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# Using an Automated Model to Identify Older Patients at Risk for 30-Day Hospital Readmission and 30-Day Mortality

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room placement was 127.38 min. The average delay time from scheduled surgery start was 24.26 min. Logistic regression identified hospital facility ( $P<0.0001$ ), surgical specialty ( $P<0.0001$ ), patient age ( $P=0.0004$ ) and late patient arrival ( $P=0.0005$ ) as significant predictors of delay. Operating room delays were responsible for \$444,074 in lost revenue.

**Conclusion:** In our study, 88% of first start cases were delayed, the majority of which were caused by the surgeon. However, hospital facility, surgical subspecialty, patient age and arrival time also significantly affected delays. Correction of operating room delays can significantly reduce hospital costs.

### **THIRD PLACE ORAL PRESENTATION**

#### **Assessing the Effectiveness of Implementation of Unified Workflow in Improvement of Medication Reconciliation for Aurora St. Luke's Family Medicine Residency Outpatients**

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**Background:** Medication errors are the most common errors occurring in hospitals. Preventable adverse drug events are linked with 1 in 5 injuries or deaths; 23% of medication errors in primary care occur due to inaccuracies in the medication list. Quality improvement projects designed to improve accuracy of outpatient medication reconciliations may decrease the number of medication errors and increase patient safety by preventing adverse drug events.

**Purpose:** To determine whether a unified workflow for medication reconciliation improves the accuracy of ambulatory, electronic medical record (EMR)-based patient medication records.

**Methods:** Retrospective study of random sample of patients from Aurora Family Medicine Residency Clinics before (prior to March 31, 2014) and after (December 10, 2014) improvements to the medication reconciliation process ( $n=80$  and  $n=77$ , respectively). Aurora pharmacy medication lists were obtained and compared to that of the EMR. To preserve patient and caregiver confidentiality, charts were assigned arbitrary identifiers. Two-sample t-tests were used to compare pre- and post-medication reconciliation. An additional patient chart audit on pre- ( $n=51$ ) and post- ( $n=45$ ) workflow implementation to assess utilization of workflow was conducted; Fisher's exact tests were used to gauge changes ( $P<0.05$ ).

**Results:** When comparing pre- and post-medication reconciliation implementation, there was a significant decrease in the number of EMR medications not on the pharmacy list (mean 0.475 vs. 0.208;  $P=0.022$ ). Number of providers reviewing the EMR medication record improved significantly by 30.4% ( $P=0.045$ ). A downward trend in the number of

unintentional medication duplicates also was observed by a 13.3% decrease ( $P=0.07$ ).

**Conclusion:** Implementation of systematic workflow and care team education led to overall improvement in accuracy of EMR medication reconciliation. This quality improvement project led to identification of multiple barriers to accuracy. Future areas of focus would include continued education around current workflow and additional attention to medication compliance via out-of-date prescriptions.

### **FIRST PLACE POSTER (tie)**

#### **Using an Automated Model to Identify Older Patients at Risk for 30-Day Hospital Readmission and 30-Day Mortality**

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**Background:** A real-time electronic health record (EHR) predictive model that identifies older patients at risk for readmission and mortality may assist the health care team in improved patient care.

**Purpose:** This study was performed to generate an automated 30-day readmission and 30-day mortality risk model using data from the EHR in hospitalized older adults.

**Methods:** This was a retrospective cohort study. Included were patients age 65 years and older admitted to the hospital from July 2012 to December 2013. An automated predictive model was derived from variables collected from the EHR including socioeconomic factors, medical diagnoses and health care utilization. The study sample was randomly divided into derivation (70%) and validation (30%) cohorts. Multiple logistic regression analysis was performed to derive a prediction model. A scoring system was developed for estimating risk of 30-day readmission.

**Results:** The study included 11,223 patients in one hospital, of which 46% were male, 20% were age  $> 85$  years, 6.2% were black, 60% required emergency admission, 2.8% required an ICU stay and 62.7% were discharged home. Overall 30-day readmission and mortality rates were 13.7% and 1.5%. The risk model predicted 30-day readmission, with c-statistics of 0.62 (95% confidence interval [CI]: 0.61–0.64) and 0.62 (95% CI: 0.60–0.65) in the derivation and validation cohorts, respectively. A readmit risk score was developed that ranged from 0 to 20. The readmission rate increased as the score increased: score 0–4, readmission rate=8.38%; score 5–9, readmission rate=13%; and score  $>10$ , readmission rate 20% ( $P<0.0001$ ) in the derivation cohort. Results were similar for validation cohort. The risk model predicted 30-day all-cause mortality with c-statistics of 0.81 (95% CI: 0.77–0.86) and 0.73 (95% CI: 0.66–0.81) in the derivation and validation cohorts. The variables associated with mortality included discharge to nursing home, urgent admission status, social

worker consultation and diagnoses of respiratory issues and dementia.

**Conclusion:** A promising automated model generated by EHR data to predict 30-day readmissions and mortality among hospitalized older adults, these findings will be used by the health care system to incorporate a real-time alert into physician workflow. Efforts to improve care will include interventions targeted at the highest-risk group.

### **FIRST PLACE POSTER (tie)**

See page 217 for citation.

### **SECOND PLACE POSTER**

See page 217 for citation.

### **THIRD PLACE POSTER**

#### **Echocardiographic Predictors of Admission Among Patients With Heart Failure With Reduced Ejection Fraction**

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**Background:** Congestive heart failure afflicts 5.7 million people in the United States with annual incidence of 600,000 and mortality of 280,000. Heart failure accounts for greater than 1 million hospitalizations annually and the single largest inpatient Medicare expense. As the U.S. population ages and greater emphasis is placed on population health as a means to bend projected health care expenditures, large health care organizations will need to develop algorithms to identify patients at high risk with heart failure and possibly preempt hospitalizations. Doppler echocardiography is routinely performed in clinical assessment of severe heart failure.

**Purpose:** We sought to determine echocardiographic parameters that predict 1-year cardiac events among ambulatory patients diagnosed with heart failure with reduced ejection fraction.

**Methods:** A retrospective single-institution investigation identified 485 patients aged < 75 years with left ventricular ejection fraction < 35%. Kaplan-Meier method was used to identify parameters that corresponded with primary endpoint of hospitalization, emergency room visit or death.

**Results:** High risk of primary endpoint could be segregated into four groups by presence of one or more of the following parameters (0, 1, 2, 3): mitral inflow E/A ratio > 1.5, mitral E-wave deceleration time < 160 ms or peak tricuspid regurgitant (TR) velocity > 3 m/s. Event-free survival was significantly lower in high-risk group compared to low-risk group (P=0.002). The 30-day hospitalization rates among those with all three factors compared to those without was 37.5% and 17.3%, P=0.018.

**Conclusion:** Presence of routine echocardiographic parameters, including E/A ratio > 1.5, E-wave deceleration time < 160 ms and TR velocity > 3 m/s, is associated with high cardiovascular event rates among nonhospitalized ambulatory patients with reduced ejection fraction heart failure.

### **RIESELBACH DISTINGUISHED PAPER #1**

#### **Cardiopulmonary Exercise Testing-Based Algorithm and Its Usefulness in Clinical Cardiology**

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**Background:** Only cardiopulmonary exercise (CPX) testing provides information on the ability of the cardiovascular system to meet the body's metabolic demands in terms of oxygen consumption (VO<sub>2</sub>) and carbon dioxide production (VCO<sub>2</sub>). However, CPX testing is underutilized by cardiologists due to complex diagnostic algorithms involving up to 30 variables as well as lack of validation studies. In addition, CPX also provides oxygen (O<sub>2</sub>) pulse as a continuous measure of stroke volume, which is its superiority to other stress modalities in which systolic function is measured at peak stress and rest. In the literature, it has been recommended that a composite criterion (combining peak O<sub>2</sub> pulse with O<sub>2</sub> pulse curve pattern) should be used to assess the cardiac function. Furthermore, the operating test characteristics and optimal cutoff of O<sub>2</sub> pulse for distinguishing cardiac from noncardiac causes of exercise limitation also are unknown.

**Purpose:** We tested whether a 6-variable algorithm would discriminate cardiac from noncardiac causes of dyspnea when compared with comprehensive CPX testing to promote its use by cardiologists. We also tested several cutoff points along with the composite criterion against the clinical standard to define the optimal O<sub>2</sub> pulse cutoff point.

**Methods:** Consecutive patients (n=54) referred for dyspnea underwent CPX test consisting of pulmonary (VO<sub>2</sub>, VCO<sub>2</sub>, 22 additional variables and invasive measurement of lactate and blood gases at peak and baseline) and cardiac (exercise ECG, heart rate and blood pressure response) components as well as medical record evaluation. Patients were categorized as normal or abnormal by an experienced pulmonologist. Abnormal patients were further categorized according to cause of dyspnea (cardiac, pulmonary, deconditioning, poor effort and miscellaneous). Subsequently, the 6-variable algorithm was applied by a cardiologist blinded to all of the information from CPX tests, and the patients were categorized similarly. The 6 variables used were peak O<sub>2</sub> uptake, peak respiratory exchange ratio, O<sub>2</sub> pulse, heart rate reserve, breathing reserve (1 - [peak ventilation (VE) / maximal voluntary ventilation]) and ventilatory efficiency (VE/VCO<sub>2</sub>). Seven O<sub>2</sub> pulse reference cutoff points