Antimicrobial Stewardship "State of the Union," 2023 and Beyond

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Antimicrobial Stewardship Collaborative of South Carolina

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No relevant conflicts of interest

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Learning objectives:

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Road Map to the Future State of Stewardship

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1) How is SC doing in terms of stewardship benchmarks?

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Learning assessment question

How does the standardized infection ratio (SIR) for *C.difficile* infection in SC compare to the 2021 national baseline?

a) It is equal to the national baseline
b) It is higher than the national baseline
c) It is lower than the national baseline

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The South is the US census region with highest outpatient antibiotic prescription rate (per 1000 population)

https://arpsp.cdc.gov/

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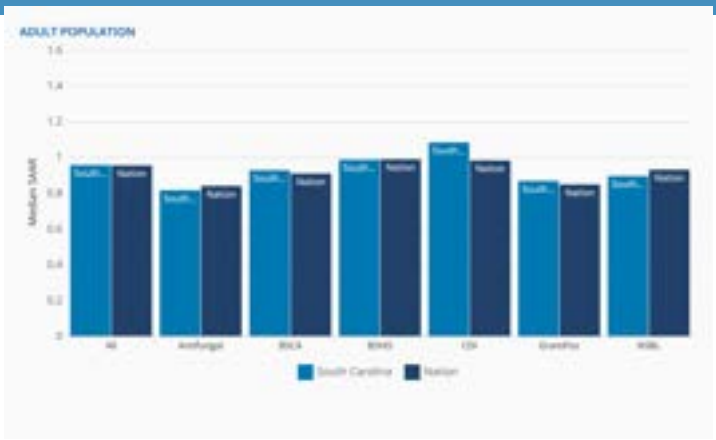
Median inpatient SAAR values (SC vs. national)



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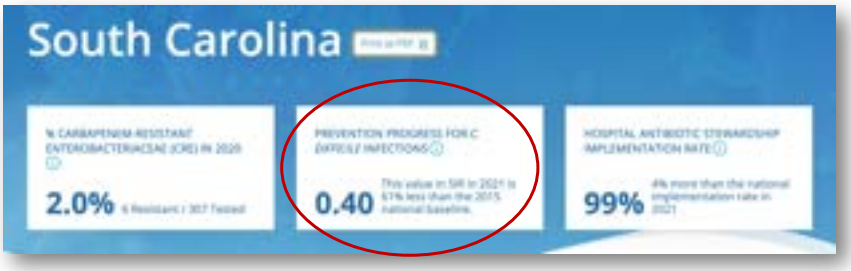
Gains made in stewardship in SC



Who is reporting into NHSN's AUR module in SC?

- Acute Care Hospitals 65
- LTCFs 6
- Inpatient Rehab Facilities 26
- Critical Access Hospitals 2
- 66.7% of eligible facilities

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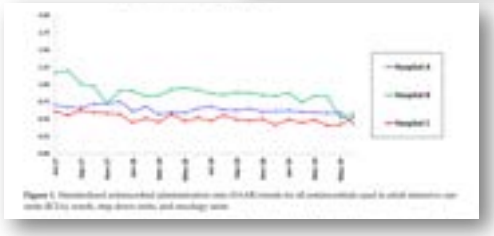

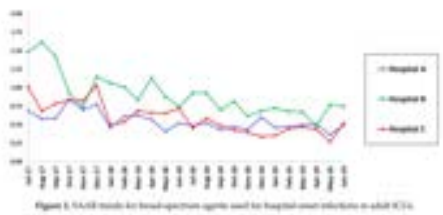

Shealy S, etc. Application of Standardized Antimicrobial Administration Ratio as a Motivational Tool within a Multi-Hospital Healthcare System. Pharmacy (Basel). 2021 Feb 7;9(1):32. doi: 10.3390/pharmacy9010032. PMID: 33562268; PMCID: PMC7930961.

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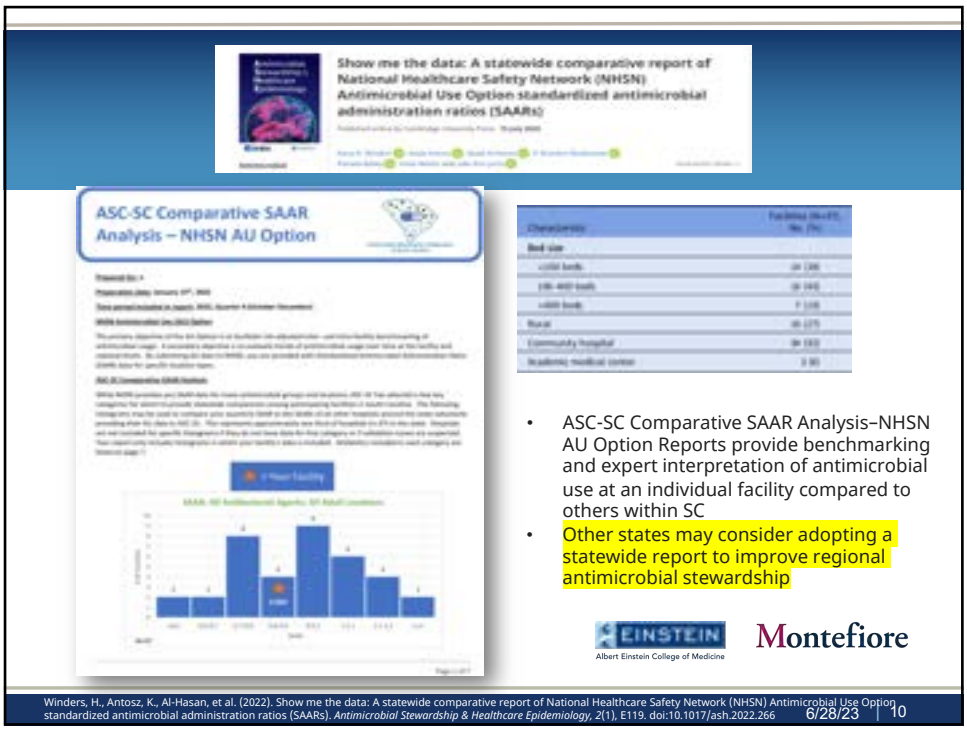
Show me the data: A statewide comparative report of National Healthcare Safety Network (NHSN) Antimicrobial Use Option standardized antimicrobial administration ratios (SAARs)
ASC-SC Comparative SAAR Analysis – NHSN AU Option
• ASC-SC Comparative SAAR Analysis–NHSN AU Option Reports provide benchmarking and expert interpretation of antimicrobial use at an individual facility compared to others within SC
• Other states may consider adopting a statewide report to improve regional antimicrobial stewardship
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Winders, H., Antosz, K., Al-Hasan, et al. (2022). Show me the data: A statewide comparative report of National Healthcare Safety Network (NHSN) Antimicrobial Use Option standardized antimicrobial administration ratios (SAARs). Antimicrobial Stewardship & Healthcare Epidemiology, 2(1), E119. doi:10.1017/ash.2022.266
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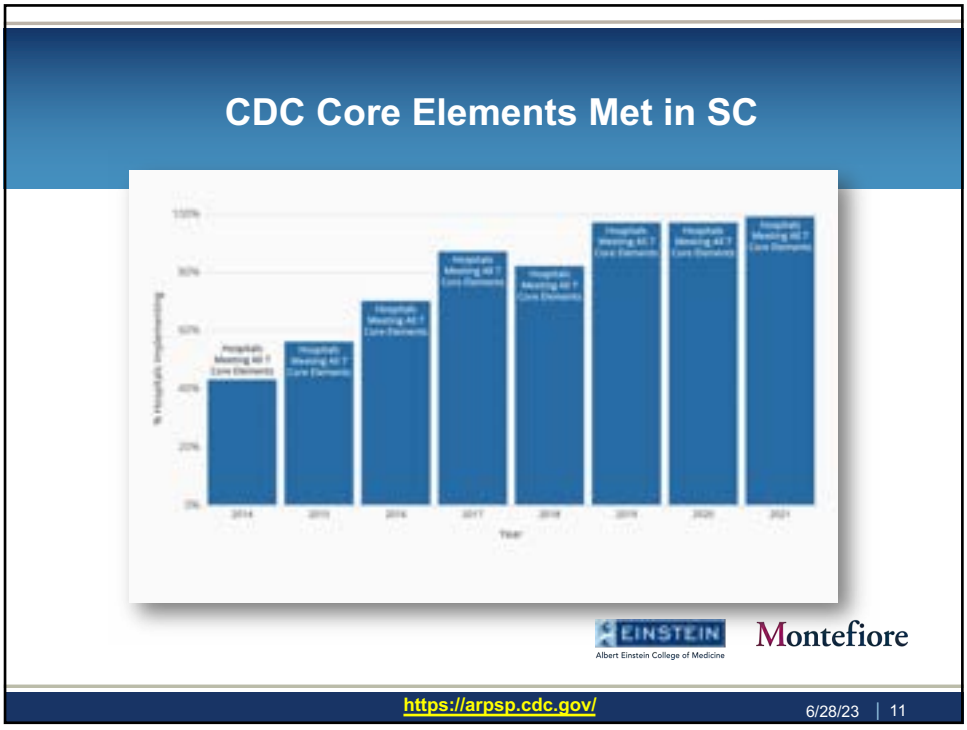
CDC Core Elements Met in SC
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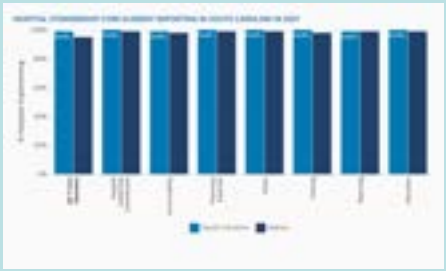
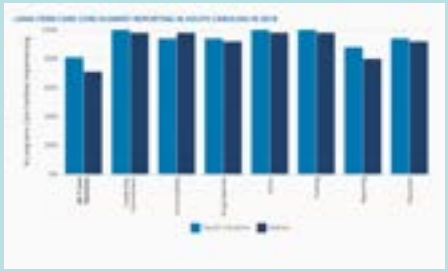
Specific Core Elements: How is SC doing (acute and LTC)?





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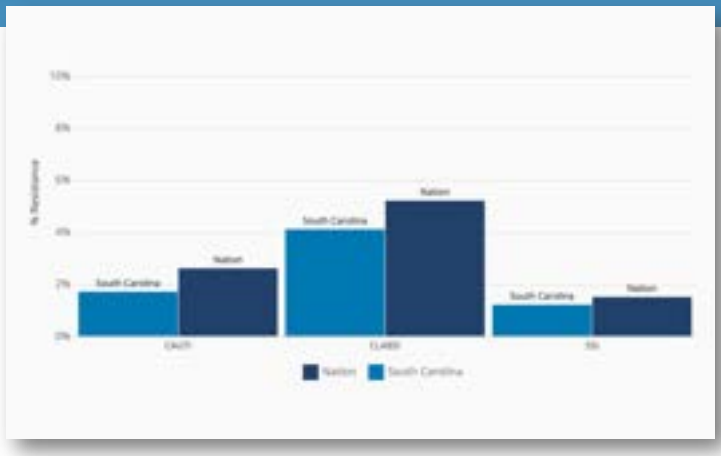
In SC, % CRE remains low as an HAI contributor



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https://arpsp.cdc.gov/ Date 13

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2) Appraise national and state activities that impact the landscape for antibiotic stewardship, including new accreditation standards and reporting requirements

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Learning assessment question

Which of the following is a new Joint Commission requirement for stewardship programs as of January 2023?

a) Competency-based assessment
b) Appointment of a qualified pharmacist/physician lead
c) Documentation of stewardship activities
d) Monitoring antibiotic use rates via NHSN's AU/R module

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Effective January 1, 2023, 12 new and revised antibiotic stewardship requirements apply to all Joint Commission–accredited hospitals and critical access hospitals

https://www.jointcommission.org/-/media/tjc/documents/standards/r3-reports/r3_antibioticstewardship_july2022_final.pdf

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Standard MM.09.01.01: The hospital establishes antibiotic stewardship as an organizational priority through support of its ASP.

- **EP 10 (new):** The hospital allocates **financial resources for staffing and information technology** to support the antibiotic stewardship program.
- **EP 11 (revised):** The governing body **appoints a physician and/or pharmacist who is qualified** through education, training, or experience in infectious diseases and/or antibiotic stewardship as the leader(s) of the antibiotic stewardship program.
- **EP 12 (revised):** The leader(s) of the antibiotic stewardship program is **responsible for the following**:
  - Developing and implementing a **hospital-wide antibiotic stewardship program** based on nationally recognized guidelines
  - **Documenting antibiotic stewardship activities**, including any new or sustained improvements
  - **Communicating and collaborating** with the medical staff, nursing leadership, and pharmacy leadership, as well as with the hospital's infection prevention and control and quality assessment and performance improvement programs on antibiotic use issues –
  - Providing **competency-based training and education** for staff on the practical applications of antibiotic stewardship guidelines, policies, and procedures
- **EP 13 (revised):** The hospital has a **multidisciplinary committee** that oversees the antibiotic stewardship program
  - May be composed of representation from the medical staff, pharmacy services, the infection prevention and control program, nursing services, microbiology, information technology, and the quality assessment and performance improvement program
  - May include **part-time or consultant staff**
  - Participation may occur **on site or remotely**

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https://www.jointcommission.org/-/media/tjc/documents/standards/r3-reports/r3_antibioticstewardship_july2022_final.pdf

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Standard MM.09.01.01 (cont.)

- **EP 14 (revised):** The antibiotic stewardship program demonstrates **coordination among all components of the hospital responsible for antibiotic use and resistance**, including, but not limited to, the infection prevention and control program, the quality assessment and performance improvement program, the medical staff, nursing services, and pharmacy services.
- **EP 15 (revised):** The antibiotic stewardship program **documents the evidence-based use of antibiotics** in all departments and services of the hospital.
- **EP 16 (new):** The antibiotic stewardship program monitors the hospital's antibiotic use by analyzing data on days of therapy per 1000 days present or 1000 patient days, *or by reporting antibiotic use data to the National Healthcare Safety Network's Antimicrobial Use Option of the Antimicrobial Use and Resistance Module.*
- **EP 17 (new):** The antibiotic stewardship program implements one or both of the **following strategies** to optimize antibiotic prescribing:
  - **Preauthorization** for specific antibiotics that includes an internal review and approval process prior to use
  - **Prospective review and feedback** regarding antibiotic prescribing practices, including the treatment of positive blood cultures, by a member of the antibiotic stewardship program
- **EP 18 (new):** The antibiotic stewardship program implements at least two **evidence-based guidelines to improve antibiotic use for the most common indications**
  - Must be based on national guidelines and reflect local susceptibilities, formulary options, and patients served

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https://www.jointcommission.org/-/media/tjc/documents/standards/r3-reports/r3_antibioticstewardship_july2022_final.pdf

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CMS 2023 IPPS Final Rule

Beginning in CY 2024, CMS finalized changes to the Medicare Promoting Interoperability Program for eligible hospitals and critical access hospitals that include a new AUR Surveillance measure under the Public Health and Clinical Data Exchange Objective.

NHSN Antimicrobial Use (AU) and Antimicrobial Resistance (AR) (AUR) Module reporting is one option to meet the Public Health Registry reporting element within the Promoting Interoperability (PI) Program

To obtain credit for calendar year 2024, eligible hospitals and CAHs must attest to being in active engagement with CDC's NHSN to submit AUR data for the EHR reporting period, or else claim an applicable exclusion.

https://www.cdc.gov/nhsn/cdaportal/datainteroperability.html

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What does this actually mean?

1. Hospitals must be in **active engagement** with CDC's NHSN (CY2024)
2. Hospitals must submit data to the ***Antibiotic Use and Resistance Module***
3. Hospitals must **receive a report from NHSN** upon successful submission

✓ 180 continuous days of data submission required

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Potential penalties (NYS)

Hospital Name	Potential Penalty if Promoting Interoperability (Meaningful Use) measures not met
All Members	**$477,794,738.93**
Hospital A	$36,823,598.48
Hospital B	$28,193,087.90
Hospital C	$21,490,933.52
Hospital D	$19,503,631.72
Hospital E	$13,838,780.04
Hospital F	$ 9,364,976.52

Slide courtesy of GNYHA AUR collaborative

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What is the goal/what will healthcare consumers see?

The Antibiotic Resistance & Patient Safety Portal (AR&PSP) is an interactive web-based application created to display data collected through CDC's NHSN, the Antibiotic Resistance Laboratory Network (AR Lab Network), and other sources. It offers enhanced data visualizations on Antibiotic Resistance, Use, and Stewardship datasets & Healthcare-Associated Infection (HAI) data.

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https://arpsp.cdc.gov/

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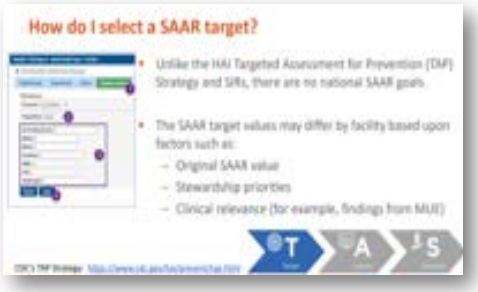
New: NHSN's Targeted Assessment for Antimicrobial Stewardship (TAS)

- Available to all hospitals utilizing NHSN's AU option
- TAS is NHSN analytic support to help ascertain facility-identified SAAR targets and assess how many fewer DOTs are required to attain SAAR target
- NHSN provides tools to assist each facility **determine their SAAR targets**
- https://www.youtube.com/watch?v=z3G26xirJzs



https://www.cdc.gov/nhsn/pdfs/training/2022/nhsn-au-option-tas-webinar-508.pdf

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Learning assessment/self-reflection

Rate the following statement (1 = far from ideal, 3 = neutral, 5 = ideal)

"Our stewardship program is adequately staffed with ID or ASP pharmacists per number of hospital beds in the facility"

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Challenge: how can we use regulatory mandates to level the playing field?

- Improved integration of IPC & AS programs
- Aligning IPC and AS metrics
- Advocating for increased staffing ratios/effort for both
- Tackling shared challenges

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NHSN metrics: moving toward value-based care

NHSN Metrics	What is it	Examples	Pros	Cons
AS: Standardized Antibiotic Administration Ratio **(SAAR)**	Risk-adjusted benchmark to interpret facility/unit-level comparative antibiotic use in context of expected rates	SAAR groupings by spectrum of activity and indication, ICU vs. facility-wide inpatient	• Most useful if trended over time & after intervention • Increasing number of reporting facilities >2500 • Unit mapping based on IPC • TAS provides targets for DOT reductions ➢ **Penalties (if reporting**	• Less well-established • Benchmarks are national, not regional • Appropriateness of antibiotic selection not represented (ICD-10s not yet part of risk-adjustment) • **Not yet ready for "primetime"; no penalties yet if benchmarks not met** • Heading in that direction?
IP: Standardized Infection Ratio **(SIR)**	Risk-adjusted benchmark to interpret facility/unit- level HAI rates in context of expected rates	CLABSI, MBI-LCBI, CAUTI, VAE, SSI, MRSA bacteremia, CDI	• **Well-established, accepted, and easy to interpret** • **Can quantify event reduction needed to achieve target** • Most useful if trended over time • Feedback to providers can be powerful	➢ **Pay-for-performance measure (punitive)** • Goal is 0 but can we get there?

ASHE debate-style commentary on SAAR applicability (Nate Shively, Yi Guo, Dan Morgan, Libby Dodds-Ashley, Arjun Srinivasan, et. al.)

Slide adapted from Dr. Mike Stevens & VIPTC

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"The CDC antimicrobial use measure is not ready for public reporting or value-based programs"

SAAR Antimicrobial Agent Category	Included Antimicrobials (Grouped by Category)			Potential Issues
Adult Broad-spectrum antibacterial agents predominantly used for hospital-onset infections	Cefepime Ceftazidime Piperacillin/tazobactam	Aztreonam (IV only) Amikacin (IV only) Gentamicin (IV only) Tobramycin (IV only)	Doripenem Imipenem/cilastatin Meropenem	• Carbapenems, aztreonam, and potentially aminoglycosides often restricted more than third- and fourth-generation cephalosporins or piperacillin-tazobactam. • Important de-escalation stewardship work occurs within this category that is invisible with this grouping.
Adult Broad-spectrum antibacterial agents predominantly used for community-acquired infections	Cefaclor Cefdinir Cefixime Cefotaxime Cefpodoxime Cefprozil Ceftriaxone Cefuroxime	Ciprofloxacin Gemifloxacin Levofloxacin Moxifloxacin	Ertapenem	• The differences in spectrum and adverse effect profile of included agents lead to important stewardship work within this category (see text).
Adult Antibacterial agents predominantly used for resistant gram-positive infections	Vancomycin (IV only)	Dalbavancin Oritavancin Ceftaroline Telavancin	Daptomycin Linezolid Tedizolid Quinupristin/dalfopristin	• Dalbavancin and oritavancin would allow hospitals to minimize this SAAR substantially. • Limited use of VRE active agents over vancomycin would not be visible. • De-escalation to vancomycin from other agents in this category would not be trackable.
Adult Antifungal agents predominantly used for invasive candidiasis	Fluconazole	Anidulafungin Caspofungin Micafungin		• De-escalation from micafungin or similar to fluconazole would not be visible.

Shively, N., & Morgan, D. (2023). The CDC antimicrobial use measure is not ready for public reporting or value-based programs. *Antimicrobial Stewardship & Healthcare Epidemiology, 3*(1), E77. doi:10.1017/ash.2023.143

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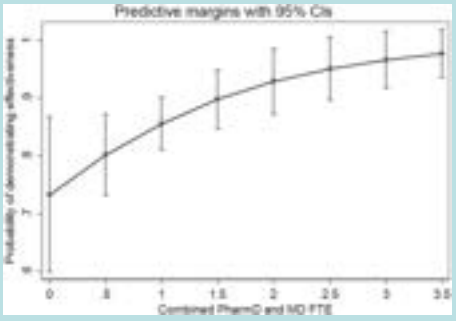
Increased staffing = "leveling up" what ASPs can achieve

Predicted effectiveness based on staffing levels



Recommended FTE by bed size

1.4 FTE (1 pharmacist, 0.4 physician) per 100-300 beds; 1:3 physician to pharmacist ratio

Each 0.50 increase in pharmacist and physician full-time equivalent (FTE) support predicted a 1.48-fold increase in the odds of effectiveness

Doernberg, et al. Essential Resources and Strategies for Antibiotic Stewardship Programs in the Acute Care Setting, *Clinical Infectious Diseases*, Volume 67, Issue 8, 15 October 2018, Pages 1168–1174, https://doi.org/10.1093/cid/civ255

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Despite progress, AS resources and staffing are far from optimal

- Barriers success include increasing volume and complexity of essential tasks, competing responsibilities, and lack of resources/dedicated budget
- *Staffing ratios remain far from published recommendations and have been slow to ramp up* (even among *US News and World Reports* highest ranked hospitals)
- Salary support is an independent predictor for achieving all 7 CDC core elements
- Formal staffing minimums need to be enforced and should be linked to sustainable funding mechanisms
  - *Solution? Convince leadership that 1+1 = 3*
    - *Improved diagnostic stewardship*
    - *Improved HO-CDI rates, decreased penalties*
    - *Improved SSI outcomes*

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Greene et al. 2020. ICHE. doi:10.1017/ice.2019.294 30

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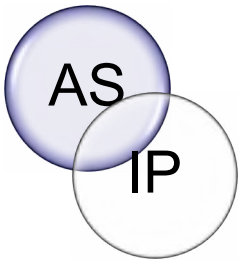
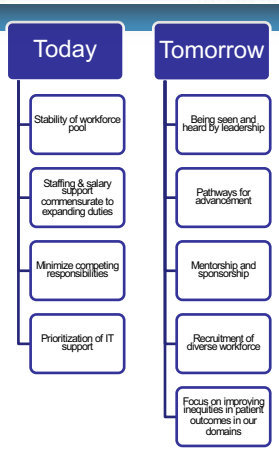


What do we want?
When do we want it?



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Nori, P., Stevens, M., & Patel, P. (2022). Rising from the pandemic ashes: Reflections on burnout and resiliency from the infection prevention and antimicrobial stewardship workforce. *Antimicrobial Stewardship & Healthcare Epidemiology, 2*(1), E101. doi:10.1017/ash.2022.240

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The future is brighter: bipartisan legislation to support IPC, ASP & public health

Legislation	Details
6/21 Pioneering Antimicrobial Subscriptions to End Upsurging Resistance (PASTEUR) Act	Proposes a subscription program to provide a predictable return on investment for new antibiotics and will establish a grant program to **strengthen hospital antibiotic stewardship programs**
3/21 Build Back Better Act (part of American Rescue plan)	Includes **$7 billion investment in stronger public health infrastructure** over the next five years; includes funding to expand IPC activities, especially in nursing homes, and other investments in AS, NHSN, Project Firstline, and surveillance and lab capacity (*primary foci of SHEA's funding advocacy in IPC & AS*)
1/22 Prepare for and Respond to Existing Viruses, Emerging New Threats and Pandemics (PREVENT Pandemics) Act	Provisions to strengthen medical supply chains, improve public health data systems and workforce, upgrade public health communications and enhance the research, development and evaluation of tests, treatments and vaccines; bill was **rolled up in the FY 2023 Omnibus Appropriations bill** (signed into law in December 2022). The final bill did not include all provisions of the original but its **passage is still considered a success.**
2/22 BIO Preparedness Workforce Pilot Program	Incorporated into the PREVENT Pandemics Act. The bill was signed into law in Dec 2022 but **does not yet include the funding needed for loan repayment program**. IDSA is leading the advocacy to fund this program

Special thanks to Lynne Bastion (SHEA), Amanda Jezek, (IDSA)

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https://www.congress.gov/

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Other major challenges impacting AMR and stewardship

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New pharmacotherapeutics year in review

Generic name	Brand name	Approval	Indication
vonoprazan, amoxicillin, and clarithromycin	Voquezna	5/3/2022	Helicobacter pylori infection
rezafungin	Rezzayo	3/22/2023	Candidemia and invasive candidiasis

FDA Center for Biologics Evaluation and Research: only 1 of 37 agents approved in 2022 and 1 of 13 approved so far in 2023 is an anti-infective

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www.fda.gov

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Reason for hope: breakthroughs beyond antibiotics

FDA NEWS RELEASE

FDA Approves First Orally Administered Fecal Microbiota Product for the Prevention of Recurrence of Clostridioides difficile Infection

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Microbiome Therapeutics

- SER-109 (VOWST) : spore-based (Firmicutes bacteria), oral microbiome therapeutic designed to break the cycle of *Clostridioides difficile* Infection (CDI) recurrence
- Rapidly and durably repairs disrupted microbiome to a state that resists colonization and growth in Phase 3 studies
- Formulated for oral delivery (4 capsules for 3 days)
- Taken after symptomatic resolution with standard of care antibiotics
- ECOSPOR IV: 86.3% of subjects had a sustained clinical response at 24 weeks
- Expanded access program ongoing in the US

Straub T, Diao L, Ford C, et al. SER-109, An Investigational Microbiome Therapeutic, Reduces Abundance of Antimicrobial Resistance Genes in Patients with Recurrent *Clostridioides difficile Infection* (rCDI) After Standard-of-Care Antibiotics. Presented at: IDWeek2021

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Reality check…record-breaking year for drug shortages

- Drug shortages reached a five-year peak in 2022, impacting almost 300 pharmaceuticals (IV saline, antipyretics, and antibiotics)
  - Mostly older, generic drugs (80% of Vizient's Essential Medications list are generic, over half approved before 1990)
- Most pronounced during 2022-2023 pediatric "multi-demic" of influenza, RSV, COVID, and GAS (impacting acetaminophen, amoxicillin, oseltamivir, etc.)
- FDA lacks end-to-end visibility into supply chain; efforts to map supply chains are not well-coordinated
- U.S. has shifted reliance on manufacturing to China & India which carries risks (*think multi-state, severe Pseudomonal eye infections due to contaminated/recalled eye-drops)*

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https://www.hsgac.senate.gov/wp-content/uploads/Drug-Shortages-HSGAC-Majority-Staff-Report-2023-03-22.pdf

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Economic$ of drug shortages

Lack of incentives for manufacturers to produce less profitable drugs; many leave the market, and few enter

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Gross, A., Kabbani, S., & Blumenthal, J. (2023). The perfect storm: Respiratory viral surges and anti-infective shortages. *Antimicrobial Stewardship & Healthcare Epidemiology, 3*(1), E89. doi:10.1017/ash.2023.160

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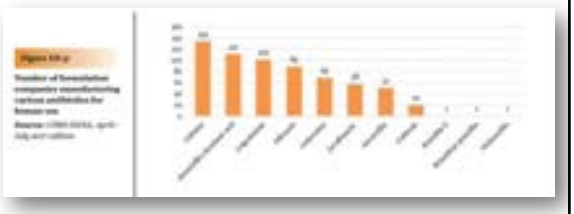
How does the global pharmaceutical industry contribute to AMR?

- **China** is the world's leading producer of pharmaceutical ingredients used to make antibiotics
- **India** is one of the highest consumers of antibiotics although per capita healthcare expenditure is much less
- Indian pharmaceutical industry supplies **20% of generic drugs** at an estimated $15B annual revenue
- *At least 40 antibiotic manufacturers and at least 250 antibiotic formulation companies in India*
- Effluent standards for pharmaceutical industry waste *do not include antibiotic residues* and are not monitored
- Antibiotic dispensing without prescription is illegal but not enforced



https://cddep.org/publications/scoping-report-antimicrobial-resistance-india/

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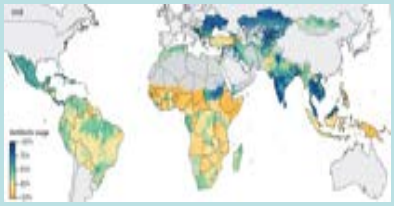
Global antibiotic consumption and usage in humans, 2000–2018: a spatial modelling study



The percentage of children (aged <5 years) with symptoms of lower respiratory tract infections with caregiver-reported antibiotic usage in low-income and middle-income countries, 2018

Temporal trends in the total antibiotic consumption rates for GBD super-regions and World Bank income groups

Annie J Browne, DPhil, et al. The Lancet Planetary Health . Volume 5 Issue 12 Pages e893-e904 (December 2021) , DOI: 10.1016/S2542-5196(21)00280-1

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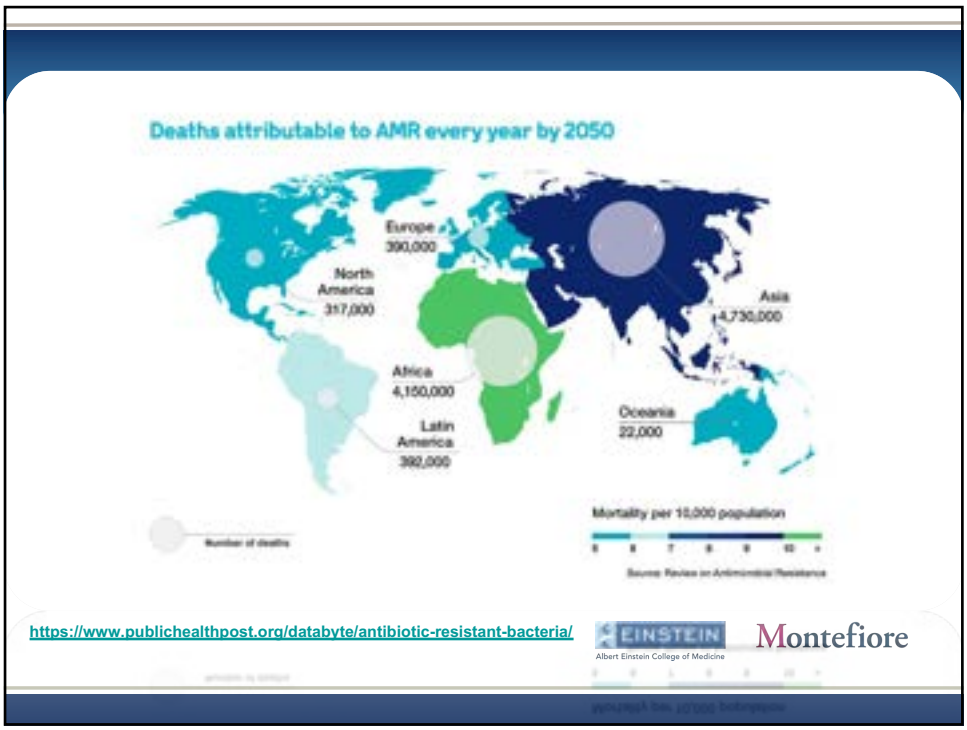

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A global "One Health" approach is the path forward for AMR mitigation

- ✓ *One health approach to AMR = addressing the interconnectedness of antibiotic overuse across the continuum (human health, agriculture, livestock, environment, etc.)*
  - ✓ AMR is a major pillar of the global One Health Joint Plan of Action, which includes UN, WHO, and global animal health groups (AMR mentioned 84 times)
- ✓ Forthcoming ASHE commentaries on global one health (Sarah Hill, et. al.) and climate change and AMR (Alison Freifeld et. al.)

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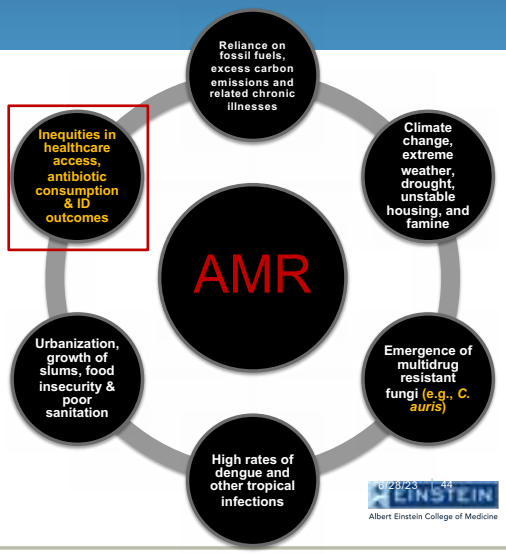
Public Health Crises & Intersection with AMR



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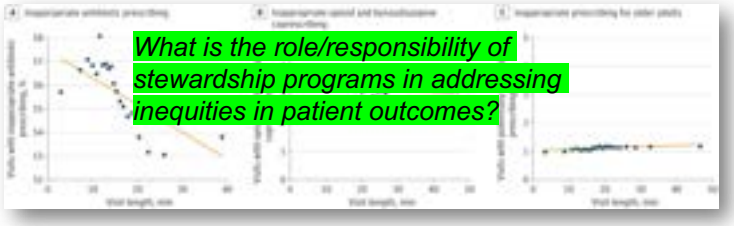
From: **Association of Primary Care Visit Length With Potentially Inappropriate Prescribing**

JAMA Health Forum. 2023;4(3):e230052. doi:10.1001/jamahealthforum.2023.0052



What is the role/responsibility of stewardship programs in addressing inequities in patient outcomes?

Findings: In this cross-sectional study of 4 360 445 patients, those who were younger, publicly insured, Hispanic, or non-Hispanic Black had shorter primary care physician visits. Shorter visits were associated with a higher likelihood of inappropriate antibiotic prescribing for patients with upper respiratory tract infections and co-prescribing of opioids and benzodiazepines for patients with painful conditions.

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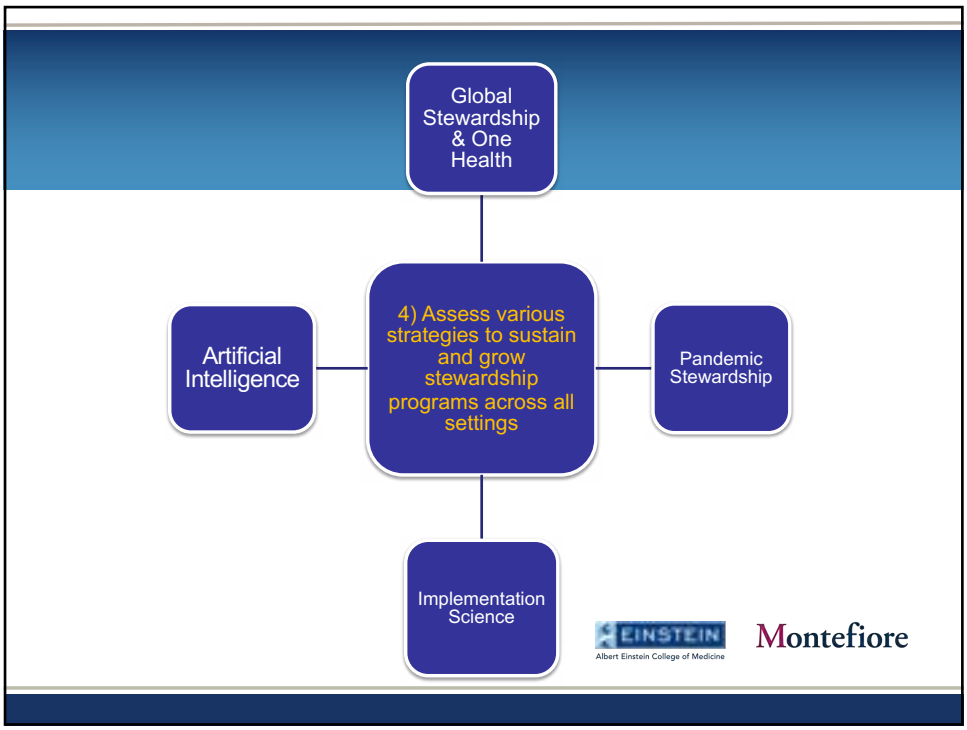

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Learning assessment question

Potential uses of artificial intelligence in antimicrobial stewardship include which of the following?

a) Helping to write scientific papers
b) Validating new rapid diagnostic technologies
c) Predicting multidrug resistance
d) Dose optimization
e) All of the above

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1) Global Stewardship & One Health

Langford, B et al. (2022). Ten ways to make the most of World Antimicrobial Awareness Week. *Antimicrobial Stewardship & Healthcare Epidemiology, 2*(1), E187. doi:10.1017/ash.2022.320

Ashiru-Oredope, D. et al (2023). Global Collaborations in Antimicrobial Stewardship: All Hands on Deck. *Antimicrobial Stewardship & Healthcare Epidemiology (accepted for publication 2/2023)*

*Forthcoming commentary by Sarah Hill, et. al. on One Health & AMR

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2) "Pandemic Stewardship"

Barlam, T., et al. (2022). SHEA statement on antibiotic stewardship in hospitals during public health emergencies. *Infection Control & Hospital Epidemiology, 43*(11), 1541-1552. doi:10.1017/ice.2022.194

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3) Implementation Science

Livorsi, D., Drainoni, M., Reisinger, H., Nanda, N., McGregor, J., Barlam, T., . . . Szymczak, J. (2022). Leveraging implementation science to advance antibiotic stewardship practice and research. *Infection Control & Hospital Epidemiology, 43*(2), 139-146. doi:10.1017/ice.2021.480

Category of Implementation Strategy	Specific Strategies Within the Category
Evaluative and iterative strategies	Audit and provide feedback[a] Assess readiness for change Conduct cyclical small tests of change
Develop stakeholder relationships	Identify and prepare champions Identify early adopters Obtain commitment letters Capture and share local knowledge[b] Build a coalition Conduct local consensus discussions[c]
Train and educate stakeholders	Conduct ongoing training Develop and distribute educational materials
Support clinicians	Clinician prompts[d] Facilitate relay of clinical data to clinicians[e]
Change infrastructure	Mandate change[f] Change accreditation requirements
Adapt and tailor to the context	Tailor strategies Promote adaptability
Provide interactive assistance	Facilitation Centralize technical assistance[g]
Engage consumers	Involve patients and family members[h] Prepare patients to be active participants[i] Use mass media
Utilize financial strategies	Alter incentive structures for clinicians

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4) Artificial Intelligence

General Definitions	
Artificial intelligence (AI)	Creating intelligent machines that can perform tasks that typically require human intelligence
Neural network	A mathematical system, modeled on the human brain, that learns skills by finding statistical patterns in data. It consists of layers of artificial neurons: The first layer receives the input data, and the last layer outputs the results. Even the experts who create neural networks don't always understand what happens in between.
Large language model	A type of neural network that learns skills — including generating prose, conducting conversations and writing computer code — by analyzing vast amounts of text from across the internet. The basic function is to predict the next word in a sequence, but these models have surprised experts by learning new abilities.
Generative A.I.	Technology that creates content — including text, images, video and computer code — by identifying patterns in large quantities of data, and then creating new, original material that has similar characteristics. Examples include ChatGPT
Terms used in healthcare	
Machine learning	A subset of AI that involves training computer systems to learn and improve without being explicitly programmed.
Deep learning	A type of machine learning that uses artificial neural networks with multiple layers to analyze and learn from a large amount of data.

Source: NYT "On Tech" newsletter, 3/27/23:

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Hey ChatGPT: "how can we prevent hospital-onset *C.difficile infection*?"

- ✓ *Vast implications for stewardship, epidemiology & public health; ethical frameworks and personal data controls need to be developed to avoid implicit biases*

Outcome?
- "text-book" responses
- Accurate, concise
- What about CDI diagnostic stewardship?
- What about leveraging the EMR?
- What about nuance and grey areas?

Bottom line: Our jobs will not be replaced…yet; we must still provide oversight and set limits on this technology

https://chat.openai.com/chat

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Marra, et al. (2023). Brave New World: Leveraging artificial intelligence for advancing healthcare epidemiology, infection prevention & antimicrobial stewardship (submitted to for publication, 3/2023)

Domains of interest	Applications of Artificial Intelligence
Infection Prevention and Hospital Epidemiology	• Predict healthcare-associated infections accurately and quickly compared to traditional methods • Help hospitals prioritize infection prevention efforts • Improve workflow for infection preventionists, minimizing hours spent in surveillance and reporting HAI events
Antimicrobial Stewardship	• Help clinicians choose the right antimicrobial agent, dose, and duration of therapy • Predict and prevent antimicrobial resistance • Support diagnostic stewardship and assist with validation of new molecular methodologies in the clinical microbiology laboratory.
Public Health	• Improve disease surveillance, outbreak detection and efficiency of disaster response, and resource allocation. • Identify false or misleading information by comparing to reputable sources of information. • Synthesize and summarize literature to support optimal decision making.

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Other valuable stewardship resources to help us "level up"

PODCASTS

1) SIDP "BREAKPOINTS" PODCAST
HTTPS://WWW.SIDP.ORG/PODCASTS

2) SHEA LEADERSHIP & MANAGEMENT PODCAST SERIES
HTTPS://LEARNINGCE.SHEA-ONLINE.ORG/CONTENT/LEADERSHIP_MANAGEMENT

TRAINING COURSES

1) IDSA STEWARDSHIP CURRICULUM WITH NEW CONTENT AND PRICING PACKAGES
HTTPS://WWW.IDSOCIETY.ORG/PROFESSIONAL-DEVELOPMENT/IDSA-ACADEMY/

2) SIDP CERTIFICATE PROGRAM
HTTPS://SIDP.ORG/STEWARDSHIP-CERTIFICATE

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Think BIG

- Provided regulatory/federal context for the expanding scope of stewardship
- Reflected on current and future challenges and addressed issues outside our traditional scope
- Assessed key areas of focus to sustain and grow stewardship programs
- Set the stage for forthcoming presentations at ASC-SC conference

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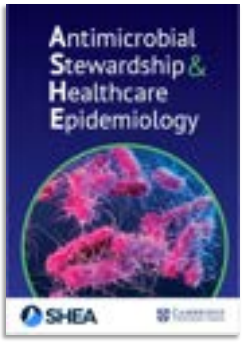

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- Pam, Julie Ann
- ASHE team (especially Alex Marra, Brad Langford & Lindsay MacMurry)
- Dr. Gonzalo Bearman (ASHE EIC)
- ASPs across the globe
- My beloved Montefiore/Einstein ASP (Yi, Mei, Jack, Terrence, Kelsie & ID fellows)

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Inspiration from local-ish rapper, J. Cole

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References

- Ashiru-Oredope, D. et al (2023). Global Collaborations in Antimicrobial Stewardship: All Hands on Deck. *Antimicrobial Stewardship & Healthcare Epidemiology (accepted for publication 2/2023)*
- Mitra-Majumdar M, Powers JH, Brown BL, *et al*. Evidence at time of regulatory approval and cost of new antibiotics in 2016-19: cohort study of FDA approved drugs. *BMJ Medicine* 2022;**1**:e000227. doi: 10.1136/bmjmed-2022-000227
- Sarah B Doernberg, Lilian M Abbo, Steven D Burdette, Neil O Fishman, Edward L Goodman, Gary R Kravitz, James E Leggett, Rebekah W Moehring, Jason G Newland, Philip A Robinson, Emily S Spivak, Pranita D Tamma, Henry F Chambers, Essential Resources and Strategies for Antibiotic Stewardship Programs in the Acute Care Setting, *Clinical Infectious Diseases*, Volume 67, Issue 8, 15 October 2018, Pages 1168–1174, https://doi.org/10.1093/cid/civ255
- Langford, B et al. (2022). Ten ways to make the most of World Antimicrobial Awareness Week. *Antimicrobial Stewardship & Healthcare Epidemiology. 2*(1), E187. doi:10.1017/ash.2022.320
- *Global antibiotic consumption and usage in humans, 2000–18: a spatial modelling study. Annie J Browne, DPhil, et al. The Lancet Planetary Health. The Lancet Planetary Health*. Volume 5 Issue 12 Pages e893-e904 (December 2021). DOI: 10.1016/S2542-5196(21)00280-1
- Belk, M., et al. (2023). Effect of microbiology comment nudging on antibiotic use in asymptomatic bacteriuria: A before-and-after quasi-experimental study. *Infection Control & Hospital Epidemiology,* 1-5. doi:10.1017/ice.2022.272
- Barlam, T., et al. (2022). SHEA statement on antibiotic stewardship in hospitals during public health emergencies. *Infection Control & Hospital Epidemiology, 43*(11), 1541-1552. doi:10.1017/ice.2022.194
- Shively, N., & Morgan, D. (2023). The CDC antimicrobial use measure is not ready for public reporting or value-based programs. *Antimicrobial Stewardship & Healthcare Epidemiology, 3*(1), E77. doi:10.1017/ash.2023.143
- Livorsi, D., Drainoni, M., Reisinger, H., Nanda, N., McGregor, J., Barlam, T., . . . Szymczak, J. (2022). Leveraging implementation science to advance antibiotic stewardship practice and research. *Infection Control & Hospital Epidemiology, 43*(2), 139-146. doi:10.1017/ice.2021.480
- Marra et al. (2023). Brave New World: Leveraging artificial intelligence for advancing healthcare epidemiology, infection prevention & antimicrobial stewardship . Accepted for publication to ICHE
- Nori, P., Stevens, M., & Patel, P. (2022). Rising from the pandemic ashes: Reflections on burnout and resiliency from the infection prevention and antimicrobial stewardship workforce. *Antimicrobial Stewardship & Healthcare Epidemiology, 2*(1), E101. doi:10.1017/ash.2022.240
- Bartles, et al. AJIC. 2018. https://doi.org/10.1016/j.ajic.2017.11.006.
- Greene et al. 2020. ICHE. doi:10.1017/ice.2019.294
- Doernberg, 2018. CID. https://doi.org/10.1093/cid/civ255
- Neprash HT, Mulcahy JF, Cross DA, Gaugler JE, Golberstein E, Ganguli I. Association of Primary Care Visit Length With Potentially Inappropriate Prescribing. *JAMA Health Forum*. 2023;4(3):e230052. doi:10.1001/jamahealthforum.2023.0052
- Straub T, Diao L, Ford C, et al. SER-109, An Investigational Microbiome Therapeutic, Reduces Abundance of Antimicrobial Resistance Genes in Patients with Recurrent *Clostridioides difficile Infection* (rCDI) After Standard-of-Care Antibiotics. Presented at: IDWeek2021
- Timbrook, T., Prinzi, A., & Spivak, E. (2023). Diagnostic and antimicrobial stewardship workforce challenges: A crisis in combating antimicrobial resistance. *Antimicrobial Stewardship & Healthcare Epidemiology, 3*(1), E60. doi:10.1017/ash.2023.147

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References cont.

- https://chat.openai.com/chat
- https://www.cambridge.org/core/services/authors/publishing-ethics/research-publishing-ethics-guidelines-for-journals/authorship-and-contributorship#ai-contributions-to-research-content
- https://cddep.org/publications/scoping-report-antimicrobial-resistance-india/
- https://www.publichealthpost.org/databyte/antibiotic-resistant-bacteria/
- https://www.hsgac.senate.gov/wp-content/uploads/Drug-Shortages-HSGAC-Majority-Staff-Report-2023-03-22.pdf
- www.fda.gov
- ASHP.org
- https://www.congress.gov/
- https://www.cdc.gov/nhsn/cdaportal/datainteroperability.html
- https://www.jointcommission.org/-/media/tjc/documents/standards/r3-reports/r3_antibioticstewardship_july2022_final.pdf
- https://www.cdc.gov/nhsn/pdfs/training/2022/nhsn-au-option-tas-webinar-508.pdf

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