappropriate Treatment of Catheter-Associated ASB

- Veterans Affairs Hospital, all UC over 3-months, patients with indwelling urinary catheter
- Determined Catheter-associated Asymptomatic Bacteriuria (CAABU) vs. CAUTI
- Results: 164 CAABU vs. 116 CAUTI
- *Of 164 CAABU, 32% inappropriate Rx w/antibiotics*
- *10 additional studies: inappropriate Rx range of 17%-83%* [Trautner BW, Grigoryan L. Approach to a positive urine culture in a patient without urinary symptoms. Infect Dis Clin North Am 2014;28:15-31]

Characteristic	Patients with CAABU	Patients with CAABU treated appropriately (*n* = 111)	Patients with CAABU treated inappropriately (*n* = 53)	*P*[a]
Sex				.21
Male	157	108 (69)	49 (31)	
Female	7	3 (43)	4 (57)	
Age, years				.04
<63	56	44 (79)	12 (21)	
≥63	108	67 (62)	41 (38)	
Hospital ward or service				.02
Extended care unit	29	14 (48)	15 (52)	
Other[b]	135	97 (72)	38 (28)	
Catheter type				.35
Foley	126	85 (67)	41 (33)	
Condom	38	26 (68)	12 (32)	
Predominant organism				.004
Gram negative	81	46 (57)	35 (43)	
Gram positive or fungal	83	65 (78)	18 (22)	
Quantity of predominant organism, cfu/mL				.02
10^5–10^8	59	47 (80)	12 (20)	
>10^8	105	64 (61)	41 (39)	
Peripheral blood WBC count, cells/mL				.61
<11	89	62 (70)	27 (30)	
≥11	75	49 (65)	26 (35)	
Urine WBC count, cells/mL				<.001
<90	125	96 (77)	29 (23)	
≥90	39	15 (38)	24 (62)	
Duration of catheterization, days				.86
<30	77	53 (69)	24 (31)	
≥30	87	58 (67)	29 (33)	

NOTE. Data are no. (%) of patients, unless otherwise indicated.
[a] By Fisher's exact test.
[b] Includes medicine, surgery, and rehabilitation wards.

Cope M, Cevallos ME, Cadle RM, Darouiche RO, Musher DM, Trautner BW. Inappropriate treatment of catheter-associated asymptomatic bacteriuria in a tertiary care hospital. Clin Infect Dis 2009;48:1182-8.

30

My appreciation to Joan Hebden for her contribution

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Redefining the Antibiotic Stewardship Team

- 2017 American Nurses Association/Centers for Disease Control and Prevention (ANA/CDC) White Paper
  - Purpose: inform RNs regarding the issue of antibiotic resistance and facilitate engagement in AS activities
  - Jan 2017 – TJC requiring inter-professional of hospital AS programs
  - Workgroup convened: 30 nurses from around the United States
- Recommendations for Education
  - Microbiology
    - How specimens for microbiology testing should be obtained
    - How to interpret microbiology test results, especially susceptibility reports
    - How to interpret the hospital antibiogram
    - Basics of distinguishing asymptomatic bacteriuria from urinary tract infection and colonization from active infection.

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Redefining the Antibiotic Stewardship Team

- Recommendations for Education
  - Pharmacology
    - Considerations for IV-to-PO conversion: what antibiotics and patients are good candidates
    - General information on antimicrobial spectra for various classes of antibiotics
    - Antibiotic interactions and incompatibilities
    - Common adverse reactions to antibiotics, with a special emphasis on recognizing and responding to suspected C. difficile infections
    - Information on therapeutic drug monitoring
    - How to assess a patient for a potential allergy to penicillin

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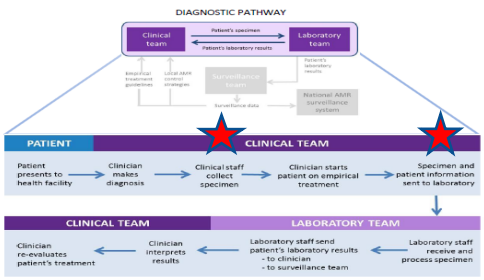
The Diagnostic Pathway

The diagnostic pathway begins when the patient presents at the health-care facility. It covers the initial interaction between the patient and clinicians and other frontline health-care workers providing care and responsible for diagnostic sampling, through to the role of the laboratory staff responsible for processing the sample and reporting the results back to the clinician. The different steps along this workflow are displayed in Figure 2.

Figure 2: Steps along the diagnostic pathway



WHO. Diagnostic stewardship. A Guide to implementation in antimicrobial resistance surveillance sites. https://apps.who.int/iris/bitstream/handle/10665/251553/WHO-DGO-AMR-2016.3-eng.pdf?sequence=1

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The Diagnostic Pathway

"Have I ordered appropriate cultures before starting antibiotics?"
Have they been obtained properly ?

The diagnostic pathway begins when the patient presents at the health-care facility. It covers the initial interaction between the patient and clinicians and other frontline health-care workers providing care and responsible for diagnostic sampling, through to the role of the laboratory staff responsible for processing the sample and reporting the results back to the clinician. The different steps along this workflow are displayed in Figure 2.

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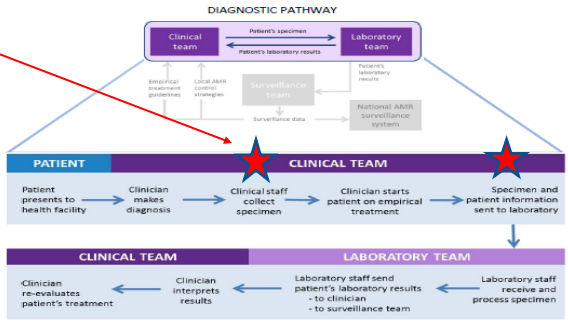

WHO. Diagnostic stewardship. A Guide to implementation in antimicrobial resistance surveillance sites. https://apps.who.int/iris/bitstream/handle/10665/251553/WHO-DGO-AMR-2016.3-eng.pdf?sequence=1

35

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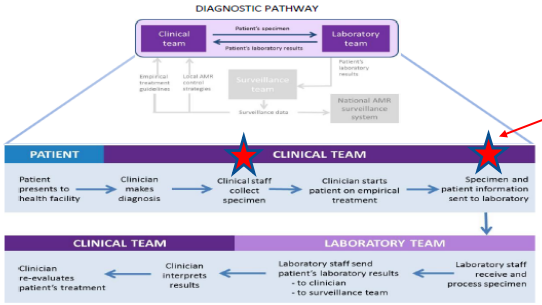

Has the specimen been preserved properly and transported in a timely manner?

WHO. Diagnostic stewardship. A Guide to implementation in antimicrobial resistance surveillance sites. https://apps.who.int/iris/bitstream/handle/10665/251553/WHO-DGO-AMR-2016.3-eng.pdf?sequence=1

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Implementing Diagnostic Stewardship

Table 1 Opportunities to implement diagnostic stewardship practices

Intervention Type	Pre-Analytic	Analytic	Post-Analytic	Diagnostic Stewardship Interventions for Urine Culturing
Treatment guidelines coupled with provider education				• Review evidence-based practices, development of institution-specific guidelines for correct UC technique and treatment of UTIs • Provider education • Active review of urine culture orders and provider feedback (peer-to-peer)
Require clinical indication when placing test order				• Build hard stops in the EHR that require providers to enter clinical indication when ordering UCs
EHR-integrated memorandum				• Build comment in the EHR that triggers when a UC is being ordered to remind the provider to avoid ordering in the absence of symptoms
Correct specimen collection technique				• Provide nurse training on appropriate UC collection technique • Provide ambulatory patients with education on correct clean-catch technique • Submit UC specimens with boric acid preservative
Assess specimen quality and reject poor quality specimens				• Laboratories should reject urine culture specimens that are submitted without preservative if >2 hours have elapsed since collection
Perform adjunctive tests to differentiate colonization infection				• Implement reflex urine culturing in the laboratory (perform UC only when UA meets predefined criteria) • Configure EHR to prioritize reflex UC • Remove UCs from order sets but retain reflex UC orders
Provide providers with guidance around test interpretation				• Build a comment in the EHR when a patient has a positive urine culture that advises providers about management of ASB.
Restrict reporting of UC results				• Report UCs as "mixed" without further information about identification when three or more organisms are recovered • Urine culture results (organism identification and/or antimicrobial susceptibility results) released only upon request of provider • Selective suppression of antimicrobial susceptibility results or use of cascade reporting

AMS antimicrobial stewardship, *DOT* days of therapy, *EHR* electronic health record, *UC* urine culture, *UTI* urinary tract infection

Claeys KC, et al. Advances and challenges in the diagnosis and treatment of urinary tract infections: the need for diagnostic stewardship. Curr Infec Dis Rpt 2019;21:1-9.

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Antibiotic Decision Making

Four Moments of Antibiotic Decision Making Adapted for Nurses

(1) Does the patient have an infection that requires antibiotics?

(2) Have appropriate cultures been ordered before starting antibiotics? What empiric therapy should be initiated?

(3) A day or more has passed. Can antibiotics be stopped? Can therapy be narrowed? Can a change be made from IV to oral therapy?

(4) What duration of antibiotic therapy is needed for the patient's diagnosis?

Monsees et al. Infection Control & Hospital Epidemiology (2019), 1–6

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The Role of Nursing in AS Programs

Nurses "Unrecognized" Role in ASP on Admission

ASP Tasks on Admission	Core Element	"Unrecognized" Nursing Role
Triage & isolation	A, DE, E	Identifies need isolation
Allergy History	A, DE, E	Takes allergy history Medication reconciliation
Cultures	A, DE, E	Collects before antibiotics Monitors results
Timely antibiotics	DE, A, T	Receives orders & reviews details, Checks allergies, administers

White Paper- Redefining the AS Team: Recommendations from the ANSJ/CDC Workgroup on the Role of RNs in Hospital AS Practices
https://www.cdc.gov/antibiotic-use/healthcare/pubs/ANA-CDC-whitepaper.pdf
Olans et. Al. CID. 2016; 62 (1): 84-89. Olans et al. AJN. 2017; 117 (8): 58-63.

A= Action, DE= Drug expertise, E= Education, T= Tracking

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The Role of Nursing in AS Programs

Nurses "Unrecognized" Role in ASP During Stay

ASP Tasks on Progress & Patient safety	Core Element	Unrecognized Nursing Role
Progress reporting	DE, A, T	Monitors Communication patient progress
Antibiotic adjustment	DE, A, T	First to get results Communicates to team
Adverse event	A, T, E	Monitors Communicates (e.g., diarrhea)
Antibiotic orders	DE, A, T, E	Review changes in patient & orders
Antibiotic resistances	DE, A, T, E	Reviews cultures Sees bug- drug mismatch OR need for isolation

White Paper- Redefining the AS Team: Recommendations from the ANSJ/CDC Workgroup on the Role of RNs in Hospital AS Practices
https://www.cdc.gov/antibiotic-use/healthcare/pubs/ANA-CDC-whitepaper.pdf
Olans et. Al. CID. 2016; 62 (1): 84-89. Olans et al. AJN. 2017; 117 (8): 58-63.

A= Action, DE= Drug expertise, E= Education, T= Tracking

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The Role of Nursing in AS Programs

Nurses "Unrecognized" Role in ASP on Discharge

ASP Task at Discharge	Core Element	Unrecognized Nurse Role
IV to PO OR Outpatient therapy	DE, A, T, E	Monitors Assesses ability to take orals
Length of stay	A, T, E	Monitor progress
Patient Education & Med Rec	DE, A, E	Educates patient & Family
Outpatient visits/ transitions/ readmissions	A, T, E	Communicates patient diagnosis, management & medication to VNS/ LTCF/ other facilities

White Paper- Redefining the AS Team: Recommendations from the ANS/CDC Workgroup on the Role of RNs in Hospital AS Practices
https://www.cdc.gov/antibiotic-use/healthcare/pubs/ANA-CDC-whitepaper.pdf
Olans et. Al. CID. 2016; 62 (1): 84-89. Olans et al. AJN. 2017; 117 (8): 58-63.

A= Action, DE= Drug expertise, E= Education, T= Tracking, VNS= visiting nurse services, LTCF= long term care

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Perceived Barriers for Nursing

Perceived Barriers	Potential Solutions
Nurse workload	Nurse feedback Algorithms Educational materials
Lack of physician support	Clinical and administrative champions Invite nurses as part of ASP
Limited knowledge	Identify knowledge gaps
Lack of experience & confidence	Identify unit champions Share successes
Nurse input not valued	Tools for nursing communication (SBAR) Clear support for nurse role in ASP

Monsees et al. Infection Control & Hospital Epidemiology (2019), 1–6

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What the Nursing Staff Didn't Know…

- *Reducing blood culture contamination rates: A systematic approach to improving quality of care*
  - Formation of a system-wide interdisciplinary group – nursing, IP and lab – to develop 3 evidence-based nursing protocols for blood culture collection: from CVC, from new PIV, with peripheral blood draw.
  - **Lessons learned: lack of knowledge regarding**
    - **Proper use of CHG for skin prep**
    - **Need to disinfect bottle tops**
    - **Removal and change of needleless connector**
    - ***Scrub the hub of CVC***

Hopkins K, et al. Am J Infect Control 2013;41:1272-4

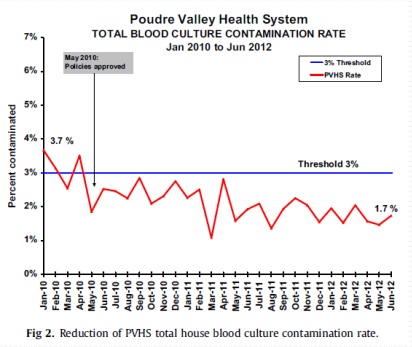

Fig 2. Reduction of PVHS total house blood culture contamination rate.

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BC Issues Affecting Optimal Outcome

- Clinical indications
- Site draws: venipuncture vs. intravascular lines
- Handling of needleless connectors
- Use of pre-packaged kits for BC Drawing
- Use of sterile gloves
- Use of masks
- Skin antisepsis
- Disinfection of BC bottle septums
- Discarding of initial volume of blood
- Recommended volumes of blood
- Order of draw
- Inoculation of aerobic and anaerobic bottles
- Labeling (site of draw)
- Transport

Garcia R, Spitzer E. **Multidisciplinary team review of best practices for collection and handling of blood cultures to determine effective interventions for increasing the yield of true-positive bacteremias, reducing contamination, and eliminating false-positive central line-associated bloodstream infections. AJIC 2015;43:1222-37.**

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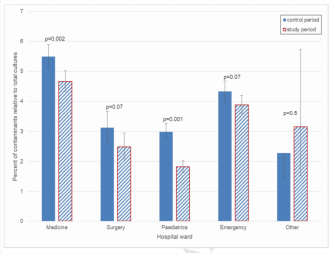
Use of Departmental Report Cards

- Prospective, controlled, before-and-after, 18-month study conducted at a 1000-bed university-affiliated hospital
- Hospital issued a monthly departmental blood culture report card on contamination rate
  - **Control** period- 49,403 cultures: 9.3% had growth; true positive 5.6%; contaminants 4.0%
  - **Study** period – 53,287 cultures: 8.3% had growth; true positive 5.2% (p = <0.02); contaminants 3.3% (p = <0.001)
- Analysis by division showed either a significant contamination reduction or a trend to reduction in all major divisions



Zimmerman FS, et al. J Hosp Infect 2018;99:236-237.

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Do We Need More Than Education?

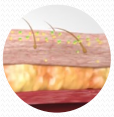
Blood culturing technology: Specimen Diversion Devices

Use of Information Technology to Optimize Ordering of Urine Cultures

Blood Culturing Technology

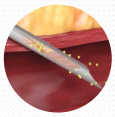
1.

Human Factor(s):
Risk of contamination during assembly and preparation of supplies, and skin prep



2.

Skin Flora:
You can disinfect but not sterilize the skin; Up to 20% of skin flora remains viable in the keratin layer of the skin even after skin prep[1]



3.

Skin Plug and Fragments:
when present, will ALWAYS enter the culture specimen bottle, and commonly will contain viable microorganisms

Mechanical diversion of the **initial 1.5-2.0 mL of blood** using a closed system has been clinically proven to **virtually eliminate** blood culture contamination[2,3]

[1]Anjanappa T. et al; Preparative Skin Preparation and Surgical Wound Infection. *Journal of Evidence based Medicine and Healthcare;*. (January 2015)
[2]M. Rupp, *et al*; Reduction in Blood Culture Contamination Through Use of Initial Specimen Diversion Device. *Clinical Infectious Diseases* (August 2017)
[3]Data on file

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Specimen Diversion Devices for Blood Culturing

Prior to use

Initial 1.5-2.0ml of blood diverted and sequestered prior to culture bottle inoculation

- ✓ Reduction in false positives up to **92%**[1,2]
- ✓ Sustained contamination rate as low as **0.2%** (P=0.001)[1]
- ✓ Positive predictive value as high as **97%**[1]
- ✓ Reduction in vancomycin DOT as much as **37%** (P=0.007)[3]
- ✓ Shorten length of stay by average of **2 days** (P=0.0001)[4]
- ✓ Reduce HAIs / HACs by as much as **23%**[5]
- ✓ Four studies, avg. annualized cost savings of **$945,000**[5]

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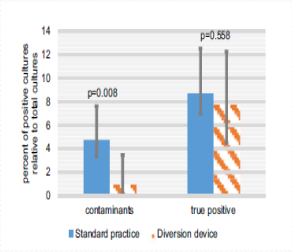
Specimen Diversion Devices for Blood Culturing

- *Reducing blood culture contamination using an initial specimen diversion device*
  - 6-month prospective controlled pragmatic study on a medical ward ; historical contamination rate of 4%
  - Intervention: initial specimen diversion device (integrated needle or attachment to a newly placed IV); controls – standard method. 671 BCs included
  - 464 cultures taken without device: 5.2% contamination rate; 207 cultures taken with the device: 1.0% contamination rate p = 0.008
  - No significant difference in true-positive rates



Zimmerman FS, et al. Am J Infect Control. Jan 2018. 10.1016/j.ajic.2018.12.004

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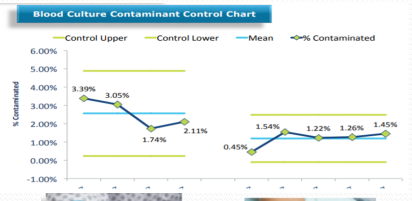
Specimen Diversion Devices for Blood Culturing

- *Preventing Blood Culture Contamination using a Novel Engineered Passive Blood Diversion Device*
  - Pre-post intervention design conducted in the ED with phlebotomy and ED staff: outcome metric -total blood culture contaminants
  - Pre-intervention – 1953 cultures; contamination rate of 0.025, 95% CI [0.019, 0.033]
  - Post-intervention - 2267 cultures; contamination rate of 0.012, 95% CI [0.008, 0.017] p <.05
    - Intervention was utilized in only 50% of blood draws during the post intervention period; first 3 months the device was only designed for vacutainer use; redesign allowed for use with newly placed lines



Sutton J, et al. Bayfront Health, St. Petersburg, FL. Presented APIC 2018: Minneapolis, MN

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Optimizing the Ordering of Urine Cultures

- Strategies used by AS programs generally focus on modulating antimicrobial use *after* their initiation
- By contrast, DS aims to reduce unnecessary detection of ASB

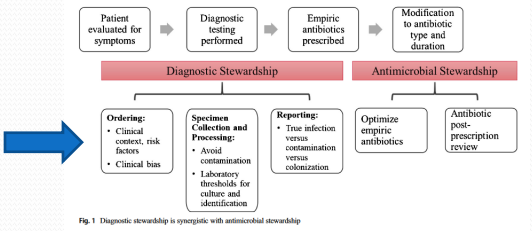

Fig. 1 Diagnostic stewardship is synergistic with antimicrobial stewardship

Claeys KC, et al. Advances and challenges in the diagnosis and treatment of urinary tract infections: the need for diagnostic stewardship. Curr Infec Dis Rpt 2019;21:1-9.

51

Optimizing the Ordering of Urine Cultures

- Study conducted on admitted patients, 1250-bed academic medical center
- Interventions: notification to providers, changes to order sets, inclusion of new urine culture reflex tests to CPOE
- Results:
  - *45.1%* decrease in rate of inpatient UCs
  - Reduction of $103,845 in lab charges to patients

	Pre-intervention	Post-intervention
Pos UCs (%)	4021 (25.5)	2621 (29.7)
UCs per 1000 PDs	38.1	20.9
Catherized UCs per 1000 PDs	7.8	1.9
CAUTI per 1000 CDs	1.25	1.27

Munigala S, et al. Effect of changing urine testing orderables and clinician order sets on inpatient urine culture testing: analysis from a large academic medical center. ICHE 2019;1-6.

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Summary

- Inter-disciplinary development of evidence-based culturing procedures, which address collection and handling, is necessary to ensure standardized practices.
- IPs can play a major role in educating nursing staff on the patient safety implications of improper culturing techniques and unnecessary antibiotic use.
- Technology has a role in optimizing the ordering and accuracy of culturing techniques.

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Thank you!

Robert Garcia, BS, MT(ASCP), CIC
robert.garcia@sbumed.org
Cell 516.810.3093

Diagnostic Stewardship: Modified Culture Testing to Enhance Antibiotic Stewardship
Robert Garcia, Stoney Brook Medicine, New York, NY
A Webber Training Teleclass

www.webbertraining.com/schedulep1.php	
August 15, 2019	*(FREE Teleclass)* BED BUG PREVENTION IN THE HEALTHCARE SETTING Speaker: **Dr. Marcia Anderson**, Environmental Protection Agency, United States
August 22, 2019	HOW TO ENGAGE AND EDUCATE NURSES IN EVIDENCE-BASED PRACTICE Speaker: **Eileen J. Carter**, Columbia University School of Nursing
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September 22, 2019	*(FREE European Teleclass – Broadcast live from the Infection Prevention Society conference)* Cottrell Lecture ... CHALLENGES AND OPPORTUNITIES IN INFECTION PREVENTION AND CONTROL Speaker: **Prof. Brett Mitchell**, Avondale College of Higher Education, Australia
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