Supplementary Table 1. Most Common Reasons for Inappropriate Antibiotic Use in 47 U.S. ICUs on March 1, 2017 with Specific Examples and Potential Intervention Strategies

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| **Reason** | **% of Survey Respondents** | **Select Illustrative Examples** | **Potential Strategies or Activities to Address** |
| Spectrum of activity too broad | 29 | * Treatment of community acquired pneumonia with hospital acquired pneumonia (HAP) regimen * Pseudomonal coverage for mild foot cellulitis in a diabetic patient * Elderly patient with sepsis of unknown source on ceftriaxone and metronidazole | * Syndrome- based guidelines * Restrictions on broad spectrum agents * Requiring indications on all antibiotic orders * Audit and feedback based on initial identified likely diagnosis (e.g., using Electronic Medical Record indication documentation, by service or by drug) * Rapid diagnostics such as MRSA nasal screening and multiplex PCR |
| Non infection / Non-bacterial infection | 22 | * Empiric treatment of asymptomatic bacteriuria * Antibiotics continued for acute myocardial infarction/ cardiac patient with congestive heart failure even though no evidence of pneumonia * Influenza/ other viral pathogen treated with antibiotics | * Diagnostic stewardship, including criteria for urine cultures and handling of culture results * Audit and feedback to prescribers in specialized areas of the hospital (e.g., Critical Care Unit) or by syndrome (e.g., cardiac patients) or by utilizing laboratory results (e.g., positive influenza results; positive urine cultures without urinalysis) |
| Duration longer than necessary | 21 | * Surgical prophylaxis continued for 3 days due to tubes or drains in place * Treatment of pneumonia longer than 5 days * Elderly patient with respiratory infection on azithromycin for > 5 days | * Guideline for surgical prophylaxis- addressing not just choice and timing of agent but also duration * Computerized order sets for surgical prophylaxis * Posters in Operating Room and post-operative areas for surgical prophylaxis (developed in consultation with surgical colleagues) * Default renewal or documentation of indication for antibiotics of > 5 days duration * Educational card for various syndromes including recommended durations of therapy |
| Adjustment in regimen not made in timely manner | 6 | * Patient treated for HAP and given broad empiric coverage which was never de-escalated based on cultures/ clinical improvement (vancomycin not discontinued) * Septic patients on cefepime and vancomycin and not de-escalated when cultures become positive * Elderly patient with respiratory infection and positive cultures for *Streptococcus pneumoniae* still on cefepime | * Restriction at 48-72 hours * Antibiotic time out and auditing at 72 hours * Co-rounding by Antibiotic Stewardship Program (ASP) and ICU team and readdressing empiric regimens at 72 hours * Audit and feedback for regimens of greater than 4-5 days. |
| Regimen does not cover all pathogens | 6 | * Adjustment not made to cover unanticipated pathogen such as methicillin-sensitive *Staphylococcus aureus* bacteremia * Suboptimal or incomplete regimen due concern for beta lactam allergy, (e.g., fluoroquinolone or monobactam with limited or no Gram-positive coverage) * Azithromycin for HAP * Empiric aminoglycoside and cefazolin for skin and soft tissue infection in immunocompromised, hospitalized >5 days patient | * Require ASP to vet priority microbiology results, such as blood cultures, influenza testing and inform/ educate providers * ASP audit and feedback on cultures, clinical status on set units or specific patient populations * System to clarify and document patient allergies * Education for prescribers on allergies * System to integrate allergy testing into routine practice upon ICU admission |
| Dosing, route or interval not correct for infection or renal function | 6 | * Inappropriate vancomycin dosing or difficulty achieving levels due to fluctuating renal function, extremes of age or size of patients | * Vancomycin nomograms and orders sets to guide dosing/ monitoring * Dosing and monitoring as an ASP/ pharmacy service or as a ICU/ ASP co- managed activity |
| Redundant antimicrobial coverage | 5 | * Double anaerobic coverage (e.g., intra abdominal infection not suspicious for *Clostridium difficile* treated with metronidazole AND beta-lactam/ beta-lactamase agent) * Directed, pan-sensitive *Escherichia coli* in urine on ceftriaxone and cefazolin | * Audit patients based on combination antibiotic regimens * Order set, education or alerts when trying to order certain antibiotic combinations |