Non-Evidence Based Medicine:
Things We Do for No Reason

1. Long courses of abx for UTI (> 3 days) and CAP (> 5 days)
2. PPI for ulcer prophylaxis on gen med wards
3. Carotid Dopplers for syncope
4. Prophylactic anticonvulsants for new brain lesion
5. K+ > 4, Mg > 2 for AMI patients
6. Reflexively transfuse cardiac patients with PRBC for HCT < 30%
7. Daily cxr in the ICU
8. Serum and RBC folate testing
9. CK-MB testing
10. Observing patients after IV to PO antibiotic switch
11. Using nebs over MDI with spacer
Objectives

- Summarize why providing high-value care is difficult but important
- Name 4-5 tests/therapies that are not high value
- Determine what you are going to do next week

High Value Care Definition

- Care that balances clinical benefit with cost and harms with the goal of improving patient outcomes

September 26, 2015

National Health Expenditures, 2012

- $2.8 trillion

- U.S. health care spending grew 3.7% in 2012
- $8,915 per person
- 17.2% of the Gross Domestic Product
- Hospital spending increased 4.9% to $882.3 billion

Why do we order unnecessary tests?

- Doctors have a “limited understanding of diagnostic and nondrug therapeutic costs”
- Patient expectations
- Insufficient understanding of the operating characteristics of tests
- Inability to retrieve previous results
- Learned behaviors
- Economic incentives (self-referral)
- Defensive medicine


Case 1

- A 71-year-old patient is transferred out of the MICU after treatment for a COPD exacerbation
- The patient was treated with steroids, NIPPV, and bronchodilators
- The resident continues the PPI that was started in the ICU for ulcer prophylaxis.

Acid-Suppressive Medication Use and the Risk for Nosocomial Gastrointestinal Tract Bleeding

- Outcome: nosocomial GI bleeding
  - Occurring outside of the ICU
  - any overt GI bleeding (hematemesis, nasogastric aspirate containing “coffee grounds” material, melena, or hematochezia)
  - occurring more than 24 hours after hospital admission
- Secondary outcome: clinically significant nosocomial GI bleeding

Acid-Suppressive Medication Use and the Risk for Nosocomial Gastrointestinal Tract Bleeding

• cohort study
  – propensity matched generalized estimating equation was used to control for confounders
• patients admitted to an academic medical center from 2004 through 2007
  – ≥ 18 years of age, hospitalized ≥ 3 days
  – not admitted for GIB
• Acid-Suppressive Meds (ASM)
  – order for a proton pump inhibitor
  – order for a histamine-2-receptor antagonist.


79,287 admissions in analytic cohort
ASM ordered in 45,882 (59%)
  – PPI 81%
  – H2-blocker 29%
Matched cohort
  – 18,983 pts each arm


Acid-Suppressive Medication Use and the Risk for Nosocomial Gastrointestinal Tract Bleeding

• primary outcome occurred in 224 admissions (0.29%)
• secondary outcome of clinically significant GI bleeding occurred in 176 admissions (0.22%).
• OR switch from unadjusted to adjusted

Number Needed to Treat

- 770 patients would need to be treated with acid-suppressive medication to prevent 1 episode of nosocomial GI bleeding.
- 834 to prevent 1 episode of clinically significant nosocomial GI bleeding.
- ASM use was associated with a 37% reduction in the odds of nosocomial GI bleeding.

Other important NNT

- ASM and hospital-acquired C difficile Infection
  - number needed to harm of 533
- ASM and hospital-acquired pneumonia
  - needed to harm of 111


Take Home

- NNH for c dif and PNA < NNT for GIB
- Recommend against prophylactic ASM use in patients outside of the ICU
- Need to figure out a subset for whom ASM NNT is < NNH
Case 2

- 70 year old with CKD Stage 3 who presents with pneumonia
- Started on Zosyn/vanc in the ED after getting a chest CT with contrast
- Patient’s GERD is treated with a PPI
- Patient has some hypotension episodes in the IMC unit
- Continues on ibuprofen for back pain
- You take over on HD 3 when Cr rises from 2 to 5mg/dL
- He has no rash and fevers are resolving

Your choice of test

In-hospital AKI

- Pre-renal
- ATN
  - Hypotension/hypoperfusion
  - Contrast
  - Meds
- AIN
Acute Interstitial Nephritis

• AIN found on 6%–30% of bx for AKI
  – No obvious cause for AKI
• Common causes of drug induced AIN
  – Abx
  – NSAIDs
  – PPIs


Gold Standard Test for AIN?

• Biopsy
  – Not all patients with AIN get a bx
• Clinical diagnosis
  – Nephrologist
  – Looking at urine sediment
• A non-invasive test would be welcomed
  – Especially to differentiate AIN vs. ATN


The Evidence Base

Most of these were not based on biopsy results

**Methods**

- Retrospective study of adult Mayo patients – 1994 to 2011
- Biopsy-proven diagnoses and UE tests
  - Histologic diagnosis in the absence of glomerular or monoclonal disease
  - Co-existing ATN and AIN were classified as AIN
- UEs were tested using Hansel’s stain
- Compared 1% and 5% UE cutoffs
- Note- pts with AKI and bx – Does not include all AKI pts


**Results**

- 566 patients
  - UE test & native kidney bx w/in a week
- 467 patients with pyuria
  - ≥ 1 white cell/HPF
- 91 patients with AIN
  - 80% drug induced
  - 16% prevalence of AIN

Sensitivity and Specificity

1% Cutoff

<table>
<thead>
<tr>
<th></th>
<th>AIN</th>
<th>No AIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ test (&gt; 1%)</td>
<td>28 (TP) A</td>
<td>151 (FP) B</td>
</tr>
<tr>
<td>Neg test (&lt; 1%)</td>
<td>63 (FN) C</td>
<td>324 (TN) D</td>
</tr>
<tr>
<td>Totals</td>
<td>91</td>
<td>475</td>
</tr>
</tbody>
</table>

- Sensitivity = 30.8%
- Specificity = 68.2%

When are Likelihood Ratios Helpful?

- LRs >10 or < 0.1: generate large, and often conclusive changes from pre- to post-test probability
- LRs of 5-10 and 0.1-0.2: generate moderate shifts in pre- to post-test probability
- LRs of 2-5 and 0.5-0.2: generate small (but sometimes important) changes in probability
- LRs of 1-2 and 0.5-1: alter probability to a small (and rarely important) degree.
- How helpful also depends on your pre-test probability
Likelihood Ratios for 1% Cutoff

- 1% UE cutoff
  - 30.8% sensitivity
  - 68.2% specificity
  - Negative LHR: 0.97
  - Positive LHR: 1.01


Sensitivity, Specificity, & LR 5% Cutoff

<table>
<thead>
<tr>
<th></th>
<th>AIN</th>
<th>No AIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ test (&gt; 5%)</td>
<td>18 (TP) A</td>
<td>42 (FP) B</td>
</tr>
<tr>
<td>Neg test (&lt; 5%)</td>
<td>73 (FN) C</td>
<td>433 (TN) D</td>
</tr>
</tbody>
</table>

- Sensitivity= 19.8%
- Specificity= 91.2%
- +LR: = 2.2
- -LR: = 0.88

Why Care About a Wrong Result?

- False Positive
  - Wrong Management
  - Steroids for no reason
- False Negative
  - You may not withdraw the offending agent
  - Steroids not given in timely fashion
Take Home

• Stains (Hansel or Wright) do not change post-test probability enough to be useful
• Consider renal biopsy

Case 3

• A 63-year-old man is admitted with a STEMI involving the inferior region.
• He has successful PTCI but his trop I peaks at 20 ng/mL.
• You are contacted by the CCU nursing staff with his BMP and Mg results:
  – Potassium: 3.7mEq/L
  – Magnesium: 1.4mEq/L.
• The nurse says, “You didn’t activate the K+ and Mg+ replacement protocol. Are you going to buff the lytes?”

Background

• Experts and professional societies recommend K+ levels between 4.0 - 5.0 mEq/L or even 4.5 - 5.5
• Most prior studies
  – conducted before routine use of -blockers, reperfusion therapy, and early invasive management
  – Small studies
  – Focus on arrhythmias and not mortality

Current Guidelines

• 2004 ACCF/AHA STEMI guidelines
  – It is reasonable to correct electrolyte and acid-base disturbances (potassium greater than 4.0 mEq/L and magnesium greater than 2.0 mg/dL) to prevent recurrent episodes of VF once an initial episode of VF has been treated. (Level of Evidence: C)

• 2013 ACCF/AHA STEMI guidelines
  – Prevention of VT/VF is directed to correction of electrolyte and acid-base abnormalities, optimization of myocardial perfusion, eradication of ongoing ischemia, and treatment of associated complications such as HF or shock.


• National Council on Potassium in Clinical Practices
  – Patients with Cardiac Arrhythmias
    • Maintenance of K+ ≥ 4.0 mmol/L
    • Coadministration of Mg+ should be considered

• Macdonald et al.
  – It is sensible to maintain a serum potassium concentration above 4.5 mmol/l during AMI
  – It would appear wise to avoid potassium levels above 5.5 mmol/l


Table 4. Clinical Evidence for Beneficial Effects of Potassium and Recommended Targets for Serum Potassium Concentration in Cardiovascular Disorders

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Recommended Level</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>3.5–5.0 mmol/L</td>
<td>High K+ diet ↓ BP</td>
</tr>
<tr>
<td>Stroke</td>
<td>Unknown</td>
<td>High K+ diet ↓ risk of stroke</td>
</tr>
<tr>
<td>Acute MI</td>
<td>4.5–5.5 mmol/L</td>
<td>Hypokalemic 1 ventricular fibrillation</td>
</tr>
<tr>
<td>Heart failure</td>
<td>4.5–5.5 mmol/L</td>
<td>Hypokalemic 1 ventricular fibrillation</td>
</tr>
</tbody>
</table>

1985- VT study and admission

**K+**

- **Patients:**
  - 60 pts admitted to CCU within 12 hrs of 1st AMI

- **Exclusion criteria—**
  - current treatment with
  - Digitalis
  - β-blockers
  - Calcium antagonists
  - antiarrhythmic drugs
  - cardiogenic shock; alcoholism; AV block > grade 1; BBB


---

**Intervention**

- **Meds that all pts received:**
  - oral diazepam
  - Oxygen
  - Morphine
  - No lyte supplements


---

**Outcomes- arrhythmias**

- **Ventricular tachycardia**
  - ≥ three consecutive ventricular complexes at a rate of greater than 120 beats/min

- **PVCs**
  - Frequent: >5 isolated unifocal beats/min
  - Bigeminy: alternate sinus and ventricular beats
  - Multifocal: multifocal beats in the same hour of recording
  - Couples: two consecutive ventricular beats, R-on-T according to R-R' 0.1-0.85
  - Overall frequency: total number of PVCs in the recording divided by the number of analyzable hours and expressed as the number per hour

Potassium and VT

Conclusions

• independent predictor variables for VT
  – serum potassium concentration at admission
  – age

V Fib and Potassium
(1074 pts on admission)

• 122 pts ≤ 3.5
  – 21 (17.2%) had v fib
• 952 pts > 3.5
  – 71 (7.5%) had v fib
Deaths and Potassium


Low Potassium and Diuretics

P > 0.05

Study Goals- JAMA 2012

• characterize the distribution and trend of serum potassium levels during hospitalization in patients with AMI
• determine the relationship between serum potassium levels and in-hospital mortality
• evaluate the relationship between potassium levels and ventricular arrhythmias or cardiac arrest in patients with AMI

Patients

- Retrospective cohort, database with 38,689 patients with AMI from 2000-2008
  - biomarker-confirmed AMI
  - had at least 1 in-hospital serum potassium
- 67 hospitals
  - 88.5% urban
  - 35.9% teaching
  - Represented all parts of US
  - Broad range of sizes


Intervention:
Potassium levels defined

- admission (baseline) serum K+ level
  - first K+ level obtained during hospitalization
- mean post-admission serum K+ level
  - Average of all K+ levels measured after the admission level but before discharge


Outcome

- relationship between mean post-admission K levels and outcomes
- relationship between admission K+ levels and outcomes


**Results**

<table>
<thead>
<tr>
<th>K (mEq/L)</th>
<th>&lt;3.0</th>
<th>3.0-3.4</th>
<th>3.5-3.9</th>
<th>4.0-4.4</th>
<th>4.5-4.9</th>
<th>5.0-5.4</th>
<th>≥5.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>46.2%</td>
<td>11.4%</td>
<td>4.8%</td>
<td>5.0%</td>
<td>10.0%</td>
<td>24.8%</td>
<td>61.4%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vfib or arrest*</th>
<th>19.2%</th>
<th>6.3%</th>
<th>4.9%</th>
<th>4.1%</th>
<th>4.1%</th>
<th>6.8%</th>
<th>14.7%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR 2.31</td>
<td>OR 1.06</td>
<td>OR 1.25</td>
<td>OR 1.25</td>
<td>OR 1.03</td>
<td>OR 1.15</td>
<td>OR 2.65</td>
</tr>
</tbody>
</table>

*Adjusted odds ratio confidence intervals overlap 1.0
Rates of In-Hospital Mortality and of the Composite of Ventricular Fibrillation or Cardiac Arrest by Mean Postadmission Serum Potassium Level

![Graph showing relationship between potassium levels and mortality](image_url)

Each x-axis interval is equal to or greater than the lower limit of the interval and less than the upper limit. The first interval includes all serum potassium levels less than 3.0 mEq/L; the last interval includes all levels equal to or greater than 5.0 mEq/L.


---

**Take-home**

- Maintaining serum potassium levels between 3.5 and 4.5 mEq/L may be more advisable than the 4.0 to 5.0 mEq/L.
- Based on an observational study, but better than any of the previous studies on which our current guidelines are based!
- Put together large trials that randomize patients with AMI to different potassium targets.

---

**Case 4- PIV**

- Your patient with PNA and AKI has been in the hospital for 4 days.
- The nurse asks if the PIV needs to be changed.
- What is your best response?
### Routine vs. Clinically Indicated

<table>
<thead>
<tr>
<th>Routine- Q3-4 days</th>
<th>Clinical Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Blockage</td>
</tr>
<tr>
<td></td>
<td>Pain</td>
</tr>
<tr>
<td></td>
<td>Redness</td>
</tr>
<tr>
<td></td>
<td>Infiltration</td>
</tr>
<tr>
<td></td>
<td>Swelling</td>
</tr>
<tr>
<td></td>
<td>Leakage</td>
</tr>
<tr>
<td></td>
<td>Phlebitis</td>
</tr>
</tbody>
</table>

### The Complications

<table>
<thead>
<tr>
<th>Peripheral vein infusion thrombophlebitis (PVT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
</tr>
<tr>
<td>Erythema</td>
</tr>
<tr>
<td>Swelling</td>
</tr>
<tr>
<td>Palpable thrombosis of the cannulated vein</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bacteremia</th>
</tr>
</thead>
</table>

### Why Thrombosis

<table>
<thead>
<tr>
<th>Drug irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical irritation from the catheter</td>
</tr>
<tr>
<td>Size of catheter</td>
</tr>
<tr>
<td>Person inserting the catheter</td>
</tr>
</tbody>
</table>
CDC Guidelines - 2011

- There is no need to replace PIV more frequently than every 72-96 hours
  - Category 1B
- No recommendation regarding replacement of PIV in adults only when clinically indicated
  - Unresolved issue
- Replace PIV in children only when clinically indicated
  - Category 1B


Cochrane 2010 Conclusions

- No conclusive evidence of benefit in changing catheters every 72 to 96 hours
- Health care organizations may consider changing PIV when clinically indicated
- Would provide significant cost savings
- Would be welcomed by patients


The Lancet Article - 2012

Intervention: Clinically indicated replacement vs. 3rd day routine replacement

Method

- Multicenter
  - 3 hospitals in Queensland, Australia
- Randomized
  - Stratified by hospital
  - Concealed before allocation
- Intention to treat
- Non-blinded
- Adults (≥18 years) with an IV catheter of expected use longer than 4 days

Outcomes

- Primary outcome
  - Phlebitis within 48 h after removal
  - The equivalence margin was set at 3%
  - 5-part definition
- Secondary endpoints
  - Catheter-related bloodstream infections
  - Local infections
  - All bloodstream infections
  - Catheter tip colonization
  - Infusion failure
  - Catheter numbers used
  - Therapy duration
  - Mortality
  - Costs

Important Inclusions/Exclusions

- Inclusion
  - PIV inserted in any clinical area
    - Including ED and OR
    - Inserted by any nurse or doctor or by IV insertion teams
- Exclusion
  - PIV inserted in an emergency
    - Bloodstream infection
    - Planned removal within 24 h
    - Already in situ for more than 72 h
Results
Where Does the Data Come From?

- Seven trials
  - 1 from England
  - 1 from India
  - 5 from Australian
- The authors of the Cochrane Analysis also were the authors of the 5 Australian studies

CRBSI

Rate between 0.0% and 0.3%

Phlebitis
Cost comparison between the trial groups (2010 Australian dollars)

<table>
<thead>
<tr>
<th></th>
<th>Routine n= 1690</th>
<th>Clinically Indicated n= 1593</th>
<th>Mean Difference (AUS $)</th>
<th>95% CI</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Cost</td>
<td>47.80 (30.00)</td>
<td>42.50 (27.00)</td>
<td>-5.30</td>
<td>-7.30 to -3.40</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Staff Cost</td>
<td>21.50 (14.10)</td>
<td>19.20 (13.10)</td>
<td>-2.30</td>
<td>-3.24 to -1.30</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Total</td>
<td>69.30 (43.50)</td>
<td>61.70 (39.50)</td>
<td>-7.60</td>
<td>-10.62 to -4.96</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>


US Implication

- 37 million patients admitted to hospitals each year in USA
  - If one third (12.5 million) needed a catheter for more than 3 days
- Clinically indicated replacement would
  - Prevent around 2.5 million unnecessary IV insertions
  - Save up to 1 million hours of staff time
  - Over 5 years would save around $400 million


Controversy!

Controversy!


Take Home

- PIV must be aseptically inserted, carefully maintained, assessed daily and removed as soon as possible
- Insertion site should be inspected at each shift change and the catheter removed if clinically indicated
- Don’t put a PIV if it is not needed
- Don’t routinely switch out PIVs

Case 5

- A 55-year old who abuses alcohol presents with hematemesis.
- He has been vomiting for days after a particularly bad binge.
- A previous EGD 2 years ago did not show varices.
- Your resident wants to place an NG.
What is less painful than NG intubation?

- Abscess incision and drainage
- Fracture reduction
- Urethral catheterization
- All other commonly performed procedures
- This talk????!!!!!


Upper GI bleeding

- Nearly 400,000 hospital admissions in the US annually
- Mortality rate: 3%-14% per admission

Gastrointest Endosc 2011;74:971-80

Why do NG lavage?

- Risk of high-risk lesions on endoscopy
  - 45% with a bloody aspirate
  - 15% with only a clear or bilious aspirate
- But, does it improve pt outcomes to know who is at higher risk?
- What we need: RCT of NG lavage
- What we have: Propensity-matched retrospective analysis.
Impact of nasogastric lavage on outcomes in acute GI bleeding

- P: 632 VA Greater Los Angeles Healthcare System patients admitted with GI bleeding.
- I: NG lavage
- C: No lavage
- O:
  - Thirty-day mortality rate
  - LOS
  - Tx requirements
  - Surgery
  - Time to endoscopy.


Confounders

- Age
- Comorbidities
- Liver Disease
- GI bleeding history Past
- Medication use
  - NSAIDs
  - PPIs
  - Clopidogrel
  - Warfarin
  - SSRIs
  - H2 blockers
- Bed Assignment
- Day of Week
- Time of Day
- Labs
  - Complete blood count
  - INR Higher
  - Platelets
  - High BUN/creatinine
  - Low albumin
- Frequency of testing
- Changes in test values
- Vital Signs- BP/HR
- Rectal results

More Confounders

- Use of Metoclopramide or erythromycin
  - Temporal pattern of administration
  - Time of administration
- Time to bowel preparation
- Performed EGD
- Performed colonoscopy
- Number of procedures
- Temporal pattern of procedure
  - EGD and colonoscopy done at the same time
- Time of procedure
- Type of endoscopy used
- Endoscopic findings
- Source of bleeding identified
- Therapeutic intervention
Methods

- NGL (cases) matched in a 1:1 ratio to patients who did not undergo NGL (control)
- Based on individual propensity scores.
Outcomes

Does this mean that physicians who order NGL (ED or GI) are just more aggressive? Can’t control for that.

Time to Endoscopy

Conclusions of Study

• Performance of NGL is unlikely to directly affect
  – mortality
  – blood transfusion
  – need for surgery
• Performance of NGL may
  – prompt more endoscopies
  – speed up time to endoscopy
  – shorten the length of hospital stay in those patients undergoing endoscopy
Does This Patient Have a Severe Upper Gastrointestinal Bleed?

<table>
<thead>
<tr>
<th>Likelihood of UGI Bleed</th>
<th>Likelihood of Severe UGI Bleed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sensitivity, %</strong></td>
<td><strong>Specificity, %</strong></td>
</tr>
<tr>
<td>89 (95% CI)</td>
<td>96 (95% CI)</td>
</tr>
<tr>
<td>77 (95% CI)</td>
<td>96 (95% CI)</td>
</tr>
</tbody>
</table>


International Consensus on Nonvariceal Upper Gastrointestinal Bleeding

- Consider placement of a nasogastric tube in selected patients because the findings may have prognostic value (unchanged from 2003 recommendations)


Conclusions of Daniel J. Pallin and John R. Saltzman from HMS

- We conclude that the practice of NG lavage in the management of patients with acute upper GI bleeding is antiquated.

What do you do next week?

- Start an HVC Committee in your hospital
- Write a TWDFNR article for JHM
  - LF@jhmi.edu
  - TWDFNR@hospitalmedicine.org
- Don’t ask about seafood/shellfish allergies before a contrast-mediated diagnostic or therapeutic procedure
- Don’t order a Hansel stain for AIN
- Don’t “Buff the Lytes”- 3.5 to 4.5 mEq/L
- Don’t change the PIV routinely but put them in aseptically, monitor them, and remove them ASAP
- Don’t NG lavage your UGI bleeders

Things We Do For No Reason

Years 1-4

1. Long courses of abx for UTI (> 3 days) and CAP (> 5 days)
2. Urine lytes (FeNa, FeUrea) for AKI
3. PPI for ulcer prophylaxis on gen med wards
4. Carotid Dopplers for syncope
5. Prophylactic anticonvulsants for new brain lesion
6. K+ > 4, Mg > 2 for AMI patients
7. Reflexively transfuse cardiac patients with PRBC for HCT < 30%
8. Daily cxr in the ICU
9. Serum and RBC folate testing
10. CK-MB testing
11. Observing patients after IV to PO antibiotic switch
12. Using nebs over MDI with spacer

Bibliography - Hansel and AIN

Bibliography- Hansel and AIN

6. http://araw.mede.uic.edu/cgi-bin/testcalc.pl

Bibliography- PIV


