



Laboratory Stewardship: Demonstrating the Value of Clinical Laboratory Medicine

Andrew Fletcher, MD, MBA, CPE



Agenda

Background

Stewardship Committee

Interventions

Result

Downstream Impact

Background

3 most significant causes
13 billion tests performed
or patient harm:

70% of digital tests misused

- 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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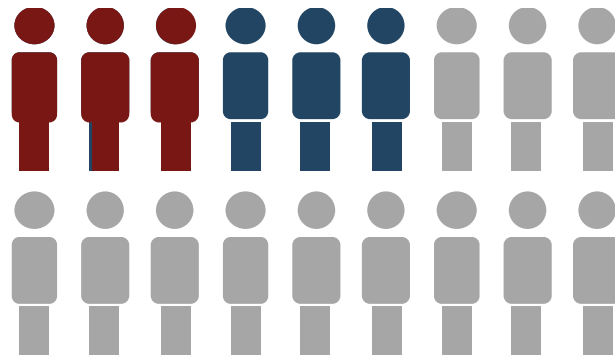
Creating Successful Laboratory Stewardship

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

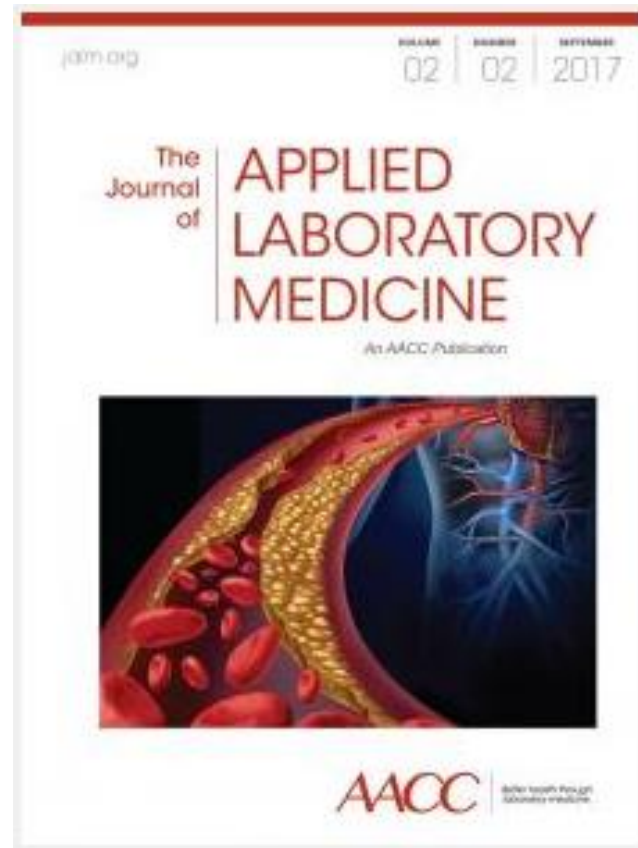
Jane A. Dickerson,^{1,2*} Andrew H. Fletcher,³ Gary Procop,⁴ David F. Keren,⁵ Ila R. Singh,⁶ Joaquin J. Garcia,⁷ Robert B. Carpenter,³ Joe Miles,³ Brian Jackson,³ and Michael L. Astion^{1,2}

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



<http://jalm.aaccjnls.org/content/2/2/259>

¹Department of Laboratories, Seattle Children's Hospital, Seattle, WA; ²Department of Laboratory Medicine, University of Washington, Seattle, WA; ³ARUP Laboratories, Salt Lake City, UT; ⁴Department of Pathology, Cleveland Clinic, Cleveland, OH; ⁵Department of Pathology, University of Michigan, Ann Arbor, MI; ⁶Department of Pathology, Texas Children's Hospital, Houston, TX; ⁷Department of Laboratories, Mayo Clinic, Rochester, MN.
*Address correspondence to this author at: Seattle Children's Hospital, 4800 Sand Point Way NE, M/S OC.8.720, Seattle, WA 98105.
Fax: 206-987-3840; e-mail: jane.dickerson@seattlechildrens.org.
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*Nonstandard abbreviations: UM, utilization management; PLUGS, Pediatric Laboratory Utilization Guidance Services; CPOE, computerized provider order entry.

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Three Initial Areas of Focus:

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



Test Consolidation

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

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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?
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- 3. In-House Testing**
Daily recurring labs
Inappropriate test intervals



Intervention Methods

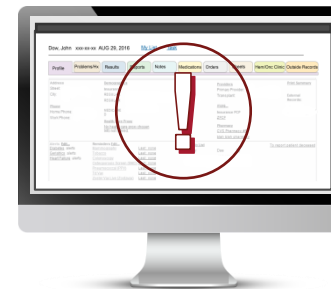
Proactive

- 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	

Average

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.

18%

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

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13 billion

laboratory tests
performed annually
in the U.S.

70%

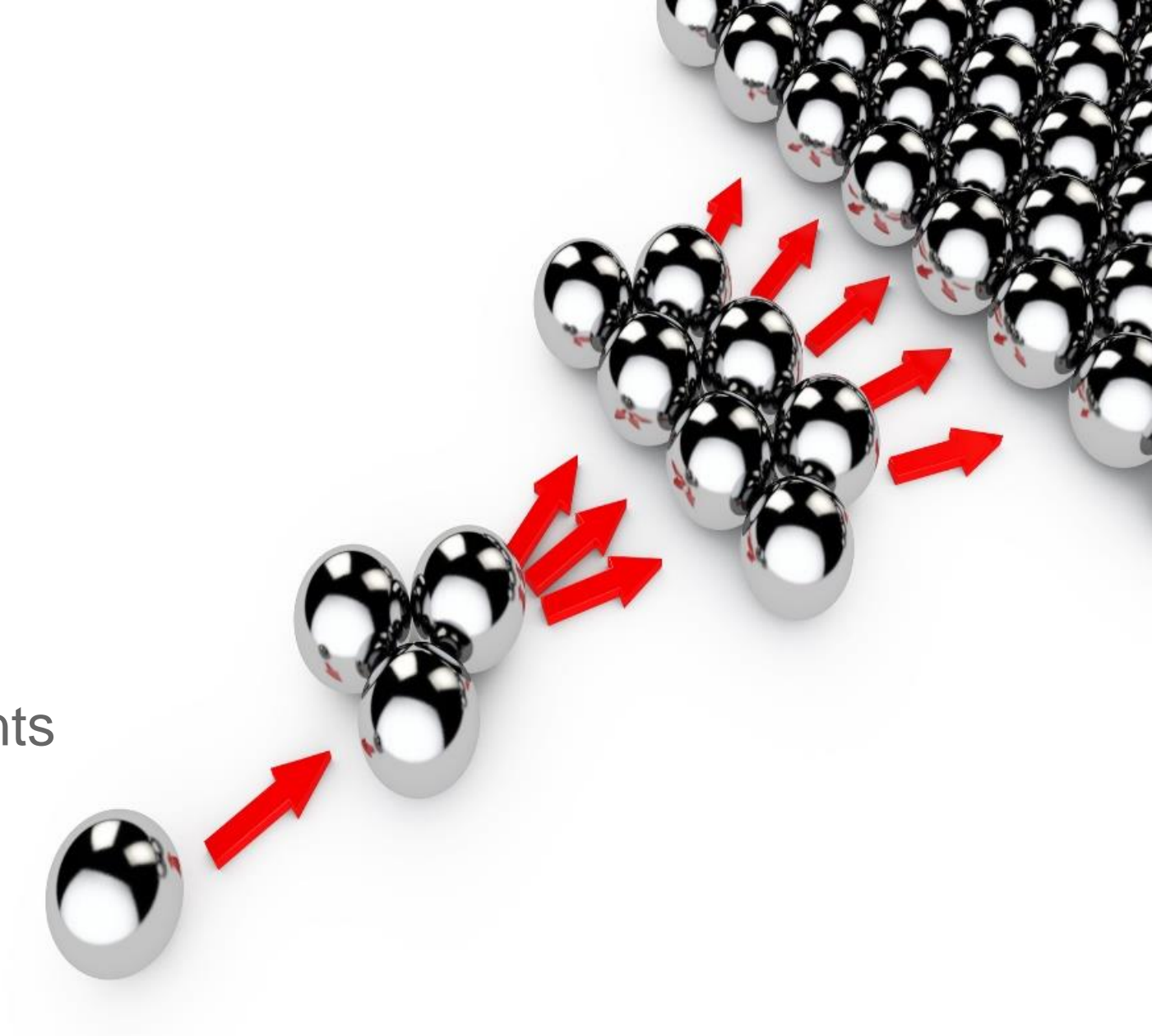
of medical decisions are
influenced by laboratory
data

3%

of U.S. healthcare
expenditures spent on
laboratory services

Downstream Impact

- **Case Management**
 - Length of stay
 - Denials of payments
- **Pharmacy**
 - Expensive biologic agents
 - Pharmacogenomics
- **Radiology**



Troponin orders and Chest Pain LOS

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

TROPONIN - I

Notify MD: Elevated Troponin Levels

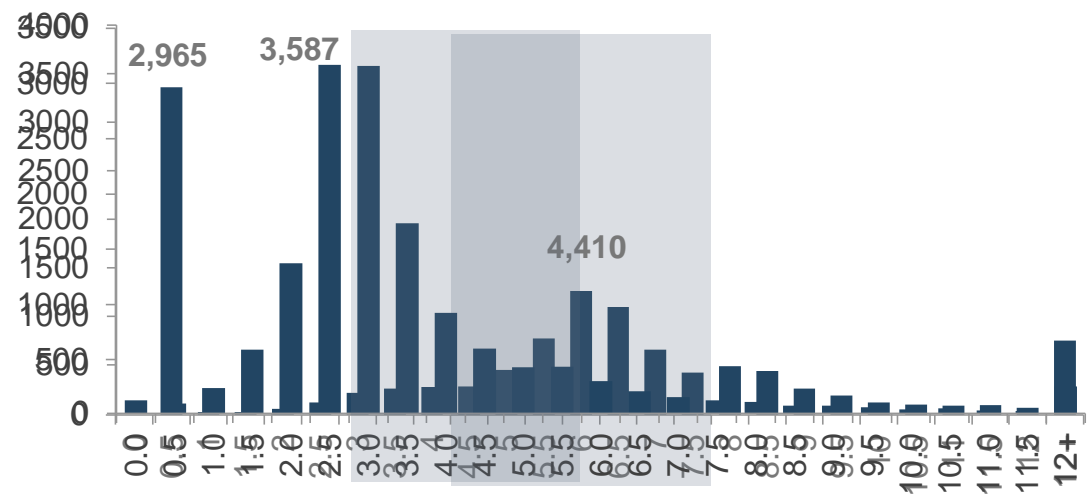
Cardiac Enzymes

- 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

?

Add Add & Close Close

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

Downstream Impact on Pharmacy Expensive Biologic Agents

- **TNF antagonists**
 - Infliximab (Remicade)
 - Adalimumab (Humira)
- **Hepatitis C antiviral agents**
 - NS5A/NS3A inhibitors

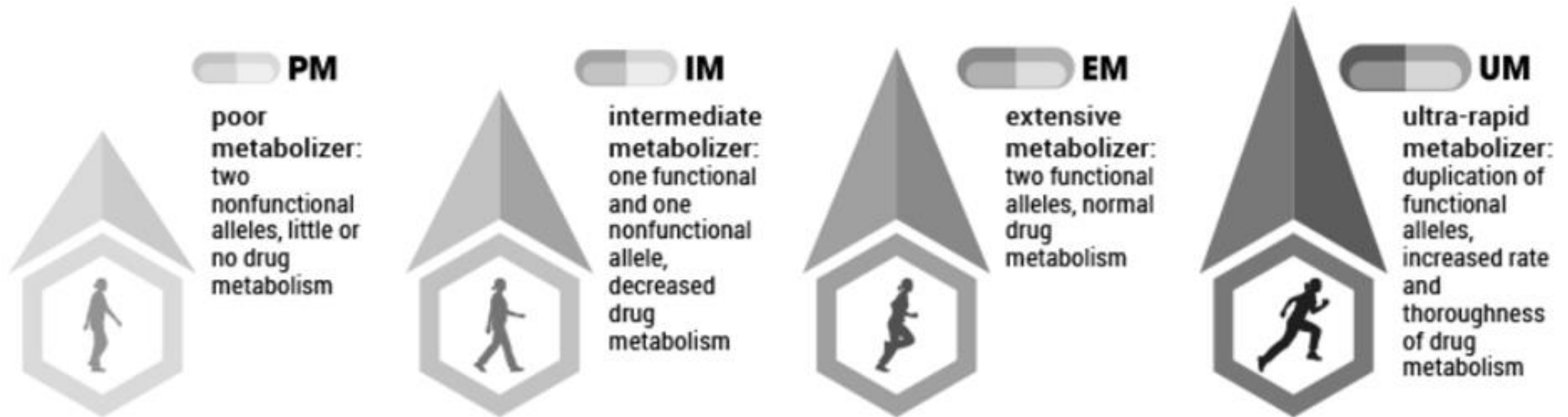
Pharmacogenetics Coagulation

Clopidogrel (Plavix)

- *CYP2C19*

Warfarin (Coumadin)

- *CYP2C9* and *VKORC1*

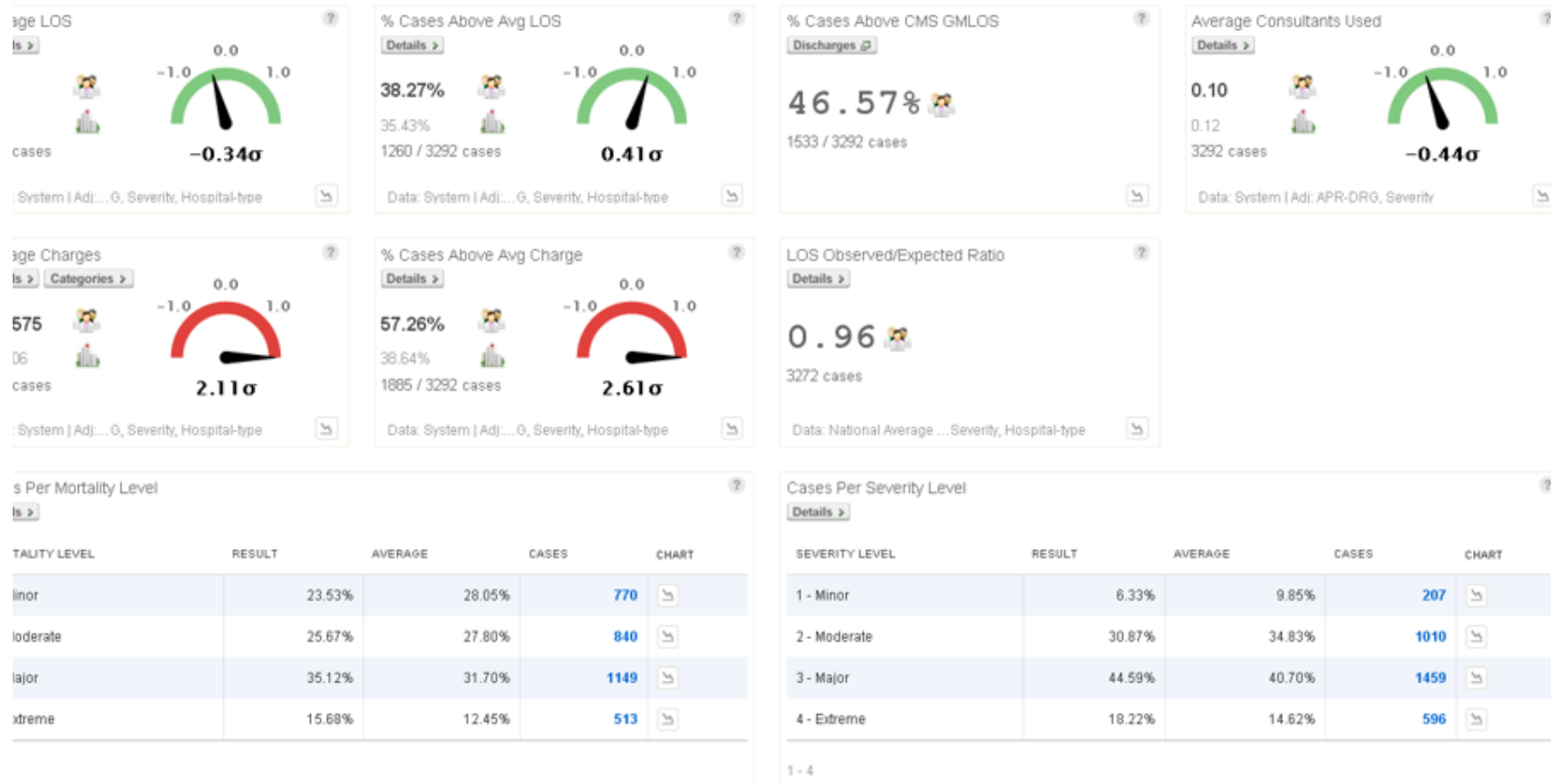


ARUP Employee Health Clinic Project

- 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 enrolment 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

CT PE Protocol



American College of Chest Physicians and American Thoracic Society

[View all recommendations from this society](#)

Released October 27, 2013

Don't perform chest computed tomography (CT angiography) to evaluate for possible pulmonary embolism in patients with a low clinical probability and negative results of a highly sensitive D-dimer assay.

Clinical practice guidelines for pulmonary embolism indicate that the cost and potential harms of CT angiography (including radiation exposure and the possibility of detecting and treating clinically insignificant pulmonary emboli with anticoagulation) outweigh the benefits for patients with a low pre-test probability of pulmonary embolism. In patients with a low clinical prediction score (e.g., Wells or Geneva score) followed by a negative D-dimer measured with a high sensitivity test (e.g., ELISA), pulmonary embolism is effectively excluded and no further imaging is indicated for pulmonary embolism evaluation.



Patient Materials

- Search [patient-friendly resources](#) by Consumer Reports.

D-Dimer and CT PE Protocol

Laboratory

Ordered By: Poe Doc4 (99965) Doctor's Name: (Last, First M) Visit Type: IP

Performing Dept: LAB Order Source: POE Target Cosigner: (Last, First M)

Entered By: Poe Doc4 On: 08/12/2015 19:28 Order ID: 74568612 Status: Active

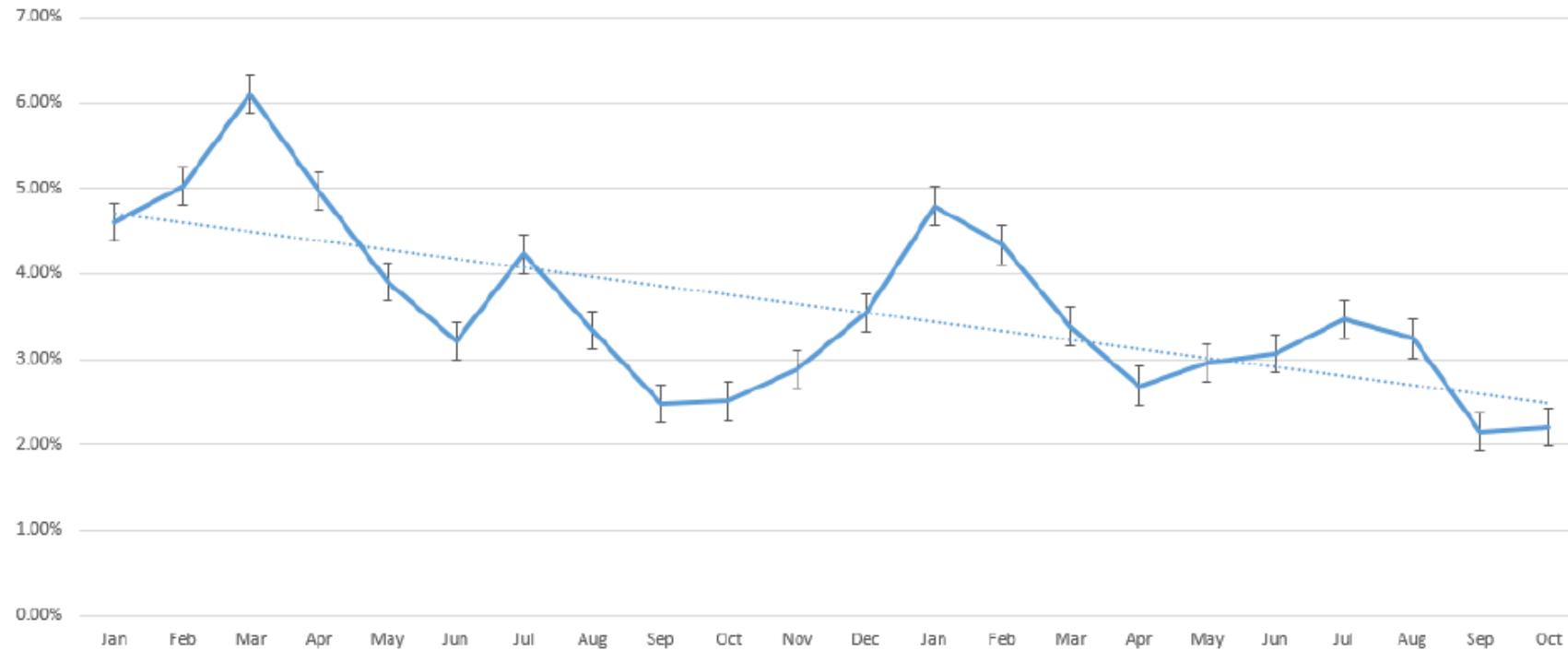
D-DIMER Routine once

Well's Criteria for Pulmonary Embolism

Clinical Signs and Symptoms of DVT	<input type="radio"/> no 0 <input checked="" type="radio"/> yes +3
PE is #1 Diagnosis, or Equally Likely	<input type="radio"/> no 0 <input checked="" type="radio"/> yes +3
Heart Rate > 100	<input type="radio"/> no 0 <input checked="" type="radio"/> yes +1.5
Immobilization at least 3 days, or Surgery in Previous 4 weeks	<input type="radio"/> no 0 <input checked="" type="radio"/> yes +1.5
Previous, objectively diagnosed PE or DVT	<input type="radio"/> no 0 <input checked="" type="radio"/> yes +1.5
Hemoptysis	<input type="radio"/> no 0 <input checked="" type="radio"/> yes +1
Malignancy w/ Treatment within 6 mo, or palliative	<input type="radio"/> no 0 <input checked="" type="radio"/> yes +1
Well's Criteria Score for PE	3

Add to Order Session Cancel Help

Percent of Patient Contacts Getting CT PE Scans



- Average percent of patients receiving CT PE scan in months prior to Aug 2015 (n=7) = 4.58%
- Average percent of patients receiving CT PE scan in months after Aug 2015 (n=15) = 3.14% (two sample t-test, $p < 0.05$)

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