What's the Harm? Development and Implementation of an Antimicrobial Stewardship Intervention Impact Score

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Background:
- Various metrics evaluate inpatient antimicrobial stewardship program (ASP) success, including:
  - antimicrobial utilization and appropriateness
  - intervention acceptance rates
  - cost savings
  - guideline adherence
- Patient safety initiatives are at the forefront of hospital quality improvement initiatives and related metrics.
- No commonly applied ASP measures evaluate patient harm.

Objective: To develop and implement a novel scoring tool quantifying the impact of ASP interventions on prevention of patient harm.

Methods:
- Setting
  - Tertiary care pediatric hospital with 386 beds
  - ASP originally established in 2008 and has conducted prospective audit with feedback (PAF) rounds since inception
- ASP created a multidisciplinary subgroup to develop a scoring tool classifying interventions as low, moderate, and high impact.
  - Low = patient harm was unlikely, but opportunities existed for minor antimicrobial optimization
  - Moderate = substantial room for optimization but still had low risk for patient harm
  - High = interventions carried a substantial risk of patient harm due to high probability of an adverse drug event or due to poor outcomes from an inappropriate regimen
- Using these principles, definitions for each level of impact were created for all ASP intervention categories (Table 1). ASP providers were trained on the tool and scored each intervention on daily PAF rounds. To improve objectivity, 2 ASP providers independently scored each intervention and discrepancies identified. Discrepancies were evaluated monthly, and the tool was modified.

Results: Between 11/9/21-3/31/22, ASP reviewed 2236 antimicrobial orders with 238 interventions made and scored for impact. Of these, 124 (52.1%) were low, 99 (41.6%) moderate, and 15 (6.3%) high impact. There were 26 scoring discrepancies identified which were discussed by the ASP subgroup. To further clarify definitions, there were 5 substantive definition changes and 4 minor modifications; most changes were made in 12/2021.

Conclusions: We describe here the successful implementation of a novel tool to score ASP interventions on stewardship impact and prevention of patient harm. Future directions include utilizing this tool to direct systematic ASP interventions, partnering with organizational patient safety, and engaging in a multi-institutional working group for further development.

Implementation of a novel impact score can more accurately capture ASP's role in **preventing patient harm**

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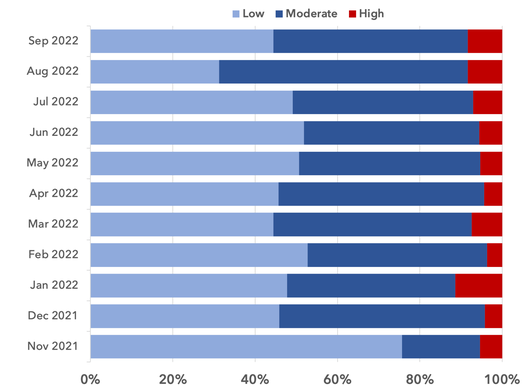
Table 1: Impact Score Definitions and Examples

	Low	Moderate	High
ID Consult	Consult as part of standard of care (care was appropriate from primary team) **Example:** Complicated pneumonia on ampicillin/sulbactam; consults for follow up; OPAT if on appropriate therapy	Consult to optimize care (suboptimal care choices made by primary team) **Example:** *S. aureus* bacteremia where on inappropriate therapy or insufficient work up; CLABSI where antibiotic lock therapy may be indicated	Consult due to clearly inappropriate care with risk for patient harm **Example:** Team planning for PICC line when PO transition is feasible; positive culture/site of infection where current antibiotics have a low likelihood of covering or reaching site of infection (i.e., CNS)
Narrow	Narrow from agent with adequate but overly broad coverage **Example:** Ceftriaxone narrowing to ampicillin for CAP; ceftriaxone to cefazolin for UTI	Narrow to agent that is treatment of choice (i.e., first-line) for indication (includes positive cultures with or without susceptibilities) **Example:** Clindamycin to cefazolin with cultures growing MSSA; Ceftriaxone to Ampicillin if S. pneumo positive cultures	Narrow from agent(s) with overly broad coverage AND potential harm (includes patients with risk factors for severe adverse effects or who are currently experiencing harm) **Example:** Cipro to ceftxime for UTI with susceptibilities; vancomycin to clindamycin for MRSA infection; Pip/tazo + vanco to alternative therapy; Cipro to alterative agent in patient experiencing psychiatric effects; Vancomycin to cefazolin for MSSA bacteremia
Broaden	Broaden to an agent to cover a pathogen in a patient with a possible/unlikely diagnosis (i.e., colonization vs. infection) **Example:** Urine culture positive in asymptomatic patient with neurogenic bladder; trach aspirate positive in patient on inappropriate therapy where team is wanting to treat	Broaden to an agent to cover the most likely pathogen(s) for diagnosis **Example:** Patient on ceftriaxone with HAP/VAP changed to cefepime; Intraabdominal infection expanded to pip/tazo to cover for *Enterococcus* spp.; patient with MDRO history expanded to cover this pathogen	Broaden due to inadequate or suboptimal coverage of isolated pathogen(s) or clinical data indicating superiority with an alternative agent **Example:** Gram stain positive for gram positive cocci in patient on gram-negative coverage only; ESBL bacteremia changed from pip/tazo to meropenem
Modify Formulation	Switch IV to PO agent for convenience and/or cost savings OR assist primary team in PO transition choice **Example:** Suggesting use of capsules or alternative suspension formulation for patient convenience	Switch IV to PO agent to reduce line entrances with PIV/CVL in place **Example:** Changing a high-bioavailable to oral in patients with an existing central line	Switch IV to PO agent to reduce potential toxicities/fluid overload Example: Patient on ketogenic diet who is receiving agent containing dextrose; modifying placement of a new central line with IV to PO switch; Changing to an appropriate Augmentin formulation per dosing strategy
Optimize Duration	Decrease estimated antimicrobial use by ≤ 2 days or unsure of teams planned duration	Decrease estimated antimicrobial use by 3-5 days	Decrease estimated antimicrobial use by ≥ 6 days
Modify Dose/ Frequency	Optimize dose to treat infection despite current dose being therapeutic/non-toxic OR adjustments with enteral antibiotics to improve compliance Example: Cephalexin QID to TID; reducing cefazolin from 50 mg/kg/dose IV q8hr to 30 mg/kg/dose IV q8hr for a SSTI	Reduce frequency of agent to reduce line entries OR suggested dose change as current dose is ineffective for low-risk infection type Example: Metronidazole IV q6hr to q8hr; increase cephalexin dose for cellulitis	Suggested dose change as current dose would likely cause harm OR ineffective treatment for high-risk infection (meningitis, endocarditis, bacteremia, complicated pneumonia, osteomyelitis, sepsis, etc.) Example: Ceftriaxone 50 mg/kg q24hr to q12hr dosing for meningitis; renal dose adjustments
Consolidate Antibiotics	–	Reduce number of antimicrobials by 1 Example: Clindamycin + ceftriaxone to ampicillin/sulbactam	Reduce number of antimicrobials by ≥ 2 Example: Cefepime + Amp + Metro consolidated to pip/tazo
Stop Antibiotics	Stopping narrow-spectrum agent(s) Example: Stopping ampicillin in patient with RSV	Stopping broad-spectrum agent(s) Example: Stopping cefepime in patient with negative blood cultures	Stop agent(s) with overly broad coverage AND potential harm (includes patients with risk factors for severe adverse effects or who are currently experiencing harm) Example: Stop vancomycin in patient with tenuous renal function
Additional Diagnostic Testing	ALL		
Immunizations	ALL		
Penicillin Allergy Referral	ALL		
Consult Another Sub-Specialty	ALL		
Additional Susceptibilities	ALL		

Figure 1: Percentage of Low, Moderate, and High Impact ASP Recommendations Per Month, Nov 2021 – Sep 2022



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