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Laboratory Test Utilization

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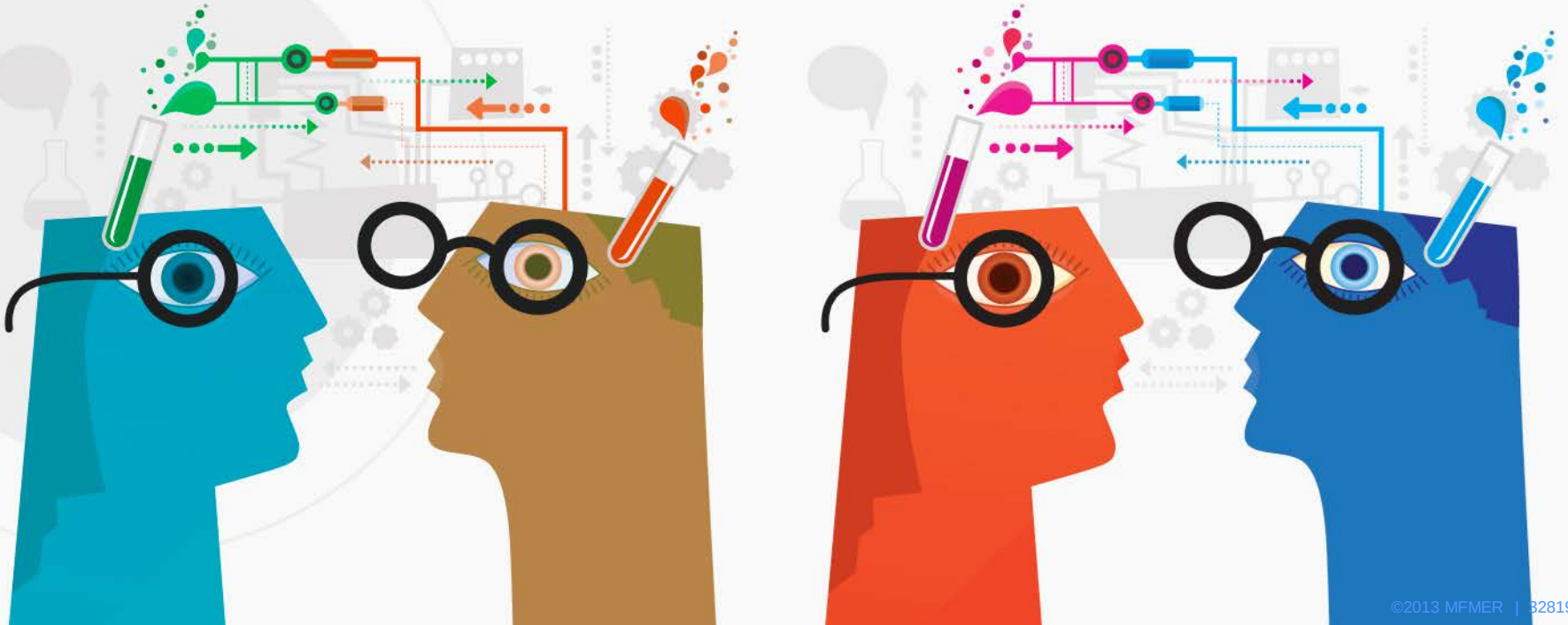

Disclosure

- Relevant Financial Relationship(s)
  - Employed by Mayo Clinic

- Off Label Usage
  - NONE

Outline

- List successful strategies to address laboratory test utilization
- Identify the most effective strategies to improve inpatient test utilization
- Define pitfalls and caveats in the implementation of test utilization strategies

Laboratory Test Utilization Definition

- A strategy for performing appropriate laboratory and pathology testing with the goal of providing high-quality, cost-effective patient care

- Laboratory tests including anatomic pathology:
  - $60 - $70 billion
  - ~4% of healthcare costs
  - 60-70% objective information in medical record
  - **Molecular / Genetics is 15% of laboratory costs; anticipated to reach 25% soon**
  - Largest growth: proprietary tests, genetic tests, and test bundling

Unnecessary laboratory testing

- Traditionally “experts” have estimated that 20-40% of lab orders were “unnecessary”
- 15 year meta-analysis of published lab utilization studies (1997-2012)
  - Zhi et al., PLoS ONE 8(11):e78962, 2013
  - Overutilization: test ordered but not indicated
  - Underutilization: test indicated but not ordered
  - Initial testing: testing during initial evaluation of patient or symptom
  - Repeat testing: Testing after initial test
  - Restrictive criteria: clear indication for test required
  - Permissive criteria: no obvious contra-indication

Unnecessary laboratory testing

- Findings from Zhi et al.
  - Overall rate of inappropriate (overutilization) testing 20.6%
  - Overall rate of underutilization 44.8% (based on fewer studies)
  - Rate of inappropriate initial testing 43.9%
  - Rate of inappropriate repeat testing 7.4%
  - Inappropriate use by restrictive criteria 44.2%
  - Inappropriate use by permissive criteria 12.0%
- 10-40% lab tests are unnecessary (using objective criteria)
- Underutilization as big a problem as overutilization

Approaches Used by Laboratories to Reduce Unnecessary Testing

- Establish a *Clinical-Laboratory Practice Committee or Clinical-Laboratory Utilization Committee*
- Review and reduce send-out testing (formulary)
  - Focus on high cost genetic testing
- Develop report cards and perform audits on providers and services
- Consultative services

Laboratory Test Algorithms and Guidelines

- Four types of algorithms:
  - **Pathologist-driven**: Review of pathology findings determine next steps in testing algorithms; cancel or add appropriate next steps
  - **Genetic Counselor-driven**: Review of genetic test requests require genetic experts with laboratory knowledge; make phone calls to add or cancel testing
  - **Laboratory-driven**: Laboratory results drive subsequent test selection. Testing is performed by laboratories using available specimens; specimens are shared between labs
  - **IT-driven**: Clinical input and information drive what testing gets ordered or not

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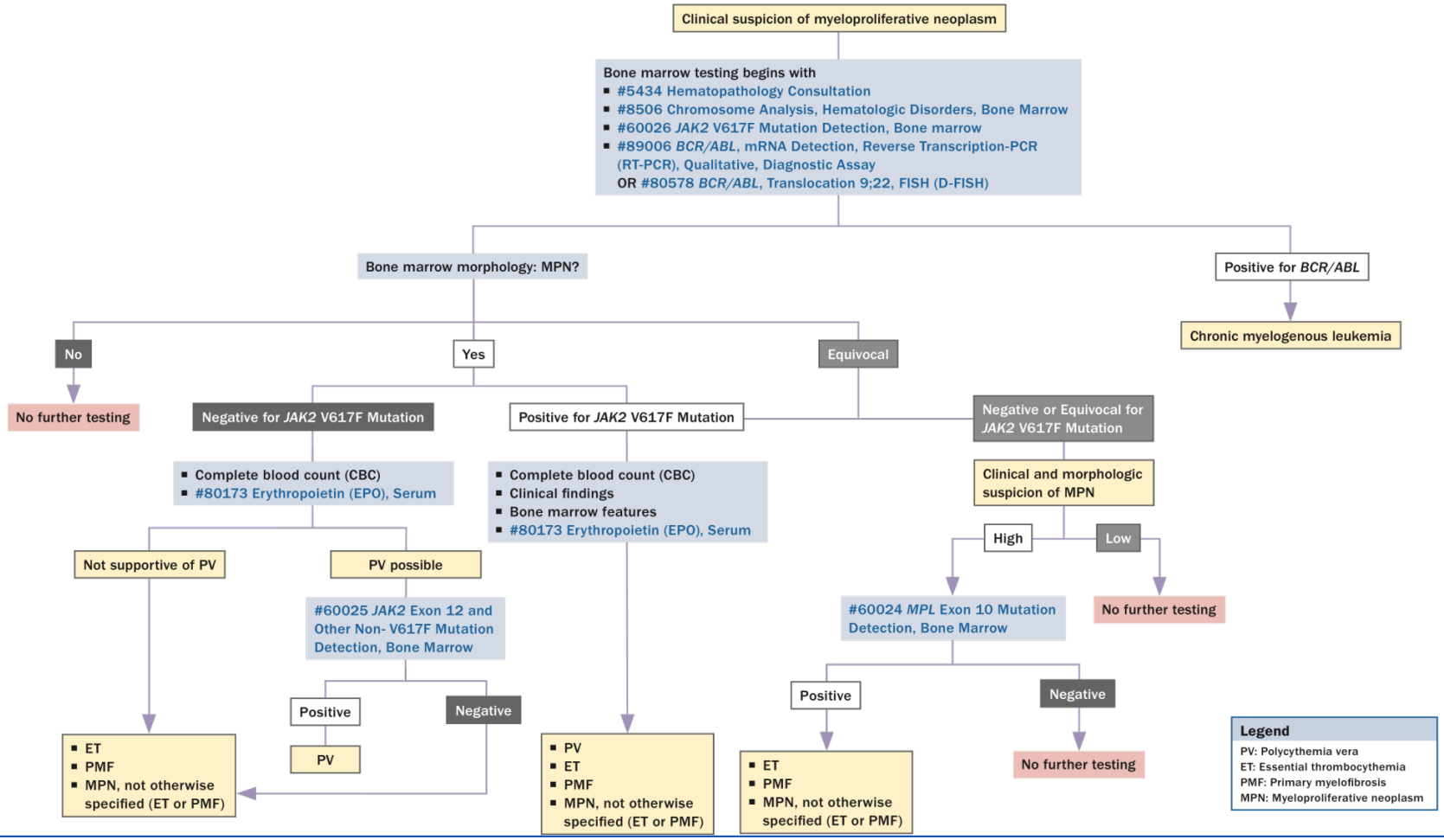
Myeloproliferative Neoplasm: A Diagnostic Approach to Bone Marrow Evaluation



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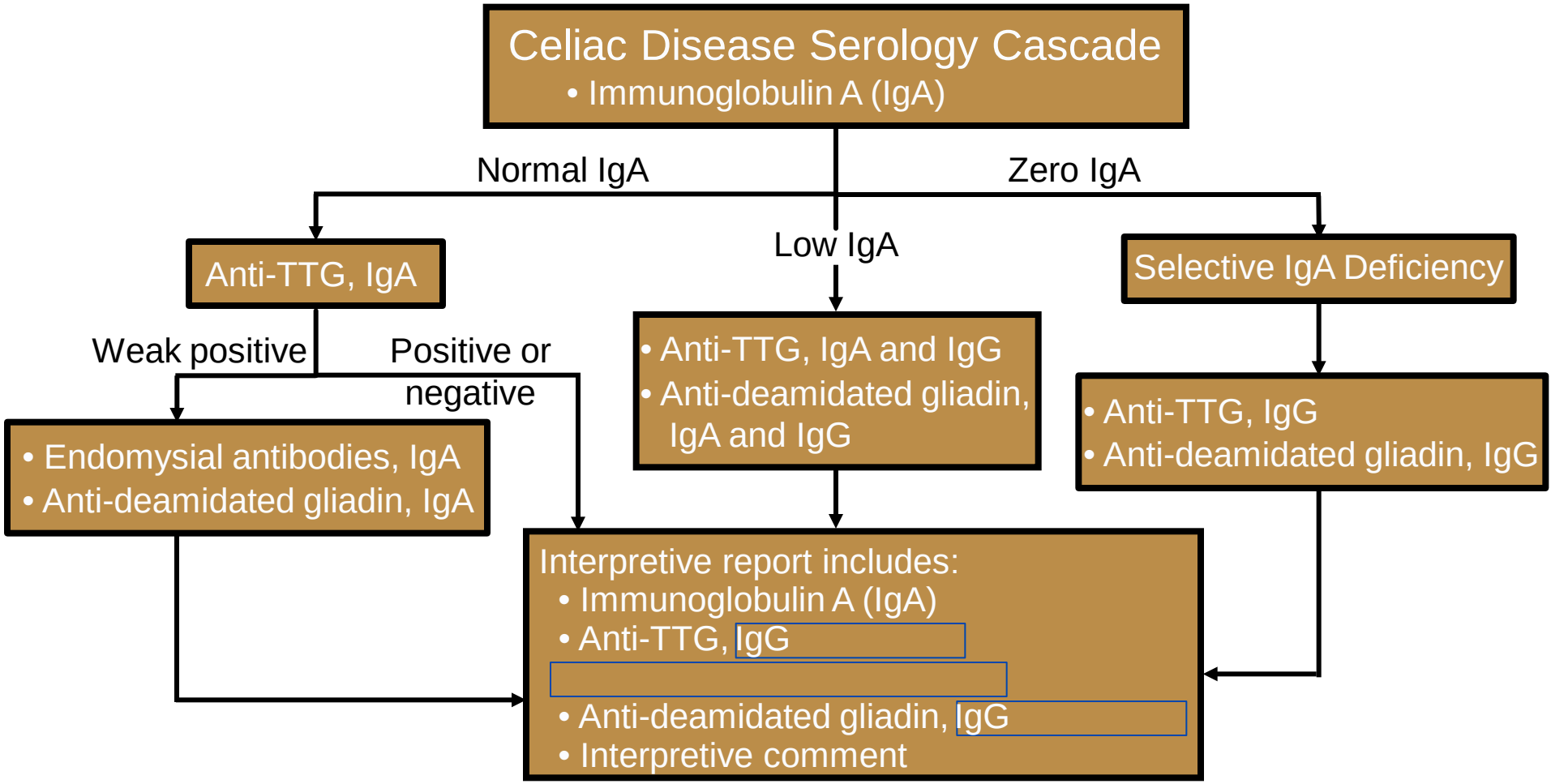
Hematopathologist-Driven Algorithm: Chromosome Utilization

	Chromosomes ordered (% of total BMs)	Chromosome abnormality rate (per 100 BM)
MCR	55%	20
MCA	85%	16
MCF	95%	21
MCF: Post-guidelines*	**47%**	**21**

Equates to a reduction of ~$600,000 costs

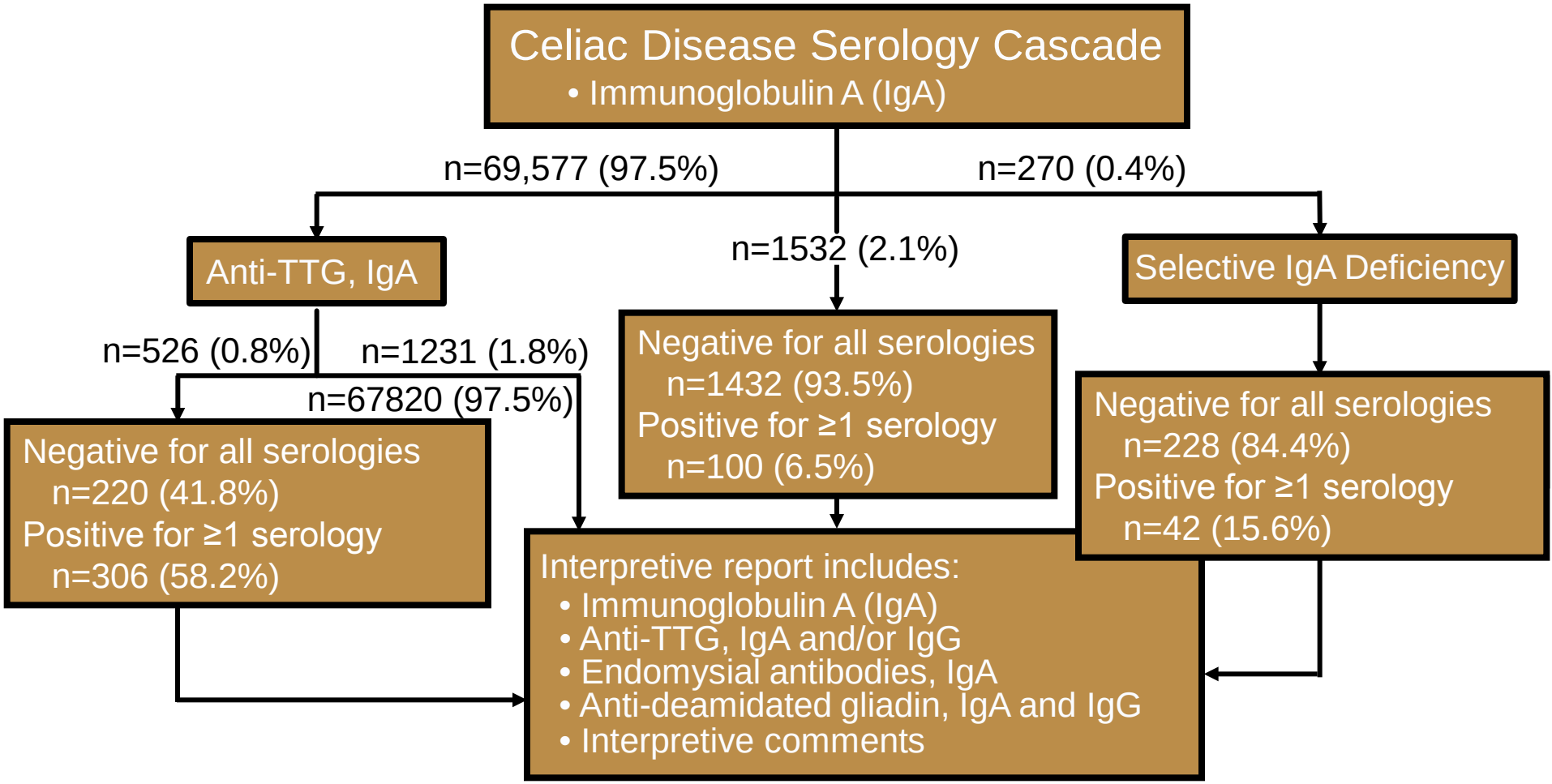
Celiac Disease *Serology Algorithm*

Laboratory-Driven Algorithm:
- One order is placed by the clinician
- The patient undergoes a single blood draw



Celiac Disease and Test Utilization

Serology Reflex Results (5/2010-12/2013)



Laboratory-Driven Algorithms

Comparison of Testing Options	
Celiac Disease Serology Cascade: Weighted Average Price	$ 67.60
Total package – if ordered a la carte	$ 515.00

Thyroid (TSH) algorithm, internal use

- 2 week snapshot internal orders (inpatient and outpatient)
  - Thyroid (TSH) cascade
    - 2413 ordered (88% normal TSH, no further testing)
    - 649 stand-alone Free T4 over same period

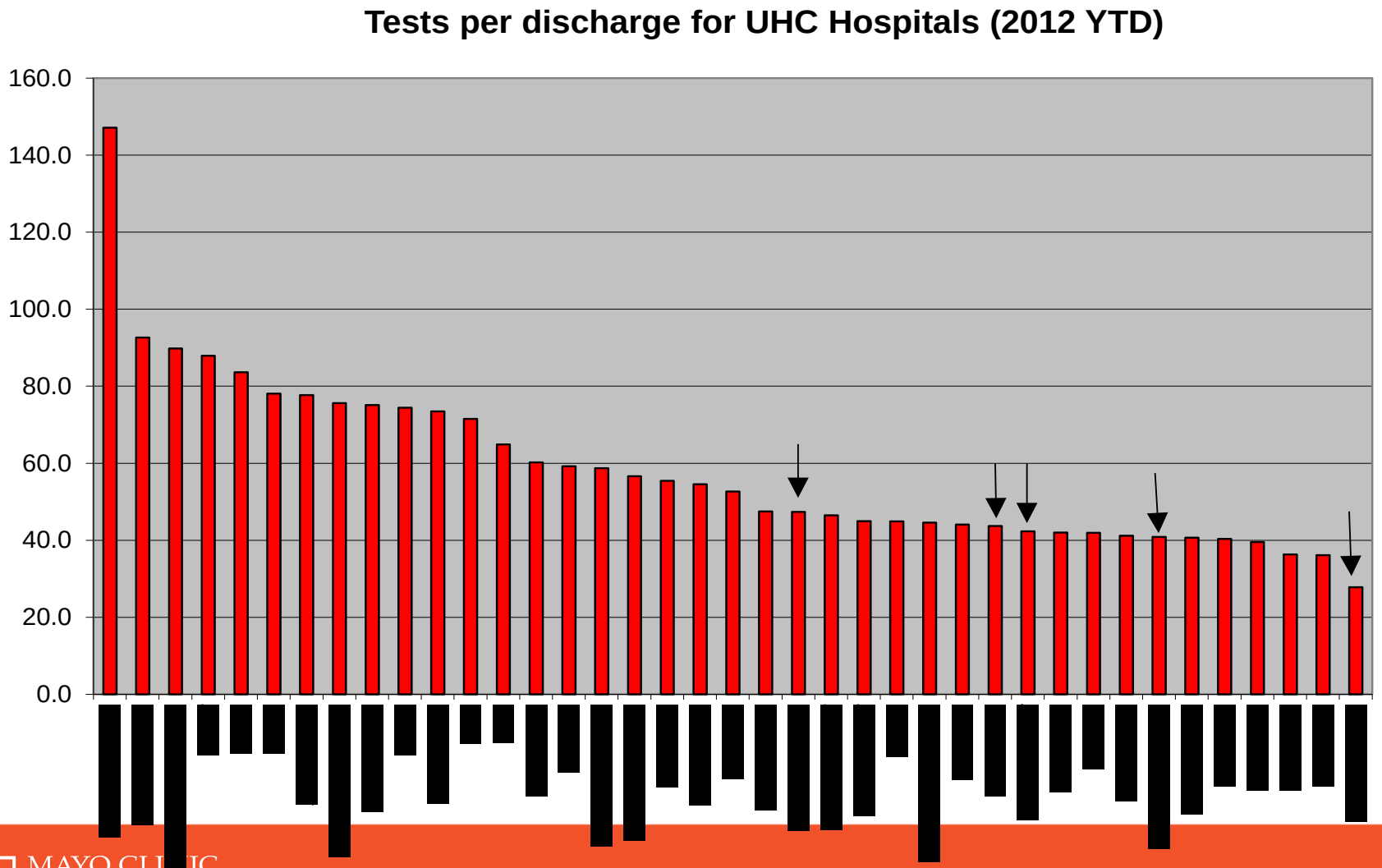
Implementing algorithms

- Pathologist-driven
  - One on one or one on group discussions
  - Usually lower volume but high cost
  - Achieve consensus but don’t worry about exceptions
- Genetic counselor-driven
  - Sell high-impact clinical groups (neuro, med genetics, peds)
  - Hire and train the staff
- Laboratory-driven
  - Embed in orders system
  - Weight the algorithm in searches or short-cuts
  - Information on algorithm components

Tests per discharge metrics

- Why worry about inpatient test utilization?
  - Generally high volume, low cost tests
  - Capitated reimbursement, no money
  - Those little tests add up
  - ~ $800 per inpatient admission (J Hosp Med 2007;2:150-7)
  - Inpatient testing practices are *highly variable*

Tests per discharge metrics
University HealthSystem Consortium



Inpatient utilization strategies of top performers

- Review order sets and order short-cuts
- Curtail standing orders
- Implement order entry decision support rules
- Provide cost information at time of order entry

Order sets

- Institutionally approved grouping of lab orders
  - May include non-lab orders
  - MCR definition = group of med and non-med orders around procedure or medical condition
- One click = multiple lab orders
- Conventional wisdom: Order sets encourage overutilization lab services

Order sets

- MCR review 25 (out of 300) order sets
- Median lab orders 3 (0-23)
  - Orders sets > 5 require provider select desired tests
- Most order sets for surgical procedures
  - 2-5 lab orders, one time post-op day 1
  - Few utilization opportunities identified
- Medical order sets (sepsis, stroke, NSTEMI)
  - Many (15-25) lab orders
  - Native state lab orders “deselected”
  - Provider picks tests necessary
  - Functions as ordering short-cut

Ordering short-cuts

- Function of electronic ordering systems
- Provider (individual or group) convenience
- Hot keys or buttons, division buttons, order sets
- Often no institutional review (regulatory req)

Ordering short-cuts

Division Orders → Internal Medicine → AM Labs

Unchecked	Albumin (Blood) 8436
Unchecked	Alkaline Phosphatase (Blood) 8340
Unchecked	Alanine Aminotransferase (ALT) (Blood) 8362
Unchecked	Aspartate Aminotransferase (AST) (Blood) 8360
Unchecked	Bilirubin Total (Blood) 81785
Unchecked	Calcium, Total (Blood) 8432
Unchecked	CBC with Differential-No Alerts (Blood) 81303
Unchecked	CBC with Differential (Blood) 9109
Unchecked	CBC without Differential (Blood) 8035
Unchecked	Creatine Kinase (CK) (Blood) 8336
Unchecked	Electrolyte Panel (Blood) 87972
Unchecked	Magnesium (Blood) 8448
Unchecked	Phosphorus (Inorganic) (Blood) 8408
Unchecked	Prothrombin Time (Blood) 9236
Unchecked	Activated Partial Thrombopl Time (Blood) 9058

Anemia Labs

Unchecked	Direct Coombs (Blood) 9008
Unchecked	Haptoglobin (Blood) 9168
Unchecked	Lactate Dehydrogenase (Blood)
Unchecked	Iron Studies

Iron Studies

Unchecked	Ferritin (Blood) 88153
Unchecked	Iron (Blood) 80201
Unchecked	Iron and Total Fe Binding Cap (Blood) 34624
Unchecked	Morphology Evaluation (Blood) 9184
Unchecked	Vitamin B12 and Folate (Blood) 84073
Unchecked	Thiamin (Vitamin B1) (Blood) 81019

HIM AM rounds lab order button study

- Eliminate albumin, CK, Phos, and Mg from daily AM rounds HIM division order button
  - Test volumes 90 days before and after
  - Volumes from 5 HIM general care units

Test	Volume pre (90 days)	Volume post (90 days)	% change IM
Albumin	814	785	- 4%
CK	283	242	- 14%
Magnesium	3987	4035	+1%
Phosphorus	2247	2033	- 10%
ELPN	10674	10482	- 2%
Alk phos	1289	1348	+5%
AST	1457	1504	+3%
Bilirubin	1240	1255	+1%
Calcium	1283	1267	- 1%

Controls

Ordering short-cuts

- Summary order sets & short-cuts
  - Order sets may or may not be an issue
  - Ordering short-cuts likely are an issue
    - Editing ordering short-cuts can lead to moderate gains in utilization
      - Gain/value of eliminating tests from panels or order short-cuts in electronic systems may not match that observed for paper orders
    - Who can make an ordering short-cut?
    - Who provides input and oversight?

Standing orders

- Order for labs in effect multiple days
- Functionality varies by electronic order system
- Magnitude of problem function of
  - Electronic order system functionality
  - Institutional culture
- SFGH study (2002-04)
  - Ban on standing orders 2003 (non-ICU)
  - Inpatient test volume year before and after
  - 12% reduction in total inpatient test volume and average tests/day
  - Am J Clin Pathol 2006;126:200-6

Standing orders

- Are standing orders a problem?
  - Perform measurement of rate
  - Define institutional policy around standing orders
  - Some tests (bedside glucose, PTT, INR) justify standing orders or orders tied to medication
- Electronic ordering system functionality can be difficult to change

Order entry decision support rules

- 3 types of inpatient decision support rules
  - Never tests (hard stop)
    - Do not contribute to decisions during inpatient stay
    - Often expensive and/or send-out
    - Examples: Thrombophilia w/u, many genetic tests
  - Frequency-limited tests (generally hard stop)
    - Repeat result (regardless of value) not needed
    - Examples: C. Diff, HbA1C, lipid panel, Hep C
  - Redundant normal values (often soft stop)
    - Rule triggered by previous result and anticipated Δ
    - Examples: iCAL, Mg, CBC with or without diff

Order entry decision support rules

- Never tests
  - Review top send-outs
  - Opinions/consensus of lab leadership
  - Opinions/consensus of medical staff leadership
- Frequency-limited tests
  - Review literature and other institutions experience
  - Opinions/consensus of lab/medical leadership
  - *Association for Clinical Biochemistry & Lab Medicine (UK) National Minimum Retesting Interval Project*
- Redundant normal values
  - Need data on ordering patterns and results
  - Hardest to do, often highest volume

Order entry decision support rules

- "Soft" repeat BNP order rule reduced inpatient BNP orders 21% ($94,000 direct savings)

  BMC Med Inform Decis Mak 2013;13:43

- ~ 70% soft redundant order pop-ups acted upon at one academic med center, ~ 30% over-ridden

  Am J Med 1999;106:144-50

- "Hard" stops should reduce volume > 50%
  - 1,25 dihydroxy vit D
  - CK-MB

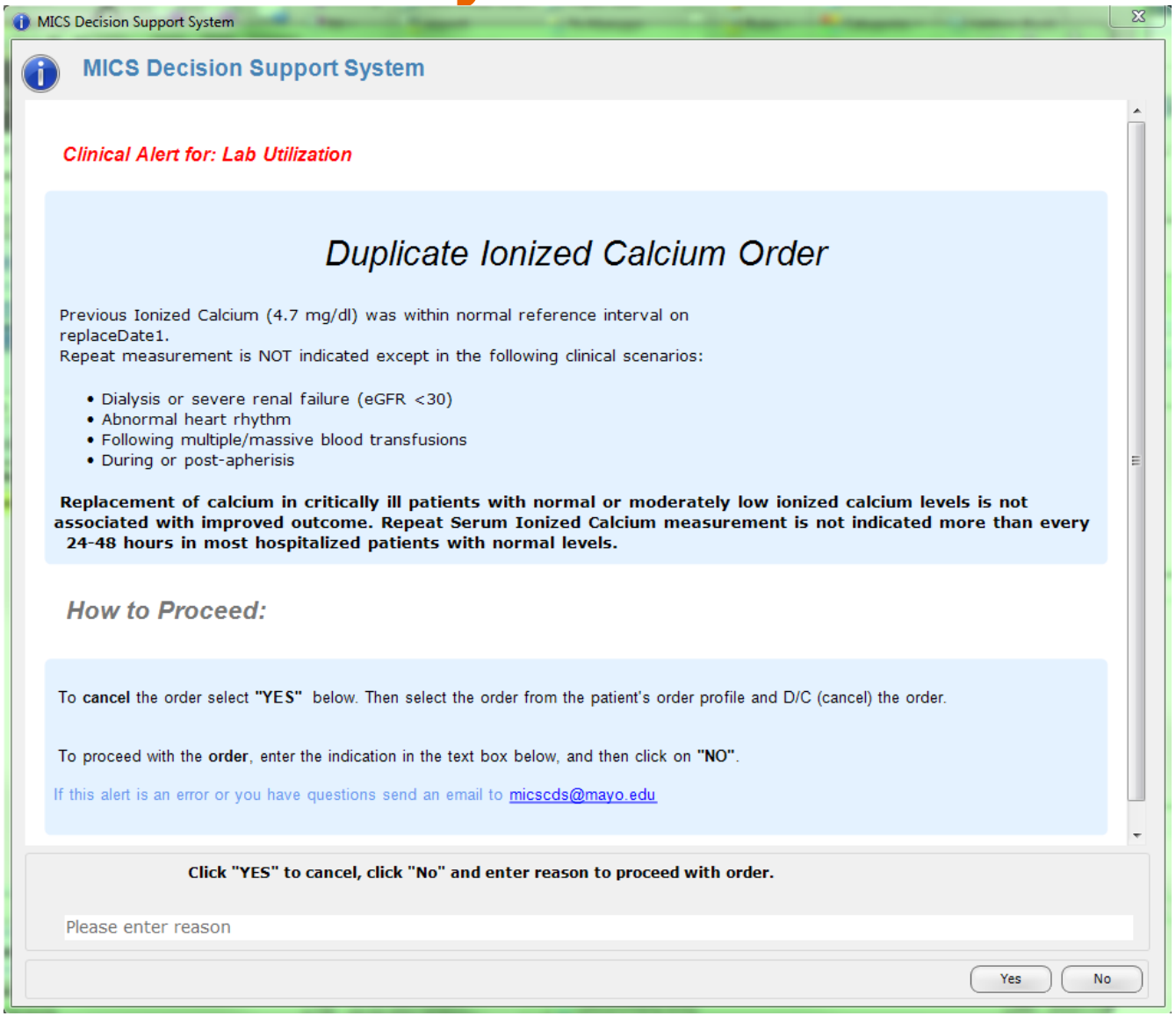
Mayo order entry decision support pilot

- Ionized calcium rule development
  - Off-line manual test = more labor
  - Culture of repeat measurement in ICU
  - Effective interventions done elsewhere
- Serum magnesium (Mg) rule
  - Shockingly high volume (3rd highest inpatient test)
  - Culture repeat ICU measurement
  - Effective intervention elsewhere
- NT Pro BNP
  - Higher cost immunoassay
  - Guidelines for hospital measurement

Mayo order entry decision support pilot

- Ionized calcium rule development
  - ~ 3000 orders/month (3 month study)
  - ~ 800 incidences/mo repeat iCAL within 24 hrs
    - 3/4 both values normal range
    - 1/4 first normal second abnormal
    - 61 incidences first value ≥ 4.8 mg/dL and second value < 4.0 mg/dL (criteria for Ca replacement)
    - Chart review indicated all 61 had exclusion criteria
      - Renal failure
      - Heart rhythm abnormality
      - Massive transfusion
      - Apheresis

iCAL order entry decision rule



Mayo order entry pilot preliminary results

- iCAL, Mg, NT pro BNP rules implemented in 3 general care and 4 ICU areas April 2014
- Test volumes 90 day before and after rule

Test	Volume pre (90 days)	Volume post (90 days)	% change
iCAL	2626	1418	- 46%
MG	7692	4867	- 37%
NT Pro BNP	345	264	- 23%
ELPN	4649	4867	+ 5%
PHOS	5531	3995	- 28%
Alk phos	1424	1421	< -1%
AST	2117	2033	-4%

Controls

- Number of times rule fired first 90 days: 4225 (of 171,397 qualifying orders)
- Number of pop-up overrides: 2624 (62%)

Order entry decision support rules

- Summary decision support rules
- 2 of 3 can be done with minimal data and IT
  - Never and frequency-limited
  - Higher impact (volume) tests will require exceptions and be more difficult
- Caveats and pitfalls
  - Institutional culture, provider time
  - Achieving consensus around rules
  - Decision-making authority
    - Top leadership must endorse decision-making body
    - Decision-making body must include lab

Cost information to providers

- Controlled trial of displaying costs for tests
  - “Cost” displayed CLFS reimbursement
  - 35 most common and 35 most expensive inpatient tests randomized
  - 30 tests cost displayed, 31 control (no cost)
  - Tests/patient day 3.72 to 3.40 cost arm
  - Tests/patient day 1.15 to 1.22 control arm
    - By chance more expensive tests randomized to control arm
  - 10% drop in total fees and fees/patient day
  - Study could not determine effectiveness at reducing expensive test ordering

JAMA Intern Med 2013;173:903-8

Cost information to providers

- What does a test cost?
  - Clin lab fee schedule reimbursement (published)
  - Lab total cost to provide service
  - Direct variable cost

Cost information to providers

- Example, serum ionized calcium
- NICU/ICU question
  - Serum iCAL vs stat whole blood (ABG) iCAL?
  - CLFS reimbursement: $7.09 serum = $7.09 whole blood iCAL
  - Lab total cost for test
    - Direct and indirect, ***fixed*** and variable
    - Serum ionized calcium: ~$4
    - Whole blood ionized calcium: ~$9

Cost information to providers

- Fixed costs fixed over relevant range
- What is the direct variable cost for each test?
  - Includes avg effort for phlebotomy and transport
  - Includes lab labor/number tests in tube
  - Includes reagents/supplies for that test
- Serum ionized calcium
  - ~$4
- Whole blood (ABG) ionized calcium
  - ~$1
- Different costs = different practices

Cost information to providers

- Alternative to calculating direct variable costs
  - $ DVC $0-10
  - $$ DVC $10-100s
  - $$$ DVC $100s-1000s
- Advantages
  - Avoid false assumptions about low cost tests
  - Much easier
- Disadvantages
  - No evidence cost information curtails use of expensive or non-routine tests

Cost information to providers

- Summary cost info
- Direct variable cost necessary to drive good decisions for high-volume in-house tests
- Overall more useful for send-out tests
  - Analytic (reference lab) cost most or all of cost of providing test
  - Straight-forward cost determination

Conclusions

- Approaches to laboratory utilization
  - Utilization committee
  - Send-out formulary
  - Algorithms and reflex testing
  - Review order sets, nonstandard (not CMS) panels and profiles
  - Report cards/audits
  - Consultative services

Conclusions

- Costs for “routine” inpatient lab testing add up
- Know how your practice stacks up (UHC)
- Ordering short-cuts
  - They will pop up everywhere
  - Go to the source (oversight/policy)
- Ordering rules/decision support
  - High value activity
  - Never and frequency-limited easiest
    - Requires defined oversight body
  - Higher volume tests require more work
- Cost information to ordering providers
  - Beware unintended consequences

Questions?