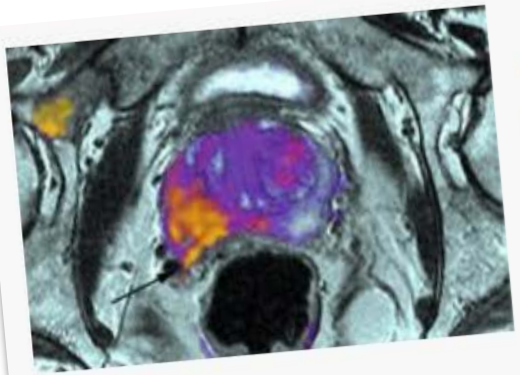
ENHANCING DATA MANAGEMENT FOR ANTIMICROBIAL STEWARDSHIP

Lauren N Hunt, PharmD, BCPS

9 May 2019



AI found to be on par with radiologists in diagnosing prostate cancer

An artificial intelligence system developed by UCLA researchers demonstrated comparable results with experienced doctors in reading magnetic resonance imaging scans.

Radiology Greg Sl

HIT Think Why libraries can become the heartbeat of health information

Americans trust and depend on their local libraries to disseminate factual, credible knowledge.

CMS using data to better monitor nursing home performance

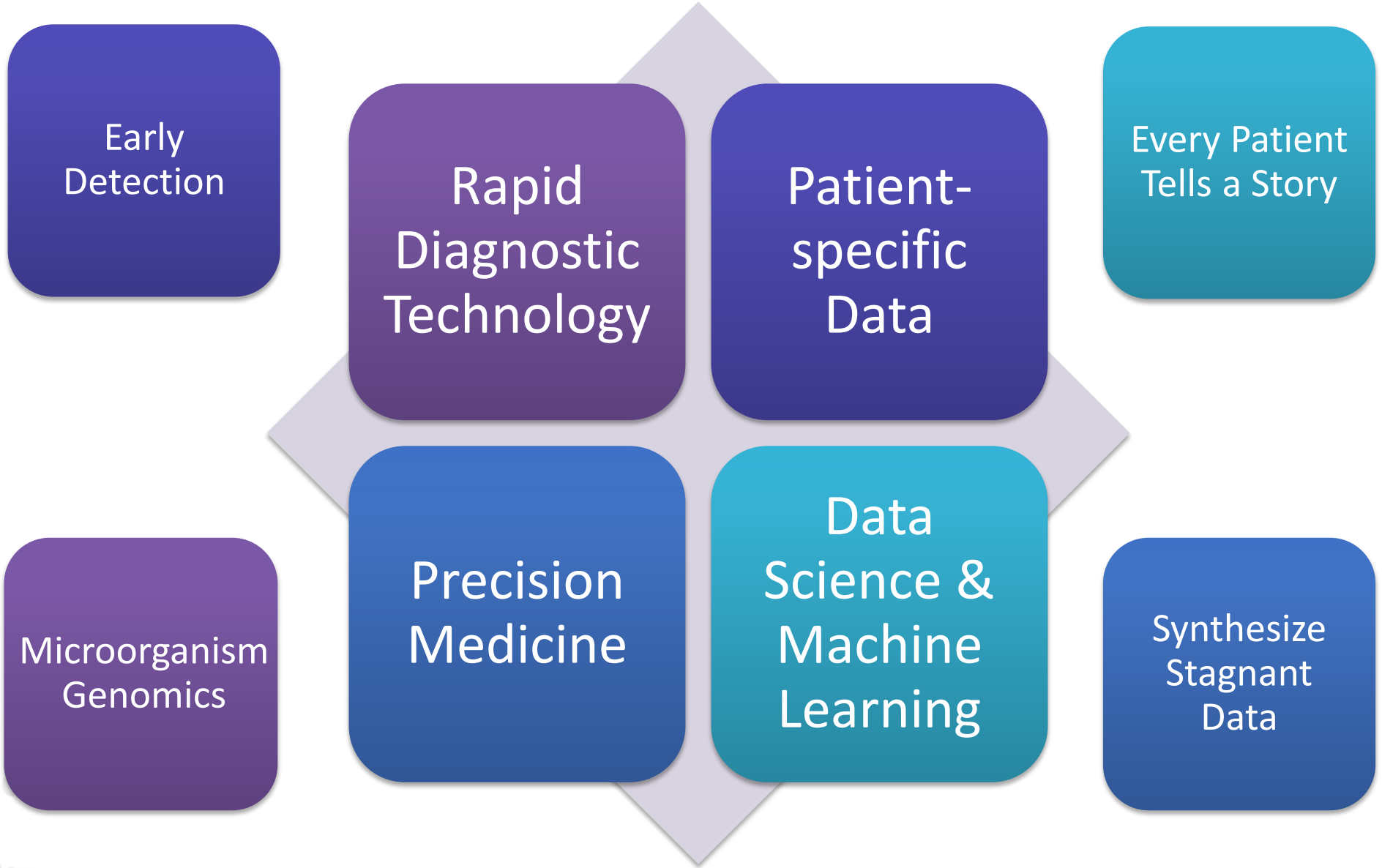
The Centers for Medicare and Medicaid Services is warning nursing homes that it wants to see better care and outcomes and is using data to track progress.

Skilled nursing facilities Joseph Goedert April 16

https://www.healthdatamanagement.com/


Receive and process the data
Validate the data
Store and protect the data
Confirm accessibility to the data
Ensure reliability of the data
Guarantee timeliness of the data
Data Management in Medicine

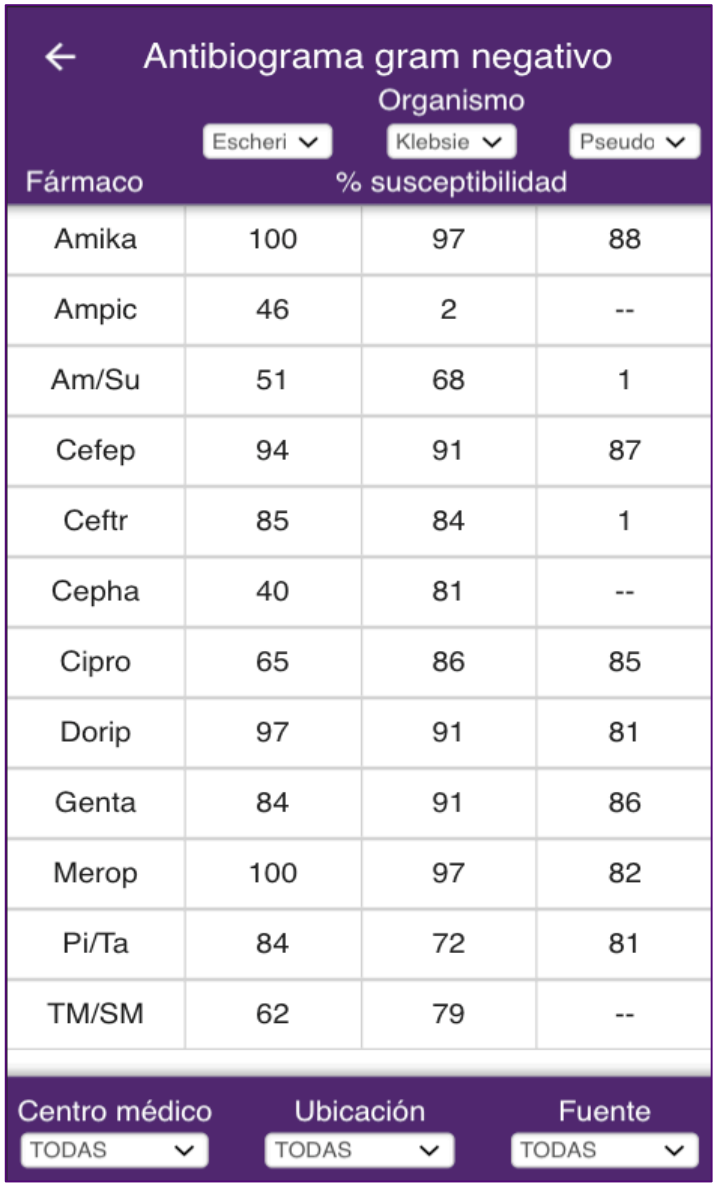
Technology as Stewardship



Mobilizing the Antibiogram

PRE: Web-Based

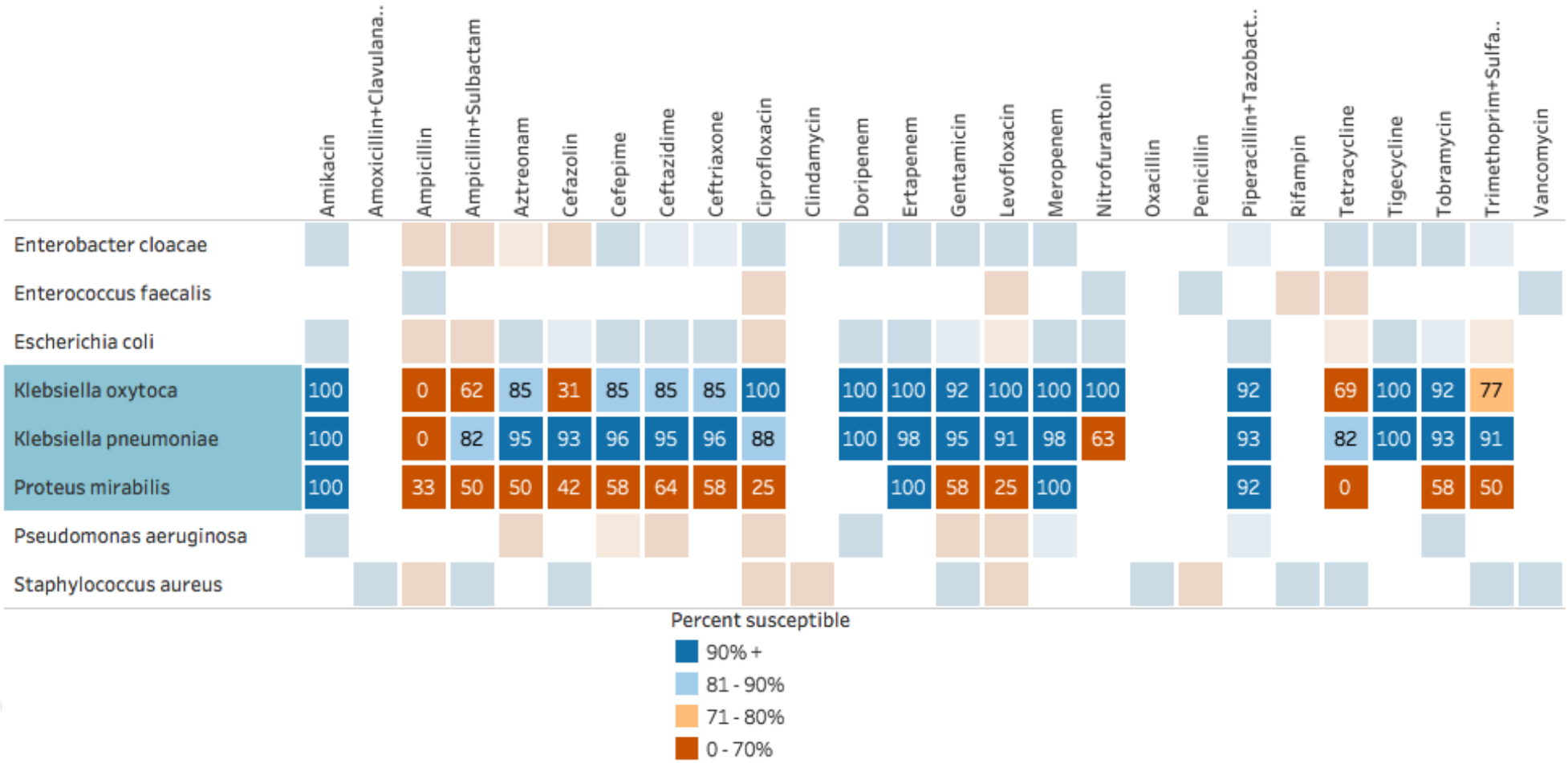
- Compiled annually by microbiology lab
- Antibiogram available hospital wide on AMS website, printed
- Visited approximately 30 times/month



POST: Mobile Technology

- Updated automatically by ILUM every quarter
- Antibiogram available on web and mobile devices
- Visited approximately 3000 times/month

Interactive Antibiogram



Approval for Restricted Antimicrobials

PRE: Unidirectional pager

- Lacks required patient fields
- No tracking of medications, indications, requestors, approval ratings
- Often required logging into the EMR
- Phone call to the requestor to approve or deny

POST: Mobile app + EMR Integration

- Required patient fields
- Tracks medications, indications, requestors, approval ratings
- Minimal need to log into the EMR
- Automating approval for requestors who have high approval rates for defined antimicrobials and indications

Approval for Restricted Antimicrobials

Ordering Provider	# Requests	Indication	Antimicrobial	% Approved
Park, Janie	78	Prophylaxis	Caspofungin	86%
Allen, Katie	102	Prophylaxis	Fluconazole	90%
Allen, Katie	109	Prophylaxis	Levofloxacin	78%
Bange, Aaron	53	Pneumonia	Levofloxacin	90%
Brinley, Sarah Lee	33	UTI	Levofloxacin	98%
Decena, Maria	54	Prophylaxis	Voriconazole	100%
Decena, Maria	54	Prophylaxis	Caspofungin	98%
Pope, Oliva	141	Prophylaxis	Caspofungin	100%
Pope, Oliva	141	Prophylaxis	Fluconazole	100%
Pope, Oliva	141	Prophylaxis	Posaconazole	100%
Pope, Oliva	141	Prophylaxis	Voriconazole	100%
Hamilton, Kara	29	Pneumonia	Levofloxacin	78%
Hamilton, Kara	29	Prophylaxis	Levofloxacin	90%
Haven, Lindsay	80	UTI	Levofloxacin	60%
Haven, Lindsay	80	Prophylaxis	Caspofungin	95%

ID Risk Factor Assessment

- Risk factors for ID are known, but meaningful aggregation is missing
- Historically: Manual EMR review for previous infections, susceptibilities, MRSA/Pseudomonas risk factors, allergies
- Unknown: What antimicrobial to use today
- Barriers:
  - Multiple cultures with varying susceptibilities
  - Persistence of resistance
  - Unknown impact of historic antimicrobial exposure

ID Risk Factor Assessment

Step 1

Aggregate and **display data** that can impact antimicrobial selection

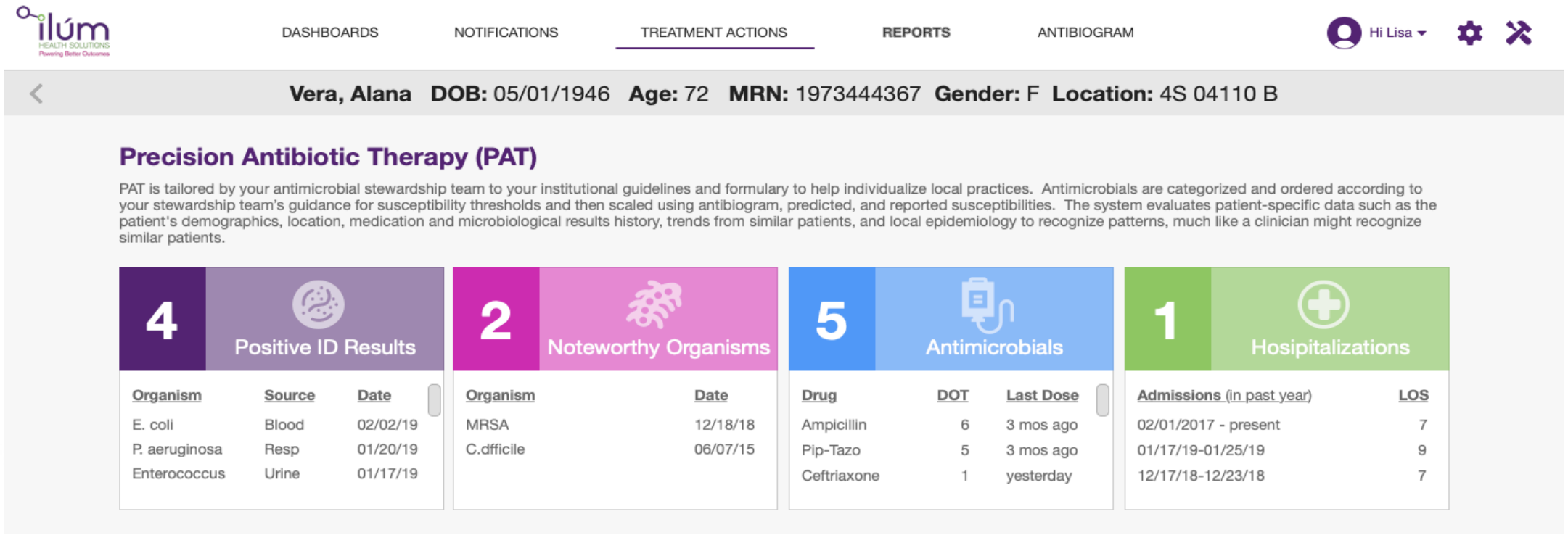
Step 2

Use data in a **manual** scoring system to perform risk assessment

Step 3

Apply **artificial intelligence** to the data to perform risk assessment ad optimize therapy

Step 1: Risk Factor Display



Step 2: Manual Scoring Systems

- APACHE II (Acute Physiology, Age, Chronic Health Evaluation)
- SIRS (Systemic Inflammatory Response Syndrome) criteria
- Quick Sequential Organ Failure Assessment (qSOFA) score
- Charlson comorbidity index
- Expanded CURB-65

Criterion	Threshold	
	SIRS	qSOFA
Body temperature (°C)	<36 or >38	-
Heart rate (beats/min)	>90	-
While blood cell count ($10^3/\mu L$)	<4 or >12	-
Respiratory rate (breaths/min)	>20	≥22
Systolic blood pressure (mmHg)	-	≤100
Glasgow Coma Scale	-	≤13

SIRS: systemic inflammatory response syndrome, qSOFA: quick Sepsis-related Organ Failure Assessment.

Healthc Inform Res. 2018;24(2):139–147.

Developing a BSI Mortality Risk Score

- **OBJECTIVE**
  - Develop a risk score to predict probability of bloodstream infections (BSIs) due to extended-spectrum β-lactamase–producing *Enterobacteriaceae* (ESBLE)
- **SETTING**
  - Two large community hospitals
- **DESIGN**
  - Retrospective case-control study
- **METHODS**
  - Multivariate logistic regression was used to identify independent risk factors for ESBLE BSI
  - The regression coefficients were then used to allocate points in extended-spectrum β-lactamase prediction score (ESBL-PS)

Infect Control Hosp Epidemiol. 2017 Mar;38(3):266-272

Bloodstream Infection Mortality Risk Score

- **RESULTS**
  - 42/910 (4.6%) patients with *Enterobacteriaceae* BSI had ESBL isolates

Point Value	Risk Factor
1	Outpatient procedures within 1 month
4	Prior infections or colonization with ESBLE within 12 months
1 course: 1 point ≥2 courses: 3 points	Number of courses of β-lactams and/or FQ used within 3 months of BSI

Score	Probability of ESBLE BSI
0	0.7%
1	5%
3	24%
4	44%

  - The area under the ROC curve for the ESBL-PS model was 0.86
  - Using ESBL-PS ≥3 to indicate high risk provided a negative predictive value of 97%
- **CONCLUSIONS**
  - ESBL-PS estimated patient-specific risk of ESBLE BSI with high discrimination
  - Incorporation of ESBL-PS with acute severity of illness may improve adequacy of empirical antimicrobial therapy and reduce carbapenem utilization

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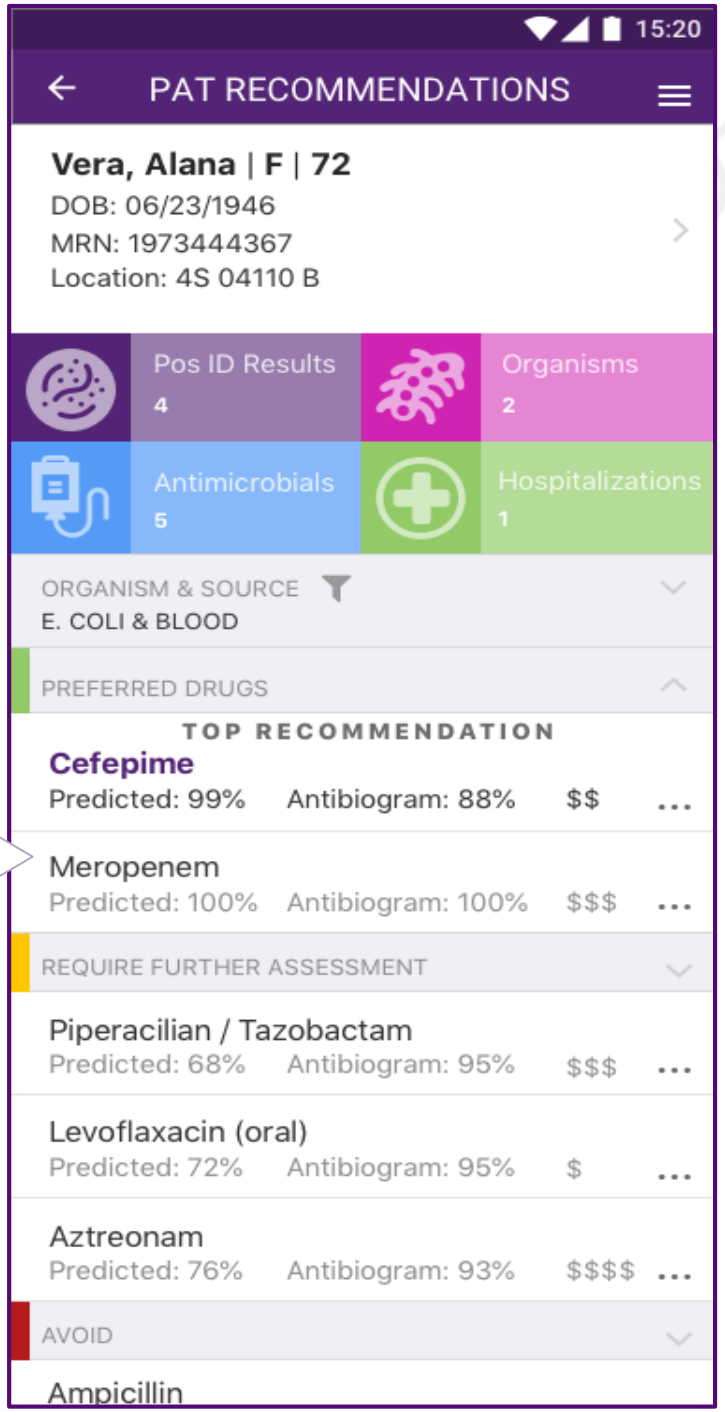
Step 3: Automated Tools

Considers patient-specific risk factors and local epidemiology

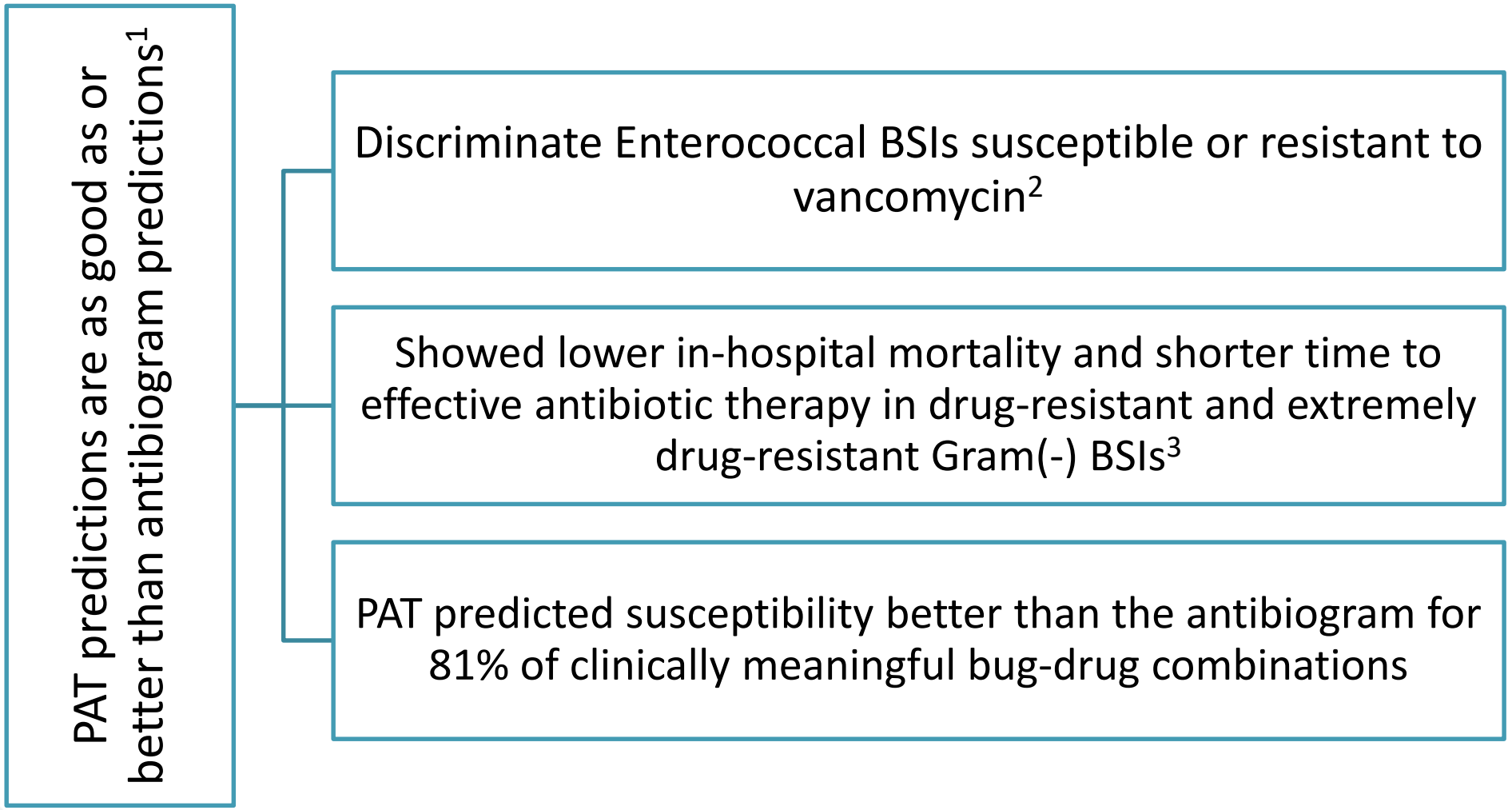
Creates susceptibility predictions before results are available

Categorization directs clinicians to the best therapy for the patient

Precision Antibiotic Therapy (PAT)



Application of PAT to Patient Care



1. SHEA Spring Conference, Top Five Featured Abstract (#10157). April 20, 2018. Portland, OR.
2. ID Week 2018. Scientific Poster Presentation: Session 219, Poster #1814. October 6, 2018. San Francisco, CA.
3. ID Week 2018. Scientific Poster Presentation: Session 218, Poster #1800. October 6, 2018. San Francisco, CA.

“The people who are crazy enough to think they can change the world are the ones who do.”

- Steve Jobs

Co-founder, Chairman, and CEO of Apple Inc.

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