



Vanderbilt University Medical Center (VUMC)

PGY-2 Pharmacy Informatics

Vanderbilt University Medical Center

- Nationally Ranked Hospital in 18 specialties, per U.S. News, and the #1 Hospital in Tennessee
- ~1400-bed tertiary med/surg academic teaching facility consisting of :
 - VUH (Adult)
 - VCH (Peds)
 - VPH (Psyc)
 - Outpatient/Ambulatory
 - Cancer Center, Vanderbilt Clinics, and academic institutions

Main Campus

The Vanderbilt Clinic

Critical Care Tower

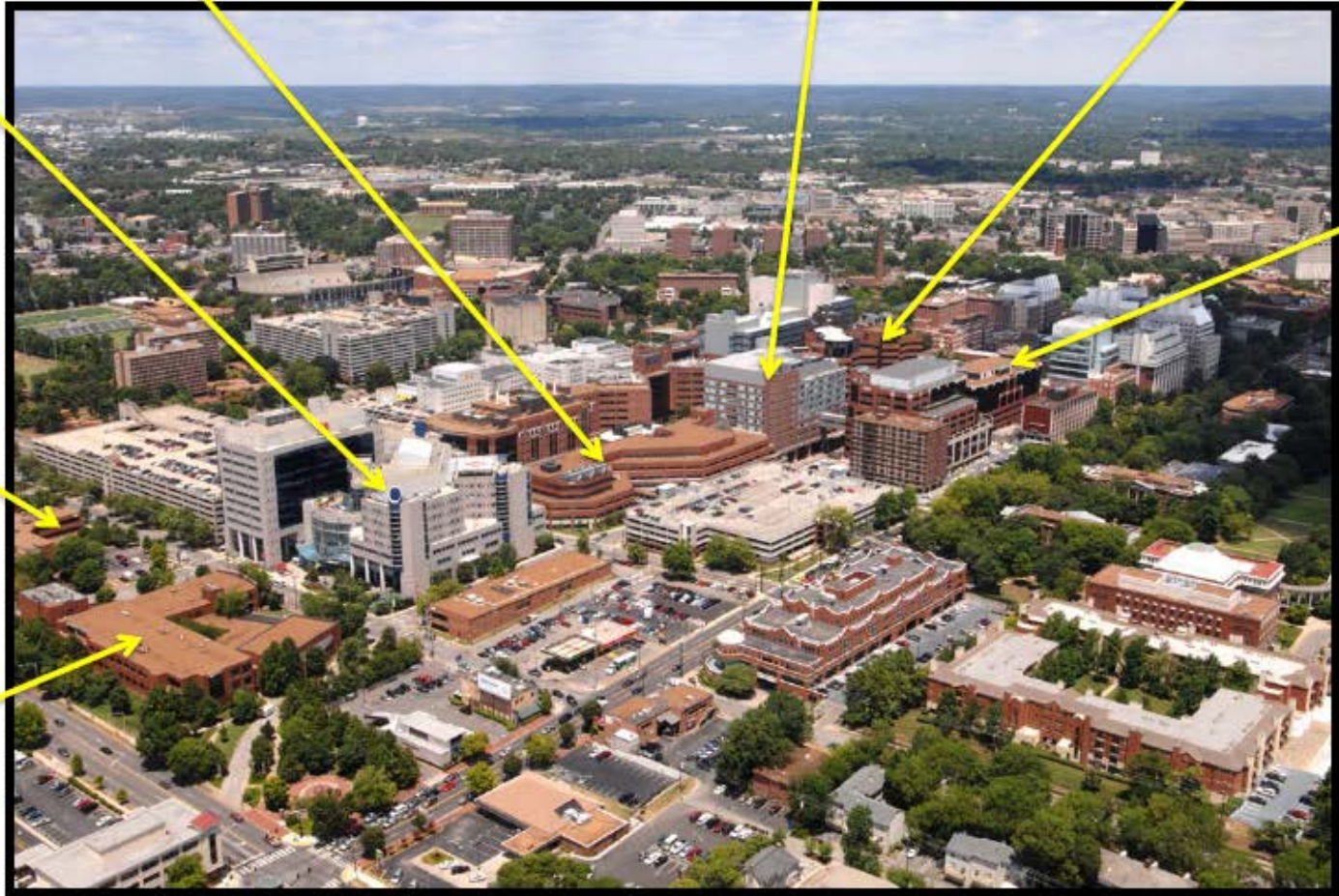
VUH Hospital

Children's Hospital

Psych Hospital

Rehab Hospital

Medical Center East



PEOPLE

SERVICE

QUALITY

GROWTH &
FINANCE

INNOVATION

Vanderbilt Wilson County Hospital

- Recent acquisition of an existing 200 inpatient bed facility and clinic.
- Will transition hospital and clinic to Epic from current EHR in late April of 2020.
- Has existing PGY1 residency program.
- Will extend Vanderbilt Health into the eastern corridor of Nashville.

PEOPLE

SERVICE

QUALITY

GROWTH &
FINANCE

INNOVATION

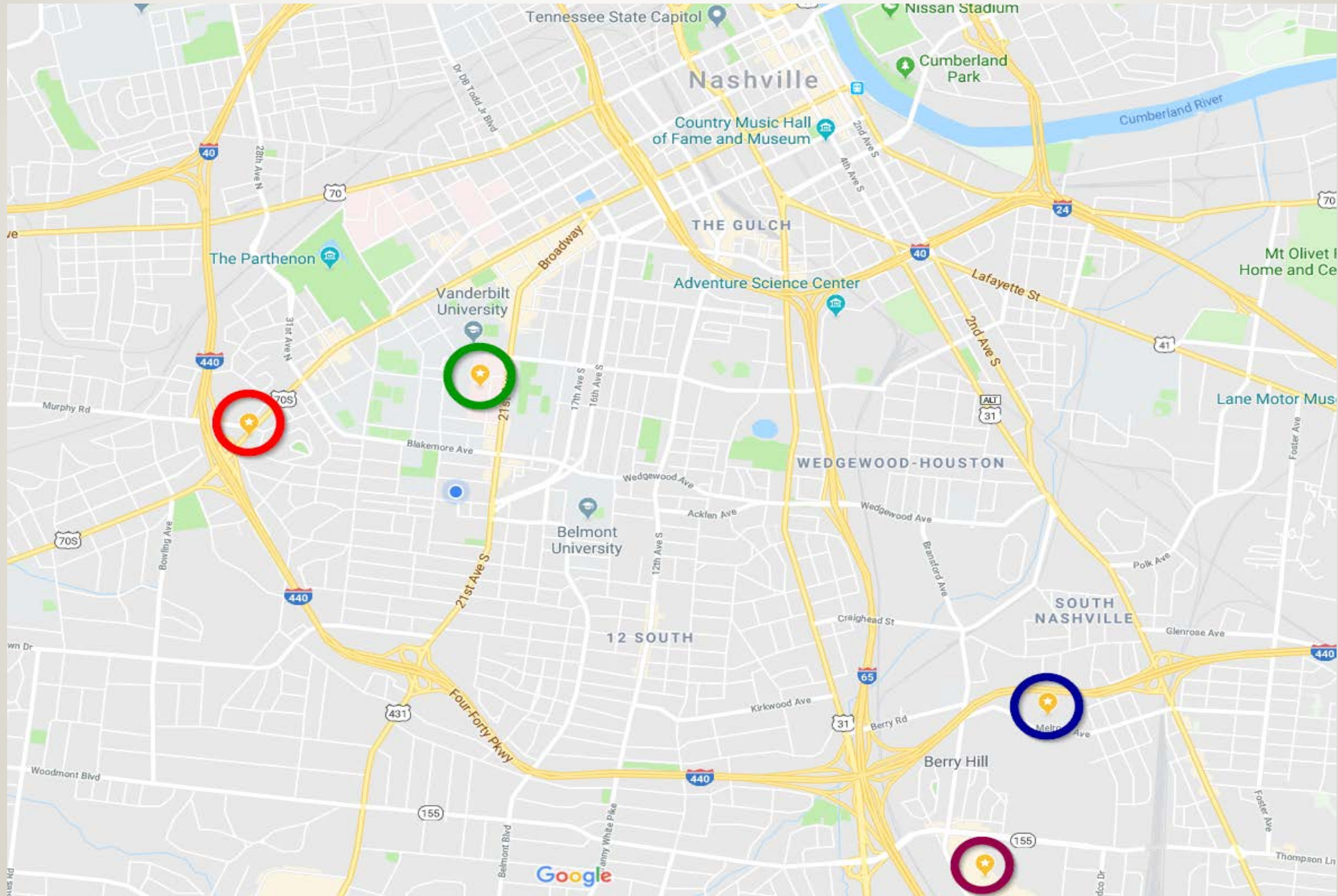
Melrose Support Services



- Specialty Pharmacy
- Mail-order Pharmacy
- 340B Pharmacy
- Central Fill Pharmacy
- Purchasing
- Vanderbilt Health Pharmacy Group



Nashville - VUMC



VANDERBILT  UNIVERSITY
MEDICAL CENTER



> \$3.3B

Annual operating revenue



> 20,000 employees

largest private employer
of Tennessee citizens



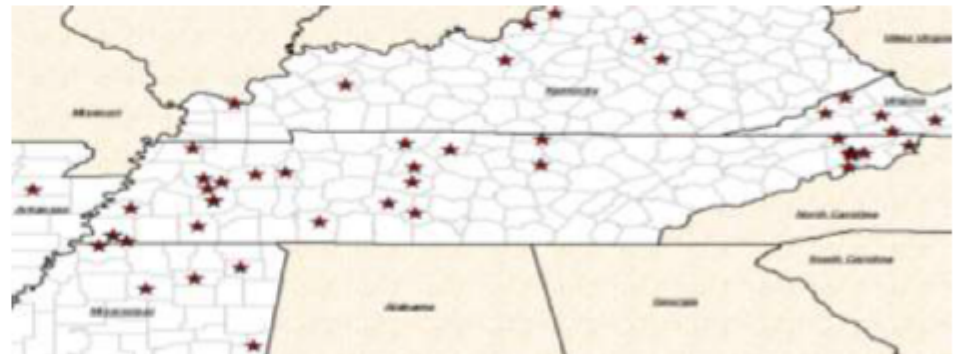
4 Hospitals (1,105 beds) & Clinics

Children's, Adult, Psychiatric, Rehabilitation

62,000 inpatient discharges

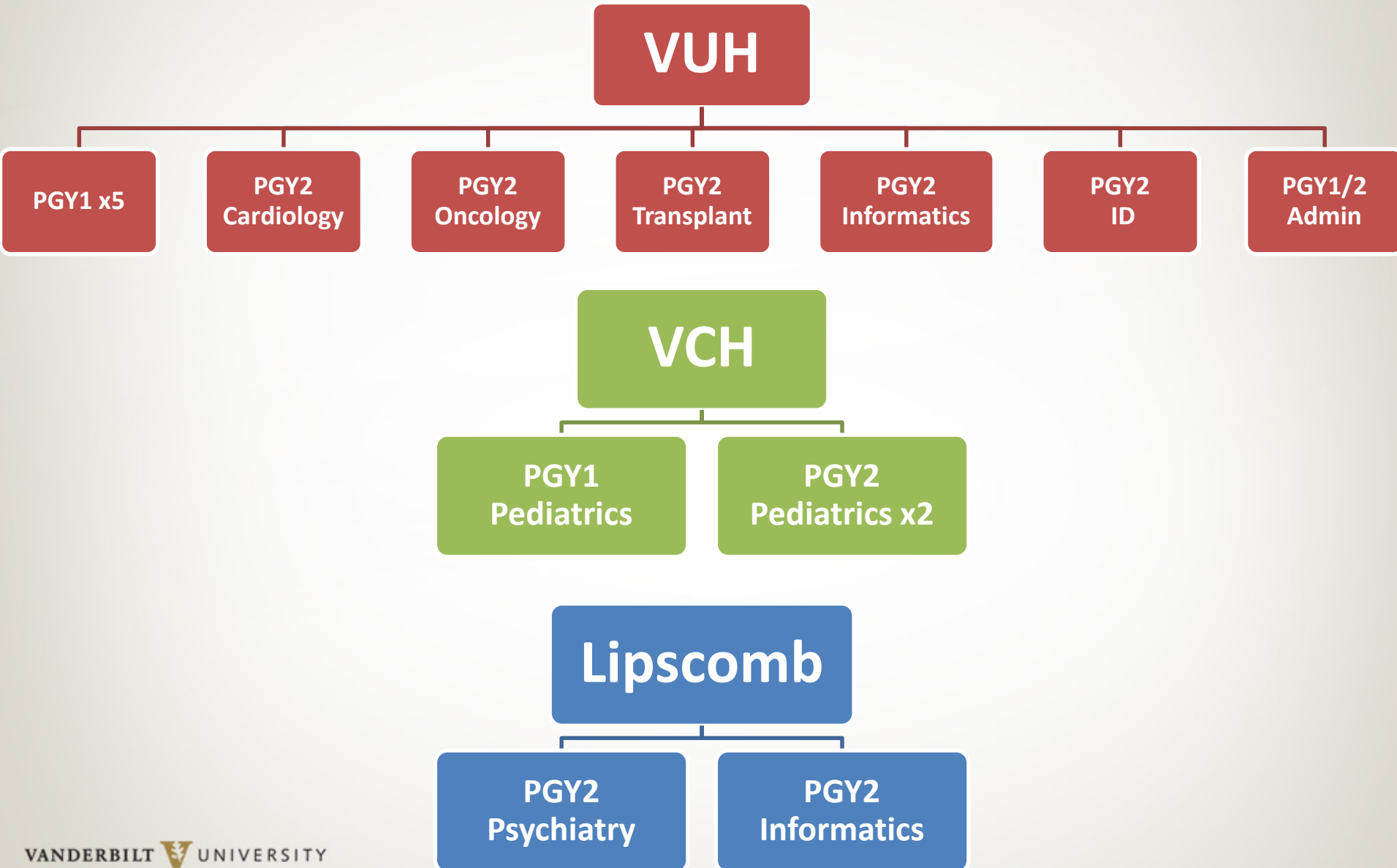
2.1 M ambulatory visits

62,000 surgical operations



Vanderbilt Health Affiliated Network

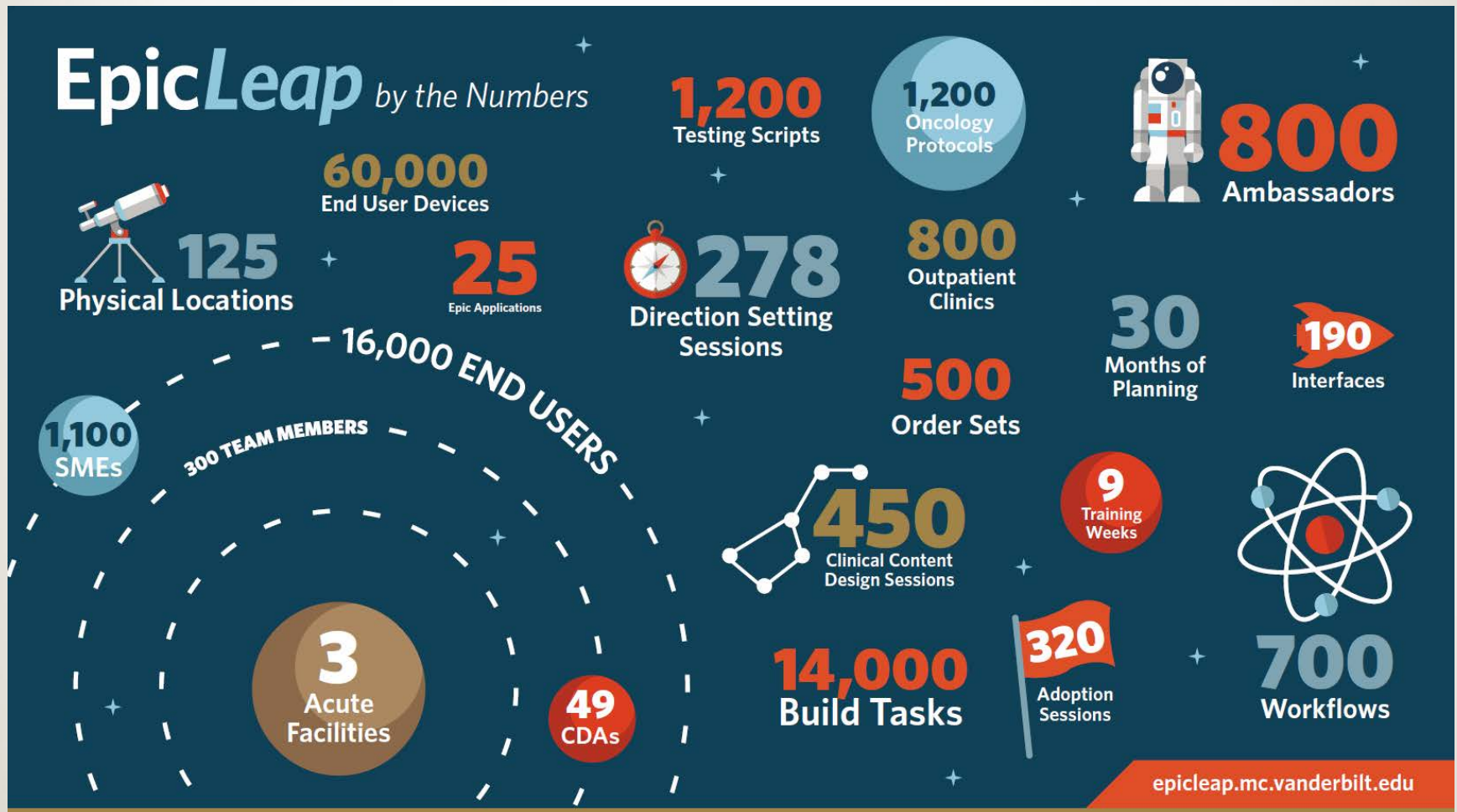
VUMC Residency Family



VUMC Residency Partnership



EpicLeap → eStar



Epic Software

Inpatient

Prelude Registration/ADT
Cadence Scheduling
Health Info Mgmt (HIM)
EpicCare Clinical System
EMR
Clinician Order Entry
Decision Support
Results Review
Clinical Documentation
MAR
Rover Barcoding
Clinical Pathways
Care Plans & Education
Infection Control
Clinical Case Management
ICU
Willow Inpatient
Pharmacy

Specialties

OpTime OR Mgmt
Anesthesia
ASAP Emergency Dept
Beaker Lab
Radiant Radiology
Beacon Oncology
Cupid Cardiology
Stork OB Labor/Delivery
Kaleidoscope
Ophthalmology
Phoenix Transplant
Orthopaedics (Bones)
Wisdom Dental

and More

Population Health and Analytics

Healthy Planet
Population Health/ACO/CINs
Cogito Analytics
Dashboards
Reporting
Analytics
Enterprise Data Warehouse
Benchmarking
Epic Earth Collaboration

Health Plans

Enrollment/Eligibility
Claims/Capitation
Utilization Management
Premium Billing
PlanLink

Social Care

Home Health & Hospice
Long Term Care
Long Term Acute Care
Community Care
Child Welfare
Behavioral Health
Schools

Mobile & Portals

MyChart
Shared EMR for patients
MyChart Bedside
Shared for hospital patients
Lucy Free-standing PHR
Canto For iPad
Haiku For iPhone & Android
Care Everywhere
Interoperability
EpicCare Link Affiliate access

Research

Patient Enrollment
Research Analytics
Research Billing
CTMS Interface

Education

Supervisory support for
Attendings
Residency workflows
Medical student training

Revenue Cycle

Resolute Hospital Billing
Resolute Professional Billing
Charge Router

Ambulatory

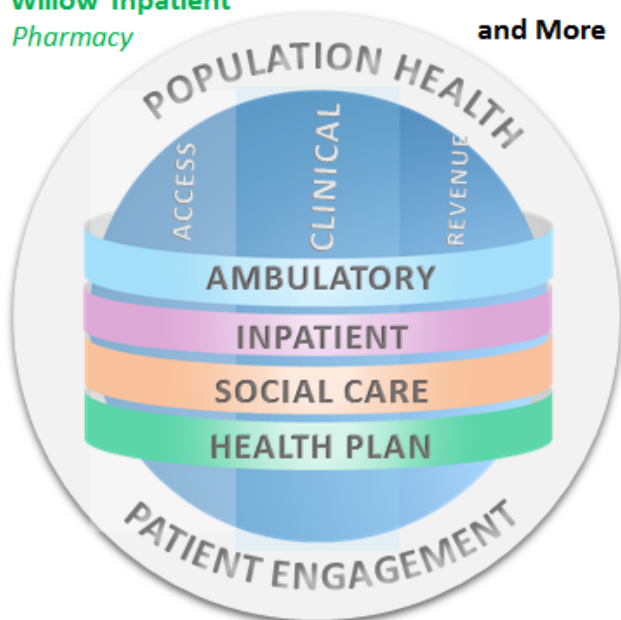
Prelude Registration
Cadence Scheduling
Call Management/CRM
EpicCare EHR
Charting
Clinician Order Entry
e-Prescribing
Decision Support
Results Review
Coding & Benefits
Nurse Triage

Willow Ambulatory
Pharmacy

Welcome Patient Check-in

Telemedicine

Video visits
Specialty consults
Remote interpreters
Care Team member
Pediatric distance care
Urgent help (trauma)
Telestroke
Remote monitoring
ICU / bed monitoring
Virtual rounds
Virtual beds



Our Mission

- Support appropriate, safe and accurate medication prescribing, preparation, dispensing, and administration throughout the medical center
- Support pharmacy processes and procedures through software and automation solutions and integration
- Support institutional financial goals by optimizing file construct and applications for business growth
- Support investigational drug service

What Do We Do?

- Pharmacy Informatics Team
 - Analysis from both a business and clinical perspective
 - Develop CDS content and workflow solutions
 - Performs QA testing on developed content
 - Supports automation integration and optimization
- Pharmacy has the largest CDS library
 - 66% Adult/General Files
 - 15% Pediatric Specific Files
 - 11% Pediatric Infusion Files
 - 8% Investigational Files

Pharmacy Informatics Key Tasks

- Create/Maintain Drug Interactions/Alerts/Dose Range
- Develop/Maintain/QA medication advisors/CDS
- Create/Maintain medication dispensable files
- Maintain custom FDB Drug Interactions/Dose Range
- Twenty-one Pharmacists at HealthIT in current state
 - Willow (8)
 - Beacon (2)
 - Orders (3)
 - Data Analytics (1)
 - EBM (1)
 - Outpatient (4)
 - Residents (2)
 - Technician/non-clinical (2)

Pharmacy Informatics Key Tasks

- Create/maintain CNR (compounding & repackaging) files and barcode links
- Provide troubleshooting/support (on-call) for medication centric issues
- Precept Pharmacy Informatics residents
- Ongoing relationship with training team to provide input on training materials

Outpatient Pharmacy Informatics

- Outpatient pharmacy entities:
 - Vanderbilt Specialty Pharmacy
 - Retail Operations (TVC, MCE, OHO, Children's)
 - For Profit Spinoff - Vanderbilt Health Pharmacy Group, Vanderbilt Health Pharmacy Solutions
 - Vanderbilt Health Affiliated Network (VHAN)
- Support various applications that are used on a day-to-day basis
 - Upgrades/New Implementations
 - Break-fixes/Troubleshooting
 - QA
 - Specialty Pharmacy Application build
- Detailed process/data workflow
- Network Security
- Business/IT compliance

Outpatient Pharmacy Informatics

<p style="text-align: center;"><u>VSP</u></p> <ul style="list-style-type: none"> • ScriptMed • AtlasRx • Opportunity Management drug maintenance • DVS Analytics 	<p style="text-align: center;"><u>Outpatient Pharmacy</u></p> <ul style="list-style-type: none"> • Emporos/Emporos Mobile • EnterpriseRx • IVR • IWR - mScripts • HVS/Logicor • ScriptCenter • RxSafe 	<p style="text-align: center;"><u>Epic</u></p> <ul style="list-style-type: none"> • Work with Willow team on Epic medication file build • Work with various Epic teams on other outpatient build needs • Surescripts/Outpatient prescribing
<p style="text-align: center;"><u>VHAN/PharmCo</u></p> <ul style="list-style-type: none"> • Integration/maintenance of VSP/Outpatient applications 	<p style="text-align: center;"><u>Inpatient/Outpatient</u></p> <ul style="list-style-type: none"> • Omnicenter 	
<p style="text-align: center;"><u>Projects</u></p> <ul style="list-style-type: none"> • Meds-to-Beds • Troubleshoot application issues • Disaster recovery • Process/Data workflows • Network schematics • New app/product implementations 		<p style="text-align: center;"><u>Reporting</u></p> <ul style="list-style-type: none"> • Operational/Financial Dashboards • Data analytics/reports <ul style="list-style-type: none"> • SQL • Tableau • Prescription data reporting

Retail Pharmacy Services



**Melrose Support Services*

McKesson High-Volume Solutions: Express-Rx

ExpressRx Track™ Tote

McKESSON
Empowering Healthcare

LVS Virtual Tour

Touch Here to Start ExpressRx Track™

- 1 Parata Max
- 2 Manual Pick Station
- 3 Unit of Use
- 4 Verification Station
- 5 AutoBagger

Optional

Explore our Virtual Facility by clicking on one of the stations above!

*Disclaimer

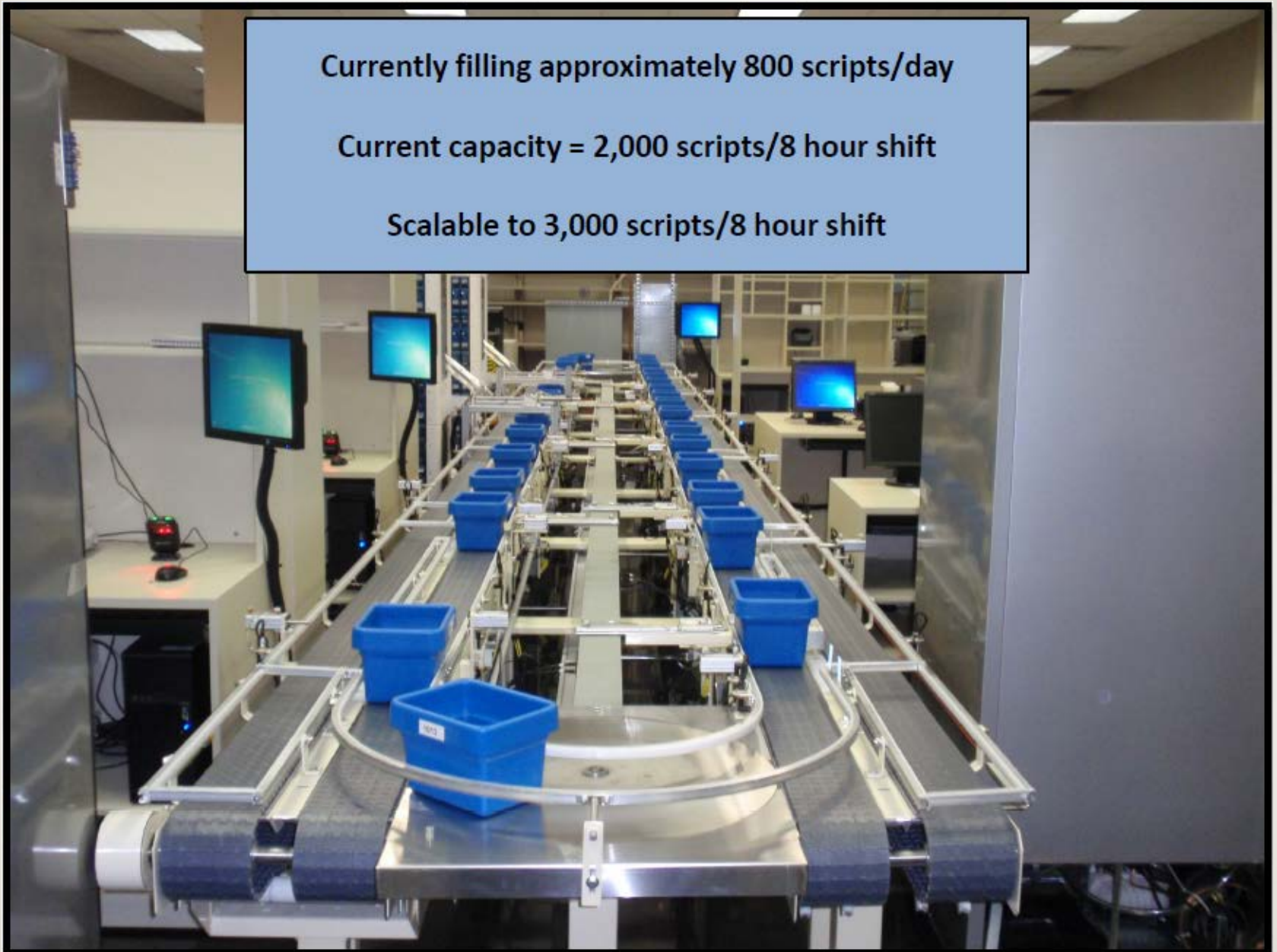
HVS Home About HVS HVS Capabilities EXIT PRESENTATION

Parata Express Personal Tour Video ExpressRx Track Puck Virtual Tour **ExpressRx Track Tote Virtual Tour** HVS Virtual Tour 888-HVS-RXRX

Currently filling approximately 800 scripts/day

Current capacity = 2,000 scripts/8 hour shift

Scalable to 3,000 scripts/8 hour shift



Request Management - JIRA

Willow
Medication Requests

Backlog
Kanban board
Releases
Reports
Issues
Components
Git Commits
Tests

Create Issue

Configure Fields

Project * Willow (WIL)

Issue Type * Medication File Request

General Clinical Procurement Billing Validation

Summary *

Generic Name

Brand Name

TALLman Lettering

Formulation

Strength (with units)

Formulary Change None

Approval Date

Priority Minor

Hazardous Product None

Create another **Create** Cancel

Request Management – Pegasus Break/Fix

PEGASUS

Home Communications Incidents Requests Changes CI Release Problem Service Catalog Support Knowledge Links

Select View: My Worklist

INCIDENTS ASSIGNED TO MY WORKGROUPS - OPEN (6) 25 filter...

ID	Date Created	Title	CI Name	Status	Customer	Priority	Assignment Group	Assigned To
	01/30/2018 12:26 PM	Missing Faxes	ENTERPRISERX	Accepted		1 - Critical	PHARMACY INFORMATICS OUTPATIENT	
	01/30/2018 11:33 AM	Incomplete Surescripts data	ESTAR WILLOW MEDICATION ORDER ENTRY_PHARMACY	Open		4 - Low	PHARMACY INFORMATICS OUTPATIENT	
	01/10/2018 05:08 PM	Changing label information for rimabotulinumtoxinB (MYOBLOC) injection from room temp to refrigerated	PHARMACY USER SUPPORT	Pending Customer		4 - Low	PHARMACY INFORMATICS INPATIENT	
	11/03/2017 03:44 PM	eStar: acu dose not putting in doses correct	ACUDOSE	Open		3 - Medium	PHARMACY INFORMATICS INPATIENT	
	11/03/2017 03:33 PM	Printing misprinting	EUD TDR	Open		2 - High	PHARMACY INFORMATICS INPATIENT	
	11/03/2017 08:39 AM	orders not crossing over	PHARMACY USER SUPPORT	Open		3 - Medium	PHARMACY INFORMATICS INPATIENT	

Showing 1 to 6 of 6 records Previous 1 Next

CHANGES THAT REQUIRE MY APPROVAL

CHANGES ASSIGNED TO MY WORKGROUPS - OPEN (11) 25 filter...

Showing 1 to 11 of 11 records Previous 1 Next

History of VUMC Clinical Systems

Before 1994	Pharmacy used vendor mainframe for 20 years
1994	Vendor CPOE pilot was not successful
1995	Vanderbilt built custom front end GUI created and success
	House-wide implementation. Rounding with laptops, StarPanel
1998	Code rewrite for stand-alone system
2001	McKesson purchased Vanderbilt's CPOE for commercial use
2005	HMM implemented
2007	Horizon Clinical Systems implementation, inpatient automation
2013	DoseEdge, VOIS (oncology information system) pilot, EnterpriseRx, Lab interface
2014	AcuDose Upgrade, Melrose Support Services (off site facility)
2015	DoseEdge & VOIS expanded implementation, TPN ordering advisor update deployment
2017-18	Epic go-live (Nov 2, 2017), Omnicell carousels & OmniCenter
2019	OmniCell cabinet replacement for enterprise

eStar

Med List Tool

Orders Order Hx Find Patients Remind Me RxAdmin Build Tools Dashboard Editor Record Viewer Data Courier

Decision Support Willow, Stewart Adult PROOF OF CONCEPT PHILLIP S. Search

CritAlert: None **Willow, Stewart Adult** CSN: 1800... Weight, Height: 131 kg (288 lb 12.8 oz), N... Allergies: No Kno... Isolation: None PCP: Jan S Delozier, MD Prim Coverage: None CrCl: <Patient's mo...
 Male, 38 y.o., 1/1/1980 Bed/Location: 8223-X Code: Not on File LoS, Admit Date: 7... Tx Team: Provider Beacon, ACNP... Care Everywhere: CSC... BSA: Patient height...
 MRN: 002001592 Adv Dir, POST?.... Pt Class: Inpatient MHAV: Inactive Dosing Weight: None

Admission

Review Home Medications 1. Review Current Orders 2. Reconcile Home Medications 3. Order Sets

Add Prior to Admission Med + Add

Sort by: Pharmaceutical Class
Mark Unreconciled Today Mark Unreconciled Yesterday Check Interactions Informants Find Unreviewed

New Prior to Admission Medications

							Last Dose	Time	Taking?
	fluticasone (FLONASE) 50 mcg/actuation nasal spray	Administer 1 spray into each nostril daily. Informant: Self Last Dose: 11/14/2018	Today Yesterday Past Week Past Month More Than A Month Unknown	11/14/2018	at	Unknown	<input checked="" type="checkbox"/>		
	loratadine (CLARITIN) 10 mg tablet	Take 10 mg by mouth daily. Informant: Self Last Dose: 11/14/2018	Today Yesterday Past Week Past Month More Than A Month Unknown	11/14/2018	at	Unknown	<input checked="" type="checkbox"/>		
	acetaminophen (TYLENOL) 500 mg tablet	Take 500 mg by mouth every 6 (six) hours as needed for mild pain. Informant: Self Last Dose: 11/14/2018	Today Yesterday Past Week Past Month More Than A Month Unknown	11/14/2018	at	Unknown	<input checked="" type="checkbox"/>		

Pharmacy: No Pharmacy Selected

Med List Status: + Add Status Comment


Mark as Reviewed Last Reviewed by Pharmacist Willow, PharmD on 9/13/2017 at 12:22 PM [History](#)

Previous Next

Best Practice Advisory

BestPractice Advisory - Willow, Amy Pediatric

High Priority (1)

 This medication is restricted to clinic use only. If Pharmacy & Therapeutics Committee approval has been granted enter the name of the approving P&T representative in the comments box.


Clinic Only medication orders that will be **Dispensed by Pharmacy** require Pharmacy & Therapeutics Committee approval as follows:

1. Call pharmacy to discuss alternative options to using Clinic Only med.
2. If no alternative to Clinic Only med exists, the provider submits an email request to PandTComm@vanderbilt.edu
3. The Clinic Only med request provides patient specific details with MRN and applicable evidence/literature.
4. A PT&D representative will notify provider with the outcome within 24 hrs.
5. Upon approval, Clinic Only med may be ordered and Pharmacy will dispense within 48-72 hours.

Remove the following orders? _____


Remove

Keep

 **inFLIXimab (REMICADE) in NS 250 mL IVPB**
intravenous, Administer over 2 Hours, Once, Today at 2030, For 1 dose

Acknowledge Reason _____

Use Approved by: (enter name below)

 **Accept**

Warfarin Dosing Advisor

Warfarin Initial Dosing Advisor

Order Mode: IP

This patient may have been tested for CYP2C9 and VKORC1 genetic variants that can affect a patient's warfarin dosing requirements. The following dosing algorithm uses genetic and other patient information to estimate a weekly warfarin dose. The dosing recommendation only applies to NEW starts of warfarin with an approximate target INR range between 2-3. [Show Algorithm](#)

Age: <input type="text" value="63"/> y	Patient Genetic Variants <input type="checkbox"/> CYP2C9 *1/*2 <input type="checkbox"/> CYP2C9 *1/*3 <input type="checkbox"/> CYP2C9 *2/*2 <input type="checkbox"/> CYP2C9 *2/*3 <input type="checkbox"/> CYP2C9 *3/*3	Patient Genetic Variants <input type="checkbox"/> VKORC1 a/a <input type="checkbox"/> VKORC1 a/g	Is the patient currently taking amiodarone ? <input type="radio"/> Yes <input checked="" type="radio"/> No
Weight: <input type="text" value="83.92"/> kg			Is the patient currently taking phenytoin, rifampin, or carbamazepine ? <input type="radio"/> Yes <input checked="" type="radio"/> No
Height: <input type="text" value="182.9"/> cm			

Initial Calculated Dose 6.79 mg rounded to 6.50 mg	Recommended Daily Dose 6.50 mg QBEDTIME (2200) at 22:00 tonight
---	--

Dose Override <input type="text" value="amount"/> mg
--

NOTE: Further dose adjustments may be necessary due to other clinical factors, such as diet and other interacting medications (e.g., antibiotics or antifungals). This algorithm ONLY considers age, height, weight, genetic factors, and select medications (amiodarone, rifampin, phenytoin, and carbamazepine).

v1.0.17

Cancel

Order 6.50 mg Warfarin

PN Order Summary

The current TPN report could not be completed. Check the setup for this TPN and its ingredients if problems persist.
Unable to determine volume in Liters.

Frequency: Continuous PN Continuous Cyclic PN - see admin instructions

For: 24 Hours Days

Starting: 11/14/2018 Today Tomorrow At: 2200 Show Additional Options

Starting: Today 2200 Ending: Tomorrow 2159

Scheduled Times

Volume: mL 1,440 mL 1,800 mL 2,400 mL 3,000 mL

Administer Over: 24 Hours 24 Hours

Taper up for: 0 Hours 1 Hours 2 Hours

Taper down for: 0 Hours 1 Hours 2 Hours

Ingredients if

Type: 131 kg

Indication: ileus/SBO/pain fistula/leak/bowel rest malabsorption Other (specify)

PN Diagnosis: benign post-op IBD pancreatitis other GI benign neoplasm malignant neoplasm critical care
systemic disease congenital disease Other (specify)

Prescriber Contact Page #: [Empty field]

Admin. Inst.: + Add Administration Instructions

Prod. Admin. Use a 1.2 micron filter. Infiltration/Extravasation Risk = Red (Vesicant)

Inst.:

Note to Pharmacy: + Add Note to Pharmacy (F6)

Pharmacy:

Amino Acids (Selection Required) + Add

- amino acid 10% (AMINOSYN II)
- amino acid 15% (AMINOSYN II)
- amino acid 8 % (HepatAmine)

Dextrose (Selection Required)

dextrose [Red icon] g 150 g 200 g 300 g 400 g

Lipids

fat emulsion 20 %

QS Base (Selection Required)

Custom Insulin Infusion

Must enter calculated rate into the "Dose" box and select appropriate action (new bag, dose/rate change, stopped,

Type BG and insulin infusion calculated rate will appear

D50W calculations will appear here – must document separately on D50W PRN Order on MAR

Documented By: INPATIENT, ATTENDING PHYSICIAN Schedule Date/Time: 10/17/17 1300

Infusion

x insulin regular human 100 units in NS 100 mL (1 unit/mL) infusion : Dose 0.1-15 Units/hr - 0.1-15 mL/hr - Intravenous - Titrated

Action: New Bag

Date: 10/17/2017 Time: 1256

Route: Intravenous

Dose: 0.1-15 Units/hr

Rate: 0.1-15 mL/hr

Order Concentration: 1 Units/mL Stopped at: 10/17/17 1256

Associated Flowsheet Rows:

New Value: Date: 10/17/2017 Time: 1256

OTHER

Blood glucose: 165

Multiplier: 0.4

Calculated insulin dose (units/hr): 4.2

Additional Actions

mL of D50W to give as IV push: no D50W dose needed

Check the box to link to previous value if no new assessment is needed. Only values from 10/17/17 1255 to 10/17/17 1256 are allowed.

No data filed in allowed time range

No data filed in allowed time range

No data filed in allowed time range

No data filed in allowed time range

No data filed in allowed time range

Admin Instructions:

Notify of House Officer if:

a) blood glucose is LESS than 60 mg/dL,
b) blood glucose is LESS than 70 mg/dL, and BG checks are not ordered for Q1H,
c) blood glucose is GREATER than 200 mg/dL,
c) Insulin drip rate suggested by MAR calculator is GREATER than current ordered dose range.

For blood glucose LESS than 70 mg/dL, blood glucose checks should be adjusted to Q1H until 2 consecutive checks have been 70 mg/dL or greater.

Treat for hypoglycemia if BG less than low target:

a) Give D50 using formula: $(BS - BG) \times 0.5 = \# \text{ mL of D50 to be given by IV Push}$,
b) Resume BG monitoring and Insulin Drip Titration protocol as shown above.

Order Questions/Answers

Blood Glucose Range: ICU Range 100-150

Initial multiplier for infusion calculation: Start with new multiplier

New multiplier for infusion calculation: 0.03

Priority: Routine

Order ID: 1010609

Ordered Infusion Rate: 0.1-15 mL/hr

Last Admin: Today 10/17/17 at 1249

Frequency: Titrated

Route: Intravenous

Order Dose: 0.1-15 Units/hr

Administration Window: 60 minutes from the due time

Order Start Time: Today 10/17/17 at 1230

Linked Line: Not Linked (as of Today 10/17/17 at 1256)

Last Flowsheet Documentation

Blood 60 filed at 10/17/17 1250 by Katelyn Kennedy Abwater, MD

glucose

Multiplier 0.4 filed at 10/17/17 1250 by Katelyn Kennedy Abwater, MD

Recent Actions

10/17 10/17

1249 1250

You are documenting 1 administration. [Accept] [Cancel]

Dispense Queue

Dispense Queue: VUH Central Pharmacy ? ↗ ✕

Dispense Type **Due Time Filter** **Sort By** 3

1 2 3
First Doses / Redispenses Cart Fills All Dispenses
Show All Next 2 Hours Next 4 Hours Next 8 Hours
Due Times Medication Order Name Dispense Code
Unit / Patient Unit / Room / Bed Patient
Refresh

1 2 3
Disperses from pharmacies: VUH Central Pharmacy
Last refresh: 1337
Remove Dispenses Order Hx

P	Order	Patient	Unit	Dispense Code	Due
	alendronate (FOSAMAX) tablet 10 mg [1095698]	Connectrx,Ramona	VUH 6N NEUR...	Unit Dose	01/09/2017 1445
	HYDROcodone-acetaminophen (NORCO) 7.5-325 mg per tablet 1 tablet [10956...	Connectrx,Ramona	VUH 6N NEUR...	Unit Dose	01/09/2017 1445
	albuterol 2.5 mg /3 mL (0.083 %) nebulizer solution 3 mg [1095703]	Connectrx,Ramona	VUH 6N NEUR...	Unit Dose	01/09/2017 1500
	insulin aspart (NovoLOG) injection 10 Units [1127928]	Willow,Cui Adult	VUH 8S MEDICI...	Unit Dose	01/17/2017 2045
	insulin glargine (LANTUS) 10 Units injection 0.1 mL [1127929]	Willow,Cui Adult	VUH 8S MEDICI...	Unit Dose	01/17/2017 2200

Selected: 0
 Loaded: 16
 All dispenses loaded

Select dispenses with same:

Medication Dispense Code Unit Select All Clear Selection 5 Print Selected

Instance-based optimization of order groups following electronic health record (EHR) implementation

Joseph A. Huenecke, PharmD¹; Edward Woo, PharmD¹; Scott D. Nelson, PharmD, MS^{1,2}

¹HealthIT, Vanderbilt University Medical Center, Nashville, TN; ² Department of Biomedical Informatics, Vanderbilt University Medical Center, Nashville, TN

Introduction

Order sets are a collection of orders aggregated in a single location for a specific condition, process, or clinical situation used during computerized provider order entry (CPOE).

Order sets have shown to improve ordering efficiency and increase adherence to evidence-based medicine, thereby decreasing variation in care.

Order sets require regular maintenance due to changes in evidence, changes in supply, or updates to internal processes.

Optimizing order sets through standardization and modularization should decrease the significant resource burden required to review and maintain these order sets.

The objective of this project is to identify similar perioperative order groups based on the overlap of their medication orders, focusing on order groups containing cefazolin, clindamycin, and vancomycin.

Methods

- Calculate the similarity between perioperative order group using the equivalence score (ES)
- ES is a modified Jaccard coefficient, measures the percent overlap between two order groups and account for small sample sizes

$$ES(S,T) = J_{Cmod}(S,T) = \frac{\sqrt{st \times (st - 0.8)}}{s + t + st}$$

s: unique source members

t: unique target members

st: overlap

- ES ranges from 0 to close to 1, with 0 implicating no overlap, and higher scores representing an increased degree of overlap
- ES ≥ 0.8 as significant relationship for manual review
- Manual review will be performed to determine if the order groups are truly duplicates or candidates for standardization, accounting for additional variables such as frequency, dose, route, and specimen type

Example

Lexical matching

Order Group 1

POST-OP ADMISSION BOWEL REGIMEN

Order Group 2

POST-OP ADMISSION PRN BOWEL REGIMEN

Explanation

- Group 1 and 2 are lexically similar. The groups differ by a single word
- The lexical similarity, would infer that the groups have similar members
- Order Group 1 and 2 contain 5 and 3 orders respectively.
- However, the two order groups are not similar.
- See explanation below

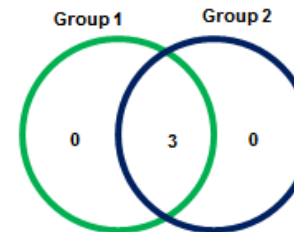
Instance-based matching

Order Group 1

POST-OP ADMISSION PRN BOWEL REGIMEN

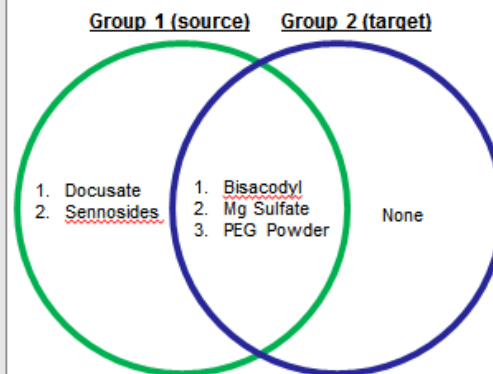
Order Group 2

NON-SURGICAL ADMISSION ORDERS PRN BOWEL REGIMEN



ES = 0.86

Instance-based Matching



Order Group 1: POST-OP ADMISSION BOWEL REGIMEN
Order Group 2: POST-OP ADMISSION PRN BOWEL REGIMEN

Explanation

- Docusate, sennosides, and sennosides-docusate are unique to Order Group 1
- Bisacodyl, Mg sulfate, and PEG powder are in Order Group 1 and Order Group 2
- Order Group 2 does not have any unique members
- ES Calculation:

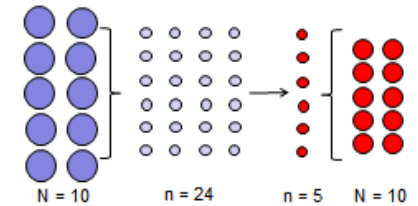
$$ES(S,T) = J_{Cmod}(S,T) = \frac{\sqrt{3 \times (3 - 0.8)}}{2 + 0 + 3}$$

$$ES(S,T) = J_{Cmod}(S,T) = 0.51$$

- Relationship between Order Group 1 and Order Group 2 does not meet the criteria for manual review

Proof-of-Concept

- Instance-based matching approach was applied to inpatient anticipatory PRN order groups (including: bowel, pain, nausea, and sleep)
- Based on this analysis, we created 5 standard order groups and retired and replaced 24 duplicate order groups affecting 10 order sets



Next Steps

Next 6 months:

- Our goal is to identify opportunities for order group standardization through automated instance-based matching techniques
- Focus on order groups containing medication orders for cefazolin, clindamycin, and vancomycin
- Complete a sensitivity analysis by incorporating frequency, dose, route, and specimen type

Future Plans:

- Expand scope of order groups
- Establish standard for order group and order set optimization

Acknowledgments

Phillip W. Stewart, DPh
PGY2 Informatics Residency Program Director

Contact Information

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Advanced clinical decision support as an alternative to traditional drug-drug and drug-pregnancy interaction alerts

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¹HealthIT, Vanderbilt University Medical Center, Nashville, TN; ²Department of Biomedical Informatics, Vanderbilt University Medical Center, Nashville, TN

Introduction

Computerized prescriber order entry (CPOE) linked with clinical decision support (CDS) has been shown to significantly reduce the incidence of ordering related medication errors.

Alert fatigue, due to an overabundance of non-specific alerts can lead to providers becoming desensitized, and as a result ignore potentially relevant alerts.

The term basic CDS has been coined to describe CDS that focuses on a single pairing of triggering criteria, such as drug-drug interaction or drug-disease state interaction.

Advanced CDS, which takes into consideration multiple patient factors, has been proposed as a more specific alternative to basic CDS alerts.

The purpose of this project is reduce the alert firing rate and improve the rate of override by replacing a select number of basic CDS alerts with advanced CDS.

Methods

Based upon review of basic CDS alert triggering and override rates, three groups of alerts were identified as possible targets for conversion to advanced CDS (Table 1).

Table 1. Selected Drug Alerts and Provider Response Rates from 10/1/18-10/31/18

K-Supplements / K-Sparing Diuretics	Viewed	136 (4.7%)
	Canceled	125 (4.3%)
	Removed	31 (1.1%)
Drug-Drug Interaction Alert	Overridden	2,630 (90.0%)
	Total	2,922
	NSAIDs/Pregnancy	Viewed 277 (8.5%)
Drug-Pregnancy Alerts (7 total alerts)	Canceled	114 (4.3%)
	Removed	23 (0.9%)
	Overridden	2,305 (86.4%)
QTc Prolonging Medications	Total	2,669
	Viewed	637 (6.0%)
	Canceled	770 (7.3%)
Drug-Drug Interaction Alerts (49 total alerts)	Removed	133 (1.3%)
	Overridden	9,013 (85.4%)
	Total	10,553

Hyperkalemia Risk Scoring System

Proposed scoring system criteria:

- +1 to score if: age > 70, CrCl < 50, DM, HF, ACE-I/ARB, K-Sparing Diuretic, Potassium Supplement
- 2 to score if: most recent, but within the past 3 days, serum K level <4 mEq/L
- 1 to score if: most recent, but within the past 3 days, serum K level <4.5 mEq/L

CPOE alert if ordering ACE, ARB, potassium sparing diuretics, or potassium supplements and risk score is >2.

Applicable risk factors and recent lab values displayed with alert.

Failsafe CDS alert will trigger if at anytime a high potassium lab value returns while patient is on ACE, ARB, potassium sparing diuretics, or potassium supplements.

Nonsteroidal Anti-Inflammatory Drugs and Pregnancy Alert

Alert currently triggers for women with active pregnancy status and women of child bearing age whom do not have any documented negative pregnancy status.

- 97% of these alerts are attributable to not having a documented negative pregnancy status.

Aim to reduce alert burden due to undocumented pregnancy status.

The teratogenic potential of NSAIDs is linked to third trimester. A BMI threshold will be incorporated to attempt to identify any patient who might have progressed into the third trimester without knowing it.

Proposed advance CDS criteria:

- Active pregnancy status
- No documented pregnancy status and BMI > 30 (would reduce number of alerts due to undocumented pregnancy status by 78%)

QT-Prolongation risk scoring system

Proposed scoring system criteria based upon validated risk score:

- +1 to score if: Age ≥ 68 years old, female, loop diuretic
- +2 to score if: Serum K <3.5 mEq/L, QTc ≥ 450 ms, h/o MI
- +3 to score if: QTc-prolonging drug already prescribed, sepsis, heart failure

Interruptive CPOE alert when ordering QTc prolonging medication if risk score ≥ 8 or if patient has of a diagnosis of long QTc syndrome.

Failsafe CDS alert if, at any time while on any QTc prolonging medication, the QTc becomes ≥ 500 ms or if the QTc increases by ≥ 60 ms since the last measurement.

Alert to include details about risk factors and include suggestions for discontinuing medications and orders for QTc monitoring.

Measuring Outcomes

The replaced basic CDS alerts will be filtered from user view; however, the alerts will still trigger in the background. This will allow for direct comparison alert trigger rates between the two types of CDS.

Provider response and override rates will be compared in the pre and post implementation.

In order to assess the sensitivity of the potassium related CDS, will compare rates of hyperkalemia between patients identified by the basic CDS and advanced CDS.

Will monitor the enterprise wide internal adverse drug event reporting system for any reports that may be contributed to the proposed changes.

Anticipated Challenges

The EHR system employed by Vanderbilt University Medical Center is used in both the inpatient hospital and outpatient clinic setting and the proposed CDS changes will need to be customized to meet the needs these different settings.

The proposed risk scoring systems are based upon models that have been developed for adult patients and customization of the advanced CDS alerts will be required to accommodate the needs of the 267 bed pediatric hospital associated with our organization.

Acknowledgments

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Conclusion

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