WORSENING TRENDS IN THE AMBULATORY MANAGEMENT OF HEADACHE
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BACKGROUND: Headache is a universal complaint and among the most common reasons for visiting a physician. Despite numerous headache practice guidelines published over the past decade, little is known about the extent to which U.S. physicians adhere to recommended therapies or how this has changed over time. In this context, we sought to characterize trends in the management and treatment of headache from 1999-2010.

METHODS: Using nationally representative data from the National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey we examined ambulatory visits for headache. Our primary outcomes included use of advanced imaging, referrals to other physicians, and use of opiates/barbiturates (guideline discordant indicators), as well as physician counseling on headache prevention and use of preventative therapies including verapamil, topiramate, amitriptyline, or propranolol (guideline concordant indicators). Other outcomes included abortive medications such as non-steroidal anti-inflammatory drugs (NSAIDs) or acetaminophen (APAP) and triptans/ergot alkaloids. We excluded visits with “red flags,” such as neurologic deficit, cancer, or trauma. We used logistic regression models for each outcome focusing on a linear trend for each two-year interval, and adjusted for age, sex, race/ethnicity, insurance, symptom duration, geographic region, urban location, and whether the healthcare professional was the primary care physician (PCP), and weighted results to reflect U.S. population estimates. Additionally, we stratified findings by migraine versus non-migraine, acute versus chronic presentations, and visits to PCPs versus non-PCPs.

RESULTS: We identified 9,110 visits for headache, which represented an estimated 139 million visits from 1999-2010. Nearly three-quarters of patients were female and mean age remained stable at approximately 46 years. Our Table summarizes unadjusted use over time. Use of advanced imaging (computed tomography or magnetic resonance imaging) rose from 7.6% in 1999-2000 to 14.1% in 2009-2010 (unadjusted p<0.001) and referrals to other physicians increased from 7.7% to 12.9% (p=0.009). In contrast, physician counseling for headache prevention declined from 22.5% in 1999-2000 to 17.3% in 2009-2010 (p=0.034). Use of preventative medications increased from 8.3% to 15.0% (p=0.003) while opiates/barbiturates remained unchanged at approximately 18%. Adjusted trends (Figure) were similar as were results after stratifying by migraine versus non-migraine, acute versus chronic presentations, and visits to PCPs versus non-PCPs, with one important difference being that non-PCPs more frequently ordered advanced imaging (p<0.001).

CONCLUSIONS: Contrary to numerous headache practice guidelines, physicians are increasingly ordering advanced imaging and referring to other physicians and less frequently offering first-line headache prevention counseling to their patients. Worsening adherence to headache guidelines represents an area of particular concern for our healthcare system and stands out as an important opportunity to improve the value of U.S. healthcare.

| Table. Unadjusted Use over Time (% of Visits) |
|-------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Year (sample n) | 1999-2000 (n=1,287) | 2001-2002 (n=1,694) | 2003-2004 (n=1,647) | 2005-2006 (n=1,453) | 2007-2008 (n=1,515) | 2009-2010 (n=1,514) | P-value |
| Advanced Imaging (CT/MRI) | 7.6 | 7.3 | 8.0 | 10.7 | 13.5 | 14.1 | <0.001 |
| Referrals to Other Physicians | 7.7 | 9.8 | 11.7 | 10.7 | 13.5 | 12.9 | 0.009 |
| Headache Prevention Counseling | 22.5 | 21.8 | 23.2 | 18.8 | 15.6 | 17.3 | 0.034 |
| Medications | NSAIDs/APAP | 16.2 | 22.9 | 18.0 | 15.9 | 19.6 | 17.2 | 0.58 |
| | Triptan/Ergot | 8.4 | 11.1 | 13.7 | 16.3 | 12.2 | 13.5 | 0.054 |
| | Preventative | 8.3 | 9.3 | 9.9 | 10.5 | 11.7 | 15.0 | 0.005 |
| | Opiate/Barbiturate | 18.3 | 16.5 | 18.9 | 17.2 | 21.2 | 18.4 | 0.63 |

Abbreviations: NSAIDs/APAP: non-steroidal anti-inflammatory drugs or acetaminophen; CT/MRI: computed tomography or magnetic resonance imaging; Preventative: propranolol, verapamil, amitriptyline, or topiramate.
IS A PHYSICIAN SCORECARD FOR DIABETES MANAGEMENT POSSIBLE?
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BACKGROUND: Physicians play an important role in helping diabetics manage their disease. However, studies suggest that physician-level factors are associated with minimal variance in glycosylated hemoglobin (HbA1c). In contrast, patient-level factors, including age, race/ethnicity, duration of diabetes, number of comorbidities, and body mass index (BMI) appear to account for almost all of the variance in HbA1c. Although the extent of physician influence on glucose control is unclear, scorecards evaluating diabetes management are becoming increasingly popular. Not surprisingly, physicians want assurance that such tools include appropriate risk adjustment (i.e., sufficiently account for patient-level factors that affect glucose control). The goals of this study were to develop a physician scorecard for diabetes management and evaluate the ability of this scorecard to identify physicians who are performing better or worse than expected after accounting for relevant patient characteristics.

METHODS: Using electronic health record (EHR) data from a large, integrated health system, we developed three logistic regression models to assess physician-level effects on diabetes control, defined as HbA1c < 8%. Model 1 predicts whether HbA1c is greater than or equal to 8% and produces an area under the curve (AUC) based upon which physician a patient sees. In this unadjusted model, the intercept varies by physician and patient-level data are excluded. Model 2 predicts the same outcome and produces an AUC based upon 40 relevant patient-level factors, including age, race/ethnicity, duration of diabetes, number and type of comorbidities, insurance type, marital status, and BMI. Using hierarchical logistic regression, Model 3 predicts HbA1c by nesting patient-level data according to physician. Using the unadjusted Model 1, we initially ranked each physician according to the proportion of patients whose most recent HbA1c was greater than or equal to 8% (i.e., the observed proportion of uncontrolled diabetics). We then used the adjusted Model 3 to re-rank each physician based upon the difference between observed and expected (computed from Model 2) proportions of patients with uncontrolled diabetes.

RESULTS: A query of our EHR indicated that 16,850 (9.3%) of 181,805 primary care patients aged 18 to 75 years have either type 1 or type 2 diabetes. Of these, the most recent HbA1c was greater than or equal to 8.0% among 3,089 (18.3%). All diabetic patients are cared for by 203 primary care physicians (PCPs), yielding an average panel size of 77. The AUC for Model 1 was 0.63, suggesting that the likelihood of having an HbA1c greater than or equal to 8% is significantly associated with the physician that each patient sees. The AUC for Model 2 is 0.71, indicating that the model which includes only patient-level data is better at predicting uncontrolled diabetes than the model which includes only physician data. Model 3 provides 95% confidence intervals for each physician's deviation from expected performance. Using this model, we found that 18 of 203 (8.9%) PCPs performed better than expected and 14 of 203 (6.9%) performed worse than expected based upon his or her patients' risk profiles and after adjusting for patient characteristics. In addition, physician ranking from the adjusted model differed from the unadjusted model such that half of the physicians initially in the top 5% for diabetes control dropped out after risk adjustment.

CONCLUSIONS: Our results indicate that differences exist among physicians in the proportion of patients who have uncontrolled diabetes. These differences persist after adjusting for multiple patient covariates. Physician performance in diabetes management can be ranked without considering patient-level covariates. However, adjusting for these characteristics using HLM produces a different ordering of physicians and permits identification of physicians who perform better or worse than expected. This approach is replicable across health systems and can serve as the foundation for quality improvement strategies which include identification of best practices, as well as education and up-training of underperforming physicians. We conclude that a physician scorecard for diabetes management is possible with appropriate risk adjustment.
VARIABILITY IN ADHERENCE TO OPIOID PRESCRIPTION GUIDELINES AMONG ADULT PRIMARY CARE PROVIDERS

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BACKGROUND: In order to reduce prescription opioid misuse, clinical guidelines recommend that primary care providers (PCPs) use opioid treatment agreements and urine drug screens to monitor patients on opioid therapy for chronic non-cancer pain, with risk for medication misuse informing monitoring intensity. Little is known about variability among individual PCPs in adherence to opioid management guidelines and whether guideline non-adherence by PCP is associated with greater misuse of opioids.

METHODS: We examined 12 months (September 2011 - August 2012) of electronic health record (EHR) data from adult primary care clinics at two community health centers and one urban safety net hospital. Patients age 18-89 were included if they had received >3 opioid prescriptions for chronic pain within a six-month period and were not receiving active cancer treatment. PCPs were included if they had >4 eligible patients. Binary outcome variables were evidence of guideline adherence through (1) EHR documentation of an opioid treatment agreement (OTA) ever, and (2) Urine Drug Screen (UDS) in the past 12 months. Evidence of misuse was a binary outcome of 2 or more early opioid refills (>2 prescriptions written 7-25 days after the previous prescription for the same medication). Covariates were patient demographics, number of primary care visits (past year), number of Emergency Department visits (past year), number of patient risk factors for opioid misuse (age <45, drug use disorder, alcohol use disorder, tobacco use, and mental health disorder), morphine equivalent daily opioid medication dose (MDD) >50 mg/day, PCP type (attending, resident, nurse practitioner), and site of care. We used odds ratios to examine the correlations among patient-level binary outcomes, and Pearson correlations to examine the relationships among PCP-level aggregates of outcomes across patients within PCPs. Further, we used multi-level modeling to account for patient clustering within PCP and examine substantive variance attributable to PCP characteristics.

RESULTS: Sixty-seven PCPs prescribed opioids to 1,546 patients (mean patients per PCP: 23, median: 14, range: 4-95). No PCP met 100% of guideline practices, and PCPs showed wide variability in adherence. PCPs had a mean of 48% of patients with OTA (median: 50%, range: 0-100%). PCPs had obtained >1 UDS for a mean of 56% of patients (median: 59%, range: 0-100%). Among the three outcomes, the PCP-level variance for OTA and UDS were greater compared to the variance for early refill. The variance for UDS decreased from 1.75 to 0.87 after adjustment for covariates and site (p < 0.001). Step-wise adjustment of the variance for UDS evaluated which portion of the adjustment led to the difference in variance. Adjustment for patient-level covariates decreased variance from 1.75 to 1.14 (p<0.001); further adjustment for PCP type did not decrease the variance (p < 0.001). Adjustment by site decreased the variance substantially to 0.88 (p < 0.001), reflecting differences in UDS prevalence across the sites (24%, 37% vs. 67%). At the patient level, the presence of >50 mg/day MDD was associated with increased odds of early refill (OR=2.92, 95% CI 2.30-3.70), of UDS (OR=2.65, 95% CI 2.06-3.41), and of an OTA (OR=1.93, 95% CI 1.53-2.44). OTA was associated with UDS (OR=8.46 95% CI 6.65-10.75) and early refill (OR=1.56, 95% CI 1.27-1.93), and early refill was associated with UDS (OR=1.76, 95% CI 1.42-2.18). PCPs with higher aggregates of MDD among their patients tend to have greater proportions of patients with early refills (r=0.38, p=0.002) and UDS (r=0.46, p<0.0001). PCPs with greater proportions of patients with UDS tend to have greater proportions of patients with OTA (r=0.34, p=0.005) and with early refills (r=0.27, p=0.03).

CONCLUSIONS: PCPs practicing with an urban underserved population show substantial heterogeneity in adherence to opioid prescription guidelines, with only half of patients getting recommended procedures. PCP use of urine drug screens, but not use of agreements, appears to be heavily influenced by the practice environment. Although high daily doses of opioid are associated with increased monitoring, they are also associated with evidence of greater misuse. Examining the time dependent relationship between monitoring and multiple early refills could help distinguish whether monitoring practices help prevent potential opioid misuse or are a reaction to it.
BACKGROUND: It is increasingly recognized that efforts to intensively improve hemoglobin A1c (A1c) and blood pressure (BP) control in patients with diabetes sometimes unintentionally result in overtreating patients who are unlikely to benefit. Recent guidelines and initiatives like Choosing Wisely recommend less aggressive treatment for older patients with limited life expectancy (LE), since such treatment is unlikely to improve outcomes and may cause harm. This suggests that medication de-intensification is indicated among many patients with limited LE. Yet, we know little about how often providers decrease treatment intensity among patients who are unlikely to benefit. We examined how often the number or dose of medications are decreased in older patients with diabetes and lower than recommended levels of A1c or BP, and whether medication de-intensification is more common in patients with lower LE.

METHODS: Using the Veterans Health Administration's (VHA) Corporate Data Warehouse, we identified all patients with diabetes, age 70 and older, receiving primary care in VHA during 2012. We then identified the patients' last A1c and BP during 2012, and their prescribed medications at the time of this index A1c or BP. Patients with A1c<6.5% and on hypoglycemic medications (other than metformin alone) were considered eligible for de-intensification. Patients with BP<130/65 and on BP medications (other than low dose angiotensin converting enzyme inhibitor (ACEI) alone or low dose angiotensin receptor blockade (ARB) alone) were similarly eligible. We determined the proportion of patients who had medications discontinued or had the dose decreased in the 6 months after the index A1c or BP. Using logistic regression, we examined the association between limited LE, based on the Charlson comorbidity index, and de-intensification, controlling for number of medications the patient was taking at the time of the index A1c or BP.

RESULTS: 500,742 patients with diabetes, age 70+, were receiving primary care in VHA during 2012. Among the 114,411 with A1c<6.5%, 51% were on no medications, 15% were on metformin only, 8% were on insulin only, 14% were on sulfonylureas only, and 12% were on other or combination therapy. Among the 36,686 eligible for de-intensification, 8,466 (23%) were de-intensified within 6 months. Patients with LE<5 years were modestly more likely to be de-intensified than those with LE>10 years (predicted probability 29% vs 19%, p<0.001). Among the 66,750 patients with a BP<130/65, 10% were on no medications, 6% were on low dose ACEI or ARB only, 22% were on 1 BP medication, and 62% were on 2 or more BP medications. Among those eligible for de-intensification, 9,883 (21%) were de-intensified. Patients with LE<5 years were somewhat more likely to be de-intensified than those with LE>10 years (predicted probability 24% vs 17%, p<0.001).

CONCLUSIONS: Despite increasing awareness that overtreatment of diabetes may be harmful in older adults, less than one quarter of patients treated to levels significantly lower than recommended had medications de-intensified. While patients with limited LE were more likely to be de-intensified than those in good health, the majority of eligible older patients, even those with limited LE, continued to receive care that is of low value or potentially harmful. Future initiatives that seek to help patients and providers choose wisely will need to address this significant clinical inertia for de-intensification of treatment.
DEFINING APPROPRIATE USE OF ACID SUPPRESSION AMONG MEDICAL INPATIENTS

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BACKGROUND: Proton pump inhibitors (PPIs) are commonly used among medical inpatients, with some studies suggesting that as many as half of all inpatients receive PPIs. Routine use of PPIs is common for symptom relief and, in higher risk patients, to reduce the risk of upper GI bleeding (UGIB). Recent evidence has suggested that PPIs increase the risk of nosocomial infections, including healthcare associated pneumonia (HCAP) and Clostridium difficile infection (CDI). We sought to examine the balance between risks and benefits of PPI use among medical inpatients in various categories of risks of UGIB, HCAP, and CDI.

METHODS: We created a microsimulation model to estimate the risks of UGIB, HCAP, and CDI among medical inpatients. Risks of each of these conditions were generated using published risk models. We then modeled changes in risk associated with PPI use for each of these outcomes, basing our estimates on meta-analyses and observational studies. We examined the overall impact of PPI use on inpatient mortality, including both population level risk and individual thresholds at which PPI use would be beneficial (through reduction in UGIB risk) or harmful (through increases in HCAP and CDI). We examined several scenarios to account for heterogeneity in the strength of the evidence for the causal relationship between PPIs and our modeled outcomes, and conducted both one-way and multivariate sensitivity analyses (using second order Monte Carlo simulation) across all parameters in the model.

RESULTS: In our first scenario, where PPI use was causally linked with changes in risks of all three outcomes (UGIB, HCAP, and CDI), we found that PPI use led to an increase in mortality in over 95% of hospitalized patients. In our second scenario, with no causal association between PPI use and CDI, we found that PPI use led to an increase in mortality in 86% of hospitalized patients. Sensitivity analyses showed that even with a low odds ratio for HCAP, PPI use led to increased mortality in 91% of cases (assuming a causal link with CDI) or 68% of cases (no causal link with CDI). We then examined percentiles of probabilities for HCAP, CDI, and UGIB to see if we could identify particular cases where benefit from PPI use was likely. However, only at extremes of the distribution were we able to identify patients who may benefit. For example, we modeled a patient at the 10th percentile for probability of HCAP, case fatality of HCAP, risk of CDI, and case fatality of CDI, but at the 90th percentile risk of UGIB risk and fatality. In such a patient, PPIs were neutral, with benefit in about half of such patients and harm in the other half.

CONCLUSIONS: Our study suggests that for the vast majority of medical inpatients, use of PPIs likely leads to an increase in short-term mortality. Even in patients at particularly high risk of UGIB, only those at the very lowest risk of HCAP and CDI should be considered for prophylactic PPI use. Indeed, our estimates suggest that withholding PPI therapy should be considered for most patients upon admission, with the exception of those who are at very high risk of or are hospitalized for UGIB. There are several limitations to our analysis. First, we are reliant on published estimates of the effect of PPI on HCAP, CDI, and UGIB, and for some outcomes, particularly CDI, there remains some controversy on the causality of the observed association. Second, we did not model additional outcomes such as length of stay; however, given the balance of risks and benefits we found, this is more likely to accentuate than alter our finding that PPIs generally lead to harm. Finally, we did not model specific settings such as the ICU or surgical patients. Overall, our findings suggest that PPI use should be avoided in the vast majority of medical inpatients.

Density plot of change in mortality for 100,000 simulations of 100-patient cohorts, assuming increased risk of CDI with acid suppression (red) and no increased risk of CDI (blue).
BACKGROUND: Although the possibility of bleeding as a result of anticoagulant treatment may limit patients from taking part in physical activity, the association between physical activity and anticoagulation-related bleeding is uncertain.

METHODS: In a Swiss prospective multicenter cohort study of 988 in- and outpatients aged ≥65 years receiving anticoagulants for acute venous thromboembolism (09/2009-04/2013), we assessed patients' self-reported physical activity level (low, medium, or high) at baseline using a previously established standard question. The primary outcome was the time to a first major bleeding, defined as fatal bleeding, symptomatic bleeding in a critical site, or bleeding causing a fall in hemoglobin or leading to transfusions. The secondary outcome was the time to a first clinically relevant non-major bleeding. We examined the association between physical activity level and the time to a first bleeding using competing risk regression, accounting for death as a competing event. We adjusted for known bleeding risk factors, including age, female gender, overt pulmonary embolism, history of major bleeding, recent major surgery, cerebrovascular disease, cardiac disease, diabetes mellitus, arterial hypertension, active cancer, chronic liver disease, chronic renal disease, risk of falls, polypharmacy, anemia, low platelets, concomitant antiplatelet therapy, and periods of anticoagulation as a time-varying covariate.

RESULTS: During a mean follow-up of 22 months, patients with a low (n=367), moderate (n=310), and high (n=311) physical activity level had an incidence of major bleeding of 11.6, 6.3, and 3.1 events per 100 patient-years, and an incidence of clinically relevant non-major bleeding of 14.0, 10.3, and 7.7 events per 100 patient-years, respectively. Compared to a low physical activity level, a moderate (adjusted sub-hazard ratio [SHR] 0.72, 95% confidence interval [CI] 0.45-1.13) and high physical activity level (adjusted SHR 0.40, 95% CI 0.22-0.72) were associated with a lower risk of major bleeding. There was no association between physical activity and clinically-relevant non-major bleeding.

CONCLUSIONS: Increasing levels of physical activity are associated with a decreased risk of major bleeding in elderly patients receiving anticoagulant therapy, indicating that physical activity is safe when taking anticoagulants.