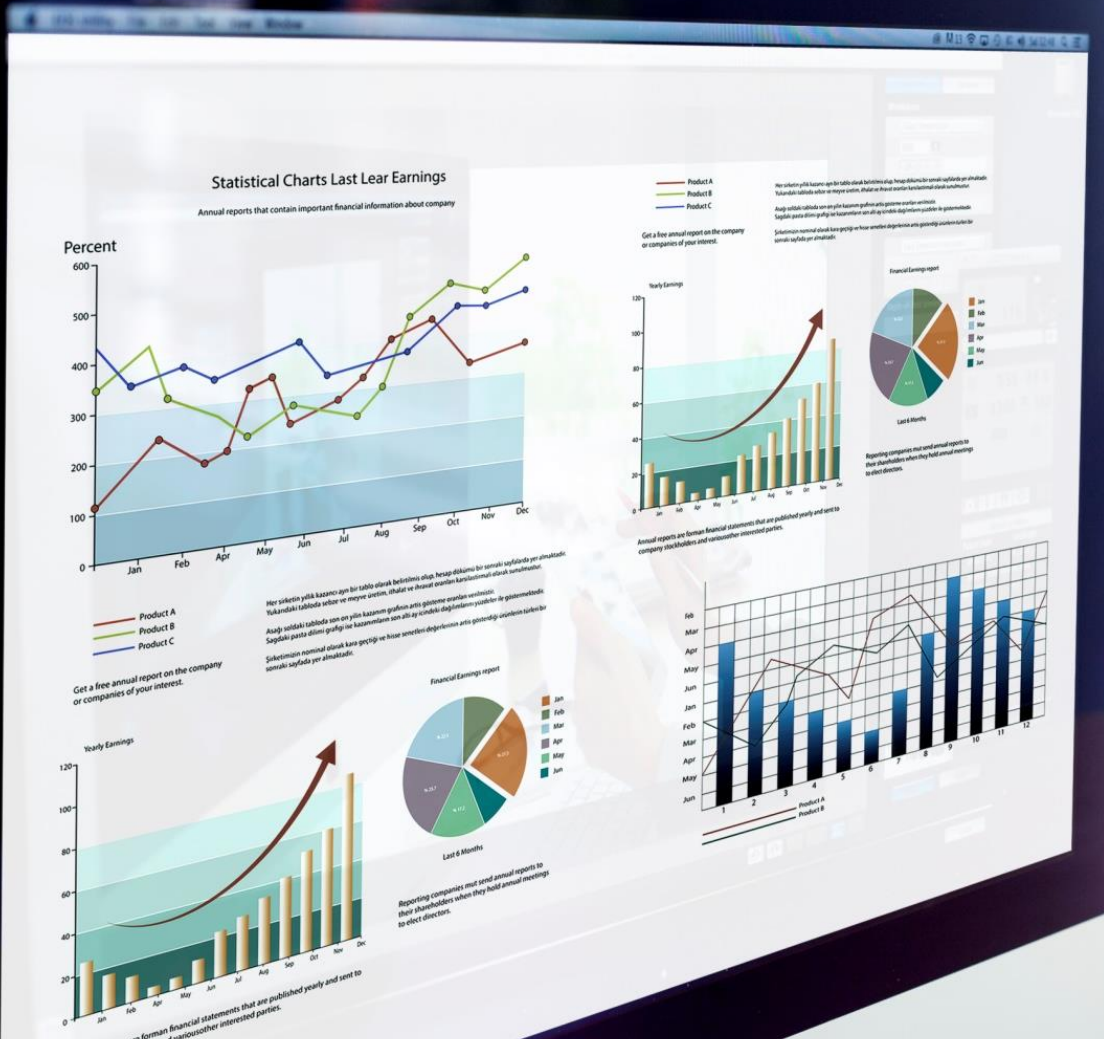


# Laboratory Stewardship: Demonstrating the Value of Clinical Laboratory Medicine

Andrew Fletcher, MD, MBA, CPE





# Agenda

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Background

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Interventions

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Result

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Downstream Impact

# Background

3 most significant causes of patient harm:  
**13 billion tests performed**

- Ordering the wrong test
- 70% decisions based**
- Failing to retrieve a test result

**10–30% unnecessary**

- Misinterpreting a test result



# Trends in Healthcare

Radiology Utilization  
Management

Blood Utilization

Laboratory  
Stewardship

Antimicrobial  
Stewardship

Pharmacy Utilization  
Management





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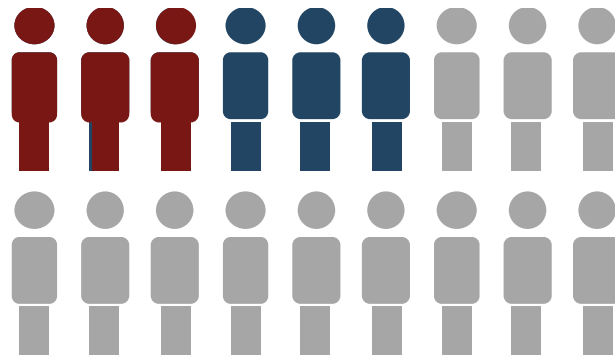
# Creating Successful Laboratory Stewardship

1/3

of labs have a  
stewardship program

1/2

of those labs have a productive  
and progressing committee



## Success Factors

Data Analysis

Formal Governance

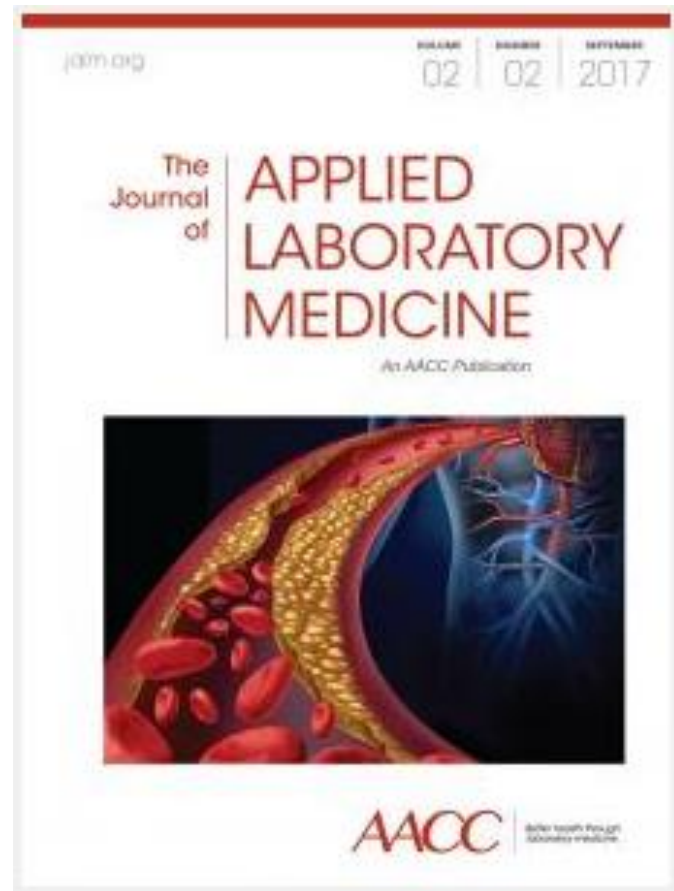
Evidence-Based Recommendations

IT Engagement and Support

Project Management

Measurement and Reporting

# NCLS Publication



## SPECIAL REPORT

### Transforming Laboratory Utilization Review into Laboratory Stewardship: Guidelines by the PLUGS National Committee for Laboratory Stewardship

Jane A. Dickerson,<sup>1,2\*</sup> Andrew H. Fletcher,<sup>3</sup> Gary Procop,<sup>4</sup> David F. Keren,<sup>5</sup> Ila R. Singh,<sup>6</sup> Joaquin J. Garcia,<sup>7</sup> Robert B. Carpenter,<sup>8</sup> Joe Miles,<sup>9</sup> Brian Jackson,<sup>3</sup> and Michael L. Astion<sup>1,2</sup>

Appropriate utilization of clinical laboratory services is important for patient care and requires institutional stewardship. Clinical laboratory stewardship programs are dedicated to improving the ordering, retrieval, and interpretation of appropriate laboratory tests. In addition, these programs focus on developing, maintaining, and improving systems to provide proper financial coverage for medically necessary testing. Overall, clinical laboratory stewardship programs help clinicians improve the quality of patient care while reducing costs to patients, hospitals, and health systems. This document, which was created by a new multiinstitutional committee interested in promoting and formalizing laboratory stewardship, summarizes core elements of successful hospital-based clinical laboratory stewardship programs. The core elements will also be helpful for independent commercial clinical laboratories.

Pathology and laboratory medicine have transformed the practice of medicine by providing tests and services for diagnosis, treatment, monitoring, and prevention of disease and driving advances in all fields of medicine. Laboratory testing is the single highest-volume medical activity with an estimated 13 billion tests performed in the US each year (1). In addition, about 70% of downstream medical decisions are based on pathology and laboratory medicine results (2).

The 3 most significant causes of patient harm related to laboratory services are ordering the

wrong test, failing to retrieve a test, and misinterpreting a test result (3). A number of studies, as well as review of insurance claims, reveal that 10%–30% of laboratory tests performed in the US are either unnecessary or inappropriate (4). About 30% of genetic test orders are inappropriate (5), and about 5% of genetic test orders are frank medical errors (6). About 7% of test results are never retrieved or retrieval is significantly delayed (7). Like all medical interventions, inappropriate laboratory test ordering and interpretation have serious effects, including delayed

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\*Nonstandard abbreviations: UM, utilization management; PLUGS, Pediatric Laboratory Utilization Guidance Services; CPOE, computerized provider order entry.

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# Interventions

## Three Initial Areas of Focus:

1. Test Consolidation
  - » How many reference labs do you use?
2. Reference Test Formulary
  - » Creation and implementation
3. In-House Testing
  - » Daily recurring labs
  - » Inappropriate test intervals



# How many reference laboratories do you use?

1. Is there a primary vendor?
2. Why are tests sometimes not consolidated?
  - » Physician request
  - » Patient request
  - » Insurance requirement
  - » Easier process for lab staff

Free Phenytoin at  
Lab X

**\$106**

---

Free Phenytoin at  
Primary Lab Vendor

**\$13**

# Interventions

## Three Initial Areas of Focus:

1. Test Consolidation
  - » How many reference labs do you use?
2. Reference Test Formulary
  - » Creation and implementation
3. In-House Testing
  - » Daily recurring labs
  - » Inappropriate test intervals



# Test Formulary

**Review**



all sendout  
testing  
performed  
in 1 year

**Eliminate**



test listing in  
menu if  
ordered <4  
times in 1 year

**Review**



remaining  
test on menu  
to see if  
reasonable

# POE Optimization

- ☐ CELIAC SEROLOGY (REF,\$\$,3d)
- ☐ IMMUNOGLOBULIN E (IGE) (REF,\$\$,5d)
- ☐ LEVETIRACETAM LEVEL (REF,\$\$,2d)
- ☐ PROTEIN C/S PANEL, FUNCTIONAL (REF,\$\$,3d)
- ☐ RENIN (REF,\$\$,2d)
- ☐ THYROID Abs (REF,\$\$,2d)
- ☐ ALPHA-FETOPROTEIN (AFP) (REF,\$\$,3d)
- ☐ B2 GLYCOPROTEIN I ABS IGG IGM (REF,\$\$,3d)
- ☐ BUPRENORPHINE and METABOLITES, URINE (REF,\$\$,5d)
- ☐ CARDIOLIPIN Abs (IgG, IgM, IgA) (REF,\$\$,2d)
- ☐ GLUTAMIC ACID DECARBOXYLASE AB (REF,\$\$,4d)
- ☐ ISLET CELL (REF,\$\$,4d)
- ☐ LAMOTRIGINE LEVEL (REF,\$\$,2d)
- ☐ OXCARBAZEPINE (TRILEPTAL) (REF,\$\$,3d)
- ☐ THYROID STIMULATING IMMUNOGLOB (REF,\$\$,3d)
- ☐ THYROXINE BINDING GLOBULIN (REF,\$\$,3d)
- ☐ TISSUE TRANSGLUTAMINASE IGA AB (REF,\$\$,3d)
- ☐ TOPIRAMATE (TOPRAMAX) LEVEL (REF,\$\$,3d)
- ☐ TPMT ENZYME (REF,\$\$,2d)
- ☐ VON WILLEBRAND MULTIMERIC PANEL (REF,\$\$,4d)
- ☐ ACTIVATED PROTEIN C RESISTANCE (REF,\$\$,5d)
- ☐ ADRENOCORTICOTROPHIC HORMONE (ACTH) (REF,\$\$,3d)
- ☐ ALDOSTERONE, SERUM (REF,\$\$,5d)
- ☐ ALDOSTERONE/RENIN ACT RATIO (REF,\$\$,6d)



# Interventions

## Three Initial Areas of Focus:

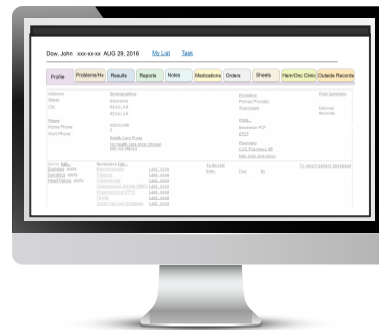
1. Test Consolidation
  - » How many reference labs do you use?
2. Reference Test Formulary
  - » Creation and implementation
3. In-House Testing
  - » Daily recurring labs
  - » Inappropriate test intervals



# Intervention Methods

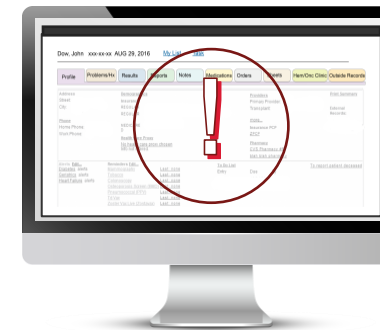
## Proactive

- Appropriate order sets
- Order management
- Preference list management
- Physician education
- Physician report cards



## Reactive

- Duplicate alerts
- Formulary restriction alerts
- Best Practice Alerts
- Physician education





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## LABORATORY STEWARDSHIP

Hospital	Total Charges	Potential Annual Savings	%
195-bed hospital (Northeast)	\$19,600,111	\$4,128,087	21%
419-bed hospital (Upper Midwest)	\$94,511,717	\$12,804,082	14%
Children's hospital (Upper Midwest)	\$12,635,262	\$1,266,516	10%
237-bed hospital (South)	\$43,047,787	\$10,698,392	25%
161-bed hospital (Southwest)*	\$77,926,758	\$9,942,054	13%
645-bed hospital (Southwest)*	\$211,943,118	\$37,916,511	18%
199-bed hospital (Southwest)*	\$70,251,035	\$15,813,898	23%
535-bed hospital (Southwest)*	\$144,127,890	\$27,008,611	19%
208-bed hospital (Southwest)*	\$56,348,672	\$10,973,516	19%
338-bed hospital (Southwest)*	\$78,046,058	\$13,476,036	17%
Average			18%

This sampling of 10 engagements represent an average of 18% **annual** savings we found from the utilization analysis reports. These are typically the highest opportunities within the hospital, but other smaller opportunities likely exist.

\*All part of one system that collectively also averaged 18% in savings for over \$638.6M in total charges



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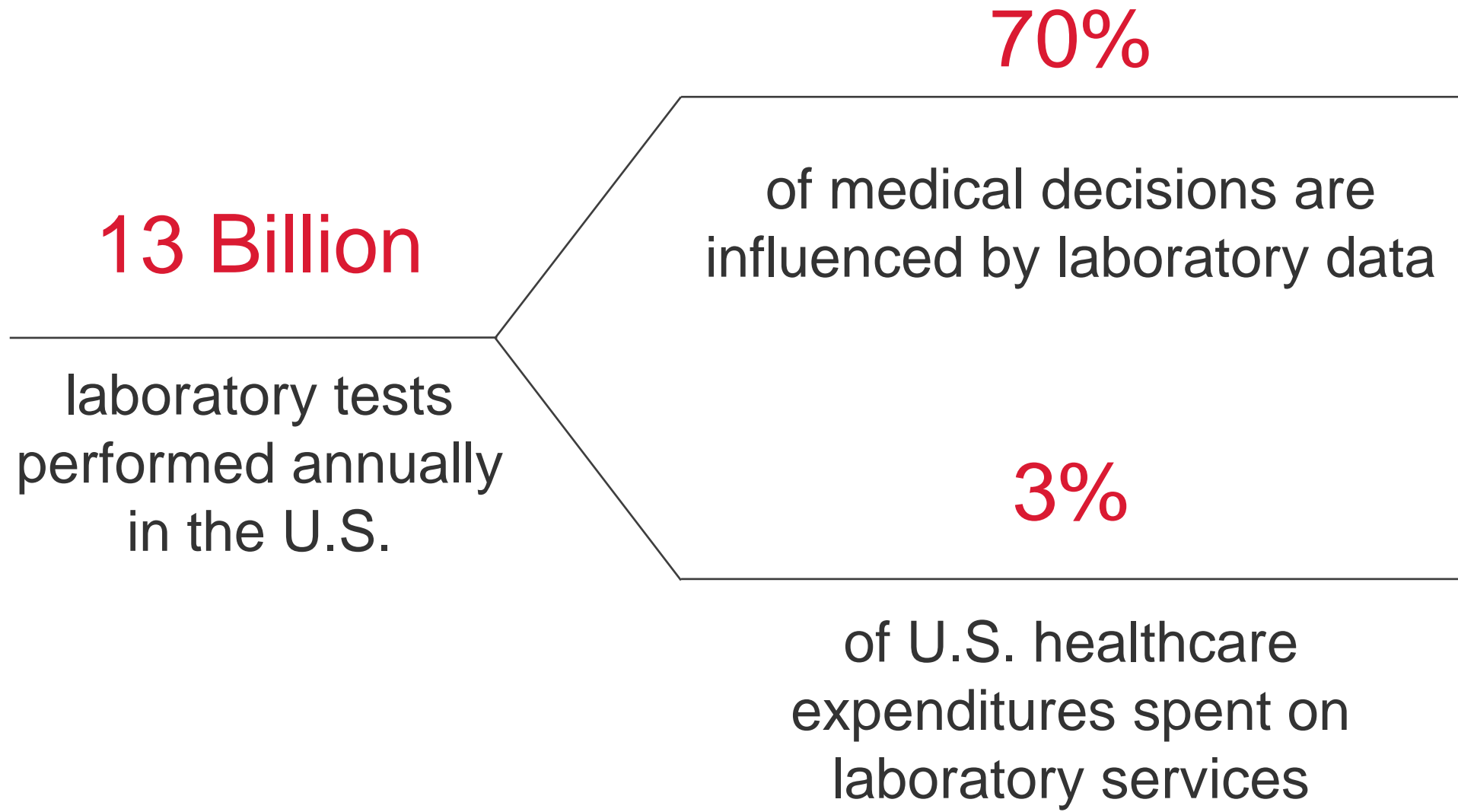
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Result

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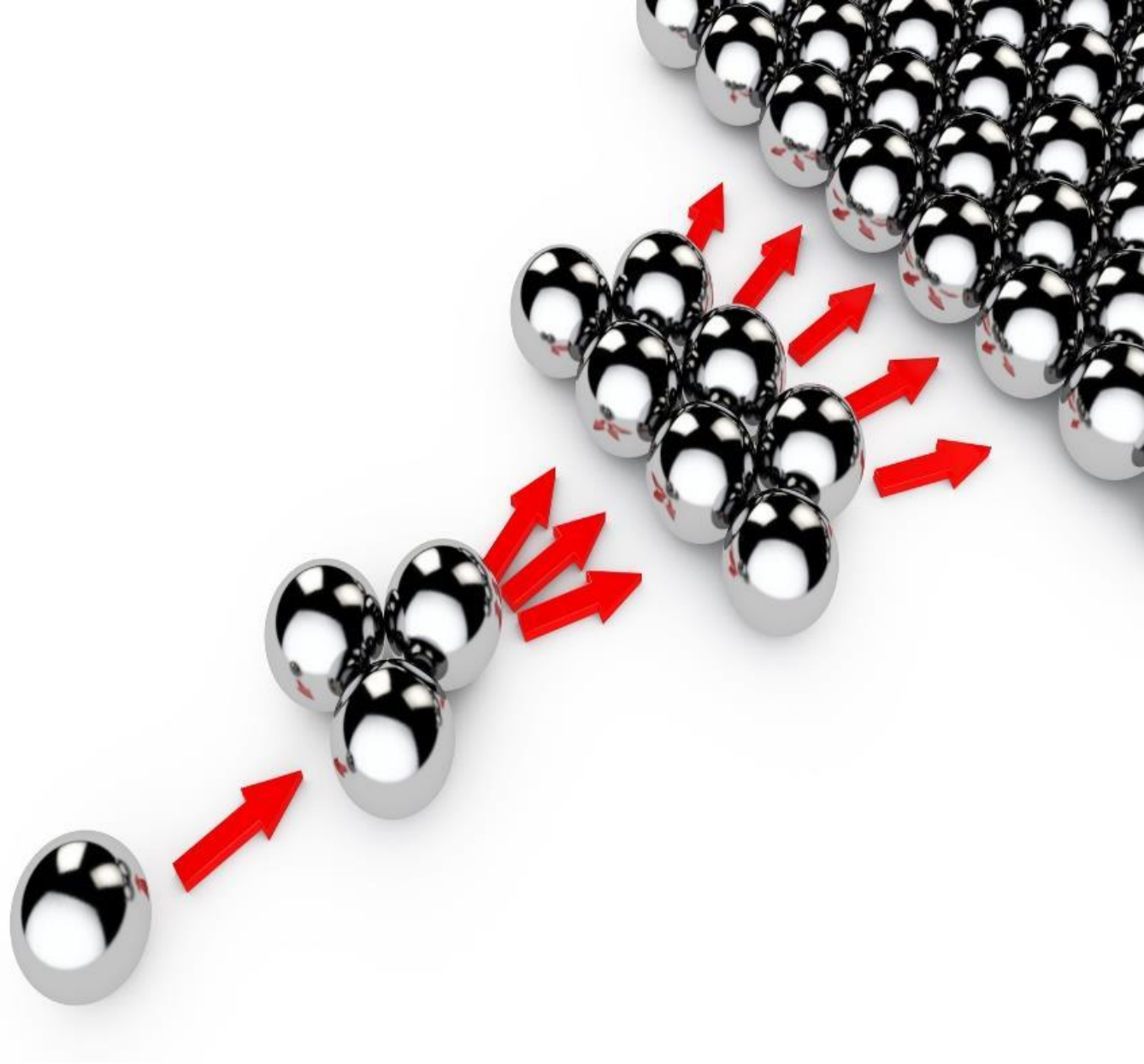
Downstream Impact





# Downstream Impact

- Case Management
  - » Length of stay
  - » Denials of payments
- Pharmacy
  - » Expensive biologic agents
  - » Pharmacogenomics
    - Coagulation
    - Pharmacogenetic panels



# Troponin Orders and Chest Pain LOS

The screenshot shows a software window titled "Order picklists -- Webpage Dialog". It features a search bar at the top with the text "troponin". Below the search bar are tabs for "Common", "Patient Based", "Order Sets", "Search", and "Personal Favorites". The "Common" tab is active, displaying a list of order sets on the left and a detailed view of selected items on the right. The left list includes categories like "00 - Updates for Physicians", "01 - Medications", "02 - IV Fluids", "03 - Blood Bank orders", "04 - Laboratory Orders", "05 - Radiology Orders", "06 - Vascular Orders", "07 - Respiratory Orders", "08 - Cardiology Tests", "09 - Diet Orders", "10 - Consult Orders", "11 - Protocol Orders", "12 - Discharge/Transfer", "14 - GetWell Network Education", "Cardiology Order Sets", "Internal Medicine Order Sets", "Pediatrics Order Sets", and "Physical Medicine/Rehab Order Sets". The right pane shows a list of Troponin-related order sets with checkboxes for selection. The bottom of the window has a "Specialty" dropdown and buttons for "?", "Add", "Add & Close", and "Close".

Order picklists -- Webpage Dialog

Selected Visit Other Visit No Visit Do Not Discontinue Orders After End of Visit

Common Patient Based Order Sets Search Personal Favorites << Session Defaults

troponin

All Meds Labs

**Favorites**

- 00 - Updates for Physicians
- 01 - Medications
- 02 - IV Fluids
- 03 - Blood Bank orders
- 04 - Laboratory Orders
- 05 - Radiology Orders
- 06 - Vascular Orders
- 07 - Respiratory Orders
- 08 - Cardiology Tests
- 09 - Diet Orders
- 10 - Consult Orders
- 11 - Protocol Orders
- 12 - Discharge/Transfer
- 14 - GetWell Network Education
- Cardiology Order Sets
- Internal Medicine Order Sets
- Pediatrics Order Sets
- Physical Medicine/Rehab Order Sets

Specialty

? Add Add & Close Close

☐ TROPONIN - I

☐ Notify MD: Elevated Troponin Levels

☐ Cardiac Enzymes

☐ Troponin STAT and then every 6 hr x 2

- ☒ TROPONIN - I Stat
- ☒ TROPONIN - I Timed Q6Hrs Daily for 12 Hours

☒ Troponin STAT and then every 4 hr x 2

- ☒ TROPONIN - I Stat
- ☒ TROPONIN - I Timed Q4Hrs Daily for 8 Hours

☐ Troponin STAT and then every 3 hr x 2

- ☒ TROPONIN - I Stat
- ☒ TROPONIN - I Timed Q3Hrs Daily for 6 Hours

☐ Troponin STAT and every 3 hrs x 4; Notify MD if positive

- ☒ TROPONIN - I Stat
- ☒ TROPONIN - I Timed Q3Hrs Daily for 12 Hours
- ☒ Notify MD: If troponin results are positive

[Evidence to use troponin as firstline cardiac biomarker](#)

☐ Troponin STAT and every 3 hrs x 4; Notify MD if positive

- ☒ TROPONIN - I Stat
- ☒ TROPONIN - I Timed Q3Hrs Daily for 12 Hours
- ☒ Notify MD: If troponin results are positive

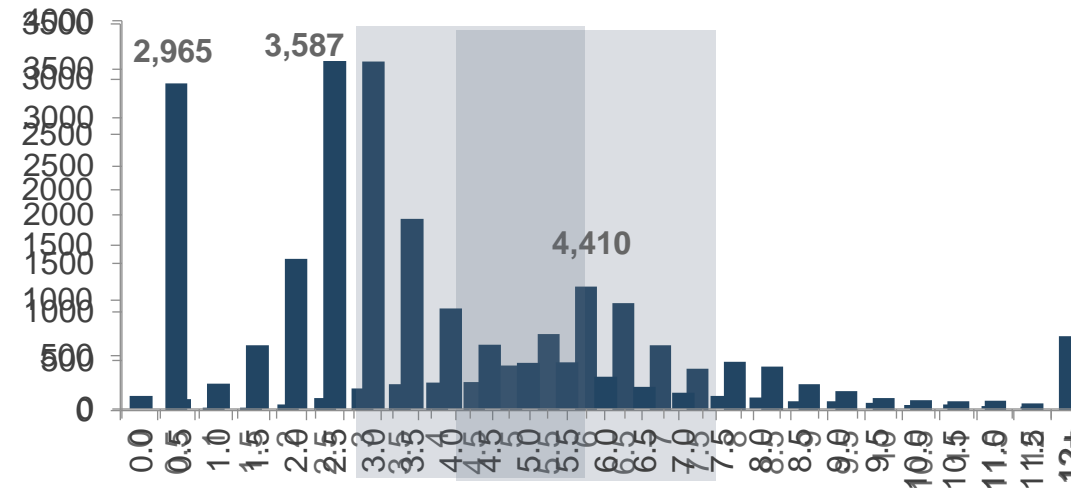
☐ TROPONIN STAT and REPEAT every 4 HRS X 2

- ☒ Perform: ISTAT troponin stat, if unavailable order Serum Troponin I stat
- ☒ TROPONIN - I Timed Q4Hrs Daily for 8 Hours

☐ Troponin STAT and then every 3 hr x 2

- ☒ TROPONIN - I Stat

# Troponin I



1

Identify order mechanisms that drive the repeat interval.

2

Modify the repeat time to be 3-6 hours after.

**Improve** the time-to-decision by improving the test interval by up to **3 hours**.

# Expensive Biologic Agents

## TNF antagonists

- Infliximab (Remicade)
- Adalimumab (Humira)

## Hepatitis C Antiviral agents

- NS5A/NS3A inhibitors



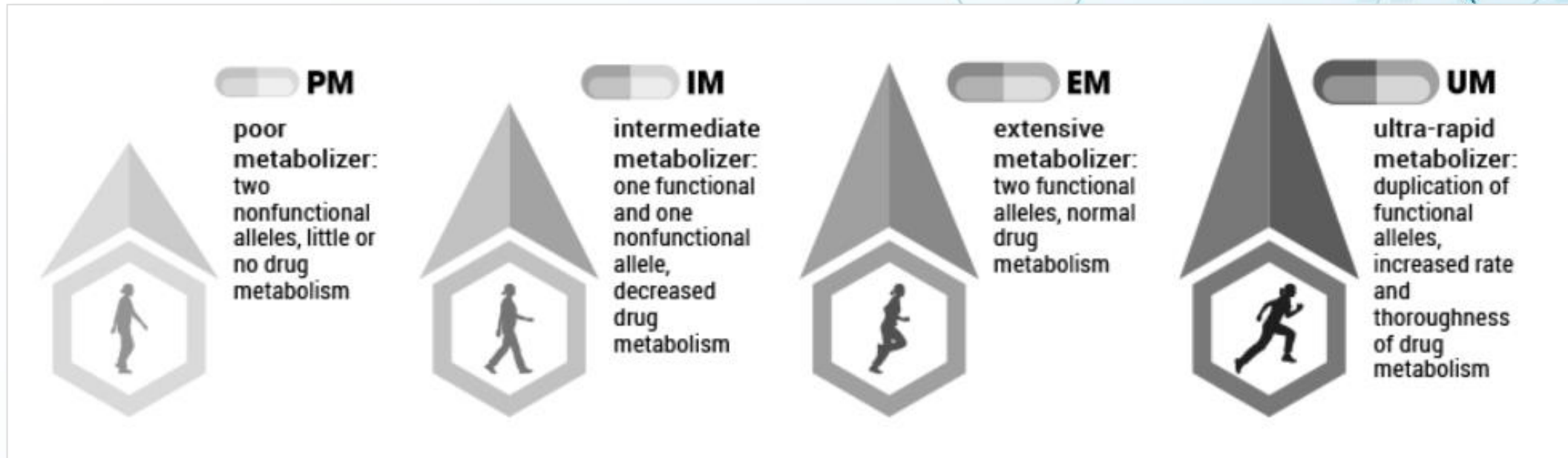
# Pharmacy-Related Projects

- Pharmacy and Lab Workflow Analysis
  - » Create collaborative efficiencies with shared workflows.
  - » Time drug administration with associated lab collections.
  - » Teamwork budget planning.
- Population Health Topics
  - » Improve the health of those in the community.
  - » Refine medication use.
- Opioid Stewardship and Antibiotic Stewardship
  - » Ensure success with appropriate lab and drug orders.
  - » Leverage order accessibility within the EHR, e.g., order sets.

# Coagulation

Clopidogrel (Plavix)  
CYP2C19

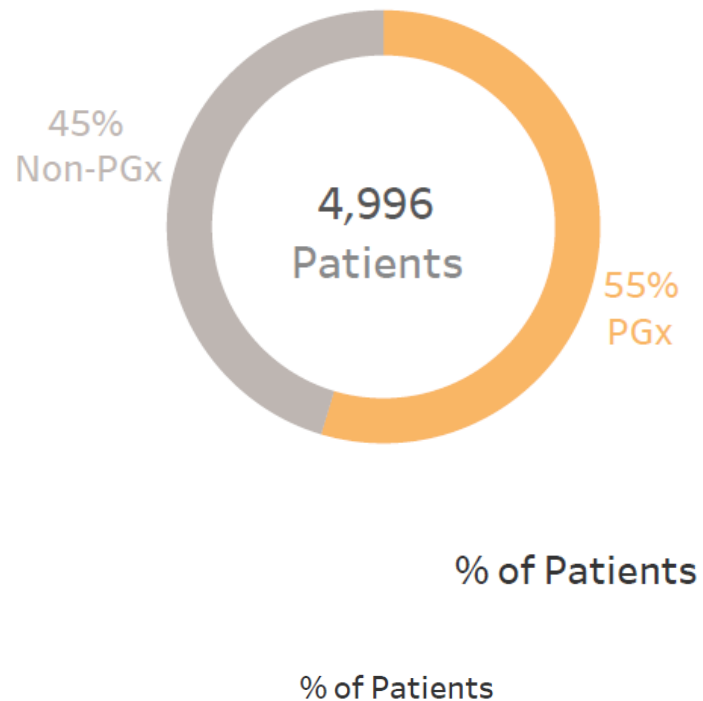
Warfarin (Coumadin)  
CYP2C9 and VKORC1



# Pharmacogenetic Panels

Most Common PGx

Overall Patients on PGx





# ARUP Employee Health Clinic Project

- Based on pharmacy claims data for ~5000 patients, 83% of actionable drug-gene interactions relate to the CYPs.
- Implementing the CYP panel because drug-gene interactions are of the HIGHEST levels of evidence.
- Inviting ~400 patients to obtain PGx testing with enrollment anticipated to begin in May 2019.

Drug	% of Patients	Primary gene
Hydrocodone	9.15%	CYP2D6
Omeprazole	8.31%	CYP2C19
Ondansetron	7.55%	CYP2D6
Bupropion	6.49%	ANKK1
Sertraline	6.02%	CYP2C19
Oxycodone	6.00%	CYP2D6
Citalopram	5.06%	CYP2C19
Metformin	4.92%	ATM
Fluoxetine	4.86%	CYP2D6
Trazodone	4.14%	CYP3A4
Atorvastatin	3.98%	CYP3A4
Codeine	3.72%	CYP2D6
Escitalopram	3.30%	CYP2C19
Amphetamine	3.08%	COMT
Tramadol	2.96%	CYP2D6
Diclofenac	2.74%	CYP2C9
Clonazepam	2.16%	CYP3A4
Alprazolam	2.16%	CYP3A4
Duloxetine	2.14%	CYP2D6
Simvastatin	1.94%	SLCO1B1
Meloxicam	1.80%	CYP2C9
Quetiapine	1.70%	CYP3A4
Methylphenidate	1.60%	MTHFR
Buspirone	1.46%	CYP3A4
Tamsulosin	1.30%	CYP2D6
Amitriptyline	1.30%	CYP2D6
Venlafaxine	1.28%	CYP2D6
Propranolol	1.28%	CYP2D6
Ketoconazole	1.28%	CYP3A4
Diazepam	1.12%	CYP2C19
Metoprolol	1.04%	CYP2D6
Pantoprazole	0.92%	CYP2C19

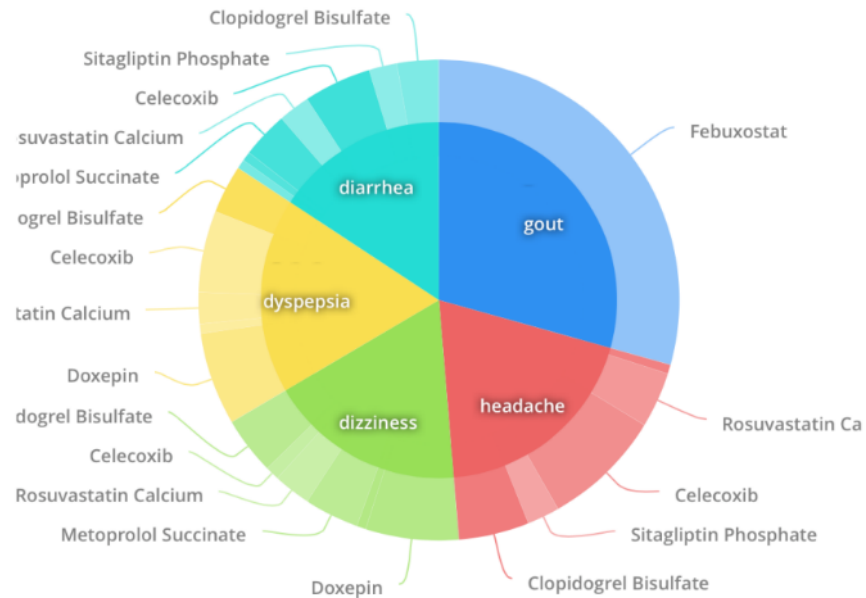
# Risk report

Open Save Export PDF

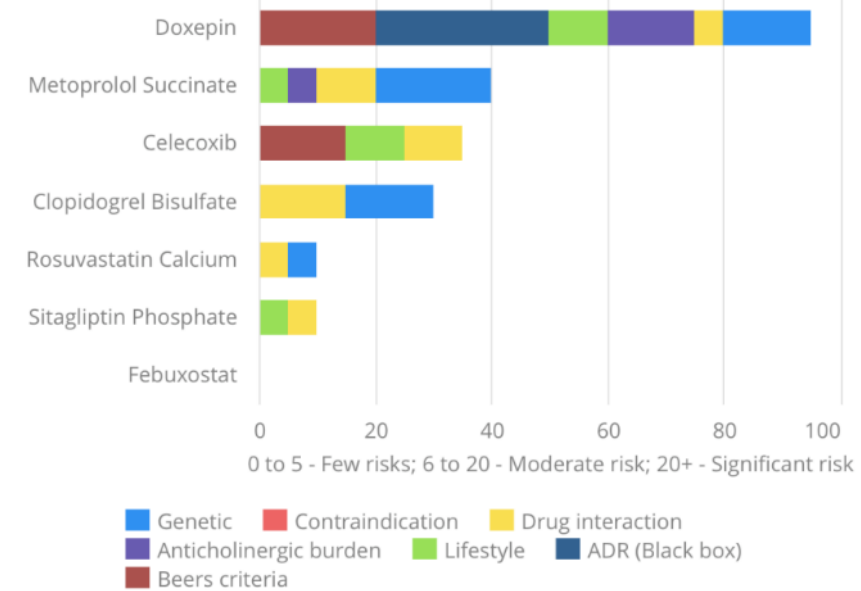
Female, age 83 years

## MOST FREQUENT SIDE EFFECTS

View all side effects



## RISK RATING BY MEDICATION

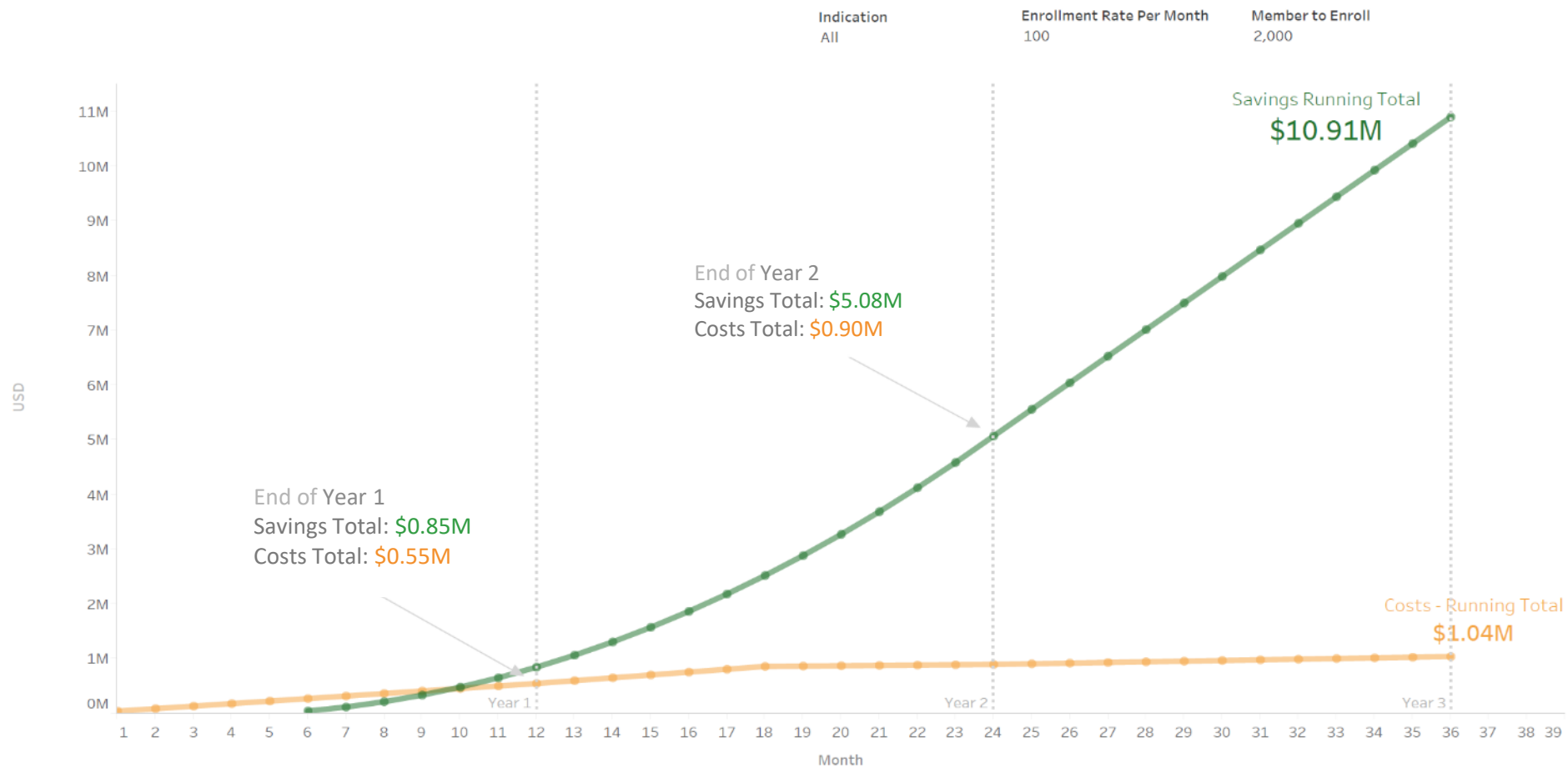


## Alternatives to Doxepin for this patient

Tricyclic and other cyclic Antidepressants

Alternative drug	Δ drug	Δ regimen	Detail	Risk chart	Est. cost/dose
<input type="checkbox"/> Maprotiline Hydrochloride Oral tablet	-60	-65	⊕		Generic: \$1.20
<input type="checkbox"/> Amitriptyline Hydrochloride Oral tablet	-35	-40	⊕		Generic: \$0.65
<input type="checkbox"/> Mirtazapine Oral disintegrating tablet	-30	-35	⊕		Brand: \$4.18 Generic: \$0.93
<input type="checkbox"/> Mirtazapine Oral tablet	-30	-35	⊕		Brand: \$5.06 Generic: \$0.46
<input type="checkbox"/> Protriptyline Hydrochloride Oral tablet	-20	-25	⊕		Brand: \$4.09 Generic: \$1.63







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