

Reducing Unnecessary Magnesium Laboratory Testing

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Background

Overuse of lab testing is known to be commonplace and contributes to shortages in lab testing materials. While practices exist at medical institutions that aim to limit lab test overuse, it is unclear which interventions are effective.

Objective

Based on the Choosing Wisely initiative recommendation of “don’t perform repetitive CBC and chemistry testing in the face of clinical and lab stability”¹, we aimed to reduce unnecessary inpatient serum magnesium laboratory testing. (Baird, 2019)

Design/Methods

- ✓ Examined historical volume of magnesium lab tests ordered and stratified them by service line
- ✓ We surveyed front-line clinicians on their magnesium test ordering process, identifying the largest, intervenable contributors to unnecessary testing
- ✓ An electronic health record intervention that limited the computerized ordering of recurrent magnesium lab tests to a maximum of 4 instances within a 48 hour period, along with clinician education was designed and implemented hospital-wide
- ✓ We compared the number of magnesium lab tests, and associated costs, ordered between the pre-intervention period (Apr-Sept 2021) and post-intervention period (Oct 2021-Apr 2022).
- ✓ We evaluated the rapid response and code blue frequency during the same periods above

Setting

Stanford University Hospital, a 584 bed, academic medical center located in Stanford, California. Organizational EHR used.

Results

- ✓ 6 months post-intervention, we found **8% overall reduction** in magnesium lab testing and ~24% reduction in the original magnesium lab orders (Average Total: 19,244/month pre vs 17,725/month post; Average Original Lab Order: 19,244/month pre vs 12,811/month post) without significant changes in rapid responses/code blues.
- ✓ Financial savings for year one are **\$67,801**.
- ✓ Magnesium lab tests were found to account for substantial yearly costs with only 25% of those tests coming back as abnormal.
- ✓ Top 5 service lines ordering magnesium tests were identified to be Cardiac Surgery, Cardiology, Hospitalist, Hematology and BMT.

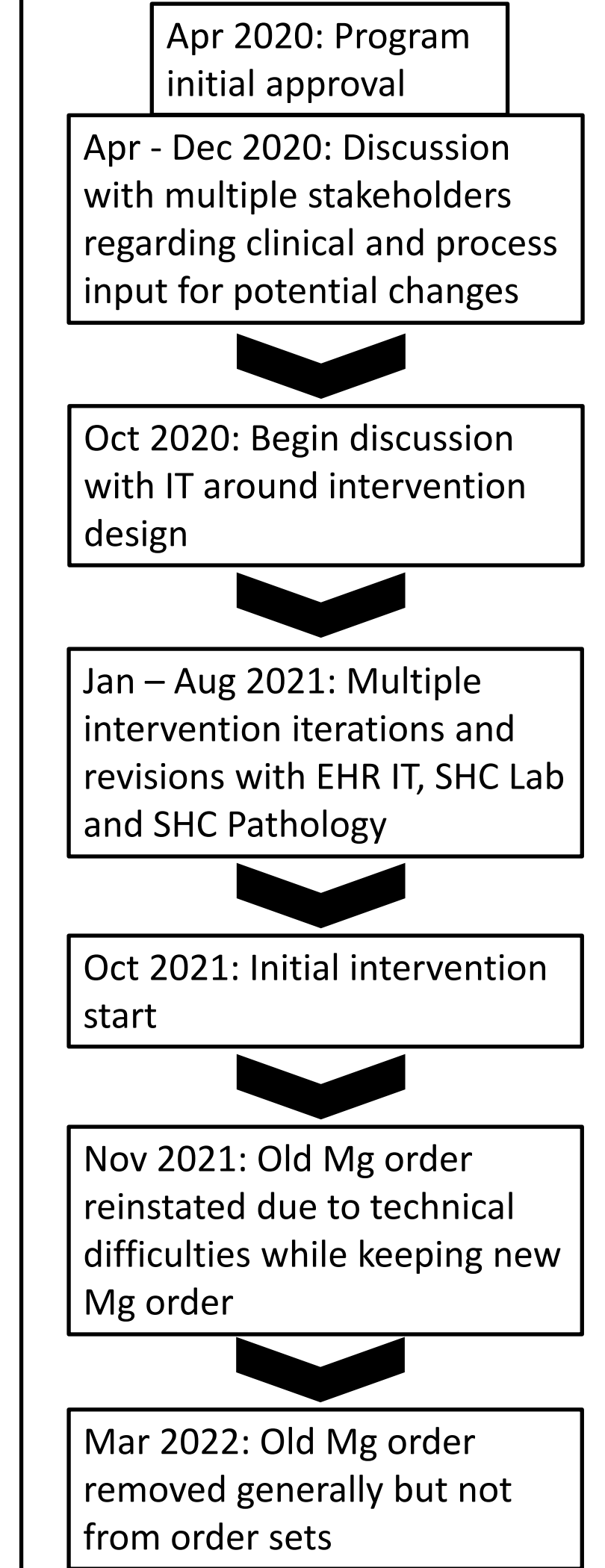
Conclusions

- ✓ Changes to order capabilities for magnesium testing can drive down overuse as well as result in hospital-wide savings.
- ✓ Limits on recurrent lab test orders in general may reduce overuse without negatively impacting patient safety.

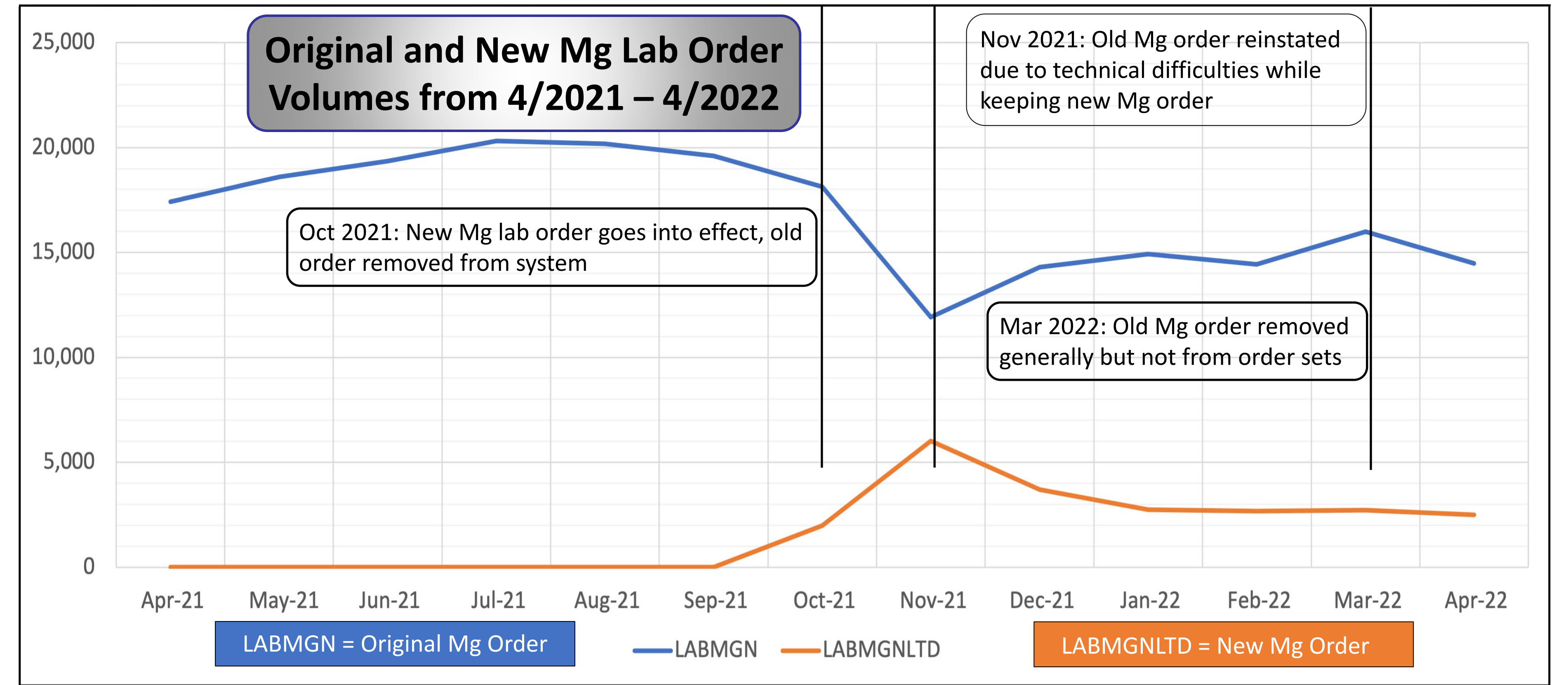
Reference: 1. Baird GS. The Choosing Wisely initiative and laboratory test stewardship. *Diagnosis* (Berl). 2019;6(1):15-23.

Disclosure: Benjamin Weia, MD, speaker for this educational activity, was a contractor for Epic. All relevant financial relationships listed for this individual has been mitigated. All others in a position to control content for this educational activity have no relevant financial relationship(s) to disclose with ineligible companies.

Process Map

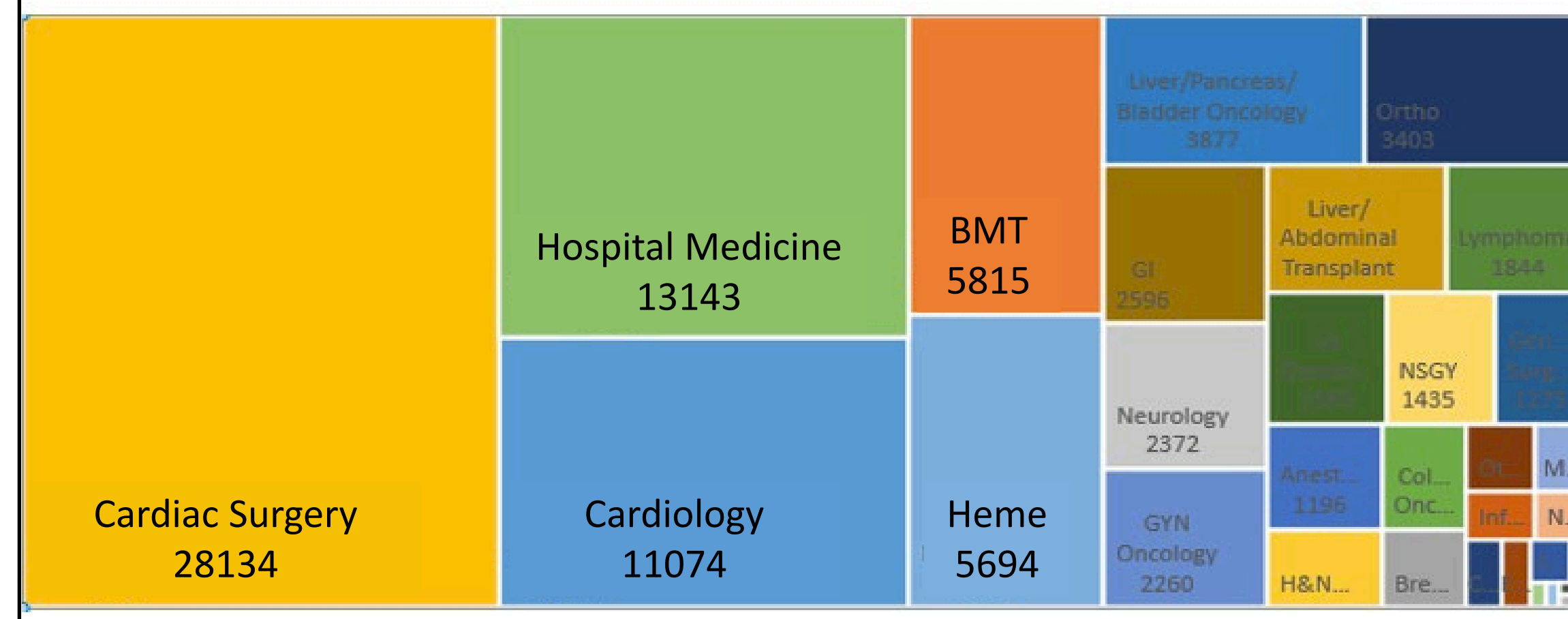


Learning objectives: 1. Reconstruct a quality improvement approach to reducing overuse of specific lab tests. 2. Apply a multidisciplinary approach to limit automatically recurring lab orders and reduce overuse of lab tests



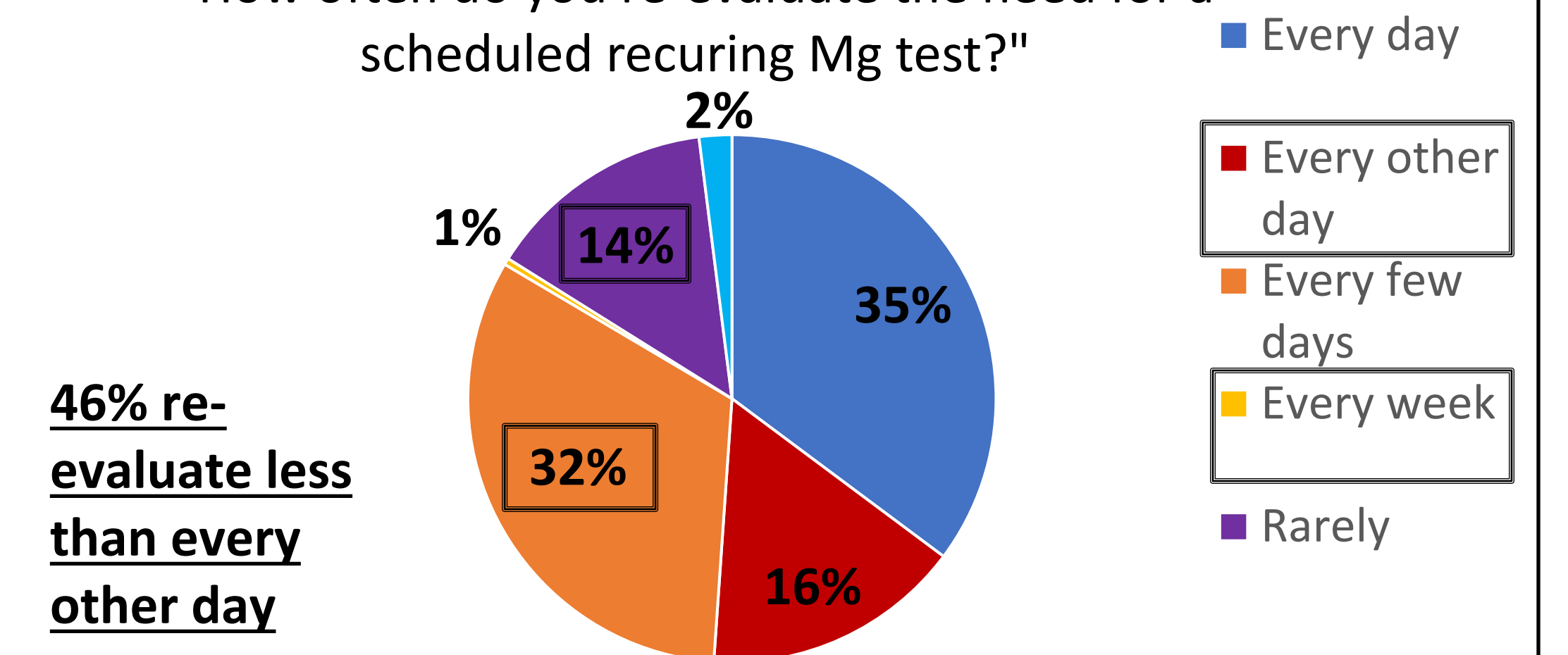
	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22
LABMGN	17,413	18,593	19,359	20,315	20,184	19,598	18,128	11,911	14,296	14,919	14,439	15,987	14,487
LABMGNLTD	-	-	-	-	-	-	1,981	6,006	3,701	2,743	2,680	2,723	2,485

Who orders Mg testing?



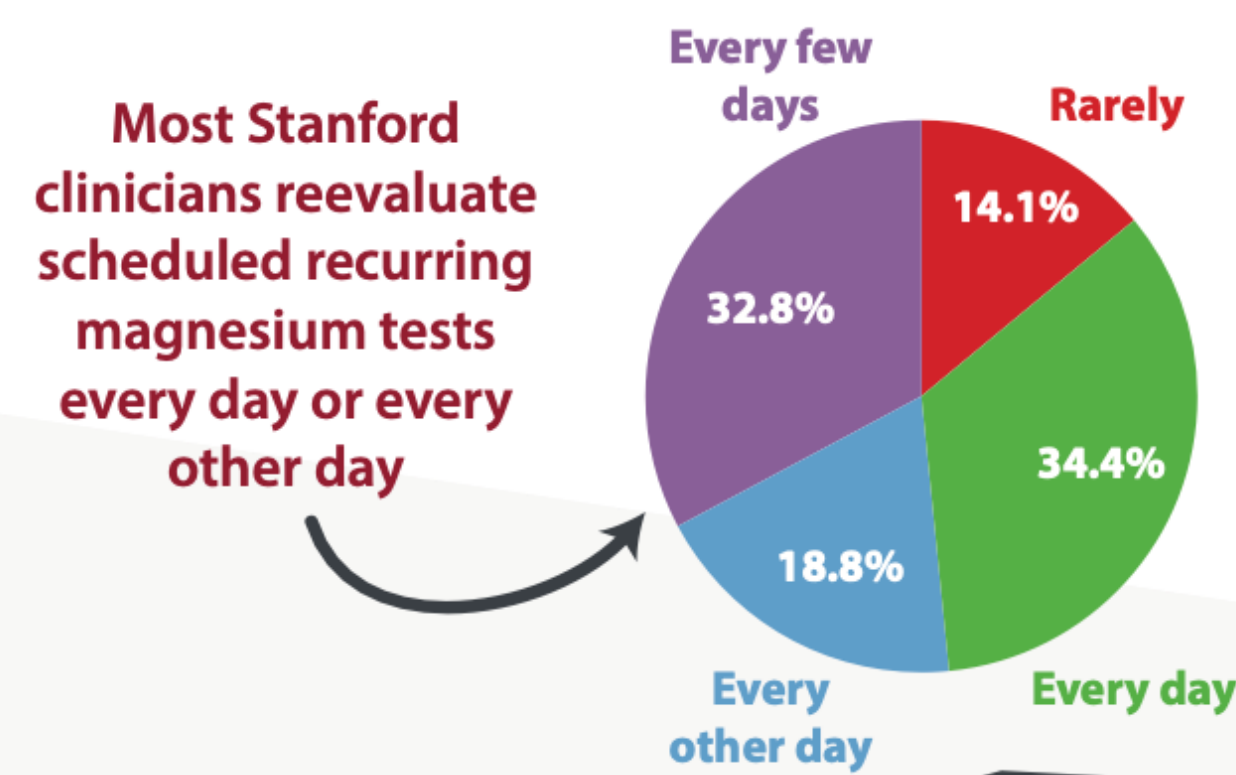
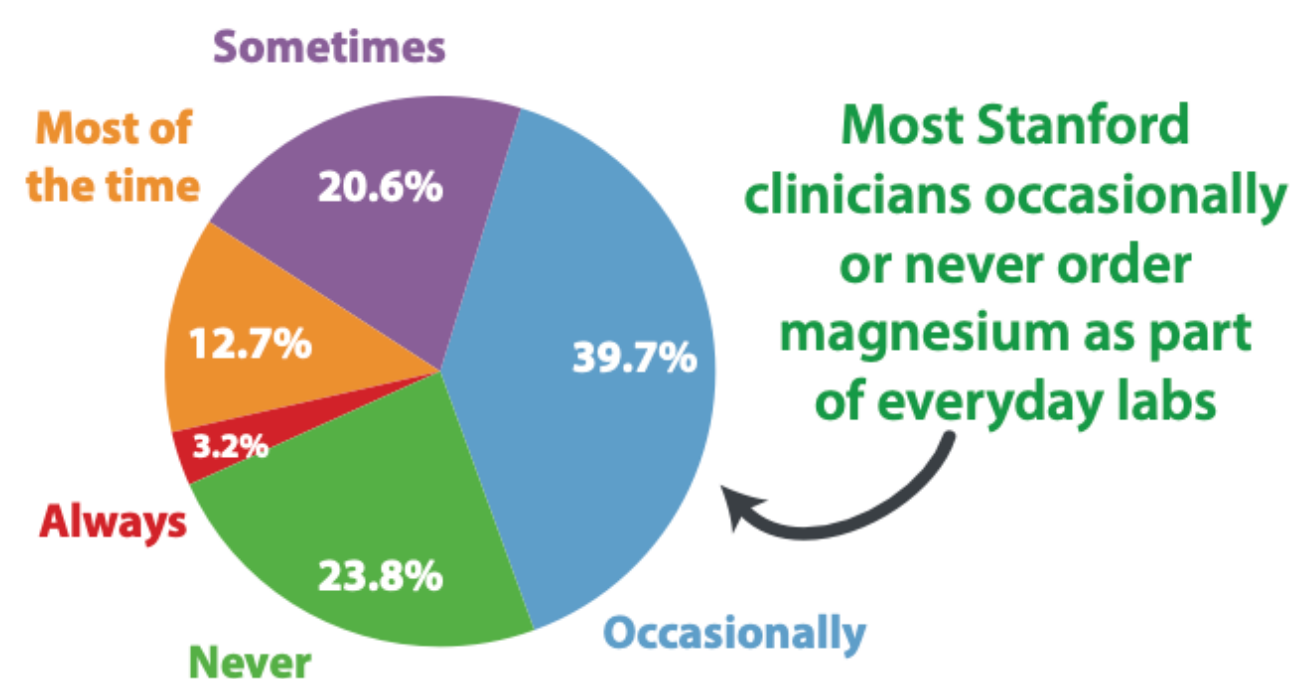
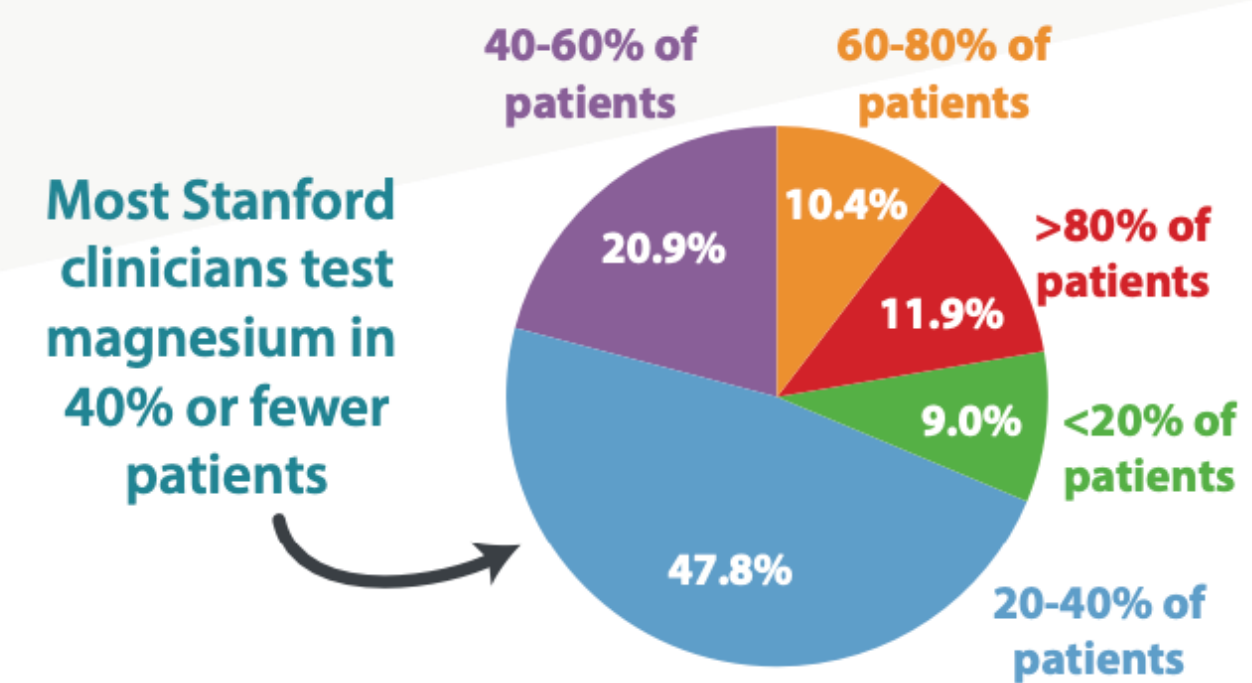
Internal Medicine Resident Survey:

"How often do you re-evaluate the need for a scheduled recurring Mg test?"



46% re-evaluate less than every other day

Magnesium testing at Stanford



Common magnesium misconceptions

- Patients in acute care should have routine magnesium testing**
Routine or repeated magnesium testing is not indicated unless evidence from the clinical evaluation of the patient suggests magnesium deficiency. (1)
- Mildly abnormal serum magnesium levels in asymptomatic patients should be repleted to prevent adverse outcomes.**
Signs or symptoms of an abnormal magnesium tend to correlate only at levels <1.0 mg/dL or >4.0 mg/dL. (1) Healthy-eating persons generally do not require any magnesium supplementation unless their levels are less than 1.0 mg/dL, and repeated magnesium testing is not needed in such individuals, unless new indications arise.
- Patients with hypokalemia or hypocalcemia should always have a serum magnesium checked and repleted.**
You only need to suspect a contributing hypomagnesemia if the hypokalemia or hypocalcemia is refractory to repletion.
- After administering IV magnesium repletion, serum magnesium can be rechecked 12-24 hours afterwards to evaluate effect of the repletion.**
After repletion, it can take 36-48 hours for magnesium to fully redistribute into the tissues. (2)

Common magnesium misconceptions

- For a patient in stable atrial fibrillation, checking and repleting Mg to >2 mg/dL daily can help prevent adverse cardiac outcomes.**
The association between serum magnesium and AF is not linear but observes a threshold. The excess risk of AF appears primarily in those in the lowest quartile of serum magnesium. (3) INSTEAD: Check once, and administer magnesium if serum magnesium is normal or low. If no change in atrial fibrillation is observed, repeated testing is not clinically indicated.
- For cardiac surgery patients, screening for serum magnesium abnormalities and repleting to >2 mg/dL decreases rate of arrhythmias.**
Multiple studies failed to identify postoperative electrolyte concentrations or supplementation therapy as risk factors. In a recent randomized control trial, maintaining serum magnesium concentrations after cardiac surgery did not reduce incidence of postoperative atrial fibrillation, while serum potassium repletion was associated with less atrial fibrillation. (4) The lack of clear evidence led to the omission of potassium and magnesium supplementation from the evidence-based guidelines recently published by the Society of Cardiovascular Anesthesiologists/European Association of Cardiothoracic Anaesthesiology on the management of AF after cardiac surgery. (5)

CSRP: Reducing Inappropriate Magnesium Serum Test

Baseline:

Oct 21, 2020 - Oct 20, 2021

Intervention Year 1

Oct 21, 2021 - Oct 20, 2022 (12 months)

Metric	Baseline	Intervention
Admissions (Population)	29,752	31,511
Sum of Magnesium Units	130,496	126,186
Intervention Savings		(\$67,801)

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2. Dickerson R. Guidelines for the Intravenous Management of Hypophosphatemia, Hypomagnesemia, Hypokalemia, and Hypocalcemia. *Hospital Pharmacy*. 2001;36(11):1201-1208.

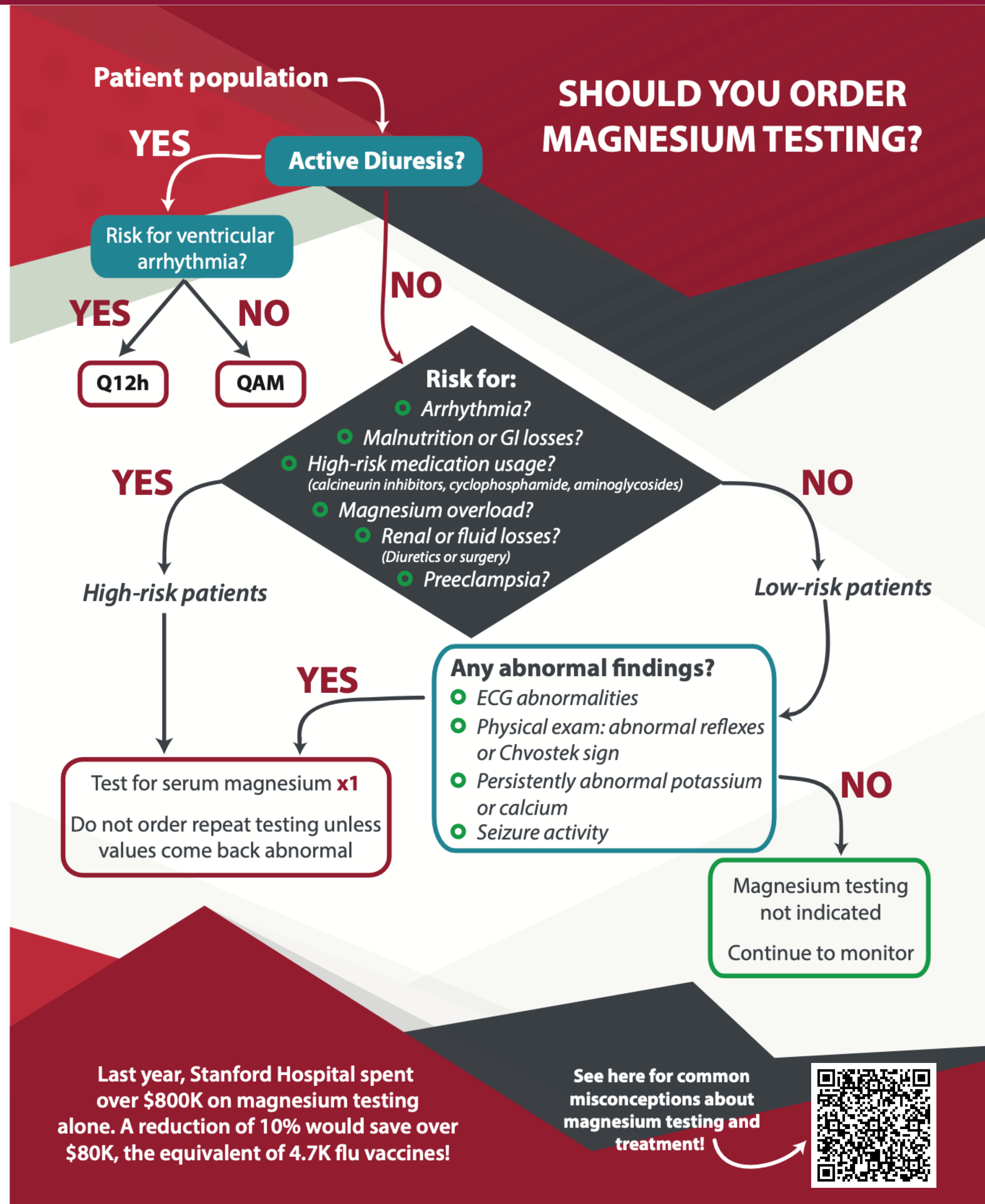
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Key Takeaways

- Follow a framework
- Engage key stakeholders early and often
- Recognize the unique nature of healthcare systems
- Account for current cultures and subcultures
- Anticipate unintentional consequences
- Less is often more

- LEAN Methodology
- What will give the necessary structure?
 - Who are the key stakeholders?
 - Where will intervention implementation affect?
 - Who is affected by this intervention?
 - How do you deal with challenges that arise?
 - What is/are the most simple and essential step(s) to solve the problem?

Lessons Learned

- Projects may need to be tailored to clinical requirements
- Include the business case for intervention
- Data isn't everything
- Student/Resident input and engagement is invaluable
- Persistence is important

- Who are the key stakeholders? Who is affected by this intervention?
- What is/are the most simple and essential step(s) to solve the problem?
- Practice habit changes require evidence-based data and ...?
- How can trainees get involved in this project?
- Just because someone says it cannot be done, doesn't mean it cannot be done.