Methods: We designated 63,681 pelvic ultrasound exams of 44,704 women performed during 1997-2006 as cases or controls. Cases included 214 exams of 188 women who received a pathologically confirmed ovarian cancer diagnosis within 1 year; controls include 63,467 exams of 44,516 women who did not. We divided all exams for cases and 10,000 randomly selected exams from controls into split-half development and validation samples (having 107 cases and 5000 controls each). The full text of development sample reports was concept-coded using caTIES. Guided by domain expertise and trial-and-error we developed an algorithm to identify cases and classified each report according to it. Expert review of the 107 case reports and random samples of 300 false positive and 300 true negative controls is ongoing, as is algorithm modification. The validation sample remains unused. **Results:** A simple algorithm employing concepts 'mass,' 'simple,' 'hemorrhagic,' and 'resolution' achieved sensitivity of 63% and specificity of 93%. Expert review indicates the algorithm may be improved by 1) focusing exclusively on concepts in the report's impression section, 2) incorporating additional concepts to identify true positives and exclude false positives, 3) developing custom NLP rules to associate organ systems and concepts referring to them, and 4) excluding concepts expressed in future and past tenses. **Conclusions:** Progress to date is encouraging for developing schemes useful for ordinal classification of clinical risk of disease. Opportunities for applying NLP to clinical text for medical research are numerous and caTIES appears to be a promising tool, especially if customized to perform domain-specific NLP tasks.

Abstract PS2-29

Incident Asthma Surveillance Using Electronic Medical Record (EMR) Data – Methods from the PASS and PASS2 Studies

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Background: Availability of longitudinal data from the electronic medical record (EMR) provides opportunities to monitor trends in the incidence and treatment of chronic diseases such as asthma. The Centers for Disease Control (CDC)-funded PASS studies developed, evaluated and implemented an algorithm for using the EMR to identify incident cases of asthma in the Kaiser Permanente Northern California (KPNW) region over a 5-year period. **Methods:** The original PASS study was carried out in two phases. In phase I candidate algorithms based on medication dispensings and asthma diagnoses from doctor visits were developed and piloted. A range of options for medication dispensing criteria, health plan eligibility, and length of the surveillance period were considered. The resulting algorithm was arrived at through a collaborative decision process involving the CDC and investigators from two field centers. In phase II the algorithm was validated by recruiting a subset of 219 randomly-selected patients identified by the algorithm as having incident asthma and collecting clinical and self-report measures from them, including pulmonary function tests. Two KPNW pulmonologists reviewed all information relating to each of these cases to arrive at a 'gold standard' asthma classification for these patients. **Results:** The final PASS asthma algorithm requires the following criteria be met: either two dispensings of asthma medication, or two or more visits at which asthma was noted as a diagnosis. The 'at-risk' population is identified by excluding those who meet these criteria in the 4 years prior to the year of interest and those who do not meet membership eligibility. Individuals in the resulting 'at-risk' population who meet the asthma criteria in the year of interest are identified as incident for asthma. The validation phase resulted in KPNW physicians rating 85% of the 219 charts reviewed as probable/possible asthma and 15% as unlikely. This represents a predictive value of 86%. This algorithm has subsequently been implemented in the 5-year PASS2 study which aims to, among other things, carry out asthma surveillance to determine the incidence and prevalence of physician-diagnosed asthma and develop and maintain a research database of incident asthma cases. The next step is to evaluate the scalability of this algorithm in other EMR-based systems. **Conclusion:** The PASS studies have demonstrated that it is feasible to develop and implement an EMR-based algorithm for asthma surveillance. Similar methods can be employed for other chronic diseases.

Abstract PS2-30

Care Coordination and Health Information Technology: Information Availability and Timeliness Across Care Transitions

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Background: Patients who require care by multiple clinicians are at risk for problems during these transitions. Use of an electronic health record (EHR) could provide clinicians a mechanism to coordinate activities and information, thereby improving care across transitions. We examined the impact of having EHR on the availability and timeliness of clinical information within an integrated delivery system. **Population:** All adult primary care clinicians (n=396 PCs) working in a large prepaid, integrated delivery system who completed the surveys in both 2005 and 2006. Overall, 57.3% were female, 48.9% were white, 83.1% were physicians, mean age was 45 years, and the mean panel size was 1540 patients. In 2005 only 2.0% of respondents had finished implementing the EHR at the time of their survey versus 39.4% in 2006. **Methods:** Using survey data collected in both 2005 and 2006, we examined clinician reports of the availability and timeliness of relevant clinical information when multiple clinicians are involved with their patients' care. We collapsed the five-point responses into two categories, e.g., high availability when the information was 'always' or 'usually' available. We defined EHR status as pre-, during, or post-implementation using the implementation dates for the medical center. Using multivariate logistic regression, adjusting for clustering by clinician, medical center, year, clinician gender, race, panel size, job title and status, we examined the association between EHR status and both clinical information availability and timeliness. **Results:** In year-one, 42.7% of PCs reported having high levels of clinical information availability, compared with 64.9% in year-two; 39.3% and 62.4% reported having high levels of timely information in years one and two, respectively. Overall, 35.3% and 57.8% reported having high levels of both information availability and timeliness in years one and two, respectively. After adjustment, clinicians working in medical centers that had completed the EHR implementation were significantly more likely to report having high levels of both clinical information availability and timeliness (OR=2.88; 95% CI, 1.46-5.69). **Conclusion:** EHRs could be an important tool for improving the timeliness and availability of clinical information. These improvements could facilitate the coordination of care between clinicians.

Abstract PS2-31

Virtual Data Warehouse 'High Utilizers'

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Background: The virtual data warehouse (VDW) was created as a mechanism for streamlining the process of proposing and conducting multi-site research by eliminating the need for custom data extraction programming at each site. At the core of the VDW are a series of standard file definitions. Content areas and data elements commonly required for research are identified, and data dictionaries created for each one. The data dictionaries specify a common format for each element—variable name, label, extended definitions, code values, and value labels. Local site programmers then developed programs to aggregate and transform their local legacy data into the standard VDW files. The data at the sites is thus made uniform, making it possible for multiple sites to run the same program against their local VDW data, and produce comparable results. The VDW is 'virtual' in the sense that the actual data remain at the local sites. It is not a centralized database held at a coordinating center and accessible only to a privileged few. Rather, it is a mechanism for sharing and reusing SAS code, and accelerating the research process. **Methods:** This poster presents data from 3 HMOs that shows how the VDW is used at these sites. **Results:** Programmers at Group Health, Kaiser Northwest, and Kaiser Colorado all use the VDW for more than multi-site projects. Using both automated file

auditing and surveys of staff we present information demonstrating how the VDW is used at the 3 HMOs. **Conclusions:** The original intent of the VDW was to increase efficiency in the use of data on multi-site studies. However, single site studies can also gain efficiencies from using the VDW and at some HMOs the VDW has become the first data source to use for almost all research. The VDW advantages of standard data structures and standard methods are also useful for single site projects.

Abstract PS2-32

Prescription Errors in the Electronic Medical Record: Provider Perceptions and Suggestions for Modification

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Background: Electronic prescribing has been purported to be the panacea in decreasing prescribing errors. However, the potential for problems has not been explored. **Aims:** To examine provider perceptions regarding the potential for prescription errors inherent in the electronic medical record (EMR) and possible solutions. This survey is part of a larger study to examine the frequency and sources of prescription errors in the EMR. **Methods:** All pediatricians, internists, family practitioners, cardiologists and oncologists within HealthPartners Medical Group were surveyed electronically. Questions included types of prescription errors, which were most problematic, impact of electronic prescription errors, frequency of errors, and suggestions for modifications. **Results:** One hundred nine out of 248 providers have currently completed surveys (45%); 52% were female, and 76% practiced for >10 years. Dosing errors (choosing wrong strength or form) were reported by 72% as being potentially problematic in the EMR, picking errors (choosing wrong medication from a list) were reported by 53%, errors in instructions (e.g., choosing bid vs. qid) by 48%, and 24% indicated other types of errors. Dosing errors were reported by half of all respondents to be most problematic, while 24% reported picking errors to be most common. Self-reports of the frequency of prescribing errors were: 9% >once/week, 34% once/month, 39% once every 3-6 months, 11% once/year, and 7% never. Using a five-point scale (1=no impact, 5=major impact), only 32% selected a 3 or higher to describe the amount that this issue impacts their practice. Concerns most frequently mentioned were issues involving dosing, inability to find desired drug, default instructions, lack of interface/communication with pharmacy, and accuracy and management of current patient medication lists. Suggestions for modifying the EMR to reduce errors included consistency in naming of medications, provider-specific drug lists, and simplifying or eliminating default directions. **Conclusions:** Providers perceive dosing errors as problematic when using the EMR. Although providers report an inherent potential for prescription errors, many do not feel that this issue has much of an impact on their practice. Suggestions for modifications should be explored to make future improvements in the electronic prescribing component of the EMR.

Abstract PS2-33

Enabling Quality of Care Metric Reporting Using an EMR

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Background: There is an increasing demand from local, state and national organizations to develop quality metric reporting in healthcare. At the same time there is both external and internal demand to not only report data, but to treat patients with multiple chronic diagnostic conditions in a cost effective manner. A model has been developed at Marshfield Clinic that offers a consistent, efficient, scalable and automated process to evaluate and report quality of care metrics and manage chronic disease populations. Data have been extracted from the electronic medical record (EMR), transformed into entity relationships, and loaded into an enterprise data warehouse to facilitate this model. **Methods:** A systematic approach has been developed to

standardize the measurement of both process and outcome quality measures using the following key steps: (1) defining and documenting quality of care metrics for a population, (2) identifying patients with the population of interest, (3) attributing those patients to a care provider, (4) evaluating and validating data, and (5) providing feedback in the form of storyboards and also in the form of an intervention list application that is managed by medical staff. The first step clearly describes and documents the population of interest and quality of care metrics to be evaluated. The remaining four steps are programmatically automated for timely and efficient evaluation. **Results:** Programs run nightly on a client PC that evaluates the health record for 61,000 unique patients with four possible chronic diagnostic conditions and up to 33 metrics. The average run time of this nightly program over a given month is 4 hours compared to a recent mandated manual chart abstraction of 418 records and 5 measures that took a total of 46 hours to complete. A report for diabetes mellitus shows improvement for low density lipoprotein control of 14% over a 2-year period. **Conclusions:** This process demonstrates a model that is re-usable and scalable, providing an efficient delivery method of quality metric reporting. Quality of metric reporting using an EMR provides a consistent, standardized, and efficient feedback loop by having defined, retrievable data.

Abstract PS2-34

A Targeted, Age-Specific Alert Within an Electronic Medical Record to Reduce Inappropriate D-dimer Testing

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Background: The negative predictive value and accuracy of d-dimer assays for venous thromboembolism (VTE) worsens with patient age, meaning additional testing is not avoided in the majority of older patients. We evaluated the effectiveness of a computerized alert to reduce the number of tests ordered for these patients. **Methods:** We hypothesized that an alert at the time of d-dimer ordering for patients ≥65-years-old would decrease the rate of d-dimer testing for these patients. We randomized two groups of clinics. We analyzed the baseline rate of d-dimer orders/1000 patient visits, the rate in the intervention group, and the rate in the control group. After 18 months, the alert was activated for control clinic providers. **Results:** Rate of d-dimers orders/1000 clinic visits in intervention clinics before and after the alert was significantly reduced. We saw a reduced rate in the control clinics also, but it was smaller (possibly due to secular trend). After the alert was turned on in the original control clinics the rate was significantly smaller. The reduced rate persisted in the intervention clinic throughout the study. No significant rate changes were seen in patients <65-years-old.

d-dimer orders/1000 patient visits

≥65-years-old	Baseline rate (no alerts)	Rate difference (95% CI)
Intervention clinics	4.91	-3.36 (-4.05, -2.66)
Rate difference (95% CI)	-1.30 (-2.18, -0.42)	
Control clinics	3.61	-1.23 (-1.91, -0.55)
<65-years-old		
No alerts		
Intervention clinics	4.07	0.30 (-0.18, 0.77)
Rate difference (95% CI)	-0.27 (-0.81, 0.27)	
Control clinics	3.8	1.53 (-0.31, 0.61)

Conclusions: A targeted electronic alert can change the ordering behavior of providers, decrease inappropriate test ordering, and may foster adherence to evidence-based guidelines for management of patients with suspected VTE.