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# Conference Proceedings: Aurora Scientific Day 2017

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# Conference Proceedings: Aurora Scientific Day 2017

The following abstracts were presented at the 43rd Annual Aurora Scientific Day research symposium, held May 24, 2017, in Milwaukee, Wisconsin. Aurora Scientific Day hosts a forum for original research conducted by faculty, fellows, residents, and other allied health professionals affiliated with Aurora Health Care, an integrated health system with hospital and clinic locations in eastern Wisconsin and northern Illinois.

## **FIRST PLACE POSTER**

### **Assessment of Chronic Disease to Determine Appropriateness of Implantable Cardioverter-Defibrillator Therapy**

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**Background:** Implantable cardioverter-defibrillator (ICD) therapy is considered appropriate when a patient is felt to have a reasonable expectation of 1-year survival. Chronic diseases have been estimated to be associated with greater than 10% annual mortality and may reduce benefits of ICD therapy. Frailty has been estimated to be associated with greater than 20% annual mortality and has been suggested to contraindicate ICD therapy.

**Purpose:** Determine a risk score that may identify patients in whom ICD implantation may not be appropriate.

**Methods:** Patients who received an ICD for primary and secondary prevention from 2008 through 2013 at the Aurora Health Care network were studied retrospectively. Using Cox regression, a scoring system based on hazard ratios was devised to reflect risk associated with comorbidities. Survival was evaluated by Kaplan-Meier estimates.

**Results:** The study cohort includes 1,558 patients (mean age: 61.3 years; 495 female). Comorbidities associated with mortality included in the risk score were need for hemodialysis, myocardial infarct within 3 months prior to ICD implantation, sustained monomorphic ventricular tachycardia, New York Heart Association functional class III, age greater than 70 years, intraventricular conduction delay, diabetes mellitus, and chronic lung disease. A risk score of greater than or equal to 6 was associated with 10% mortality at 1 year and more than 20% mortality by 2 years.

**Conclusion:** Chronic comorbidities have a cumulative effect on mortality. Using our scoring system, patients with a risk score of 6 or greater have at least 10% mortality at 1 year and more than 20% mortality by 2 years.

## **SELECT ABSTRACTS**

### **Sensitivity of Current Methods for Diagnosing and Documenting Metabolic Syndrome Within a Large Community-Based Health Care System**

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**Background:** Metabolic syndrome (MetS) is a constellation of metabolic conditions, including abdominal obesity, high blood pressure, high triglyceride level, low high-density-lipoprotein level and high fasting blood glucose level, that increase the risk of developing chronic health conditions. Various combinations of diagnostic criteria have been proposed, including those by the National Cholesterol Education Program Adult Treatment Panel III (ATP III), World Health Organization (WHO) and International Diabetes Foundation (IDF), among others. However, inconsistent use of diagnostic criteria and inadequate scientific evidence supporting use of specific criteria are current problems in health care.

**Purpose:** Quantify the prevalence of MetS diagnosis within the Aurora Health Care patient population and determine the sensitivity (ie, accuracy) achieved in documenting MetS within Aurora, recognizing ATP III, WHO and IDF definitions of MetS as diagnostic gold standards.

**Methods:** We conducted a retrospective review of all patients encountered within Aurora from January 1, 2012, to December 31, 2015. Patients were examined to determine the occurrence and associated dates of MetS diagnosis and all indications of satisfied MetS diagnostic criteria. Indications of obesity, hyperglycemia, hypertriglyceridemia, hypoalbuminemia and hypertension, as variably defined in ATP III, WHO and IDF guidelines, included relevant diagnoses, abnormal clinical and laboratory test results and use of medications. Sociodemographic data also were collected.

**Results:** In total, 1,369,620 unique patients visited Aurora during the study period, with 28% of patients aged  $\geq 60$  years and most identifying as non-Hispanic white (76.8%) or black (9.93%) race. Only 4,978 patients (0.36%) received a clinical diagnosis of MetS despite evidence of satisfied ATP III and WHO criteria in 12.0% and 16.7% of patients, respectively. Satisfaction of IDF criteria occurred in only 0.16% of patients. Except for hyperglycemia, individual diagnostic criteria also showed lower-than-expected rates of clinical diagnosis. For example, obesity was diagnosed in 7.86% of patients but suggested in 39.3% of patients with body mass index  $\geq 30$  kg/m<sup>2</sup>. The true positive rate (ie, percentage of patients with satisfied criteria who also were clinically diagnosed) was lowest in older, male, black or Hispanic patients.

**Conclusion:** Within Aurora, metabolic syndrome is rarely and variably diagnosed in medical practice, despite clear evidence of satisfied ATP III and WHO criteria.

### Improved Service Efficiency Improves Racial Disparity in Diabetic Care

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**Background:** Racial disparities in diabetes care have been documented. Disparities also have been shown to affect service quality and outcome of diabetic care. Analysis of our internal medicine residency clinic diabetic care management performance across REAL-G (race, ethnicity, age, preferred language and/or gender) showed race-based disparity on two outcome measures: 1) measurement of glycohemoglobin (A1C) at least twice a year; and 2) target blood pressure of < 140/90.

**Purpose:** Develop interventions to decrease racial disparities in diabetes care among patients managed by an internal medicine residency clinic, as part of the Alliance of Independent Academic Medical Center's National Initiative V project.

**Methods:** Interventions were developed following analysis of clinic performance data by REAL-G categories, workflow analysis and multidisciplinary clinic team meetings. A point-of-care A1C machine was procured and workflow developed using the Plan-Do-Study-Act cycle. Staff training was conducted. A rolling 12 months data set was obtained from electronic health records. Baseline data range was December 2014 to November 2015, while endline data were from January 2016 to December 2016. The interventions were launched in July 2016. Percentage difference between baseline and endline outcome indicators was calculated and Z-score test assessed. Statistical significance was set at  $P < 0.05$ .

**Results:** At baseline, 62.9% (401 of 638) of patients who self-identified as African American/black (AA) had A1C measured at least twice a year compared to 74.3% (107 of 144) of patients who self-identified as white/Caucasian (WC), a percentage difference of 11.4% ( $P=0.01$ ). For goal blood pressure in diabetics, 71.0% (453 of 638) of AA met the target as compared to 80.6% (116 of 144) of WC, a percentage difference of 9.6% ( $P=0.003$ ). Following the intervention, a higher percentage of AA patients (71.4% [381 of 534]) had at least two A1C measured during project period. The outcome also showed improvement for WC (79.8% [95 of 119]). The percentage difference between races narrowed to 8.5% ( $P=0.06$ ). For goal blood pressure, 75.1% of AA achieved the target compared to 81.5% of WC, with percentage difference narrowing to 6.4% ( $P=0.14$ ).

**Conclusion:** Racial disparities in diabetes were confirmed, even for a clinic setting in which black patients are predominant. Racial disparity can be improved by implementing interventions that improve service for all patients.

### Generation of a Patient-Derived Brain Metastasis Breast Cancer Cell Line via Novel Orthotopic Injection Placement and Serial Mouse Transplantation to Develop PDX Mouse Model

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**Background:** The incidence of brain metastasis appears to be increasing, potentially due to advanced technology that aids early diagnosis. Patient-derived xenografts (PDX) have high translational value, as these models retain key functional characteristics of the patient tumor. PDX models are useful to understand the molecular basis of tumorigenesis and to identify new treatment targets. However, generating a first-line PDX model is challenging as engraftment failure is high. Serial transplanting tumor tissue via mouse-to-mouse propagation increases engraftment rates and decreases PDX development time. Herein we report methods to generate a PDX cell line from patient-derived tumor tissue that includes the cerebral aqueduct as a novel intracranial orthotopic implantation site.

**Purpose:** Develop human tumors in mouse models for therapeutic purpose.

**Methods:** Patient-derived brain metastasis tumor tissue was enzymatically dissociated into a single cell suspension and maintained in neurocult media supplemented with human recombinant bFGF and EGF (20 ng/ml). The cells were seeded at a density of  $1.0 \times 10^4/\text{cm}^2$  on ultra-low attachment plates and maintained at 37°C with 5% CO<sub>2</sub>. PDX models were generated via orthotopic stereotactic surgeries. Athymic nude mice were anesthetized with an intraperitoneal injection of ketamine (100 mg/kg) and xylazine (10 mg/kg). The cerebral aqueduct was located using these coordinates from bregma: A: -5; L: +0.2; V: -2.4. Mice were injected with  $5.0 \times 10^4$  cells in 2 µl of media at a rate of 0.4 µl/min. Mice were monitored daily for symptoms of tumor formation. Upon becoming symptomatic, mice were euthanized and tumor tissue was harvested for both culture and H&E stain for tumor verification.

**Results:** Mice injected with primary patient cells (first-generation mice) developed tumors at 7 weeks (average: 6.77 weeks), second-generation mice yielded tumors at 2 weeks (average: 13.5 days), and third-generation mice replicated results from second-generation mice (average: 13 days). H&E stain revealed invasive tumor masses in the ventricular system that extended from the cerebral aqueduct to the lateral ventricles. Immunohistochemistry analysis confirmed the third-generation cell line retained key characteristics of the patient tumor.

**Conclusion:** These methods successfully generated a PDX cell line from patient-derived brain metastasis that demonstrates reliable tumor formation and phenotypic stability. Importantly, our unique intracranial implantation site revealed several distinct masses, a hallmark of brain metastasis in patients.

### Decreasing Time to Broad Spectrum Antibiotics for Septic Patients in the Emergency Department

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**Background:** Timely administration of broad spectrum antibiotics has been shown to be directly correlated with decreased mortality for patients with severe sepsis and septic shock. As such, both the Surviving Sepsis Campaign and the SEP-1 CMS measure recognize timely antibiotic administration as a cornerstone of therapy for patients with severe sepsis or septic shock.

**Purpose:** Decrease time to broad spectrum antibiotic administration for septic patients in the emergency department (ED) of Aurora St. Luke's Medical Center.

**Methods:** An alert within the electronic medical record was created to more rapidly identify potentially septic patients in the ED. After

receiving the alert, ED pharmacists reviewed the patient profile, including differential diagnosis; antibiotic allergies, reactions and/or previous tolerance; recent bacterial cultures; and any antibiotics already ordered, to assess dose and spectrum of coverage. Pharmacists intervened as needed to ensure patients received appropriate broad spectrum antibiotics. Antibiotics were defined as broad spectrum in the same manner as by the Centers of Medicare and Medicaid Services in its Early Management Bundle, Severe Sepsis/Septic Shock. Education was provided to physicians, nurses and pharmacists to encourage timely administration. Outcomes to be measured include mean time to broad spectrum antibiotics, percentage of patients who received broad spectrum antibiotics within 1 hour of presentation, and percentage of patients who received broad spectrum antibiotics within 3 hours of presentation.

**Results:** Pre-alert intervention, patients who were coded with the ICD-10 codes for sepsis, severe sepsis or septic shock in May 2016 (n=65) were analyzed to determine mean time to broad spectrum antibiotics ( $2.81 \pm 1.63$  hours), percentage of patients who received broad spectrum antibiotics within 1 hour (3.1%), and percentage of patients who received broad spectrum antibiotics within 3 hours (67.7%). Post-alert outcomes will be reported at Aurora Scientific Day.

**Conclusion:** To be reported at Aurora Scientific Day.

### **Mechanisms of Left Ventricular Thrombus Formation in Heart Failure With Reduced Ejection Fraction: Novel Insights From Two-Dimensional Speckle Tracking Echocardiography**

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**Background:** Patients suffering from heart failure with reduced ejection fraction (HFrEF) are at increased risk for left ventricular (LV) thrombus and subsequent thromboembolism, yet anticoagulation is not routinely recommended for left ventricular ejection fraction (LVEF) alone. We sought to determine the role of two-dimensional speckle tracking echocardiography (2D-STE) to quantify regional changes in cardiac function associated with LV thrombus, which may prospectively guide anticoagulation.

**Purpose:** Help enable cardiovascular clinicians to use 2D-STE to evaluate regional strain patterns among patients with HFrEF with and without LV thrombus. Our results suggest that statistically lower regional longitudinal strain patterns in a well-matched cohort identified patients with thrombus. The postulate that these patterns existed prior to the formation of thrombus remains to be tested. Our results warrant further investigation with a larger prospective cohort.

**Methods:** We retrospectively identified patients with  $LVEF \leq 35\%$  who had LV thrombus (n=12) and a matched (in demographics and LVEF) cohort who did not have LV thrombus (n=36). We performed offline 2D-STE longitudinal strain analysis. Descriptive statistics were used to compare variables.

**Results:** The average age of identified patients was  $62.7 \pm 15.0$  years; 71% were male. LVEF was not statistically different. LV end-diastolic diameter was increased in LV thrombus group ( $6.2 \pm 1.1$  cm vs  $5.5 \pm 0.65$  cm,  $P=0.014$ ). LV thrombus group had consistently reduced regional strain in the inferior wall ( $-5.3 \pm 3.9$  vs  $-8.3 \pm 4.1$ ,  $P=0.033$ ), at the apex ( $-5.3 \pm 4.4$  vs  $-8.9 \pm 4.0$ ,  $P=0.012$ ), and in the left anterior descending coronary distribution ( $-5.3 \pm 3.4$  vs  $-7.8 \pm 3.4$ ,  $P=0.031$ ). There was no significant difference in global longitudinal strain or strain dispersion.

**Conclusion:** Among patients with HFrEF, LV thrombus is associated with reduced longitudinal strain in inferior and apical regions and in the left anterior descending territory.

### **Challenges in Delivering Refugee Health Services**

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**Background:** Aurora Health Care is the major health care system providing care to refugees in Milwaukee, where half of Wisconsin's refugee population resides. Like many other institutions caring for refugee patients, Aurora faces significant challenges when trying to address refugee health needs. Even with the assistance of medical interpreters, cultural differences, language barriers and limited patient health literacy, as well as lack of knowledge of refugee patients' backgrounds, are major obstacles encountered by health care providers in this setting.

**Purpose:** This quality improvement study aims to assess Aurora providers' perceptions of the benefits and barriers to working with refugee patient populations.

**Methods:** An online survey was distributed to health care providers and staff at two academic family practice clinics before and after a 5-session educational series. Each educational session delivered monthly focused on refugee cultural awareness. Mental health providers and former refugees working as case managers or interpreters provided education about the main refugee populations in Wisconsin and the refugee resettlement process. The survey assessed participants' perceptions about providing health care to refugees. Participants were asked to respond to questions on a Likert scale from 1 to 7 (ie, strongly disagree to strongly agree) and to two questions comprised of rank choices investigating barriers to effective health care delivery. Responses to questions on Likert scale  $\geq 5$  were lumped into an agreement category, while all others were considered a disagreement. Fisher's exact test was used to compare pre- and posteducation responses.

**Results:** Perception about new medical knowledge and cultural competency had statistically significant increase comparing pre- and postintervention data ( $P=0.0474$ ). Insufficient interpreter services and insufficient time for appointments were ranked the top barriers to providing health care services to refugees before and after intervention. Participants also ranked refugees' poor understanding of the U.S. health care system as the biggest challenge in delivering care for refugee patients before and after intervention, followed by communication with resettlement agencies in the preintervention survey and cultural differences in the postintervention survey.

**Conclusion:** Promotion of cultural awareness and proficiency within groups delivering primary care to refugees can be a valuable tool when trying to overcome obstacles.

### **Identifying and Targeting Age-Related Colorectal Cancer Screening Rate Disparities in Family Medicine Residency Clinics**

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**Background:** Health care systems continuously seek to improve patient care through population-level analysis of clinical quality metrics and patient characteristics to identify disparities in care. Nationally, disparities in colorectal cancer (CRC) screening rates have been identified with lower screening rates reported for patients who are uninsured and/or lower socioeconomic status, African American/black, Asian, and non-English-speaking Hispanic patients. No age-related CRC screening rate disparities with associated interventions have been reported.

**Purpose:** Determine and address CRC screening disparities in care provided to eligible patients > 50 years old in two primary care residency clinics.

**Methods:** Retrospective analysis using REAL-G (race, ethnicity, age, preferred language, gender) categories and insurance coverage was completed on a 12-month data set to identify presence of CRC screening disparities. Barriers to CRC screening for largest disparity gap were then identified by clinic staff at two family medicine residency clinics (a third primary care clinic in same zip code and service region were used for nonintervention comparison) using the Institute for Healthcare Improvement fishbone approach. The project team, informed by the literature, then identified and implemented targeted interventions, monitoring progress during a 6-month period. Interventions included provider education with periodic reminders regarding system-approved CRC screening options and a workflow-based intervention. Postintervention analysis was completed using same preintervention approach.

**Results:** The largest CRC screening disparity for region and clinics was associated with age, with screening gaps ranging from 13% to 15% between populations aged 50–54 years versus >65 years. CRC screening rate disparities by race, ethnicity, and gender were less than 10%. Postintervention, one targeted clinic had a 6% increase in the CRC screening rates in the target population (age: 50–54) while a second targeted clinic had a 1% increase in screening rates during this period. The comparison primary care residency clinic had a 1% decline in CRC screening rates. Differences in insurance utilization types for CRC screening rates by clinic were noted. Differences between targeted clinic screening rates were attributed to successful workflow implementation and provider/staff champions.

**Conclusion:** Analyzing population data at a micro/clinic level using REAL-G categories can inform targeted interventions that aim to reduce health disparity gaps.

### Variations in Practice of Apnea Test for Brain Death: Review From a Multihospital Health Care System

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**Background:** Ventilation encompasses both active and passive processes. Air is initially drawn into the lungs due to a negative intrathoracic pressure created using the respiratory muscles, most importantly the diaphragm. In contrast, expiration is the passive relaxation of the respiratory muscles. Oxygenation occurs when oxygen diffuses across the alveolar-capillary membrane. The ability to oxygenate without ventilation has been termed apneic diffusion oxygenation or apneic oxygenation. We believe it is crucial to keep alveoli open in order for adequate oxygenation to occur. This can be achieved with the aid of positive end-expiratory pressure (PEEP). We investigated this concept in patients who are brain-dead because they cannot ventilate. The stimulus to breathe originates from chemoreceptors in the brainstem. These cells respond to a decrease

in pH by triggering the body to take a breath. A positive apnea test confirms that the patient has no functioning brainstem.

**Purpose:** Determine the rate of pO<sub>2</sub> and pCO<sub>2</sub> changes during different methods of the apnea test and identify variations in practice within Aurora Health Care.

**Methods:** Data were collected retrospectively on brain-dead patients older than 18 years. Data points pulled from Epic medical records included serial arterial blood gases (ABGs) that were completed during the apnea test and patient demographics. The rate of change in pCO<sub>2</sub> and pO<sub>2</sub> was evaluated using both Mann-Whitney and two-sample t-tests comparing a PEEP valve group to all other oxygenation methods.

**Results:** Eight variations of the test were performed, with median starting CO<sub>2</sub> for the oxygenation and PEEP group of 43 and 44 mmHg, respectively (95% confidence interval: 26–53, P=0.6771). Oxygenation group had a mean CO<sub>2</sub> increase of 2.95 mmHg/minute, whereas the PEEP valve group increased at 4.60 mmHg/minute. No statistical significance was found (P=0.0508). Neither was there significant difference between the rate of desaturation between the oxygenation and PEEP valve group (6.53 mmHg vs 2.60 mmHg, respectively; P=0.5536).

**Conclusion:** We found no difference in the rate of CO<sub>2</sub> increase comparing the oxygenation group to the PEEP valve group. This suggests that there is no significant component of CO<sub>2</sub> washout in the lungs using the PEEP valve setup. A superior method of apneic oxygen was not able to be demonstrated with our results due to an insufficient sample size and practice variations. The most common method to perform the apnea test at our institutions is preoxygenation.

### Effects of Revision Surgery on Grade of Adverse Local Tissue Reaction Following Recall of a Modular Hip Implant

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**Background:** The Stryker Rejuvenate modular hip implant device allows for greater versatility in matching a patient's anatomy than conventional implants. Device recalls and in vivo metal hypersensitivity after total hip arthroplasty (THA) are common. However, recall of the Rejuvenate implant represents one of the largest recall volumes to date, highlighting our uncertainty regarding causes of device metal fretting/corrosion and adverse local tissue reaction (ALTR). While devices with metal-on-metal bearings historically were culprits for release of metal debris, more recently developed modular-neck devices add opportunity for adjacent metal components to rub together. With the Rejuvenate device, corrosion or fretting likely occurs at the cobalt-chromium neck and titanium stem interface. Cobalt (Co) and chromium (Cr) particles then irritate tissues locally and cause a gradation of problems or indications of ALTR.

**Purpose:** Quantify the effect of revision surgery on ALTR grade in patients who previously underwent THA receiving the recalled Rejuvenate hip implant.

**Methods:** We conducted a prospective observational study of all patients who underwent THA performed by a single Aurora Health Care orthopedic surgeon using the Rejuvenate implant. Following implant recall in July 2012, patients were notified via letter/phone and asked to visit regularly (every 3–6 months) for lab work, imaging and device assessment. Using repeated measures multinomial logit analysis we examined the effect of revision surgery on abnormal grade of ALTR (ie, grade 1–4 vs 0), adjusting

for patient characteristics, device specifications and indicators of post-THA complication (serum Cr ion, Co ion, C-reactive protein, erythrocyte sedimentation rate).

**Results:** In total, 162 hips and 152 unique patients underwent THA during September 2009–May 2012, with 78 hips subsequently revised during 2012–2015. Patients were of median age 62 years (range: 32–90), nearly all non-Hispanic white (89%) and mostly female (58%). Several variables were significantly associated ( $P<0.05$ ) with ALTR grade, including occurrence of complication symptoms (eg, pain), patient age, and Co ion concentrations. Revision surgery was the most strongly associated variable with ALTR, with 5 times greater odds of abnormal grade when not undergoing revision (odds ratio: 5.68, 95% confidence interval: 2.69–11.9).

**Conclusion:** Within Aurora, patients who underwent THA with the Stryker Rejuvenate hip implant often experienced the complications of ALTR, but revision surgery reduced the ALTR grade.

### Family Practice Resident Expectations by Year From Faculty and Resident Perspectives: A Quality Improvement Initiative

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**Background:** The transition from student to physician requires substantial commitment and work from residents as well as guidance from program faculty. The Accreditation Council for Graduate Medical Education (ACGME) has standardized certain academic requirements for U.S. residency programs; however, faculty expectations of residents according to year in the program are less formal and more a hidden curriculum. Setting expectations for residents to consult could better help residents navigate their graduate medical education experience and achieve the level of excellence expected by ACGME.

**Purpose:** Our quality improvement study aimed to: 1) determine what the expectations of family practice residents were based on feedback from faculty members and current residents; and 2) share these expectations with residents.

**Methods:** A preintervention survey was emailed to family medicine program faculty and residents regarding resident expectations according to year in the program. Based on the results of the preintervention survey, expectations were outlined in a handout according to year in the program and were presented to current residents during scheduled didactic time. Residents who responded to the preintervention survey were then asked to respond to the postintervention survey. Fisher exact tests were used to compare pre- and postintervention survey responses.

**Results:** Overall, 64% (14 of 22) of faculty and 64% (18 of 28) of residents responded to the preintervention survey. While 79% of faculty expressed that they had specific expectations for residents, 77% felt that residents did not know these expectations. Additionally, while residents (94%) believed faculty had expectations of them, only 33% knew what the expectations were. Following intervention, 15 of 18 residents responded, with 79% now reporting they knew what the expectations were ( $P=0.02$ ). The handout was found useful by all those queried, and 85% felt it clarified expectations.

**Conclusion:** At baseline, residents and faculty knew there were expectations for residents as they progress through the program, but those expectations were not explicit. Despite the lack of vertical communication, the expectations from both groups were surprisingly similar. A handout delivered electronically and at didactic sessions

was deemed useful and clarified expectations.

### The Lifestyle Initiative: An Innovative Coaching-Based Quality Improvement Study to Improve the Health of Aurora Health Care Caregivers and Family Members

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**Background:** Self-management support has been shown to improve clinical outcomes. Health coaching, one form of self-management support, empowers patients within the health care system by providing information and through collaboratively developed care plans.

**Purpose:** Assess the impact of The Lifestyle Initiative, a coaching-based health program utilized by Aurora Health Care caregivers or family members.

**Methods:** The Lifestyle Initiative is a coaching-based approach for Aurora caregivers or family members enrolled in Aurora's health insurance network. Individuals were recruited from the care management database, and all participants had an Aurora primary care provider. Participation was limited to those  $\geq 18$  years of age who had a diagnosis of type 2 diabetes or hypertension (or both), had glycated hemoglobin (A1c)  $\leq 8.0$ , and were not on insulin. The Lifestyle Initiative was rolled out in three phases. Phase I: health coaching sessions through a standard web- and app-based platform (Noom Health), and access to a stress-management program (HeartMath). Phase II: health coaching sessions through a standard web- and app-based platform co-created by Aurora's Department of Integrative Medicine and Noom Health, and access to HeartMath; Phase III: health coaching sessions through a standard web- and app-based platform (Noom Health), and a customized web- and app-based platform. Those enrolled in each phase acted as their own controls. Paired t-tests were used to compare pre- and postintervention results of each phase.

**Results:** The majority of Phase I participants ( $n=23$ ; mean age 54.4 years) were female (91.3%) and white (52.2%). Preintervention A1c and blood pressure were not statistically different postintervention. However, pre- vs postintervention weights were statistically different (228.2 vs 218.5 lb;  $P<0.01$ ), as well as pre- vs postintervention body mass index (37.3 vs 35.7 kg/m<sup>2</sup>;  $P<0.01$ ). The majority of Phase II participants ( $n=63$ ; mean age 54.8 years) also were female (81.0%) and white (88.9%). Pre- and postintervention blood pressures were not statistically different. However, pre- vs postintervention A1c (7.2 vs 6.6;  $P<0.02$ ), weights (229.6 vs 225.7 lb;  $P<0.05$ ), and body mass index (37.1 vs 36.5 kg/m<sup>2</sup>;  $P<0.05$ ) were statistically improved. Phase III data collection is underway.

**Conclusion:** The Lifestyle Initiative health coaching program significantly improves certain health metrics when applied to health system employees and family members with diabetes or hypertension. Further study is needed to explore sustainability and the effects of more robust programs.

### Improving Obstetrics in Family Medicine Residency Clinics: A Quality Improvement Study

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**Background:** Prenatal care/deliveries within our family medicine clinics have declined, perhaps because patients are unaware that our clinics provide these services. With lower volumes, clinicians may feel less comfortable with current skills/knowledge of obstetric (OB) care.

**Purpose:** Increase family medicine clinic OB numbers, patient awareness, and clinician comfort/knowledge in OB.

**Methods:** English-fluient patients (18–50 years), residents and faculty at Aurora family medicine residency clinics were included. Patients were provided preintervention surveys upon check-in. Residents/faculty were surveyed via Survey Monkey. Changes made based on initial survey results were: 1) increasing systemwide awareness that our caregivers provide OB care, through fliers at emergency departments/urgent cares or posters in clinic waiting rooms; 2) keeping at least one same-day visit for OB patients; 3) distributing standard OB note templates to residents/faculty; and 4) placing patient educational handouts at each clinic. Patients, residents and faculty were reassessed at 9 months postintervention. Surveys were analyzed with Fisher's exact tests.

**Results:** Respondents to the preintervention survey included 83 patients, 26 residents and 19 faculty; 61 patients, 23 residents and 21 faculty responded to the postintervention survey. On both pre- and post-surveys, patients knew that their providers delivered babies (59% vs 57%, respectively;  $P=0.86$ ). However, only 22% and 33% of patients, respectively, had a doctor at our clinics deliver their baby or partner's baby ( $P=0.25$ ). Even so, 95% and 100% of patients, respectively, would recommend their friends or family to our family practice clinics if they became pregnant ( $P=0.14$ ). On the pre-survey, 38% of residents felt clinic OB numbers were adequate versus 70% following intervention ( $P<0.05$ ). On both pre- and post-surveys, residents planned on incorporating obstetric or prenatal care into their future practice (42% vs 52%, respectively;  $P=0.57$ ). On both pre- and post-surveys, faculty felt comfortable with OB skills and knowledge (53% vs 62%, respectively;  $P=0.75$ ). Lifestyle was the most common reason faculty gave for why they stopped doing deliveries (37% vs 33%, respectively).

**Conclusion:** Implementation of changes to our OB workflow resulted in non-statistically significant improvements in viewpoints toward OB. Resident feelings of OB number adequacy significantly improved following intervention. Further study in multiple clinics could confirm the effectiveness and reasons for success of our interventions.

### Brain Imaging in Older Patients With Delirium

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**Background:** Delirium is a common, serious and costly condition in older patients admitted to the hospital. This study describes the prevalence and results of brain imaging among a cohort of older hospitalized patients with and without delirium.

**Purpose:** Investigate the frequency and results of brain imaging in older patients with delirium as compared to those without delirium.

**Methods:** This was a cross-sectional study. Data were collected on hospitalized patients age 65 years or older who were admitted to 3 hospitals in Milwaukee, Wisconsin, during a 1-month period in the fall of 2013. Subjects were tested for delirium via the "Confusion Assessment Method" by researchers for another study. The collected data included demographics, presence of delirium, computed tomography (CT) and magnetic resonance imaging (MRI), and results of the imaging procedures. The imaging studies were done as

a part of their medical care. The authors reviewed the radiologist's final readings of the imaging studies. For all categorical variables, chi-squared/Fisher's test was used with alpha of 0.05.

**Results:** A total of 92 patients were included in the study. Prevalence of delirium was 17.4%. Mean age was 77 years. Overall, 24% had a CT and 9% an MRI, with the most common abnormal finding being chronic microvascular changes (13%). CT scan was performed in 44% of patients with delirium and 20% of patients without delirium ( $P=0.04$ ). MRI was performed in zero patients with delirium and 11% without delirium ( $P=0.34$ ). When patients with delirium were compared with patients without delirium, respectively: normal imaging was described in 1 vs 2 patients ( $P=0.70$ ); cerebral atrophy in 3 vs 6 ( $P=0.99$ ); chronic microvascular changes in 2 vs 10 ( $P=0.17$ ); and acute hematoma (subdural or intraparenchymal) in 3 (43%) vs 0 ( $P=0.02$ ).

**Conclusion:** In this limited study, patients with delirium were noted to be more likely to have had a CT scan. Older patients with delirium had a variety of findings on brain imaging, some of which were more clinically relevant. No specific imaging changes were diagnostic for delirium.

### Quality Improvement Study for Postpartum Hypertension Readmissions

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**Background:** Hospital readmission rates are a focus of the Centers for Medicare and Medicaid Services. This was identified as a system opportunity to improve health care quality and patient education in order to reduce preventable readmissions. In 2009, 27% of obstetric readmissions were due to hypertensive disease, and preventable readmissions regarding hypertension are flagged as an area for quality improvement in our health care system. There is limited evidence on specific management of postpartum hypertension.

**Purpose:** Identify risk factors in our community and reduce postpartum readmissions for hypertension within our hospital.

**Methods:** We performed a retrospective chart review from November 2014 to November 2015. We collected demographic data, comorbidities and information regarding hospitalization and readmission. In this, we identified 28 readmissions for postpartum hypertension, representing 57% of obstetric readmissions and noted that discharge instructions and blood pressure monitoring postpartum were two areas for improvement. Only 18% had printed instructions regarding postpartum hypertension. Via multidisciplinary education sessions, we aimed to increase surveillance for postpartum vitals for at-risk patients and provide appropriate verbal and written precautions for signs and symptoms of de novo or worsening hypertensive disease. We also improved access to care by scheduling blood pressure checks within 72 hours of discharge and utilization of visiting nursing services for blood pressure checks. The same measures were then recollected for readmissions from June 2016 to December 2016.

**Results:** After intervention, 61% of readmissions were related to hypertension, with 31 readmissions. Overall, there was a significant improvement in written discharge instructions regarding postpartum hypertension, with 94% receiving written instructions. At discharge, 33% had blood pressure checks and 13% had visiting nursing services arranged.

**Conclusion:** Postpartum hypertension is more recognized, and readmissions are becoming more common. We increased efforts to optimize medical management of hypertension and reduce preventable readmissions. Improvement in discharge instructions for patients did not decrease overall admission for postpartum hypertension but may have improved overall patient care. Overall cost analysis would be beneficial to see further economic impact.

### **Robustness of a Newly Proposed Risk Schema for Lymphatic Dissemination in Endometrioid Endometrial Cancer**

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**Background:** Surgical management for endometrioid endometrial cancer (EEC) includes complete lymph node dissection for all patients at risk of lymphatic dissemination. The standard risk schema, defined by Mayo Clinic, identifies low-risk patients as those with grade 1/2 EEC, myometrial invasion (MI)  $\leq$  50%, and tumor diameter (TD)  $\leq$  2 cm. We recently proposed (and published) a risk schema containing modified forms of grade, MI and TD that suggests a significant decrease in false-negative rate and need for lymphadenectomy in low-risk women.

**Purpose:** Evaluate robustness of our proposed schema for lymphatic dissemination risk stratification in a subsequent EEC patient cohort.

**Methods:** We retrospectively applied the proposed schema to patients diagnosed with stage I–III EEC during 2014–2015 who underwent pelvic and/or para-aortic lymph node removal. Cancer Registry data were confirmed via chart review. Consistent with the cohort studied during model development, the validation cohort included non-Hispanic white or black patients with complete data describing TD ( $\leq$ 50 mm or  $>$ 50 mm), MI ( $\leq$ 33%,  $>$ 33% to  $\leq$ 66%, or  $>$ 66%) and grade (1 or 2–3).

**Results:** In the validation cohort, 29 (11.7%) of the 247 EEC patients were node-positive (vs 9.2% of 737 patients in the development cohort). Risk stratification using the proposed schema produced similar false-positive rates during model development (57.2%) and validation (54.6%), both 20% lower than when using the standard schema (76.2% and 74.3%, respectively). False-negative rates, however, were noticeably different between development and validation cohorts using both the proposed (0% and 13.8%) and standard (1.47% and 6.90%) schemas, suggesting a shift toward low-risk classification in node-positive patients of the validation cohort.

**Conclusion:** Application of the proposed risk stratification schema to an alternative patient cohort verified the utility of modified risk criteria, including TD with 50-mm cutoff, for identifying low-risk EEC patients who may not require node evaluation. However, in the validation cohort, greater prevalence of lymph node metastasis and low-risk classification of node-positive patients was observed. Discrepancy between cohorts is likely due to greater utilization of sentinel lymph node mapping during the validation period, allowing for increased detection of low-volume metastases. Continued model development and validation is needed, especially to account for the increased sensitivity of new technologies.

### **FMT Placed by Colonoscopy: Systematic Review and Meta-Analysis**

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**Background:** Fecal transplants are successful in the treatment of recurrent or refractory *Clostridium difficile* infections (CDI), but there is no consensus on the best method of instillation. Studies have shown greater success with lower gastrointestinal tract placement, but technical aspects of placement are not validated.

**Purpose:** This review aims to identify common traits and procedural techniques of successful fecal microbiota transplant (FMT) therapy via colonoscopy.

**Methods:** An electronic search was conducted using OVID Medline and PubMed for articles published from January 2010 to January 2016. The primary outcome of interest was cure by FMT placed via colonoscopy.

**Results:** Of the 337 articles reviewed, we included 24 studies, from which 11 case reports were excluded from data analysis. The resultant data included 366 patients (64% female). Point estimate for cure of CDI after FMT for patients over 65 years of age (9%) was 84.6% (95% confidence interval [CI]: 0.58–0.96;  $P < 0.016$ ), cure over the age of 18 with no upper limit specified on age (74%) was 85.4% (95% CI: 0.76–0.91;  $P < 0.001$ ) and, for those identified strictly as 18–65 years old (17%), cure was 93% (95% CI: 0.83–0.98;  $P < 0.001$ ). Patients who stopped antibiotics at least 48 hours prior to FMT (37%) had a cure rate of 86% (95% CI: 0.78–0.91;  $P < 0.001$ ) compared to 95% (95% CI: 0.90–0.98;  $P < 0.001$ ) in patients who stopped antibiotics at least 24 hours prior to FMT (43%) and 81% (95% CI: 0.53–0.94;  $P < 0.035$ ) in those who stopped less than 24 hours prior to FMT (15%). In studies that specified use of GoLYTELY<sup>®</sup> prep prior to colonoscopy (58%), cure was 91% (95% CI: 0.85–0.95;  $P < 0.001$ ); whereas those using a split 2-L polyethylene glycol prep (21%) had 79% cure (95% CI: 0.61–0.90;  $P < 0.004$ ). Placement of FMT throughout the colon (6.8%) had 96% cure (95% CI: 0.77–0.99;  $P < 0.002$ ) versus terminal ileum to cecum placement (59%) at 88% cure (95% CI: 0.78–0.94;  $P < 0.001$ ) and cecum to ascending colon (28%) at 86% cure (95% CI: 0.63–0.95;  $P < 0.006$ ). Studies that specified the use of loperamide after FMT (21%) had a cure of 85% (95% CI: 0.63–0.95;  $P < 0.004$ ).

**Conclusion:** FMT placed by colonoscopy has a role in the cure of recurrent or refractory CDI. Stopping antibiotics 24 hours prior to FMT results in higher percentage cure (95%). Distribution of FMT throughout the colon has better outcomes than FMT instillation at other locations. Effect of loperamide post-FMT placement is not conclusive due to the low percentage of reported use. Prospective studies are recommended to study these factors for confirmation of effects.

### **Six-Year Experience of Influenza Vaccination as a Condition of Employment for a Large Regional Health Care System**

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**Background:** Influenza remains a significant contributor to morbidity and mortality in the United States. Health care workers (HCW) can be both victims and vectors of influenza. Influenza vaccination of HCW is protective for both caregivers and patients, but voluntary programs generally fail to achieve rates recommended by the Centers for Disease Control and Prevention. Despite a complex, multifaceted influenza program initiated in 1996 that included significant education and promotion as well as free on-site vaccination, annual Aurora Health Care caregiver immunization rates remained in the mid-70s until adoption of a “condition of employment” strategy in 2011.

**Purpose:** Discuss the annual effectiveness of the program at achieving caregiver vaccination.

**Methods:** A steering committee and subgroups meet regularly to evaluate exemption requests, vaccine supply/distribution/ordering, immunization rates and general program overview. In July 2016, an online wellness survey of influenza program perceptions was offered to all Aurora caregivers.

**Results:** In the 2016–2017 flu season, 97.3% of HCW were vaccinated. New medical exemption requests have varied from 72 to 127 per year, with a decreasing trend again reflecting the prevalence of permanent exemption. The number of approved annual religious exemptions grew from 39 in 2011 to 64 in 2016–2017. Since the initial year of implementation, when resignation of 11 HCW was attributed to the vaccination requirement, the number of such resignations has dwindled to 2. Caregiver perceptions: 1,931 caregivers completed the online survey (approximately 6.4% of all employees). A 5-point Likert scale was used to assess level of agreement with several statements. Caregivers expressed the highest level of agreement with the statement that “the program makes it convenient to get vaccinated” (89% agree or strongly agree) and the lowest level agreement with “the program keeps me healthier” (54% agree or strongly agree).

**Conclusion:** An influenza program as a condition of employment leads to high levels of immunization of HCW, with minimal impact on HCW retention and satisfactory satisfaction among HCW.

### **Positive Impact on Patient Satisfaction and Caregiver Identification Using Team Facecards: A Quality Improvement Study**

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**Background:** Patients satisfaction is an increasingly important metric in measuring the quality of care that hospitals and physicians provide. It can be difficult for patients to remember their providers and their roles, all of which may potentially impact a patient’s overall satisfaction.

**Purpose:** To see if giving facecards with pictures and names of caregivers and description of roles improved patient satisfaction and identification of care team members.

**Methods:** Team facecards were designed and distributed to the patients during the interventional period of the study. Patients’ identification of team members, the role of each physician and overall satisfaction was measured using a longitudinal prospective survey. Patients in the control arm of the study took the same survey but did not receive team facecards.

**Results:** A total of 192 patients completed the survey. They were divided into a control group (n=96, 50%) and an interventional group (n=96, 50%) during the period of the study (February 2016–August 2016). Patients who received the intervention were more likely to identify: their team attending (71 [74%] in the interventional group vs [34.4%] in the control group;  $P<0.001$ ); team resident (40 [40.7%] in the interventional group vs 25 [26%] in the control group;  $P=0.0222$ ); team intern (42 [43.8%] in the interventional group vs 19 [19.8%] in the control group;  $P=0.0004$ ). Patients in the interventional group reported slightly higher level of satisfaction (72 [75%] reported level of satisfaction  $> 9$  on a scale of 1 to 10 in the interventional group vs 59 [61.5%] in the control group).

**Conclusion:** Use of facecards improves patient identification of primary team members and roles; however, patients still lack enough knowledge of provider roles. Use of facecards showed a slight improvement on overall patient satisfaction.

### **Relative Associations of Age, Height, and Weight on Sinus of Valsalva and Mid-Ascending Aorta: An Imaging and Epidemiology Study**

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**Background:** Prior studies show ascending aorta diameter varies with age, height and weight, but they did not evaluate relative influence of these variables on aortic diameter. Since height is genetically determined, and genetic disorders like Marfan syndrome are predominantly associated with sinus of Valsalva (SOV) dilation, we hypothesized height may have stronger association with SOV.

**Purpose:** Based on anecdotal observation, since age, weight and obesity are acquired attributes, we hypothesized age, weight and body mass index may have greater association with mid-ascending aorta (MAA) diameter, even in normal patients.

**Methods:** We evaluated echocardiographic studies of patients  $\geq 15$  years old that were done in the last 4 years to measure SOV and MAA diameter in normal patients (defined as: medical records and echocardiograms did not reveal any of the 28 aortic dilation risk factors listed in the American Heart Association 2010 guidelines).

**Results:** Of 65,843 patients, 3,201 were identified as normal. SOV measurements were available in 2,046, MAA in 2,334. Age had stronger correlation with MAA ( $\beta=0.50$ ;  $r=0.52$ ;  $P<0.001$ ) than SOV ( $\beta=0.33$ ;  $r=0.35$ ;  $P<0.001$ ). Weight was similarly correlated with diameters of SOV ( $r=0.37$ ;  $P<0.001$ ) and MAA ( $r=0.37$ ;  $P<0.001$ ). Height had stronger correlation with SOV diameter ( $\beta=0.41$ ;  $r=0.38$ ;  $P<0.001$ ) than MAA ( $\beta=0.26$ ;  $r=0.25$ ;  $P<0.001$ ).

**Conclusion:** These data suggest that in normal subjects, age, weight and body mass index have stronger associations with the mid-ascending aorta, whereas height has a stronger association with the sinus of Valsalva.

## Additional Presentations

The following citations reflect other research works presented at Aurora Scientific Day 2017, some of which were published as abstracts or articles in scientific journals.

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**Rieselbach Distinguished Paper Session I:** Dang G, Olet S, Shahreyar M, Sulemanjee N, Ammar K, Choudhuri I, Niazi I, Sra J, Tajik AJ, Jahangir A. Incremental value of estimated glomerular filtration rate in improving stroke risk stratification in patients with and without atrial fibrillation considered to be low risk by CHA<sub>2</sub>DS<sub>2</sub>-VASc score. *J Am Coll Cardiol*. 2017;69(11 suppl):499.

**Rieselbach Distinguished Paper Session II:** Stanenas SM, Greer DM, Kram JJ, Tjoe JA, Dorton B. Hormonal contraception and therapy use in breast cancer survivors: Do recurrence and mortality risks increase? Orally presented at 43rd Annual Aurora Scientific Day, Milwaukee, WI, May 24, 2017.

**First Place Oral Presentation:** Tjoe J, Greer D, Dalmar A. Racial/ethnic disparities in malignant phyllodes tumors of the breast: analysis of the National Cancer Database, 1998-2012. *Ann Surg Oncol*. 2017;24(2 suppl):252-3.

**Second Place Oral Presentation:** Behrens JA. Management of the third stage of labor in second trimester deliveries: How long is too long? Orally presented at the Central Association of Obstetricians 84th Annual Meeting, October 20, 2017, Scottsdale, AZ.

**Third Place Oral Presentation:** Habib I, Esser-Lipp F, Kenyon C, Hernandez L, Guda NM. Pediatric GI endoscopic procedures can be safely done in ambulatory surgery centers. *Gastrointest Endosc*. 2017;85:AB418.

**Second Place Poster:** Kotovicz F, Kram JJ, Flores K, Webster J, McDearmon S, Phelps B, Baumgardner DJ. P458 Impact of primary care provider education on appropriate level of opioid prescription for chronic noncancer pain (CNCP). 2016 North American Primary Care Research Group Annual Meeting Educational Sessions. Available at: <http://www.naperg.org/Conferences/AnnualMeeting/SearchEducationalSessions-2016?m=6&s=18003>.

**Third Place Poster (tie):** Kress D, Erickson L, Zahwe F, Mengesha T, Krum D, Sra J. Characterizing recurrence following hybrid ablation in patients with persistent atrial fibrillation. Poster presented at 43rd Annual Aurora Scientific Day, Milwaukee, WI, May 24, 2017.

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