CAPE CHARM Collaboration to Harmonize Antimicrobial Registry Measures

Developing Local AI Models for Pharmacy

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Collaboration to Harmonize Antimicrobial Registry Measures

Learning Objectives

- Describe the differences between local artificial intelligence (AI) and cloud-hosted AI in terms of privacy, control, connectivity, and infrastructure.
- Identify at least three pharmacy workflows in which local AI may improve efficiency or access to information.
- Identify privacy, accuracy, bias, and hallucination risks associated with AI use in pharmacy, along with the need for human oversight.
- Describe the roles of pharmacists and pharmacy technicians in validating, documenting, and escalating AI-generated outputs.
- List the recommended first steps for a small, governed local AI pilot in a pharmacy setting.

Financial Disclosure

Michael Klepser declares that he has a relevant affiliation or financial arrangement as a member of the Advisory Board at Abbott Diagnostics.

Kushal Dahal declare that they have not had a relevant affiliation or financial arrangement with any ineligible companies that may have a direct interest in the subject matter of this continuing pharmacy education activity within the past 24 months.

Additionally, members of the District 4 Planning Committee and NABP staff involved in the planning of this activity do not have any current affiliation or financial arrangement with any ineligible companies that may have a direct interest in the subject matter of NABP's CPE program within the last 24 months.

All relevant financial relationships have been mitigated.

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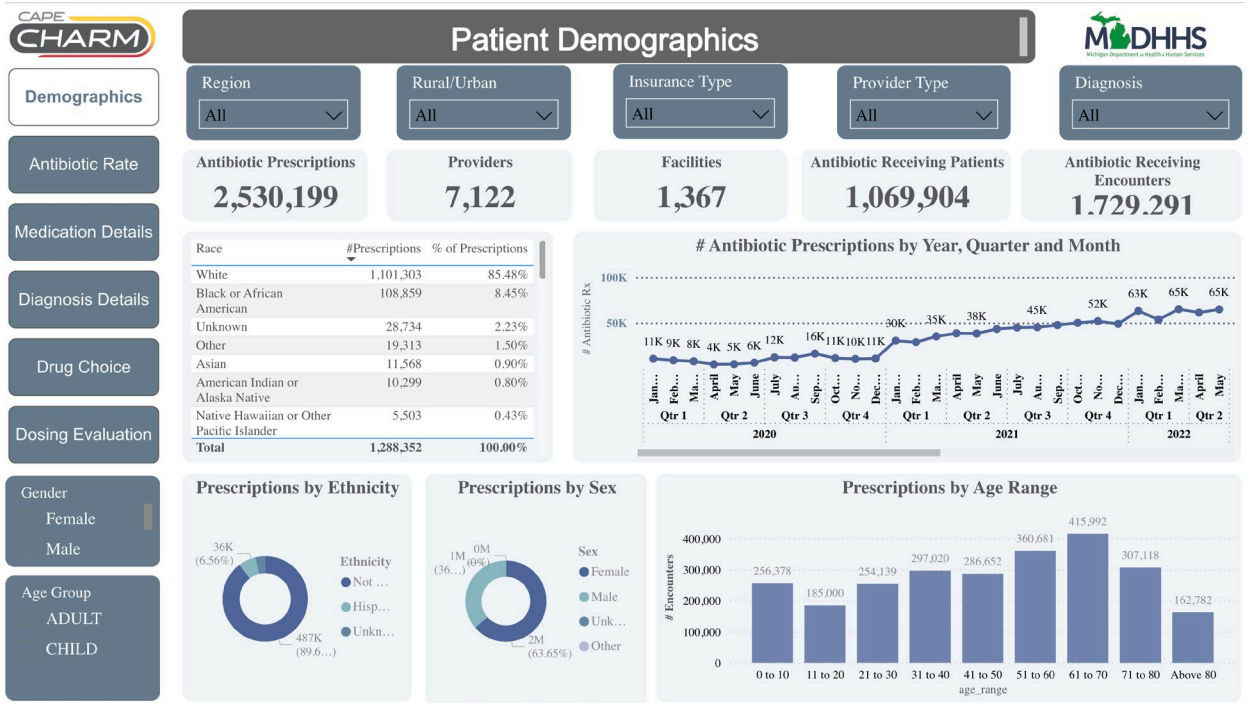
AI Use Disclosure

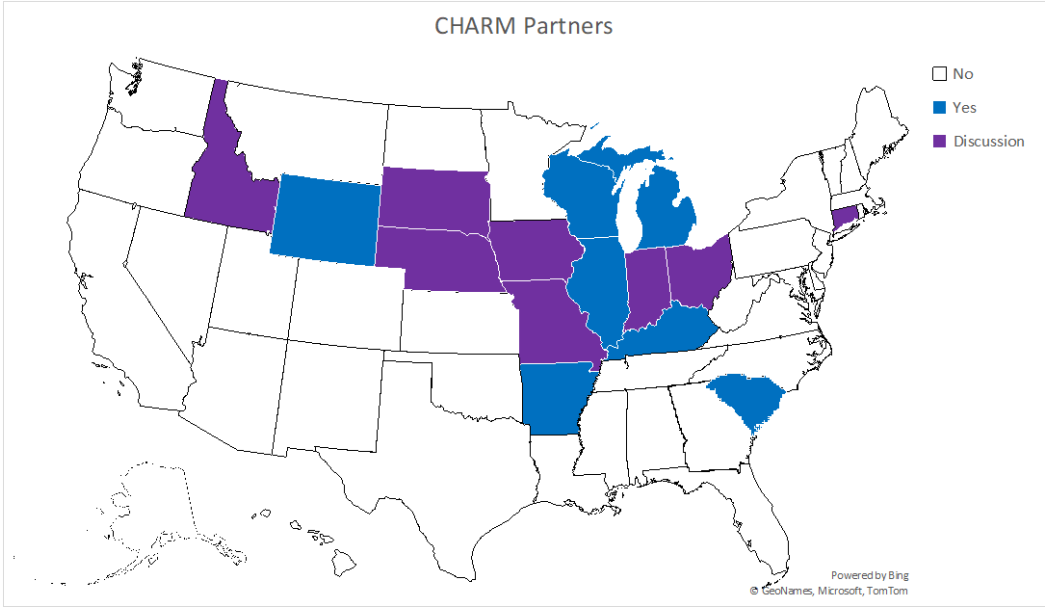
- Application: ChatGPT by OpenAI. Model/version: GPT 5.6 Sol.
- Purpose: Assistance with drafting and refining presentation text and learning objectives.
- Date used: September 10, 2026.
- All AI-assisted content was reviewed by the presenter for accuracy, supporting evidence, relevance, bias or discrimination, and potential intellectual property or copyright infringement. Cited references were independently verified for accuracy and appropriateness. The presenter takes responsibility for the final educational content.

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Collaboration to Harmonize Antimicrobial Registry Measures

- We partner with health systems and create antimicrobial dashboards using their EHR.
- Receives EHRR records from 40+ health care systems
- 2 million+ patients antibiotic records
- Funding partners: MDHHS, IDPH, NE DHHS





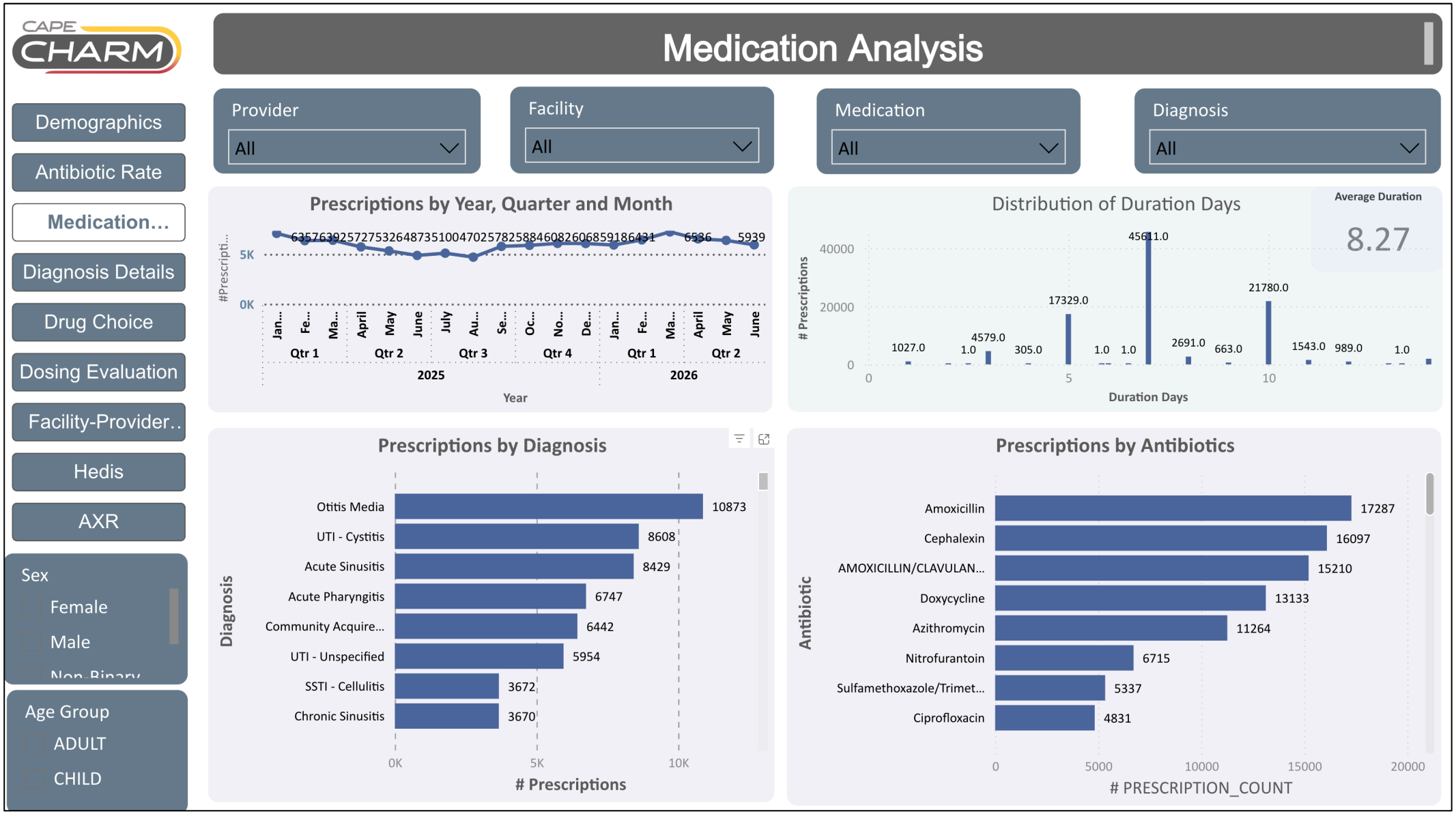
CAPE CHARM Collaboration to Advance Pharmacy Enterprises

CHARM uses EHR data extracts to generate antibiotic dashboards.

- **Health-system-specific Dashboard** – Designed for partnering healthcare facilities to support outpatient antimicrobial stewardship. Facilities use it to identify problematic prescribing practices, set intervention targets, and assess the effectiveness of the interventions.
- **Benchmarking Dashboard** – Shared with partnering facilities, this dashboard aggregates data across all participating sites while anonymizing facility and provider names for comparative analysis.

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Monitor Antibiotic Prescription Trend



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AI Incorporation at CHARM

- Focused on real AI use cases that support charm workflow.
- Following AI based projects are in final phase for implementation
  - AI for Drug Classifications
  - AI for Diagnosis Classifications
  - Outlier detection in antibiotic prescriptions using AI
  - EHR Data Standardization using local AI
  - AI-Powered Analytics Chatbot

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Use Case 1: AI for Drug Classifications

Antimicrobial Stewardship & Healthcare Epidemiology (2025), **5**, e324, 1–7
doi:10.1017/ash.2025.10235

Original Article

Evaluation of large language models for antimicrobial classification: implications for antimicrobial stewardship programs

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Use Case 1: AI for Drug Classifications

MEDICATION	DRUG CLASS
DIPHENHYDRAMINE HCL/ZINC ACET	Non-antimicrobial
SOFOSBUVIR/VELPATASVIR	Antiviral
GLYCERIN/PROP GLY/POLYQUAT 15	Non-antimicrobial
EMTRICITABINE 100 MG-TENOFOVIR DISOPROXIL FUMARATE 150 MG TABLET	Antiviral
Clotrimazole 1 % Cream	Antifungal
LIDOCAINE 3 %-HYDROCORTISONE 0.5 % RECTAL CREAM	Non-antimicrobial
CEFPODOXIME 100 MG ORAL TAB	Antibiotic
LAMIVUDINE 100 MG TABLET	Antiviral
FLAGYL 250 mg tablet	Antibiotic
BALOXAVIR MARBOXIL 80 MG TABLET	Antiviral

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Use Case 1: AI for Drug Classifications

- N=7,239 prescription drug entries
- Accuracy ranged 75-99% depending on the model.
- Processing time was <1 minute, compared with the manual classification of 18 hours.

Use Case 2: AI for Diagnosis Classifications

ICD-10	ICD-10 Description	Diagnosis Category	Classification
A799	Rickettsiosis, unspecified	Viral Infection - Miscellaneous	Antibiotic Not Needed
A8030	Acute paralytic poliomyelitis, unspecified	Viral Infection - Miscellaneous	Antibiotic Not Needed
A8039	Other acute paralytic poliomyelitis	Viral Infection - Miscellaneous	Antibiotic Not Needed
E10620	Type 1 diabetes mellitus with diabetic dermatitis	SSTI - Miscellaneous	Antibiotic Needed
E10621	Type 1 diabetes mellitus with foot ulcer	SSTI - Miscellaneous	Antibiotic Needed
E10622	Type 1 diabetes mellitus with other skin ulcer	SSTI - Miscellaneous	Antibiotic Needed
B949	Sequelae of unspecified infectious and parasitic disease	Miscellaneous	Antibiotic Possibly Needed
H9201	Otalgia, right ear	Otitis media	Antibiotic Possibly Needed

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Use Case 2: AI for Diagnosis Classifications

- N=74,261 ICD-10 codes
- Accuracy ranged 30-54%, depending on the model.
- Processing time was 2-15 minutes, compared with the manual classification of 480 hours.

Use Case 2: AI for Diagnosis Classifications

- Three ML algorithms were used (Random Forest, XGBoost, and logistic regression)
- ML models achieved >98% accuracy.
- Processing time was 15 minutes, compared with the LLM taking 2-15 minutes and manual taking 480 hours.

Use Case 3: Outlier detection in antibiotic prescriptions using AI.

- AI identifies unusual antibiotic prescriptions that may need clinician review.
- Factors such as diagnosis, antibiotic, dose, duration, age, sex, and weight to train AI model.
- Generates outlier Excel reports and provider/facility summaries of flagged prescriptions.
- Review results are stored in the CHARM Review Tool, allowing clinicians to provide feedback and continuously improve the model.
- Current evaluation shows 80–90% agreement with CHARM concordance measures
- 87% of flagged prescriptions were considered inappropriate or potentially inappropriate during clinical review.

Project Workflow:

CHARM Data

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Data Cleaning & Standardization

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AI Model (Isolation Forest)

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Flagged Outliers

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Clinician Review

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Model Improvement

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Outlier detection in antibiotic prescriptions using AI.

Example of flagged prescriptions

Diagnosis	Antibiotic Choice	Duration (Days)	Dose	Flagged Reason	Review Status	Clinician Review
Acute uncomplicated UTI	Ciprofloxacin	10	500 mg BID	Inappropriate drug choice	Flagged	Review
Acute sinusitis	Azithromycin	14	500 mg daily	High duration	Flagged	Review
Otitis media	Amoxicillin-clavulanate	10	90 mg/kg/day	High dosing	Flagged	Review
Pharyngitis	Levofloxacin	7	750 mg daily	Inappropriate drug choice	Flagged	Review
Cellulitis	Cephalexin	14	1000 mg QID	High duration	Flagged	Review

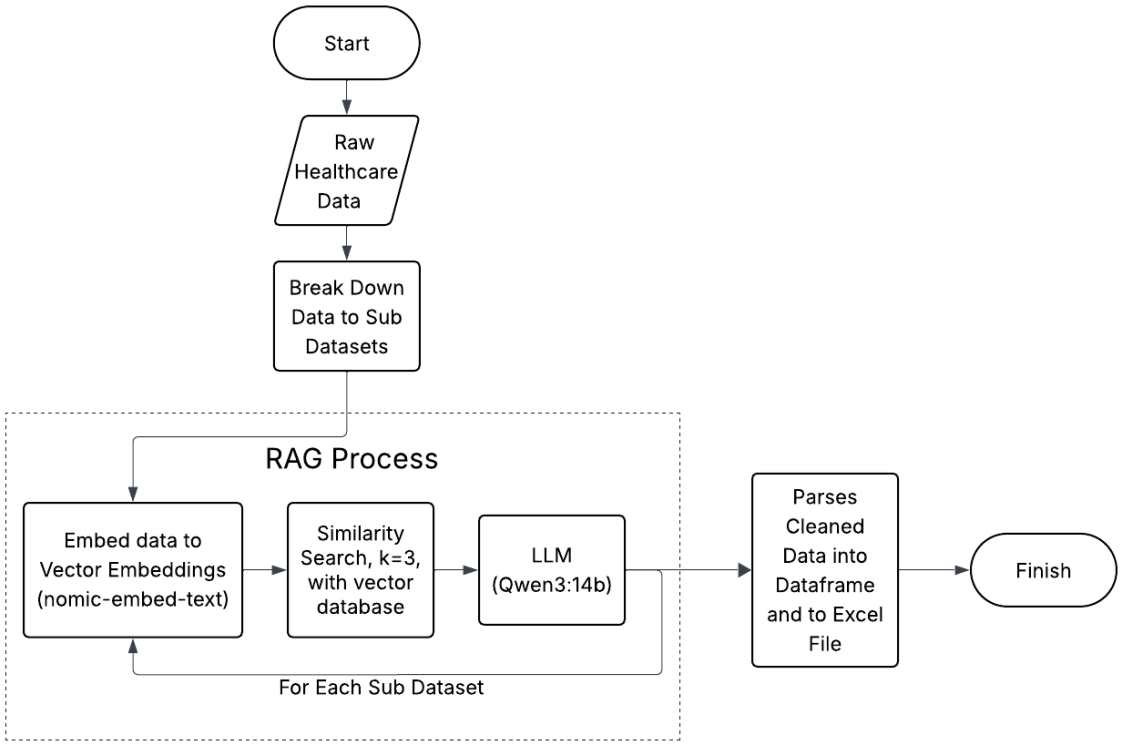
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Use Case 4: AI for EHR Data Standardization

- Developed a local AI solution to clean and standardize electronic health record (EHR) prescription data while keeping patient data secure.
- Automatically converts inconsistent medication names, dosages, frequencies, and routes into a standardized, analytics-ready dataset.
- Uses open-source AI models, Prompt Engineering, RAG, and LoRA fine-tuning to improve accuracy and reduce manual data cleaning.
- Includes a human review workflow for uncertain records, ensuring reliable and trustworthy standardized data.
- Produces high-quality, analytics-ready data for antimicrobial stewardship, clinical research, quality improvement, and AI applications.

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AI for EHR Data Standardization



raw_antibiotic_name	raw_dose_quantity	patient_instructions
Amoxicillin 500 MG ORAL TAB	20 Tablet	Take 1 Tablet by mouth Twice Daily for 10 days

Antibiotic	Numeric Frequency	Numeric Duration	Dosage	Daily Dose
AMOXICILLIN	2	10	500	1000

Use Case 5 :AI-Powered Analytics Chatbot

- Developed an AI-powered chatbot that allows users to ask questions about CHARM data using plain English instead of SQL.
- Automatically converts user questions into SQL queries and retrieves real data directly from the CHARM database.
- Built with privacy and security controls, allowing only read-only, aggregated data while protecting patient-level information.
- Includes an AI self-correction process that automatically fixes invalid SQL queries before returning results.
- Makes health care analytics faster and more accessible, enabling clinicians and researchers to explore dashboard data without SQL knowledge.

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AI-Powered Analytics Chatbot

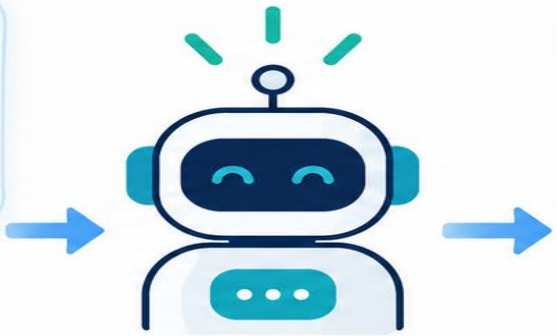
Example: Ask a CHARM Analytics Question

Plain-English question in → aggregated answer out

Give me antibiotics prescribed for UTI with average duration for each antibiotic.



User asks a question in plain English



CHARM AI translates the question and queries the database

Returned aggregated table

Antibiotic	Prescriptions	Avg Duration (Days)	% of UTI Rx
Nitrofurantoin	1,240	5.2	38%
TMP-SMX	860	4.8	26%
Ciprofloxacin	510	6.7	16%
Cephalexin	420	6.1	13%
Amoxicillin-clavulanate	230	7.0	7%

Clinicians and researchers can get quick, secure, easy-to-understand answers without writing SQL.

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Questions

1. Which group includes three pharmacy workflows where AI may improve efficiency or access to information?

A. Classifying medications, standardizing prescription data, and answering questions about pharmacy data
B. Replacing pharmacists, approving every prescription, and eliminating clinical review
C. Making all treatment decisions, removing privacy controls, and skipping data validation
D. Guaranteeing accurate diagnoses, preventing every error, and replacing patient counseling

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Questions

2. Why should pharmacy staff validate AI-generated results before using them?

A. AI always produces the same results as a clinician
B. AI can produce inaccurate, biased, or invented information
C. Local AI eliminates the need for human oversight
D. Faster processing guarantees accurate results

Questions

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3. When AI flags an antibiotic prescription as unusual, what should happen next?

A. Automatically discontinue the antibiotic
B. Assume the prescription is inappropriate
C. Have a clinician review the prescription and record feedback
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Answers

1. A: The presentation includes medication classification, EHR data standardization, and an analytics chatbot as AI use cases.
2. B: AI accuracy varies. In the presentation, LLM diagnosis classification had low accuracy, demonstrating the need to evaluate results.
3. C: The CHARM workflow includes clinician review and stored feedback to help improve the model.

Session Code

LR3X

0.5 contact hours (0.05 CEU)

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Claims must be submitted by the morning of December 14, 2026.

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