the web portals and cholesterol test results. **Methods:** The health system implemented a web-based tool for all patients who registered to use the website in November 2005, allowing members to securely access a personal health record, as well as e-mail their physicians, and view their lab results. In this study, we defined patients as web-portal users when patients emailed their physicians or viewed lab results at the first time. We examined the association of patient web-portal use and low-density lipoprotein cholesterol (LDL) level using linear regression with fixed effect at patient level, adjusting for medical center electronic health record (EHR) implementation, quarter for seasonality, and year for temporal trend. **Results:** The 169,711 patients in the IDS diabetes registry at the start of 2004 were followed through 2009. The number of patients who had used patient web-portal increased dramatically from 16% in 2006 to 35% in 2009. During 2004-2009, a total number of 1,070,856 LDL tests were performed among the study subjects and 18% of the tests were done after patients used the web-portal. Overall patient web-portal use was associated with reduction of LDL value by 0.81 mg/dL (95% CI: 0.64-0.97). Further examination among patients stratified by their baseline LDL (last value in 2003) showed that the largest reduction in LDL was found among those with worst control: on average, LDL level dropped by 0.36 mg/dL (95% CI: 0.14-0.57) among those with baseline LDL <100 mg/dL, 0.90mg/dL (95% CI: 0.63-1.18) among those with baseline LDL 100- <130mg/dL, and 2.04 mg/dL (95% CI: 1.59-2.50) among those with baseline LDL >130 mg/dL. **Conclusions:** Patient use of a web-based portal to review laboratory results or email their clinicians increased substantially between 2006 and 2009. Patient use of web portals was associated with improvement of LDL level, with greater improvement among patients in worse control.

Keywords: Patient Portal; Diabetes; LDL

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PS2-5:

Prevalence of Migraine in a Diverse Community – Electronic Methods for Migraine Ascertainment in a Large Integrated Health Plan

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Background/Aims: Migraine, a common neurological disorder, is among the top 20 causes of disability worldwide. One-year prevalence of migraine in the US is estimated to range from 8-15%, with women affected at approximately three times the rate of men. Current methods for migraine ascertainment from headache clinics and surveys are costly, affected by clinic-ascertainment bias, and do not work in situations where patient contact is not feasible. With the growing use of electronic medical records (EMR), new methods must be developed for identifying and tracking migraine prevalence over time. We sought to develop an EMR algorithm, to identify migraine, and to characterize its prevalence in Kaiser Permanente Northern California (KPNC). **Methods:** From EMRs of all KPNC members, we collected all outpatient migraine diagnoses (ICD9 code 346.xx) and migraine-specific prescriptions (ergots, triptans, and acetaminophen with caffeine) for 2006-2010. We chart-reviewed a random sample to develop an electronic Migraine Probability Algorithm (score 0-100). We tested the algorithm in a second independent chart review. Using membership data, we calculated prevalences by age, race, and gender. **Results:** We identified 313,174 KPNC members with evidence of migraine - 233,620 women and 79,554 men. The 5-year period-prevalence of migraine among KPNC adults was 17.1% for women and 5.9% for men. Among children, rates did not differ by gender (<2%) until the age of 10, when prevalences were higher - 5.8% for girls and 3.5% for boys. For women, prevalence peaked at ages 25-29. In contrast, males experienced flat prevalence with age (range 5%-6%). Overall, Whites had higher prevalence than Asians, but Blacks did not differ appreciably. **Conclusions:** We used EMR data to capture migraine diagnoses and show prevalence patterns similar to those reported in the literature. Prevalence of diagnosed migraine in KPNC was 2.5-3 times higher in women than men; migraine peaked with age in women, but remained flat for men; and prevalence of migraine among Asian adults was roughly 2/3 that of Whites. These methods for ascertainment of migraine are inexpensive and easy to implement and have applications and implications that extend well to other institutions and debilitating pain conditions.

Keywords: Electronic Medical Records; Migraine; Epidemiology

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PS2-6:

Who Opens Alerts to Physicians? (And Who Doesn't?)

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Background/Aims: With the increasing adoption of electronic medical records (EMR), there are many opportunities to implement systems of information flow, like alerts to providers. Tests of such systems have varied results. **Methods:** Within a multispecialty group practice that uses Epic EMR, we conducted a trial of automated alerts to primary care physicians and their staff when older patients were discharged from hospital to home. We generated alerts for new medications, drug interactions, dose problems, or monitoring needs. Provider staff received alerts to schedule an office visit. Alerts appeared in the recipient's Epic in-basket. Using EMR "digital crumbs", we tracked the length of time before alerts were viewed. We analyzed the impact of physician age, gender, department, and employment status (full-time, part-time). We also analyzed the impact of patient conditions, including age, gender, comorbidity, and number of office visits in the previous year. **Results:** Of 763 alerts to physicians, 616 (81%) were opened within one day. Characteristics associated with timely opening were age <50 (OR 1.7, 95% CI 1.1, 2.6) and full-time employment (OR 2.9, 95% CI 1.6, 5.2). Of 1928 alerts to staff, 1173 (61%) were opened within one day. Physician characteristics associated with staff opening of alerts were gender (staff of male physicians were more likely to open the alerts within one day [OR 1.8, 95% CI 1.4, 2.4]), and being a member of the Family Medicine department (OR 1.9, 95% CI 1.3, 2.6) or sub-specialty department (OR 16.6, 95% CI 2.3, 122.3). Staff of full-time physicians were less likely to open alerts within one day (OR 0.64, 95% CI 0.47, 0.87). Controlling for patient characteristics had no impact on results. **Conclusions:** Special efforts may be required to reach physicians working part-time and older physicians. The characteristics related to staff opening of alerts are specific to this group practice, but the high level of variability across physician types and departments is likely to be an issue in many settings. Design of a system directed at reaching staff quickly may require in-depth assessment of work flow and communication patterns in clinical departments.

Keywords: Health Information Technology; Electronic Medical Record; Alerts

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PS2-7:

Automated Ordering and Sample Collection to Leverage Electronic Medical Record Based Genetic Research – The Geisinger MyCode Project

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Background/Aims: The Geisinger MyCode project is a system-wide biobanking project with DNA and serum samples from over 35,000 Geisinger patients. We summarize an automated process for ordering and collection of samples linkable to EMR data for research studies. **Methods:** Eligibility lists for enrolling patients of interest are automatically generated using inclusion criteria and daily clinic schedules. Research staff use eligibility lists to consent patients to participate in MyCode during a regularly scheduled clinic visit. An opt-in consent process is used. After consent, an automatic blood order is placed in the patient's EMR. Electronic orders are executed by a clinical phlebotomist at the time of a clinical blood draw. Samples are stored using a unique study ID, but remain linkable to the patient's EMR data through a data broker process. De-identified clinical data is obtained from Geisinger's enterprise data warehouse to create phenotypes for genetic research. **Results:** The MyCode biobank includes over 35,000 participants and more than 104,000 samples. 85% of patients approached give consent to participate. 90% also agree to be recontacted to participate in future research studies. The standing research blood order allows for collection of serial samples. The retention rate for participation is 99%. More than 24,000 MyCode samples have been used in over 20 research projects. In the past 2 years, externally funded research projects that utilize the MyCode

biobank total twelve million dollars, representing a several-fold return on investment. **Conclusions:** The seamless integration of the automated MyCode process with existing clinical infrastructure maximizes the efficiency of research sample collection and minimizes costs. The process allows resources to be focused on interaction with the patients during consent. The opt-in consent allows samples to be linked to EMR data. The persistent link allows repeat access to the patient's EMR data for longitudinal studies. This approach is highly efficient and does not require patients to have an extra needle stick or research visit, which contributes to the high enrollment rate. The trade-off is a potential lag between consent and sample collection. Future goals include improvements in enrollment efficiency and developing approaches for returning results.

Keywords: Biobank; EMR; MyCode

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PS2-8:

ePhenotyping for Abdominal Aortic Aneurysm

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Background/Aims: A large volume of clinical data is captured in electronic medical records (EMRs), and feasibly extracting the data to define clinical phenotypes is valuable to health care research. We designed an algorithm to define abdominal aortic aneurysm (AAA) cases and controls. We implemented the algorithm using our institutional warehouse and propose using the HMORN Virtual Data Warehouse (VDW) to replicate our findings. **Methods:** The cohort consisted of individuals enrolled in the Geisinger MyCode biobank or consented for research in other studies (such as the Vascular Department). The Structured Query Language (SQL) algorithm utilized CPT codes and ICD9 codes and vital signs data to define individuals as cases, controls or excludes. AAA cases were defined as having an AAA repair procedure, or at least one vascular clinic encounter with a ruptured AAA, or at least two vascular clinic encounters with an unruptured AAA. AAA controls were neither excludes nor cases, had an encounter within the past 5 years, and never had an ICD9 code 441.3, 441.4, or 441.9. Individuals were excluded based on certain medical conditions, age younger than 40 or older than 89, not having an encounter within 5 years, or having an ICD9 diagnosis of 441. **Results:** We screened the records of 29,770 individuals, identifying 1,155 AAA cases and 17,523 controls. We excluded 337 individuals based on predisposing genetic conditions, 109 individuals without a visit within the past 5 years and 10,398 individuals based on age. To assure that we had true AAA cases, 248 individuals with ICD-9 codes of 441.x (which includes thoracic and unspecified site of aneurysm) were excluded. The algorithm was validated on a subset of individuals by manual chart review and demonstrated a Positive Predictive Value (PPV) of 94% and sensitivity of 100%. **Conclusions:** We designed an ePhenotyping algorithm to identify AAA cases and controls from the EMR with high PPV and sensitivity necessary for research purposes. The VDW provides an excellent opportunity to broaden the study population characteristics and replicate the findings.

Keywords: Electronic Medical Records; Abdominal Aortic Aneurysm

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PS2-9:

The NIH Health Care Systems Research Collaboratory

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Background/Aims: In September 2012, NIH funded the Health Care Systems (HCS) Research Collaboratory to engage health care systems as research partners in conducting large-scale pragmatic clinical studies. The goals of the HSC Collaboratory are to provide leadership and technical expertise to support innovative pragmatic clinical trials leveraging health information technology, specifically electronic health records (EHRs), in partnership within health care delivery systems. **Methods:** The HSC Collaboratory currently consists of a Coordinating Center and seven funded

pragmatic trials. The HMORN plays a major role both in the Coordinating Center and in four of the initial seven funded trials. We describe the HMORN contribution to the Coordinating Center. **Results:** The HCS Coordinating Center cores provide technical expertise and support to Collaboratory investigators and their health care system partners; develop technical and policy guidelines to advance research in health care systems; and disseminate lessons learned. The HMORN is leading two cores: the IT core (led by the Harvard Pilgrim Health Care Institute) is developing the NIH Distributed Research Network and is also responsible for providing tools for extracting information from EHRs and for data sharing; the Health Systems Interaction Core (led by the Group Health Research Institute) is responsible for optimizing research interactions with health care delivery organizations. HPHCI and GHRI also participate in the biostatistics core. Additional Coordinating Center activities include defining clinical phenotypes in EHRs; engaging stakeholders and promoting participation by all relevant communities; creating reusable, sustainable models for incorporation of patient reported outcomes; and addressing ethical considerations arising in the conduct of health system based research. **Conclusions:** The NIH HCS Research Collaboratory program is advancing the nation's capacity for cost-effective, large-scale, pragmatic clinical studies. The HMORN leads several aspects of this work and can directly benefit from the Collaboratory's activities as the scope of resources expands to support additional delivery system based research activities.

Keywords: Clinical Trials; Comparative Effectiveness; Electronic Health Records

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PS2-10:

Economic Impact of Electronic Health Information Exchange

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Background/Aims: More than 40% of outpatient visits involve a transition in care. Effectively coordinating care across providers is critical to reducing healthcare costs and improving patient safety and quality of care. Electronic health information exchange (eHIE) facilitates coordination of care by enabling information transfer across providers and medical clinics. By increasing care coordination, eHIE is expected to reduce healthcare costs resulting from redundant lab tests and radiology studies. In this study, we examine the economic consequences of eHIE in the context of x-ray imaging for bone fractures. **Methods:** We have previously demonstrated that eHIE is associated with a significant reduction in follow-up x-ray imaging for patients with bone fractures of the extremities. This retrospective cohort study of Kaiser Permanente Mid-Atlantic States (KPMAS) members compared the rate of duplicate x-rays in patients with a diagnosis of bone fractures from the Emergency Department (ED) or from outpatient care between 2006 and 2010. Here, we use the Medicare fee schedule to estimate costs for all imaging events, including x-rays, CT scans and MRIs, during the two month period following the initial fracture diagnosis. We estimate total cost by identifying all relevant radiology procedures during the two months following the index event and assigning costs based on published estimates for each procedure. **Results:** The study included 5680 patients from KPMAS with bone fractures diagnoses. 38% of patients were initially seen in the ED, while 62% of patients were seen in outpatient care. The median cost of imaging procedures in the month after diagnosis was \$30.60. Patients who received diagnosis and follow-up care at facilities that did not have active eHIE cost the healthcare system 1.7 times as much as patients who received diagnosis and follow-up care at institutions that electronically shared radiology data between facilities and providers. **Conclusions:** eHIE reduces healthcare costs related to duplication of diagnostic tests, specifically imaging studies. Next steps will be to evaluate the impact of different eHIE access methods on its effectiveness.

Keywords: Health Information Exchange; Health Information Technology; Radiology

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