Improving Patient Safety at Discharge: A Review of Beneficiary Travel at Hines VA

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(1) Background & Problem Statement

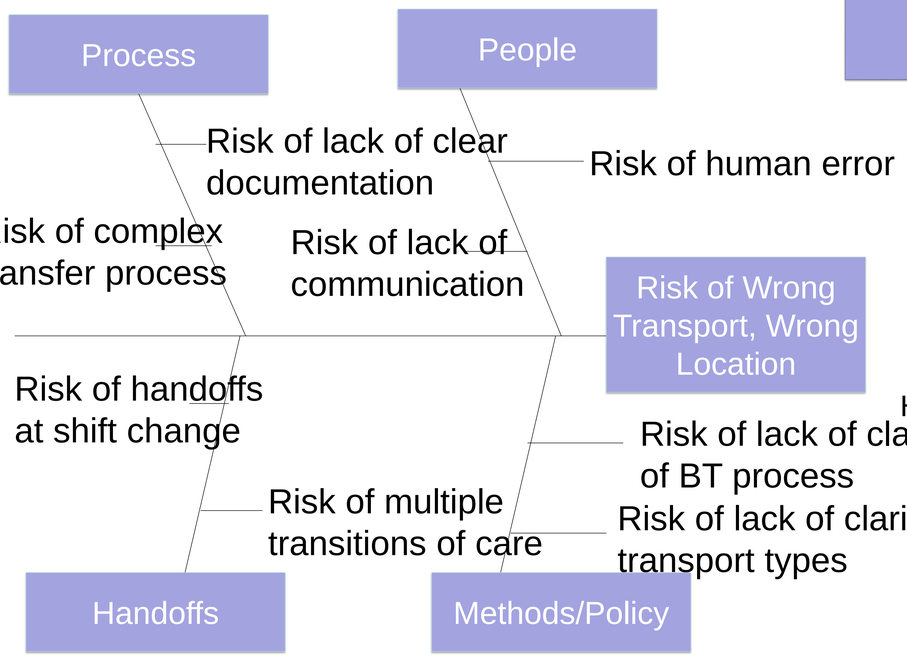
•The Beneficiary Travel program at the VA provides transport to veterans to and from the VA.

•While the program generally works efficiently, there are multiple sources for potential error within the system.

•The process involves multiple teams, varying modes of transportation based on patient needs and acuity, and handoffs occurring at all hours of the day.

•Additionally, the process itself is at times, convoluted and improvements can be made in streamlining the process.

(2) Fishbone Diagram



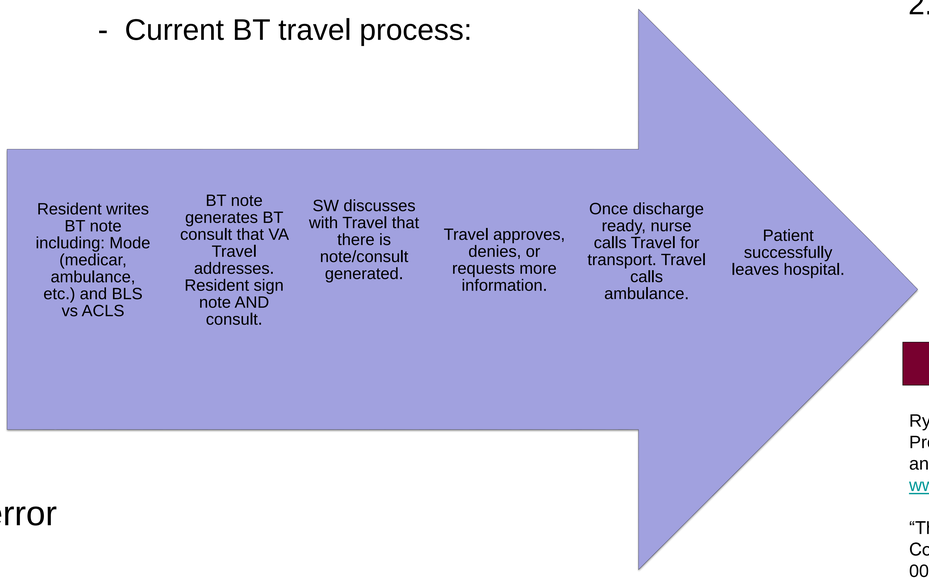
(3) Current Process

Multiple sources of potential communication breakdown exist in the process

- The process involves VA travel, social workers, physicians, nurses that can lead to errors in communication

Clarity Regarding BT Travel Process/Appropriate Type of Transport

- Current BT travel process:



- The Office of Inspector General monitored SMT (Special Mode Transportation) and found that inappropriate mode of transport ordered 13% of time[2]

Handoffs Occur at Shift Change

- Primary teams often are no longer available by time patient leaves hospital allowing for potential error[3]

- Daytime hospital discharges are significantly safer but may be harder to implement[4].

(5) Proposed Action Items

1. Clarity Regarding BT Process/Types of Transport
   - Timely, closed loop communication between physician and VA travel team
   - Communication of ACLS vs. BLS transport criteria
   - Clearly defined roles needed for those involved in BT process with standardization of process
2. Improvement of Handoffs/Adjustment of Resources
   - Discharges later in day should have standardized handoffs with focus on critical discharge information, decreasing potential for error
   - Day prior to discharge planning to become focus of afternoon touchback rounds between social workers and physician teams rather than facilitating same day late discharge (if deemed safer)

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Development of a Standardized Hypothermia Protocol For Post Cardiac Arrest Patients

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BACKGROUND

Several studies over the past years have shown a benefit in overall outcomes (mortality and neurologic outcomes) in cardiac arrest patients who received targeted temperature management as part of their treatment. While the specific details regarding initial rhythm, in-hospital vs out of hospital arrest, method of cooling, and specific temperature ranges are still being debated, the current AHA guidelines recommend as part of their ACLS algorithm that patients who achieve return of spontaneous circulation but not following commands after optimization of respiratory function/hypotension be initiated on targeted temperature management.

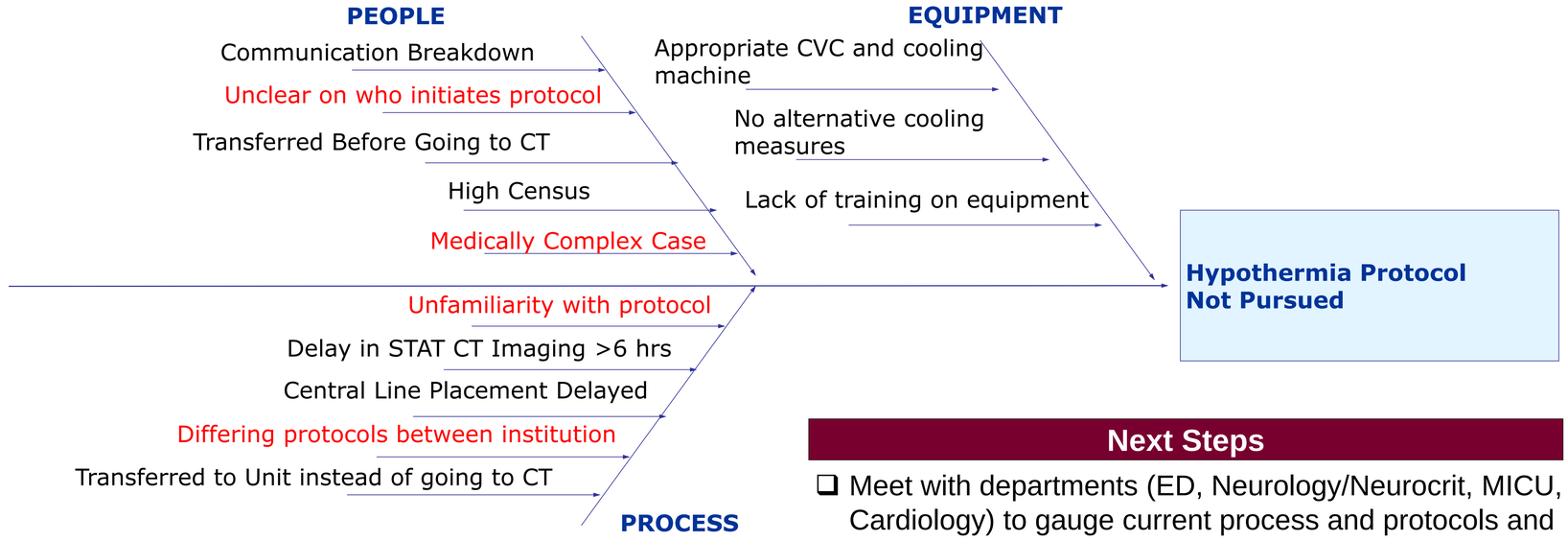
Various institutions have differing protocols for qualifications for hypothermia as well as methods for carrying it out. Given this, and the fact that many housestaff and physicians come from varying backgrounds of training in prior institutions, there may at times be confusion/uncertainty in these protocols. In my patient safety conference, I reviewed a case in which a patient who may have potentially benefitted from targeted temperature therapy did not receive it due to delay in initiating it.

PROBLEM STATEMENT AND RESULTS

The lack of a universally known standardized hypothermia protocol leads to missed opportunities for post cardiac arrest patients from receiving targeted temperature management in a timely manner.

- Main root causes of this missed opportunity for targeted temperature therapy included:
  - Miscommunication
  - Unfamiliarity regarding inclusion/exclusion criteria for initiating targeted temperature therapy
  - Institutional differences in cooling methods (ie: external vs central line cooling).

FISHBONE DIAGRAM



LITERATURE REVIEW

Schenone et al.; 2016:
- Lower Mortality (OR 0.51, 95% CI 0l.41-0.64)
- Improved Neurologic Outcome (OR 2.48, 95% CI 1.91-3.22)

Nielsen et al.;
- Similar improvements in outcomes for temperatures at 33 C vs 36 C

Glover et al.;
- Intravascular vs Surface Cooling led to similar outcomes

PROPOSED ACTION ITEMS

- ❑ Development of standardized protocol across all hospital services
- ❑ Implement a hypothermia protocol order set within the EMR (Epic and CPRS)
- ❑ Implement a CODE BLUE Flowsheet for RNs asking if hypothermia protocol was considered in patients achieving ROSC (Why vs Why Not)
- ❑ Pre and Post Intervention Survey: Nursing, Housestaff (Residents, Fellows, Attendings), RT

Next Steps

- ❑ Meet with departments (ED, Neurology/Neurocrit, MICU, Cardiology) to gauge current process and protocols and for feedback/concerns
- ❑ Review CODE BLUE data over past 1 year
- ❑ Assess capabilities at LUMC vs HVA (Cooling mechanism, continuous monitors, etc)
- ❑ Create survey to send out to nursing, techs, and house staff to gauge current level of knowledge of initiating hypothermia protocol and process for managing it

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Resident-Led Heart Failure Research Initiative Utilizing Get with the Guidelines Registry

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Background

- Nearly 6.5 million Americans live with heart failure (HF), the leading cause of hospitalization among adults 65 and older.
- HF readmission rates remain one of the biggest challenges in health care today, with national 30-day readmission rates estimated at 22%.
  - Possible explanations include medication optimization, patient education, and follow up appointment scheduled at time of discharge.
- AHA/ACC guidelines state that participation in QI programs and patient registries can be beneficial in improving quality of heart failure care.

Objective

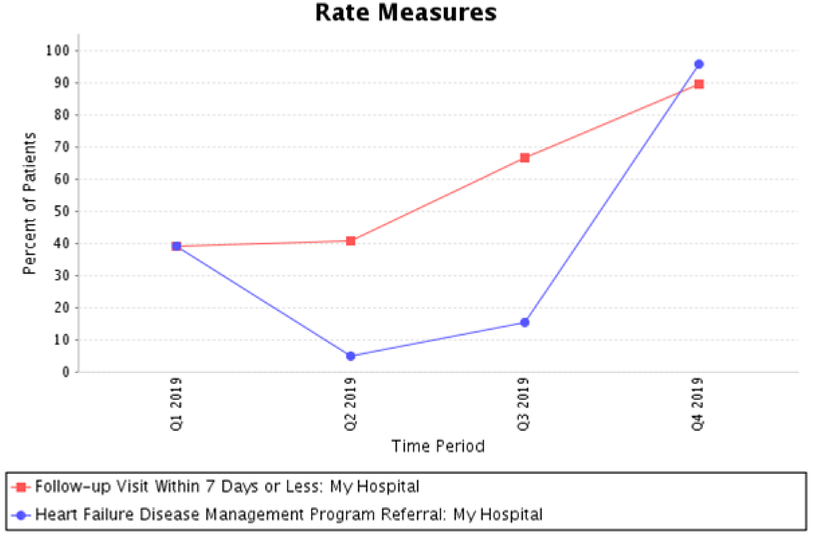
- Assemble a resident-led team to coordinate quality improvement objectives in collaboration with the American Heart Association (AHA) for the purpose of improved heart failure outcomes at Loyola University Medical Center (LUMC).

Methods

- A team consisting of 3 IM residents, 2 cardiology fellows, and a heart failure attending was created to collected baseline data on patients discharge for heart failure exacerbations from January to December 2019 at LUMC.
- The study was partnered with the AHA Get With The Guidelines (GWTG) program.
- Data was collected quarterly on patient demographics, implementation of goal-directed medical therapy and 7-day follow up. Results were entered into a GWTG database and reviewed by an AHA consultant
- Key measures included follow up visit scheduled within 7 days of discharge and referral to a heart failure disease management program

Results

- From January-December 2019, 194 patients were entered into the GWTG-HF registry. Mean age was 68.6 years (SD 15.2, range 19-97). Mean length of stay was 8.39 days (SD 10.16, range 1-74). Due to low n values, GDMT adherence was disregarded since many patients were excluded from these measures for various clinical reasons (preserved ejection fraction, hyperkalemia, etc.)
- 24.2% of patients were readmitted for heart failure within 30 days of discharge.
- Follow up visits within 7 days of discharge improved from 38.9% in Q1 to 89.5% in Q4 (%Δ133.2).
- The heart failure disease management program referral measure improved from 39.1% in Q1 to 95.7% in Q4 (%Δ144.76%). This measure requires documentation of the provider recommending that the patient follow up with a qualifying HF disease management program as defined by the AHA.



Conclusions

- Baseline data from 2019 indicated a consistent improvement in key metric recordings throughout the year, although other processes could be implemented to improve accuracy and utility of feedback for LUMC.
- Improvement in rate measures likely reflect variability in resident data collection as no intervention was observed during this time.
- Targeted interventions:
  - Increased frequency of collection
  - Increased total patients entered
  - Monthly meetings with AHA consultants to improve data collection uniformity

Limitations

- Small sample size may not accurately reflect key HF metrics
- Variability in resident data collection techniques may explain differences in referral measures and 7 day follow up rates between quarters

Future Research

- Future projects will prioritize baseline data that accurately reflects LUMC key metrics. QI projects will then be implemented in real-time based on documented deficiencies.

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Immunological and Clinical Profiles of Patients Receiving Immune Checkpoint Inhibitors and Investigation of Potential Biomarkers for Immune-Related Adverse Events.

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LOYOLA UNIVERSITY CHICAGO HEALTH SCIENCES DIVISION

Introduction

Immune-related adverse events (irAEs) related to immune checkpoint inhibitors (ICIs) may target any organ and originate from autoreactive T cells injuring host tissues. There is a need to develop prognostic and predictive biomarkers to distinguish patients who will benefit from ICIs avoiding irAEs during treatment. We propose that irAEs are the result of many biological variables. We hypothesize that within each patient's complex immunological profile, there may be patterns and associations which exist that represent a state of inflammation that is present prior to ICI therapy and hypothesize this could predict irAEs development.

Objectives

Our primary objective of this study is to analyze the differences in the immunological profile among patients receiving ICIs (for various advanced malignancies) through high dimensional data analysis of immunological, genetic, histological, and clinical data coupled with pattern recognition. Our secondary objectives are to identify biomarkers that will predict clinical toxicity to ICIs before, during, and after discontinuation of ICIs. Our exploratory objectives are to examine the mutational load of patients on ICIs and to correlate with treatment outcomes as well as predictors of irAEs.

Methods

We will create individual immunological profiles of patients prior to receiving ICIs. Assays to be included: PBMC composition, circulating chemokines/cytokines, and IκB degradation status. CD4 and CD8 T cells will be studied for their phenotype, activation status, proliferative capacity and cytolytic granules. Clinical data will be collected on the cohort and will include: demographic data, past medical history, social history, number of prior treatments, and basic laboratory data.

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Table 1. Patient demographics

	Average	Range
Age (years)	60.8	18-87
BMI (kg/m^2)	27.6	16-45
	n	**%**
Gender		
Male	65	71
Female	27	29
Race		
White	78	85
Hispanic	10	11
Black	4	4
ECOG		
0	28	30
1	51	55
2	10	11
≥3	3	3
# of Prior Tx		
0	39	42
1	29	32
≥2	24	26
Type of CI		
Ipi	3	3
Nivo	42	46
Ipi/Nivo	16	17
Pembro	26	28
Other	4	4

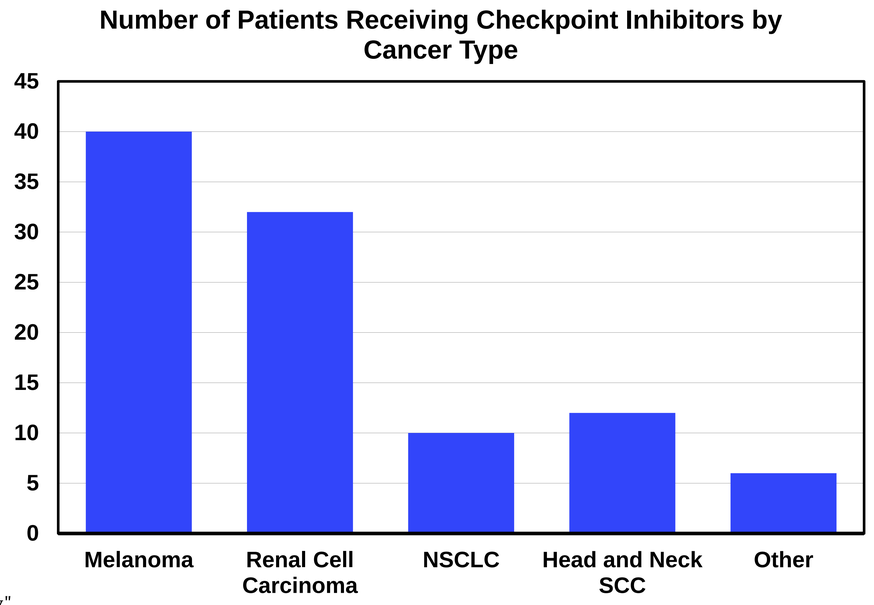


Figure 1: Number of patients treated with checkpoint inhibitor by disease

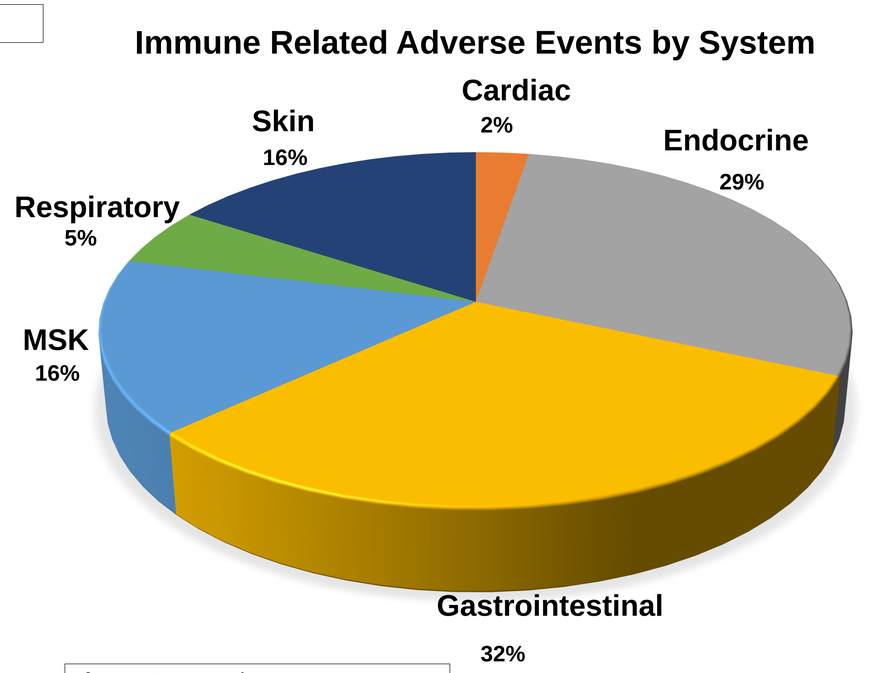


Figure 2: IRAE by organ system

Immune Related Event by Grade		
Grade	**Melanoma (n=19)**	**RCC (n=12)**
1	0 (0%)	0 (0%)
2	12 (63%)	9 (75%)
3	3 (16%)	2 (17%)
4	4 (21%)	1 (8%)
5	0 (0%)	0 (0%)

Table 2: Grade of IRAE by disease type

Conclusion/Future Directions

- Majority of patients enrolled are white, male, ECOG 0-1
- Nivolumab and Pembrolizumab were most commonly used
- Most patients received ICI for melanoma or RCC
- Majority of IRAEs involved the gastrointestinal, endocrine or musculoskeletal systems
- Majority of IRAEs were grade 2
- The immunological profile of these patients will be analyzed before, during, and after discontinuation of the ICI
- Identifying biomarkers that predict response or toxicity will help risk stratify patients and guide therapy

Using Point-of-Care Ultrasound to improve physical exam skills and patient interaction in an internal medicine residency program

Principal Investigator: Laura Ozark, M.D.

Co-Investigators: Michelle Lundholm, M.D., Anshu Hemrajani, M.D., Kent Aje M.D., Fizza Hussain, M.D., Maria Latz, M.D., Christopher Kasia, M.D.

Introduction

- Point-of-care ultrasound (POCUS) is considered the “new stethoscope” in medicine[1,2]
- POCUS enhances our traditional bedside exam and helps discover findings in a timely manner to improve management[3]
- POCUS is also an opportunity for an extended doctor-patient interaction, improving patient satisfaction and health outcomes[3-8]
- Despite all its benefits, only 37.5% of US IM residency programs include POCUS training[9,10] and no studies have been done on resident satisfaction
- The Cardiopulmonary Limited Ultrasonography Examination (CLUE)[11] looks at four different POCUS views (Fig.1) with IVC to help diagnose common causes of shortness of breath, and is relatively simple to learn

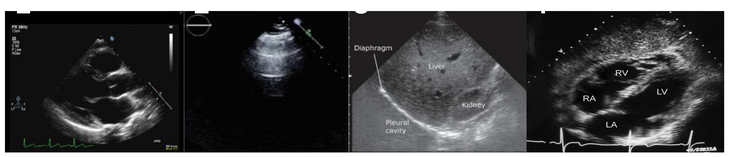


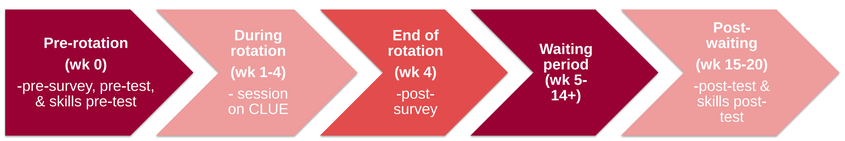
Figure 1. The four main CLUE views, from left to right: 1) parasternal long axis, 2) lung anteroapex, 3) lung posterolateral base, and 4) subcostal four-chamber

Aims

- At LUMC, all residents are taught CLUE in a workshop at the start of their intern year, but there is no expectation to use the POCUS skills, nor formal curriculum to follow up, so the knowledge and skills acquired deteriorate from disuse
- LUMC is starting a formal POCUS curriculum for IM residents on Gen Med rotations, drawing on the experience of other programs[12]
- We hypothesize that residents who participate in POCUS will find increased satisfaction and meaning as they engage more with their patients, make more diagnoses themselves in a timely and efficient manner, and feel empowered by this new tool

Methods & Design

- **Study design:** prospective survey
- **Inclusion criteria**: all residents on the Loyola Gen Med rotation starting 11/11/19--present. 8 potential enrollees per 4-week block, anticipate running until end of academic year
- **Exclusion criteria:** prior CLUE training (outside of LUMC workshop), or already on Loyola Gen Med since 11/11/19
- **Each participant receives:** a pre-rotation survey (1-5 Likert scale assessing overall satisfaction with patient care), knowledge test (out of 21) and skills test (out of 30); a post-rotation survey; and a retention knowledge test and skills test. During the rotation, residents get a 1-hr teaching session on CLUE, and are expected to use CLUE at least 4 times in the month.



- **Materials:** GME departmental U/S is made available through Dr. Ozark, also medical student’s access to Butterfly handheld U/S
- **Statistics:** T-testing, with pre- and post- rotation data paired for each resident

Preliminary Data

- 5 of 13 residents responded to pre-rotation survey, 80% stated they were not comfortable performing CLUE independently, and wanted to have more opportunities to use the skill
- 9 of 13 residents performed pre-rotation skills tests, average score of 18.4/30 (61%)
- 1 of 13 completed pre-rotation knowledge test
- Awaiting post-rotation data for comparison

Conclusion

- Majority of residents coming onto the Gen Med service feel they need more practice with POCUS and CLUE
- This study is ongoing to collect more data on how residents feel about CLUE and any changes in their satisfaction, knowledge, or skills after our curriculum addition
- Making time for surveys, tests, and additional activities remains a challenge for residents on an already busy service, but resident education and satisfaction remain key goals

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Fractional Flow Reserve-Computed Tomography vs Traditional Stress Test for Evaluation of Stable Coronary Artery Disease

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Introduction

Coronary computed tomography fractional flow reserve (FFR-CT) is a relatively new, non-invasive method of calculating the degree to which the blood flow changes over the length of a coronary artery using computational fluid dynamics.[1] This can be used to determine whether a patient is experiencing ischemic symptoms related to a specific lesion, which can be intervened upon. The FAME trial showed that in patients with multivessel coronary artery disease, an FFR-guided approach during conventional coronary angiography reduced the composite of death, nonfatal MI, and repeat revascularization at one year compared to anatomic guided intervention.[2] FAME2 added to this by finding that among patients with stable CAD with FFR ≤ 0.80, PCI plus optimal medical therapy reduces the composite rate of death, nonfatal MI, and urgent revascularization compared with OMT alone.[3] By quantifying the flow continuously along the length of the coronary arteries and enabling visualization of discrete stenoses, FFR-CT may enable physicians to determine which of their patients are suffering from lesion-specific ischemia, which may be amenable to revascularization, versus diffuse CAD, which may be best treated with OMT or coronary artery bypass graft surgery. Indeed, the DEFER trial demonstrated that coronary revascularization could be safely deferred when lesions had an FFR > 0.75.[4] Lastly, the advent of FFR-CT may change the way physicians evaluate suspected ischemic chest pain. The SCOT-HEART and PROMISE trials showed that coronary CTA may be an alternative to standard of care[5] and stress-testing,[6] respectively, in low-intermediate risk patients presenting with chest pain. In patients with diabetes in particular, a sub-analysis of the PROMISE trial showed that CTA-guided management strategy resulted in fewer adverse CV outcomes than a functional testing strategy.[7] Our study will assess the associations between traditional stress test findings versus anatomic and functional findings utilizing an FFR-CT guided diagnostic strategy.

Objectives

We hypothesize that FFR-CT will not be associated with stress test findings. In this preliminary analysis, our objective was to determine the association of stress test results with FFR-CT results, along with associations between demographic and risk factor variables.

Methods

This is a retrospective study comparing non-invasive stress testing to fractional flow reserve – computed tomography (FFR-CT) in terms of CAD >50% and FFR-CT <0.80.
Study population: Patients age >=18 at Loyola who have undergone FFR-CT for evaluation of coronary artery disease from 2015 to present.
Exclusion criteria: Patients without corresponding progress notes in Loyola's electronic medical record.
Statistics: General descriptive statistics (means, standard deviations, frequencies) were used to summarize patient characteristics and stress-test results for the entire cohort and separately for each group. Students t-test were used to compare associations of continuous variables and Chi-sq test or Fisher's exact test were used to compare associations of categorical variables.

Results

There were 597 individuals in the database. 206 individuals had paired non-invasive stress test, FFR-CT results. Patients had an average age of 60.3 and BMI of 29.5. 42% were male and the majority had HPL and HTN. Of the 206 stress tests, 75% were exercise. In addition, 70% were Echo, 26% Nuclear, and 4% EKG alone. Older age, HPL, and HTN were all significantly associated with CAD >50%. There was no association of stress test results and positive CAD >50% (p-value = 0.927, Table 1). Of those with CAD >50% only 4% had positive stress test. Of those with CAD <50%, 36% had negative stress test. Similarly, there was no association with stress test results and positive FFR-CT, defined as a decrease in FFR to <0.80 (p-value=0.910, Table 2). Of those with positive FFR-CT, only 5% had positive stress test. Of those with negative FFR-CT, 36% had negative stress test.

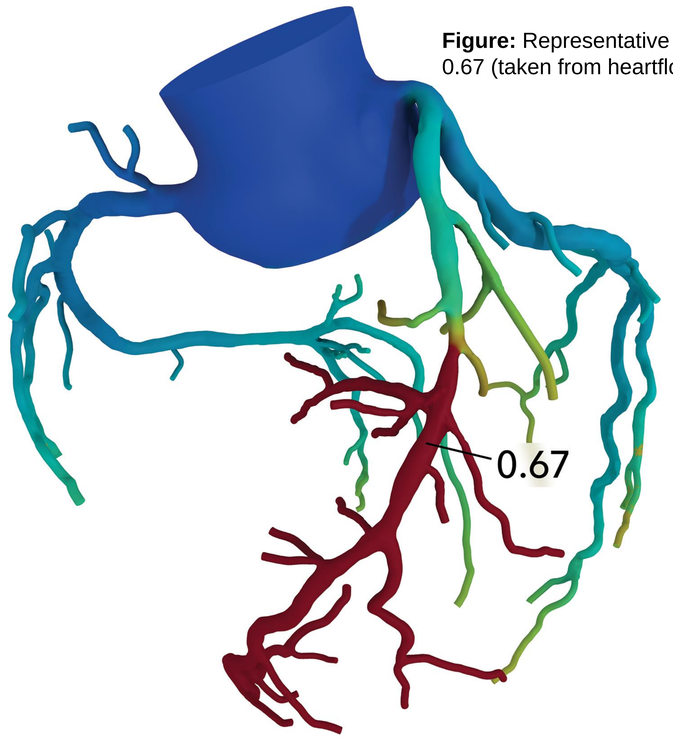

Figure: Representative image of FFR-CT analysis showing a focal stenosis resulting in a reduction in blood flow to 0.67 (taken from heartflow.com).

Table 2. Associations with FFR-CT < 0.80

Patient Characteristics:	Total, N=206, n (%)	FFR-CT <0.80, N=94, n (%)	FFR-CT >0.80, N=112, n (%)	P-Value*
Age, Mean (SD)	60.3 (11.5)	61 (12.3)	59.7 (10.7)	0.421
BMI, Mean (SD)	29.5 (5.6)	29.4 (4.9)	29.6 (6.1)	0.782
Male	87 (42)	43 (46)	44 (39)	0.350
Diabetes	38 (18)	20 (21)	18 (16)	0.337
HPL	145 (70)	75 (80)	70 (63)	0.007
HTN	135 (66)	65 (69)	70 (63)	0.317
Stress Test Results:				
Stress Test: Negative	77 (37)	37 (39)	40 (36)	0.910
Stress Test: Equivocal	97 (47)	42 (45)	55 (49)	
Stress Test: Positive	10 (5)	5 (5)	5 (4)	
Stress Test: Indeterminate	22 (11)	10 (11)	12 (11)	
DTS: intermediate risk	74 (50)	29 (45)	45 (54)	0.284
DTS: low risk	73 (50)	35 (55)	38 (46)	
Duke Treadmill Score, Mean (SD)	4.8 (4.8)	5.3 (5)	4.5 (4.7)	0.297
METS Score, Mean (SD)	10.3 (3.4)	10.4 (3.6)	10.3 (3.3)	0.902

*P-value calculated with t-test, Chi-sq test, or Fisher's exact test, where appropriate

Table 1. Associations with CAD >50%

Patient Characteristics:	Total, N=206, n (%)	CAD >50%, N=79, n (%)	CAD <50%, N=127, n (%)	P-Value*
Age, Mean (SD)	60.3 (11.5)	62.9 (11.5)	58.7 (11.2)	0.011
BMI, Mean (SD)	29.5 (5.6)	30 (5.4)	29.2 (5.7)	0.316
Male	87 (42)	36 (46)	51 (40)	0.444
Diabetes	38 (18)	19 (24)	19 (15)	0.102
HPL	145 (70)	63 (80)	82 (65)	0.020
HTN	135 (66)	63 (80)	72 (57)	0.001
Stress Test Results:				
Stress Test: Negative	77 (37)	31 (39)	46 (36)	0.927
Stress Test: Equivocal	97 (47)	36 (46)	61 (48)	
Stress Test: Positive	10 (5)	3 (4)	7 (6)	
Stress Test: Indeterminate	22 (11)	9 (11)	13 (10)	
DTS: intermediate risk	74 (50)	25 (51)	49 (50)	0.907
DTS: low risk	73 (50)	24 (49)	49 (50)	
Duke Treadmill Score, Mean (SD)	4.8 (4.8)	4.5 (4.7)	5 (4.9)	0.590
METS Score, Mean (SD)	10.3 (3.4)	9.6 (3.4)	10.7 (3.4)	0.065
FFR-CT:				
Positive FFR-CT	94 (46)	54 (68)	40 (31)	<0.001

*P-value calculated with t-test, Chi-sq test, or Fisher's exact test, where appropriate

Conclusion

This preliminary analysis shows that there is little correlation between stress test results and the presence of CAD found on FFR-CT. This indicates a novel role for FFR-CT in the non-invasive diagnosis of CAD.

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Factors contributing to hospital readmissions: a self assessment

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(1) Background

Audits can serve as a powerful tool for a critical evaluation of starkly routine clinical decisions. They have been employed in a variety of settings, in the medical realm, though underutilized they have shown some success in improving patient outcomes. A look back at our efforts to provide the best for patients when viewed in a seemingly objective light may indeed seem humbling when backed by data to boot, but could also be used as a guide to effect change in our practice for the better.

Unplanned readmissions can mount an unnecessary burden on health systems. Surprisingly a fifth of all patients in a 2013 study of hospitalized Medicare recipients were readmitted within a 30-day period [1]. In older adults, readmission risk seems to increase incrementally with age and number of previous admissions, with discharge to long-term care appearing to be the greatest population-attributable variable.[2][3] Modifiable issues such as low health literacy have been noted to be a significant risk factor associated with 30-day hospital utilization.[4]

This self-audit aims to recognize such variables on analysis of data gathered from five study patients readmitted to a general medicine ward between September and October 2019 at the Edward Hines, Jr. VA medical center.

(2) Self-audit patient characteristics

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
Age (yr)	52	66	77	79	89
ED visits/ 6 months	8	1	0	9	0
Hosp adm/ 6 months	5	0	0	5	0
Index LOS (d)	3	4	7	2	6
Time to readmission (d)	13	2	13	5	4

(3) Gap Analysis

Opportunities for improvement	Perceived obstacles to desired goal	Possible Remedies
Early inpatient identification of high risk patient groups for resource allocation	Difficulty in accurately identifying patients at high risk of readmissions at triage and assessment	Using validated scoring tools to predict healthcare utilization (e.g., LACE, HARP)
Effective preventive measures in place for preventing readmissions	Lack of robust communication between multiple providers	Telemedicine and EHR optimization

(4) Lessons Learned

- Social factors (such as homelessness, alcohol use, caregiver status) appear to have a significant influence on patient readmissions.
- Early clarification of patient goals of care can help direct ongoing management

Self-audits are only as reliable as their own subjective interpretations.[5] I hope this project can be informative to other clinicians as it was for me and motivate them to carry out their own exercise in self reflection.

(5) Proposed Action Items

Improving patient education:

➢ An inpatient “health literacy” team dispatched after LOS exceeds 48H tasked with identifying high risk patients (e.g., prior admissions or AMA discharges) and illustrate to them the significance of hospitalizations and discuss management strategies including patient goals of care.

Reinforcement with teach-back:

➢ Nurses to follow up within 24H discharge to reaffirm discharge instructions across the transition from the hospital to home setting, and if needed facilitate inpatient provider to patient communication.

(6) Future Directions

- Possible scope: Action items trialed at successive levels of LUMC and Trinity Health System, with the aim to reduce unplanned hospital admissions to the inpatient internal medicine service to >15% over 3 monthly intervals.
- Health literacy teams to ideally include a social worker and/ or a case manager, a palliative care consultant, and one member of the primary clinical team, who may be a medical student familiar with the patient’s care plan.
- In the unprecedented era of the COVID 19 pandemic, the early adopters of telemedicine (both patients and providers) may find themselves with the unique charge of establishing simplified frameworks to maintain strong and reliable channels of communication.

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Effect of Supplemental Education Materials on Patient Awareness and Understanding of Pulmonary Embolism

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Background

- The mainstay of outpatient therapy after hospital discharge for acute pulmonary embolism (PE) includes oral anticoagulation for at least three months
- Patient education is an integral part of management of acute Pulmonary Embolism (PE). We aim to assess the impact of supplemental PE education packet on patient's comprehension of acute PE pathophysiology and treatment options

Methods

- Acute PE patients managed by pulmonary embolism response team (PERT) received a 14-question multiple choice survey during admission.
- Patients received supplemental education materials (Figure 1) and completed a follow up survey in post-PE clinic. The survey included questions on presenting signs/symptoms of acute PE, diagnostic tests, and anticoagulation regimens. We compared the proportion of patients who correctly answered each question at baseline and follow up.

Figure 2

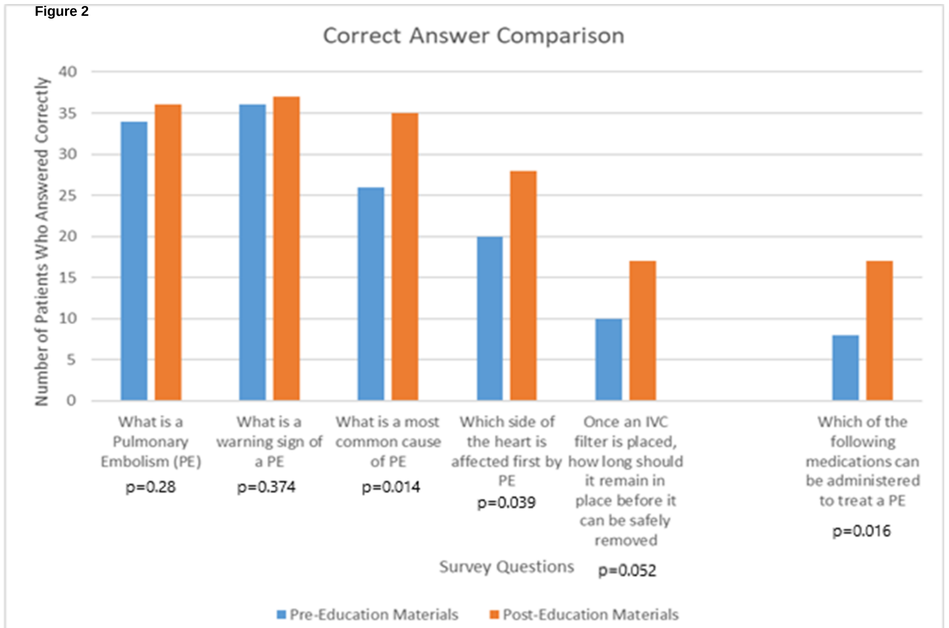
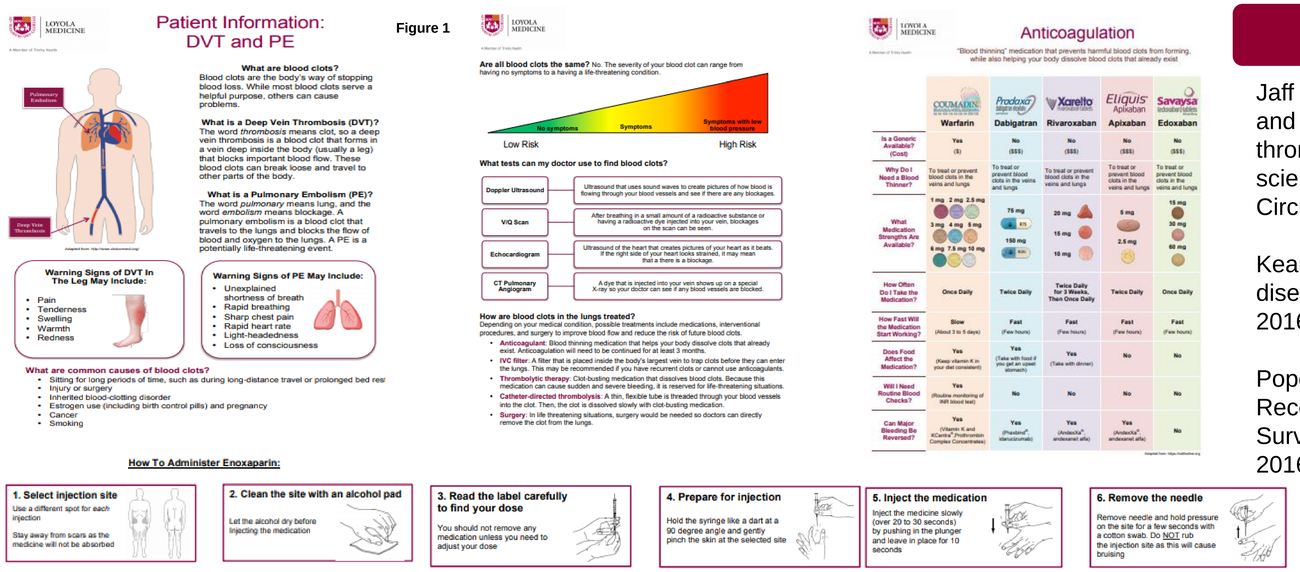


Figure 1



Results

- Forty-two patients completed baseline and follow-up surveys. Median time to follow up was thirty six days.
- The educational packet was associated with improvement in patient comprehension about PE and treatment. (Figure 2).
- The majority of responders correctly identified "What is a PE" (82% pre, 86% post) and if a severe PE can affect systemic blood pressure (100% pre, 97%) while the lowest scoring question among responders involved correctly identifying medical therapy for acute PE (17% pre, 28% post)
- The change in overall survey score pre vs post-educational material was 1.57 points (p=0.000258).

Conclusion

- Patient education is an integral part of pulmonary embolisn management. There are substantial gaps between what clinicians convey to the patient and their comprehension .
- Educational pamphlets are useful tools to address gaps in patients knowledge and understanding of PE,
- Improved patient understanding may reduce the rate of anticoagulation non-compliance and readmission

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Disclosures: None

Age and Sex Disparities in Hypertension Control: The Multi-Ethnic Study of Atherosclerosis (MESA)

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Loyola University Medical Center

Introduction

Cardiovascular disease is the number one cause of death among women. Previous studies suggest that uncontrolled hypertension is higher among women than men in older age groups. We used data from the Multi-Ethnic Study of Atherosclerosis (MESA), a cohort of adults without baseline CVD, to assess the association of age and sex with hypertension control.

Methods

MESA recruited 6814 men and women, age 45 to 84 years, from six communities in the U.S. during years 2000-2002 and follow-up exams occurred approximately every two years for a total of 6 exams.

Analysis was limited to participants with treated hypertension (use of BP lowering medications) at any of the first 5 MESA exams and who did not die before exam 5 (n=2017 at baseline exam).

At each exam, resting BP was measured in triplicate at one-minute intervals using an automated oscillometric device and hypertension control was defined as treated hypertension with BP < 140/90 mmHg.

Mixed effects models were utilized to examine the association of sex with hypertension control by age group while accounting for the clustering within sites and intra-individual correlation and adjustment for demographics, co-morbidities, smoking, alcohol use, and education.

Marginal effects was used to calculate the adjusted probability of hypertension control by sex and by age group at a given exam.

Conclusion

Hypertension control differs by sex among older age groups. Interventions are needed to address age-related sex disparities in hypertension control.

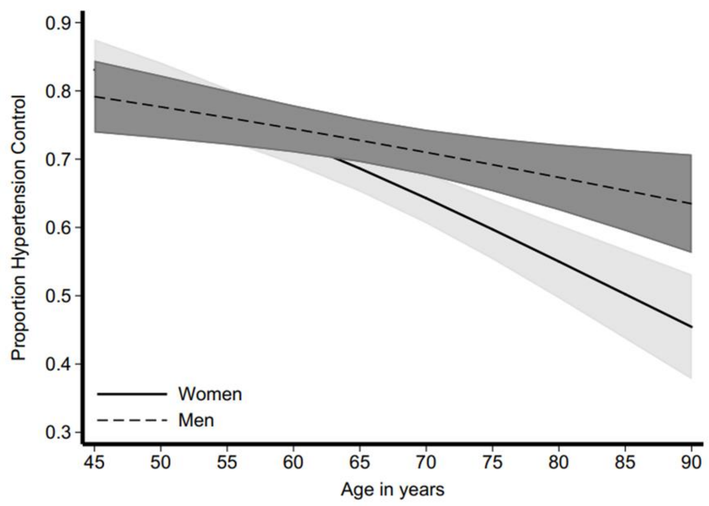
Results

In 2017 Adults with Treated Hypertension:
- Controlled Hypertension: 63.1%
- Mean Age: 64.0 years (Standard Deviation 9.1)
- Males:43.3%
- Race/Ethnicity: White 33.5%;Chinese 9.2%; Black 37.2%; Hispanic 20.1%.

Women:
The probability of hypertension control declined from 74.6% (95% CI 70.8%, 78.5%) for age 45-64 years to 55.9% (95% CI 50.0, 61.8%) for age 85+ years.

Men:
The probability of hypertension control declined from 74.0% (95% CI 70.0%, 78.0%) for age 45-64 years to 70.6%(95% CI 65.7%, 75.5%) for age 85+ years.

Results



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Assessment of Technical Heterogeneity Among Diagnostic Tests to Detect Germline Risk Variants for Hereditary Hematopoietic Malignancies

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Introduction

- Hereditary hematopoietic malignancies (HHMs) are syndromes driven by germline mutations that significantly increase an individual's lifetime risk of blood cancer
- Identification of HHMs helps patients understand why they developed a hematologic malignancy and facilitates testing in family members who may also harbor germline mutations
- Cascade testing in asymptomatic family members reduces risk of donor-derived leukemia, since first degree-relatives often serve as stem cell donors
- While some germline variants are able to be incidentally found via panel testing for somatic mutations, several genetics companies offer testing specifically intended for the discovery of HHMs
- A systematic assessment of the assay characteristics, methodologies and performance attributes of commercial assays has never been performed

Methods

We analyzed commercially available next-generation sequencing (NGS) assays marketed for evaluation of HHMs. Excluded from our analysis were somatic mutation panels for hematologic malignancies or solid tumors mutational profiling. Using company websites and the NCBI Genetic Testing Registry (https://www.ncbi.nlm.nih.gov/gtr/), we compiled data on the number of genes included in each assay, testing cost, turn around time, specimen types accepted, and sequencing specific metrics on commercially available assays intended for use in suspected HHMs, specifically hereditary myelodysplastic syndromes/acute leukemia panels (n=8). Companies were contacted, provided a draft manuscript of the data and given the opportunity to review, clarify of contest any of the information presented herein.

Practical attributes of commercial NGS assays for HHMs vary dramatically

Company / Institution	Preferred Specimen	# Genes Included	List Price (USD)	Turnaround (days)	CNV Resolution / Limitations	CNV Confirmation	SNV Confirmation
Laboratory A	WB*	16	250**	14	Single exon resolution	aCGH	Sanger
Laboratory B	SF	12	990	18	70% sensitivity for CNVs of 1-3 exons	aCGH	Upon Review
Laboratory C	WB, purified DNA, saliva*	41	1600	21 - 28	May not reliably detect partial exon CNVs or indels > 50 bp	qPCR if < 10 exons	Upon Review
Laboratory D	SF	12	3285	21	Cannot reliably detect 20-250 bp deletions or 10-250 bp insertions	aCGH/MLPA	Upon Review
Laboratory E	SF, WB, saliva, buccal*	16	1450	14 - 21	Single exon resolution	qPCR, MLPA	Sanger
Laboratory F	SF	28	4000	42	May not reliably detect partial-exon CNVs or rearrangements < 400 bp	aCGH	Sanger
Laboratory G	WB*	12	3500	28	Single exon resolution	aCGH	Sanger
Laboratory H	WB	73	4702	42	Reliably detects CNVs of 3+ exons	MLPA/ddPCR	Sanger

Table 1. Practical and Technical Attributes of Commercial HHM Assays. Eight HHM assays were identified. Data were collected from laboratory websites, test requisition forms, and test information sheets. Laboratories are anonymized in the table above to prevent confrontation. Numerous tissue specimen types were accepted. Some laboratories (*) indicated the need for non-blood specimens in patients with active hematopoietic malignancies or who had received allogeneic transplants. Genes included reflect those on primary MDS/AL HHM panels for each laboratory and excluded "add-on" genes. Price reflects the list price before the application of health insurance cost reductions or maximum out-of-pocket (**) policies adopted by some entities. "Upon review" indicates that variants are not reflexively validated but are instead confirmed by secondary methodology only if internal quality standards are not met. USD; US dollars, WB; whole blood, SF; skin fibroblasts, CNV; copy number variant, SNV; single nucleotide variant, indel; insertion/deletion, aCGH; array comparative genomic hybridization, MLPA; multiplex ligation-dependent probe amplification, qPCR; quantitative polymerase chain reaction, ddPCR; droplet digital polymerase chain reaction.

Discordant inclusion of HHM-associated genes across commercial testing panels

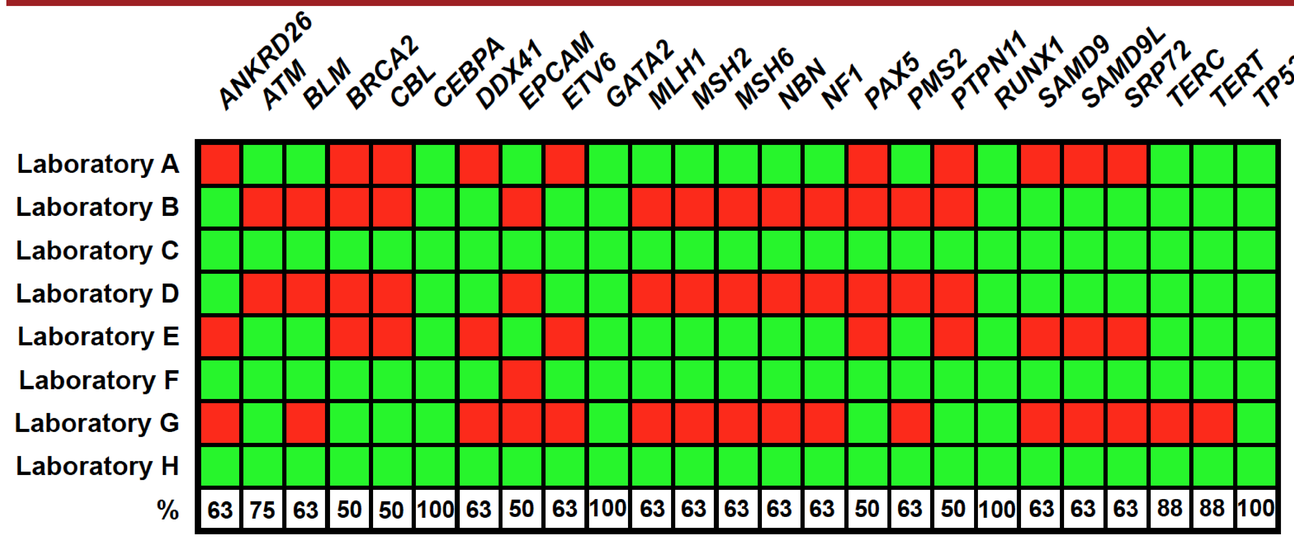

Figure 1. Cross-panel comparison of genes included in commercial HHM testing. A binary matrix approach was employed wherein any single gene (vertical columns) included on single commercial panel (horizontal rows) is cross-referenced for inclusion on all other assays marketed for detection of hereditary MDS/acute leukemia. Inclusion of a single gene across all assays is depicted as a percent in the bottom row. Analysis of MDS/acute leukemia panels revealed marked discordance among gene inclusion with only 3 of 82 genes (*CEBPA, GATA2,TP53*) included on all panels. **Figure 2. Clonal Architecture of donor-derived AML (next panel, top).** Timeline of the acquired mutations identified within a donor-recipient pair misidentified by commercial testing and referred to University of Chicago Medical center for study. Molecular profiling and allele fractions from samples at various time points are given in vertical columns. Data here include mobilized PBSC product from the donor and data from the recipient's skin fibroblasts at this time frame, although they were collected after HSCT. Subsequent samples are shown in columns to the right. Allele fractions are given in circles, with the size of the circle proportional to allele fraction.

Clonal Architecture of donor-derived AML case

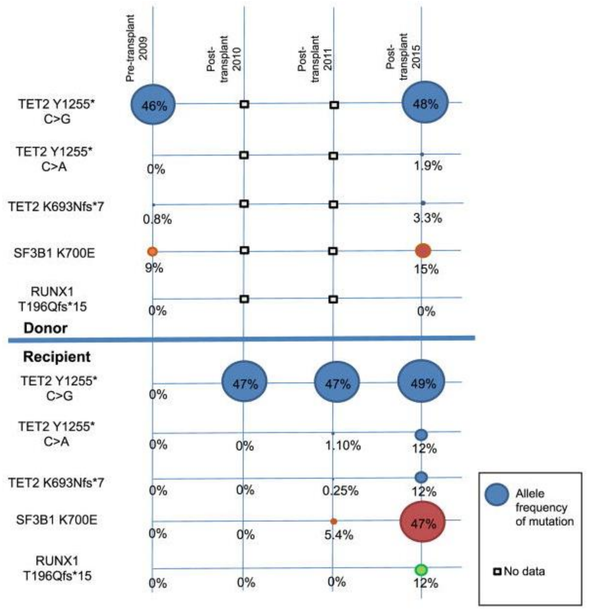

Figure 2. Described on previous panel (bottom)

Conclusion & Future Directions

- Most commercially available assays marketed for the detection of HHMs fail to detect the majority of genes implicated in HHMs
- Labs varied significantly in terms of tissue types accepted for sequencing, with many labs accepting peripheral blood as appropriate germline tissue despite blood representing involved tumor tissue in HHMs
- Given the gaps in commercial test characteristics, individuals/families harboring germline variants are likely being erroneously reassured by false-negative results
- Ongoing work seeks to characterize assay performance in sequence-specific parameters such as copy number variants, insertions, deletions, and coverage depth
- Analysis of assays intended for the detection of solid tumor predisposition represents a clinically meaningful follow-up study

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Stanford Integrated Psychosocial Assessment for Transplant (SIPAT) is associated with alcohol recidivism in patients with alcoholic liver disease undergoing evaluation for liver transplant

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Introduction

- Alcohol-related liver disease (ALD) has become the most common indication for LT in the US and Europe, surpassing HCV & NASH.[1] Alcohol recidivism is common after OLT.[2]
- Mandated length of sobriety, the so-called “6 month rule” in patients with ALD is a poor predictor of recidivism after transplant.[2] Psychosocial factors are linked to alcohol relapse in patients with alcohol cirrhosis who undergo transplant.[3]
- Stanford Integrated Psychosocial Assessment for Transplant (SIPAT) is a validated, multi-domain questionnaire utilized by a psychologist or social worker to assess psychological risk factors for poor medical and psychological outcomes in solid-organ transplant candidates.[4]
- The predictive value of SIPAT for alcohol recidivism in liver transplant patients has not been extensively studied.

Specific Aims

- Aim 1: To compare clinical characteristics and SIPAT domains/subdomains between patients with ALD who did and did not have alcohol recidivism after LT evaluation including post-transplantation.
- Aim 2: To develop a model for alcohol recidivism in transplant candidates.

Methods

- Our cohort of 258 patients with ALD was identified from a database of 1119 patients undergoing LT evaluation between 2012 and 2018 at Loyola University Medical Center. Of those evaluated, 29.7% (n=77) received a liver transplant.
- ALD diagnosed by biopsy or clinical features by a transplant hepatologist. Severe alcoholic hepatitis (sAH) was diagnosed using recommendations from the NIAAA Alcoholic Hepatitis Consortia.[3] Alcohol recidivism was determined by patient self-report, positive urine or blood test, or strong clinical evidence.
- Patient information including demographics, pre/post transplant clinical data were collected from the EMR.
- SIPAT was administered to all patients undergoing evaluation for LT.
- Graft injury was defined as increasing or persistent elevations in serum levels of LFTs ≥6 months after LT. Graft failure was defined as re-transplantation or death.
- SIPAT scores were compared by alcohol recidivism using chi-square or Fisher’s exact tests for nominal variables and t-tests or Wilcoxon rank sum tests for continuous variables.
- Models to predict alcohol recidivism were identified using best subsets logistic regression. Adjusted odds ratios and the area under the receiver operating characteristic curve (AUC) were computed for candidate models.

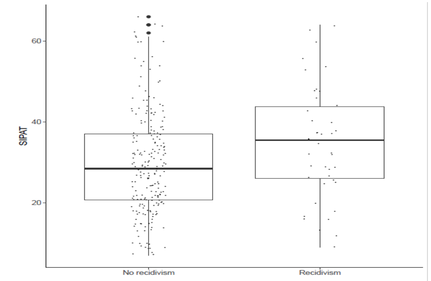
Table 1: Results

	Overall n=259	Alcohol recidivism n=51 (19.7%)	No alcohol recidivism n=208 (80.3%)	p-value
Age, mean (SD)	54.9 (9.6)	50.4 (8.6)	56.1 (9.5)	<0.001
Female, n (%)	66 (25.6)	14 (27.5)	52 (25.1)	0.73
Race/ethnicity, n (%) (n=238)				
Non-Hispanic White	168 (70.3)	37 (78.7)	131 (68.2)	0.66
Non-Hispanic Black	12 (5.0)	1 (2.1)	11 (5.7)	
Hispanic	51 (21.3)	8 (17.0)	43 (22.4)	
Other	8 (3.3)	1 (2.1)	7 (3.6)	
Insurance, n (%)				
Medicare	71 (28.6)	11 (22.9)	60 (30.0)	0.026
Medicaid	69 (27.8)	21 (43.8)	48 (24.0)	
Private	101 (40.7)	14 (29.2)	87 (43.5)	
Uninsured	3 (1.2)	0 (0.0)	3 (1.5)	
Other	4 (1.6)	2 (4.2)	2 (1.0)	
Currently employed, n (%) (n=203)	107 (52.5)	19 (47.5)	88 (53.7)	0.48
MELD at OLT evaluation, median (IQR)	20(15-26)	18 (13-24)	21(15-26)	0.17
Alcoholic hepatitis, n (%)	50 (19.3)	18 (35.3)	32 (15.4)	0.001
Narcotic use, n (%)	85 (32.9)	18 (35.3)	67 (32.4)	0.69
Psychiatric comorbidities, n (%)				
Bipolar disorder	5 (1.9)	2 (3.9)	3 (1.4)	0.26
General anxiety	18 (7.0)	6 (14.3)	12 (5.6)	0.13
Depression	39 (15.1)	7 (13.7)	32 (15.4)	0.77
Complications of cirrhosis, n (%)				
Ascites	215 (83.0)	42 (82.4)	173 (83.2)	0.89
Hepatic encephalopathy	165 (63.7)	27 (52.9)	138 (66.3)	0.074
History of variceal bleeding	51 (19.7)	11 (21.6)	40 (19.2)	0.71
Jaundice	110 (42.5)	23 (45.1)	87 (41.8)	0.67
History of SBP	33 (12.7)	9 (17.6)	24 (11.5)	0.24
History of SRS	30 (11.6)	8 (15.7)	22 (10.6)	0.31
Portopulmonary hypertension	3 (1.2)	0 (0.0)	3 (1.4)	0.99
Hepatopulmonary syndrome	6 (2.3)	0 (0.0)	6 (2.9)	0.60
Final listing decision*, n (%) (n=253)				
Listed	159 (62.8)	26 (54.2)	133 (64.9)	0.073
Denied	63 (24.9)	18 (37.5)	45 (22.0)	
Other	31 (12.3)	4 (8.3)	27 (13.2)	
Received OLT, n (%)	77 (29.7)	11 (21.6)	66 (31.7)	0.17
- Graft Injury	23 (30.3)	2(20%)	21(31.8)	0.71
- Graft Failure	4(36.4)	1(33.3)	3(37.5)	0.99
Died, n (%)	85 (32.9)	17 (33.3)	68 (32.9)	0.95

Table 2: SIPAT scores by alcohol recidivism

	Overall n=259	Alcohol recidivism n=51 (19.7%)	No alcohol recidivism n=208 (80.3%)	p-value
Total SIPAT, median (IQR)	29 (21-38)	35 (26-43)	29 (20-37)	0.022
Subscales, median (IQR)				
Readiness and illness management	5 (1-10)	8 (3-14)	5 (1-10)	0.004
Social support level	4 (2-7)	2 (0-7)	4 (2-7)	0.24
Psychological stability	5 (2-7)	5 (2-8)	4 (2-7)	0.49
Lifestyle and substance use	14 (10-18)	15 (12-20)	14 (10-17)	0.077

Graph 1: Overall SIPAT score by alcohol recidivism



Bar graph 1: SIPAT responses by alcohol recidivism

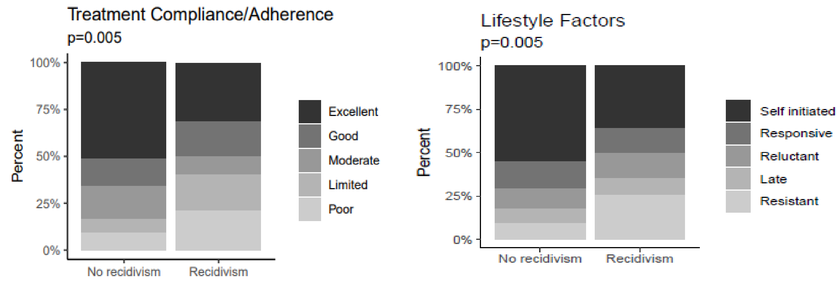


Table 3: Models of Alcohol Recidivism

	Model 1		Model 2		Model 3		Model 4	
	Odds ratio (95% CI)	p-value	Odds ratio (95% CI)	p-value	Odds ratio (95% CI)	p-value	Odds ratio (95% CI)	p-value
Age (5 year increase)	0.78 (0.65-0.94)	0.009			0.75 (0.63-0.90)	0.001		
Alcoholic hepatitis		0.10		0.003				
Yes	1.96 (0.88-4.37)		3.01 (1.44-6.26)					
No	1 (reference)		1 (reference)					
Treatment Compliance/Adherence		0.013		0.013		0.018		0.022
Excellent	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
Good or moderate	1.69 (0.74-3.87)	0.21	1.83 (0.81-4.13)	0.14	1.51 (0.67-3.39)	0.32	1.52 (0.69-3.35)	0.30
Limited or poor	3.55 (1.52-8.25)	0.003	3.51 (1.52-8.11)	0.003	3.30 (1.43-7.64)	0.005	3.14 (1.38-7.13)	0.006
Influence of Personality Traits		0.25		0.31		0.22		0.27
None	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
At least minimal	1.77 (0.67-4.67)		1.65 (0.63-4.27)		1.81 (0.70-4.70)		1.68 (0.67-4.23)	
Problems with Truthfulness		0.83		0.62		0.76		0.49
None	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
At least minor	1.10 (0.47-2.58)		1.23 (0.53-2.86)		1.14 (0.49-2.64)		1.33 (0.59-3.04)	
Alcohol use disorder						0.30		0.079
Not dependent					1 (reference)		1 (reference)	
Dependent					1.44 (0.72-2.87)		1.82 (0.93-3.53)	
Model AUC (95% CI)	0.76 (0.69-0.84)		0.73 (0.66-0.80)		0.75 (0.67-0.82)		0.69 (0.61-0.77)	

Conclusion

- Patients with alcohol recidivism evaluated for LT had significantly higher total SIPAT scores than those who remained abstinent. The readiness/illness management subscale had the strongest association with recidivism.
- The SIPAT provides an objective tool to aid in the psychosocial evaluation of patients with ALD for liver transplantation.

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The effectiveness of Pulmonary Nodule biopsy in the Loyola Lung Cancer Screening Clinic

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Loyola University Medical Center

Abstract

It is estimated that the prevalence of pulmonary nodules in the US ranges form 150,000 to 1 million annually. Most nodules are often benign, in fact 96% of nodules biopsied in the National Lung Screening Trial were false positives. Lung Cancer remains the 3rd most common cancer and the leading cause of cancer death in the U.S. The 5 year survival for all lung cancer is 18%, however for Stage 1 is 73-90% stressing the importance of diagnosing cancer early.

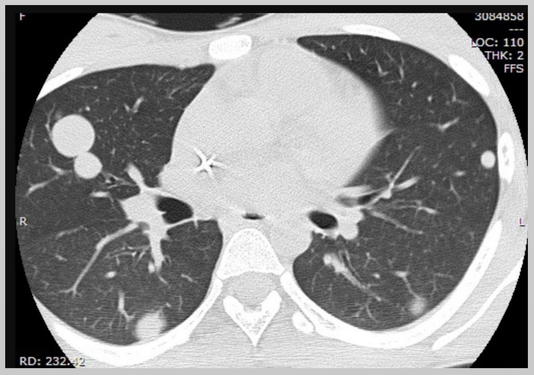
Current validated risk prediction models for Pulmonary Nodules use radiographic features and clinical characteristics such as Age, Sex, Family History, Pack year history and Upper lobe prominence. A limitation to these models is that they are very specific to the population they were developed in and are poorly externally validated. Additionally, models are not helpful in assessing nodules less than 8 mm or apply to subsolid nodules. Inadequate risk prediction can lead to unnecessary invasive procedures such as biopsy and wedge resection in addition to anxiety for patients due to concern about potential malignancy.

Currently, the McWilliams model remains the most validated risk prediction model however most clinicians continue to estimate risk intuitively.

Introduction

We would like to build a better risk prediction model for Pulmonary Nodules by improving image analysis techniques. Radiomics is the concept where images are converted into mineable data for machine learning algorithms to find physical features by a process called segmentation. There are many examples of Radiomics in medicine, one being in a study by Aerts et al. who found common features among head and neck cancers and lung cancers that predicted mortality. Additionally, Nasief et al. found that in pancreatic cancer changes of radiomic features overtime can predict response to chemotherapy treatment. We plan to adapt an existing risk prediction model for pulmonary nodules for the Loyola population.

A potential risk prediction model could be used by clinicians at Loyola to risk stratify pulmonary nodules and to possibly guide management about obtaining a biopsy. An improved sensitivity and specificity for this model may lead to less false negatives and improving mortality with earlier identification of malignancy. .



Methodology

This will be a retrospective study on patients who are enrolled into the Loyola Lung Cancer Screening Clinic. The inclusion criteria are patients who have a 30 pack year history or quit within the past 15 years based on current USPSTF guidelines. Information regarding patient demographics, medical history, nodule characteristics and biopsy results will be collected into RedCap.

Results

1,548 patients were identified in the Loyola Lung Cancer Screening clinic program. Of these patients, 58 have biopsy confirmed malignancy with the majority (29 of 58) being Adenocarcinoma. Those with confirmed malignancy had an average of 47.2 pack years while those who have not been biopsied have an average 47.9 pack year history.

Conclusion

Further collection of data is needed to calculate the false positive rate for biopsy. Based on preliminary data, the average pack year history does not seem to correlate with an increased risk of malignancy. We suspect that improved image analysis using machine learning algorithms may improve current risk prediction models.

Acknowledgements

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Utilizing the *Measure Accurately, Act Rapidly, and Partnering with Patients* Protocol in a High Cardiovascular Risk Population: Targeting a Blood Pressure Goal <130/80 in a VA Outpatient Clinic

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Introduction

A recent multifaceted hypertension improvement model, endorsed by the AHA/AMA, entitled *Measure Accurately, Act Rapidly, and Partner with Patients (MAP)*, reduced average blood pressure (BP), decreased PCP therapeutic inertia (TI) and maintained BP at goal when applied to underserved primary care clinics[1,2,3].

This model focuses on 3 major areas: 1.) instituting unattended automated office blood pressure (AOBP) measurements 2.) reducing physician TI and 3.) improving patient education on high blood pressure, medication compliance, and lifestyle modifications.[4]

The original *MAP* protocol targets a blood pressure goal of <140/90 for all patients, regardless of baseline comorbidities.[5,6] According to the 2017 ACC/AHA guidelines, it is now recommended to target a stricter blood pressure goal of <130/80 for patients with high risk conditions including diabetes mellitus (DM), chronic kidney disease (CKD), cardiovascular disease (CVD), 10-year ASCVD risk >10% and age 65 to 75 years old.[7] Our VA resident clinic's current proportion of high risk patients at their individualized BP goal is ~50%.

Objectives

- Increase the number of high-risk hypertensive patients with a BP <130/<80 to ≥70%
- Decrease primary care physician TI by ≥10%.
- Maintain an LPN workflow compliance of ≥85%
- Compare systolic (SBP) and diastolic blood pressure (DBP) terminal digit preference (TDP) at baseline and post-*MAP* protocol implementation. This was used as a surrogate marker of BP measurement accuracy.

Methods

2309 patients were evaluated for the study. 1128 were initially excluded from the pre-*MAP group* and another 489 were excluded from the post-*MAP* group due to lack of PCP follow up during the study period. 692 patients were followed for a total of 20 weeks.

Inclusion criteria:
- VA patients 18- 85 years old
- Established diagnosis of HTN
- At least 1 clinic visit with their assigned PCP and 1 recorded office BP between July 31st 2018 – August 1st 2019

Exclusion criteria:
- < 18 years olf or >85 years old
- No previous diagnosis of HTN
- Hospice and/or palliative care enrollment
- ESRD requiring hemodialysis
- Heart transplant recipient

Measurement Protocol: Mandatory 5 minute rest period in proper seated position within a private exam room. If initial attended AOBP was ≥140/90, two additional unattended AOBP measurements were taken. The PCP was instructed to use the average BP for treatment decisions.

Workflow Compliance definition:

$$\frac{\#\ patients\ with\ initial\ AOBP \geq \frac{140}{90}\ followed\ by\ unattended\ AOBP}{\#\ of\ patients\ with\ initial\ AOBP \geq\ 140/90}$$

Therapeutic Inertia definition:

$$\frac{\#\ of\ patient\ encounters\ with\ average\ AOBP\ over\ goal\ without\ medication\ intensification}{\#\ of\ patient\ encounters\ with\ average\ AOBP\ over\ goal}$$

Results

Baseline Demographics and Clinical Characteristics		
Average Age ± SD		69.7 ± 7.9 years
Male sex		1181 (100%)
Race	**Black n (%)**	201 (29%)
	White n (%)	444 (64%)
	Other n (%)	47 (7%)
DM n (%)		328 (47%)
CKD n (%)		149 (22%)
CVD n (%)		303 (44%)

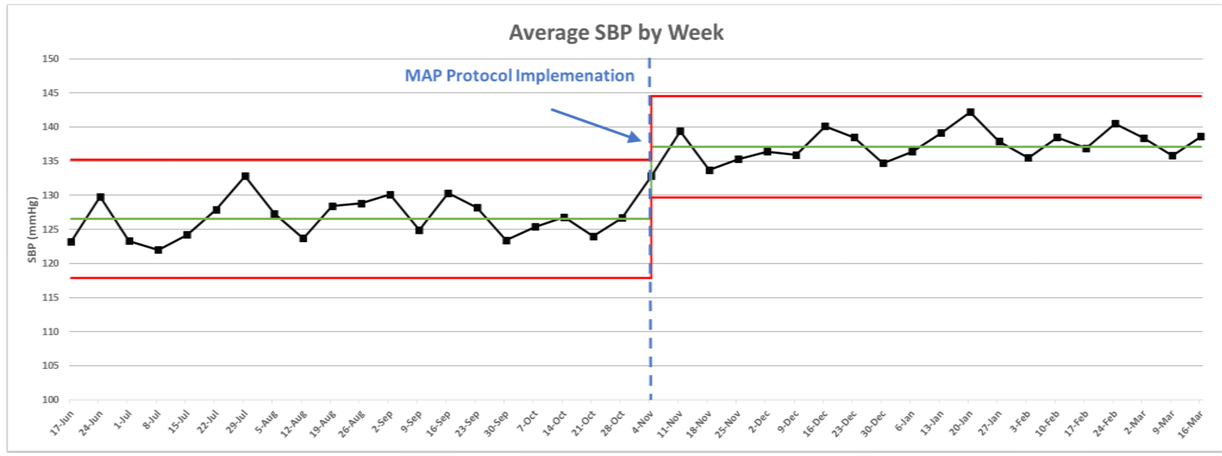

Figure 1: Baseline average SBP and DBP was 126.3 and 74.0, respectively. Post-*MAP* increased to 137.4 and 76.6, respectively. This unexpected change was likely driven by elimination of human error, rounding and confirmation bias (See **Figure 2**). We believe the baseline BPs are falsely low due to biases that manual auscultatory techniques are prone to.

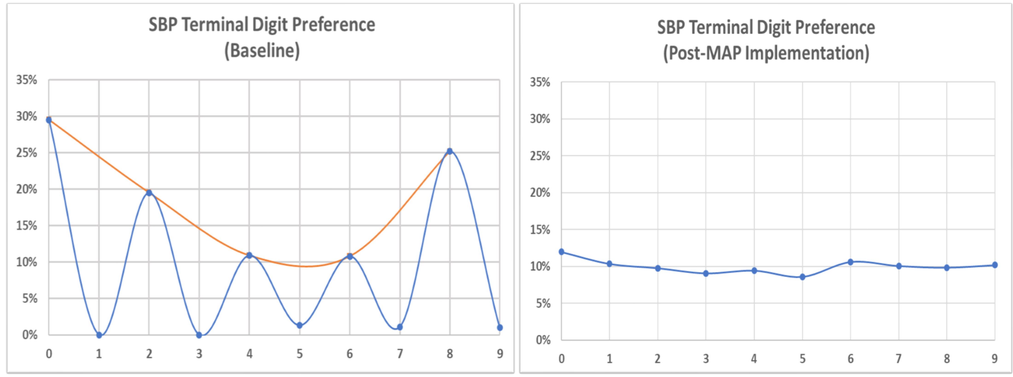

Figure 2: Left.) TDP for baseline manual auscultatory technique suggests an inherent bias to round down the blood pressure to, or just below, the preferred BP target which causes an over representation of "0" or "8." This trend was also seen with diastolic blood pressure. Right.) TDP for AOBP protocol suggests an elimination of TDP with AOBP which should minimize bias and human error

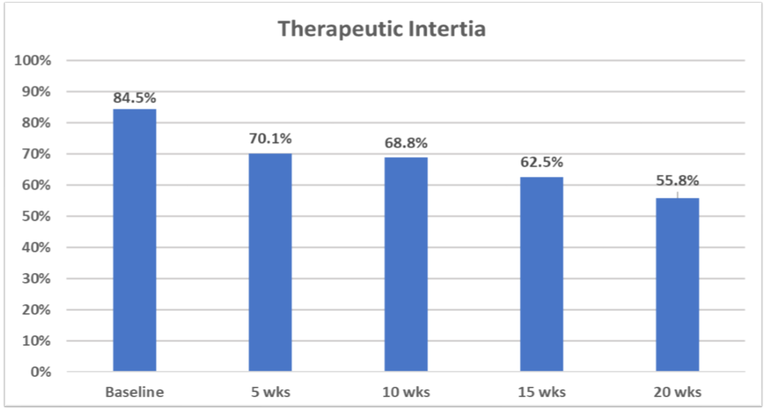

Figure 3: Rates of TI decreased nearly 30% by the end of the study period.

Conclusions

- The implementation of the *MAP* protocol leads to less human error and minimalization of bias in office-based BP measurement.
- The *MAP* protocol is an effective tool for lowering therapeutic inertia
- LPN workflow compliance averaged >88% over 20 weeks which suggests ease of fidelity
- This protocol is an effective way to validate a primary care clinic population's true baseline BP averages and the percentage of patient's at their BP goal.
- A longer study period is needed to assess the efficacy and utility of increasing the percentage of patient's at their BP goal.
- This protocol is a low-cost measure by which to improve hypertension management and can be quickly adapted in an outpatient healthcare setting.

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EFFECTS OF ATRIAL FIBRILLATION ABLATION ON LEFT ATRIAL FUNCTION AS EVALUATED BY CARDIAC MAGNETIC RESONANCE IMAGING

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Background

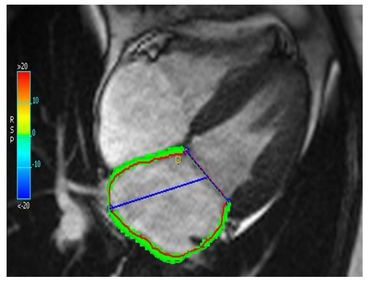
Radiofrequency ablation (RFA) is a widely used procedure for rhythm control in patients with atrial fibrillation (AF).

Recent studies have suggested an important role for cardiac magnetic resonance imaging (CMR) in patient selection for AF ablation, however the effects of RFA on left atrial (LA) remodeling remain unclear.

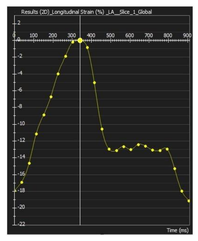
We sought to evaluate the impact of RFA on atrial remodeling and its association with AF recurrence.

Methods

•86 patients with AF were prospectively enrolled between 11/2014 and 11/2018 prior to RFA and CMR.
•LA size and function were assessed with volumetric and strain analysis.



Baseline characteristics	n=86
Age, mean ± SD years	60.5 ± 10.7
Male, n (%)	62 (72.1)
Caucasian, n (%)	82 (95.3)
Sinus rhythm at CMR, n (%)	55 (64.0)
Hypertension	42 (48.8)
CAD	21 (24.4)
Congestive heart failure	18 (20.9)
LVEF	57.3 (52-62)



Left atrial functions formulas
LA volume = 8/3 π (A4ch) (A2ch) / L
Passive LAEF = (max volume-preA volume)/max volume
Active LAEF = (preA volume-min volume)/preA volume
Total LAEF = (max volume-min volume)/max volume
LA expansion index = (max volume-min volume)/min volume
Global Peak Longitudinal Strain = average for 2ch and 4ch
Pulmonary vein area = π d1 d2

Results

•79 patients underwent RFA, of which 41 (51%) had paroxysmal AF.
•After RFA patients were followed for a median of 2 years (IQR: 1.0-3.4 years).
•Post-ablation CMR was performed in 34 patients after a median period of 116 days (IQR: 104-150 days).

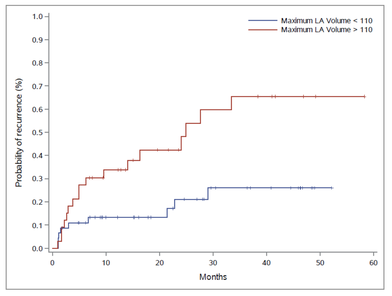
LA functions pre vs post RFA	Pre-ablation	Post-ablation	p-value
Sinus rhythm, n (%)	20 (58.8)	30 (88.2)	0.002
LAVol max, mL	106.6 (89.1, 136.4)	96.6 (81.3, 105.5)	0.02
LAVol max index, mL/m²	50.2 (40.8, 64.0)	44.5 (38.2, 54.0)	0.01
LAVol min, mL	62.6 (52.1, 90.8)	52.7 (41.8, 66.7)	0.02
LAVol min index, mL/m²	29.0 (23.0, 40.8)	24.0 (20.2, 32.9)	0.03
LAVol preA, mL	80.1 (62.5, 102.0)	71.1 (60.6, 84.6)	0.02
LAVol preA index, mL/m²	37.0 (29.7, 47.2)	31.2 (27.7, 41.5)	0.03
LAEF Passive, %	24.2 (23.0, 27.8)	24.9 (19.8, 29.8)	0.96
LAEF Active, %	31.4 (25.6, 38.6)	25.7 (20.6, 33.8)	0.001
LAEF Total, %	42.1 (25.4, 52.1)	45.8 (36.7, 48.7)	0.5
LA expansion index, %	72.6 (34.1, 108.7)	81.3 (50.8, 94.9)	0.5
Peak GLS	-16.6 (-18.6, -14.2)	-14.2 (-16.6, -11.9)	0.06
RA volume, mL	143.2 (113.0, 178.7)	125.1 (98.7, 145.4)	0.002
RA volume index, mL/m²	66.7 (53.6, 79.8)	56 (47, 71)	0.002
RUPV area, mm²	1277 (1043, 1527)	906 (731, 1217)	<0.001
RLPV area, mm²	971 (816, 1206)	840 (587, 975)	<0.001
LUPV area (n=27), mm²	791 (643, 976)	619 (432, 743)	<0.001
LLPV area (n=27), mm²	570 (480, 756)	444 (390, 659)	0.006
LCPV area (n=7), mm²	1555 (1226, 1789)	1187 (683, 1628)	0.02

Patient characteristics by recurrence of AF	Recurrence n=26 (33%)	No recurrence n=53 (67%)	p-value
Age at CMR, mean ± SD	64.5 ± 6.9	57.3 ± 11.6	0.001
Sinus rhythm, n (%)	10 (38.5)	42 (79.2)	<0.001
Persistent AF, n (%)	20 (76.9)	18 (34.0)	<0.001
Congestive heart failure, n (%)	4 (15.4)	14 (26.4)	0.3
Hypertension, n (%)	15 (57.7)	22 (41.5)	0.2
LAVol max, mL	132.6 (99.5, 158.2)	96.6 (79.6, 115.8)	0.002
LAVol max index, mL/m²	63.6 (43.4, 69.7)	45.9 (38.8, 56.2)	0.005
LAVol min, mL	88.0 (59.9, 121.7)	51.9 (34.9, 63.6)	<0.001
LAVol min index, mL/m²	39.7 (25.3, 55.4)	23.8 (17.0, 30.5)	0.002
LAVol preA, mL	107.8 (54.5, 121.8)	69.4 (51.8, 82.0)	0.06
LAVol preA index, mL/m²	48.7 (28.8, 52.2)	33.7 (26.1, 41.7)	0.05
LAEF Passive, %	24.2 (20.1, 28.2)	26.1 (22.9, 30.1)	0.3
LAEF Active, %	28.6 (18.9, 41.7)	36.3 (29.9, 41.6)	0.1
LAEF Total, %	31.8 (20.7, 46.6)	51.4 (40.7, 58.8)	0.002
LA expansion index, %	46.7 (26.2, 87.4)	105.8 (68.5, 142.9)	0.002
Peak GLS	-16.5 (-18.6, -13.5)	-17.2 (-20.7, -15.4)	0.3
LVEF, %	54.2 (49.4, 60.3)	57.9 (52.4, 62.3)	0.1
RA volume, mL	147.8 (136.1, 178.2)	132.7 (113.1, 150.6)	0.02
RA volume index, mL/m²	70.8 (57.0, 82.1)	65.6 (53.2, 72.3)	0.1
RUPV area, mm²	1549 (1228, 1842)	1060 (885, 1317)	<0.001
RLPV area, mm²	1102 (884, 1406)	886 (735, 1183)	0.04
LUPV area (n=52), mm²	940 (818, 1249)	683 (555, 846)	0.004
LLPV area (n=52), mm²	667 (570, 790)	516 (480, 622)	0.04
LCPV area (n=27), mm²	1781 (1345, 2073)	1246 (1056, 1630)	0.08

* data presented as median (IQR) unless mentioned otherwise

Results (continued)

•There was a significant decrease in LA volume post RFA, but no change in strain / ejection fraction.
•Right atrial volume and pulmonary vein size also decreased after RFA.
•Out of 79 ablation patients, 26 (33%) had AF recurrence [median:148 (IQR: 55-605) days].
•Predictors for recurrence included older age, absence of sinus rhythm at enrollment, persistent AF, higher LA volume, lower total LAEF, higher RA volume, and higher pulmonary veins area.
•After adjusting for age, persistent AF, sinus rhythm at enrollment, and hypertension; the maximum left atrial volume and the RUPV area were predictors for AF recurrence after RFA.



Figures 1-2: Kaplan Meier Curves for time to AF recurrence by LA Volume (top) and RUVP (bottom)
P value =0.02 for Max LA Volume, and p-value is <0.001 for RUVP

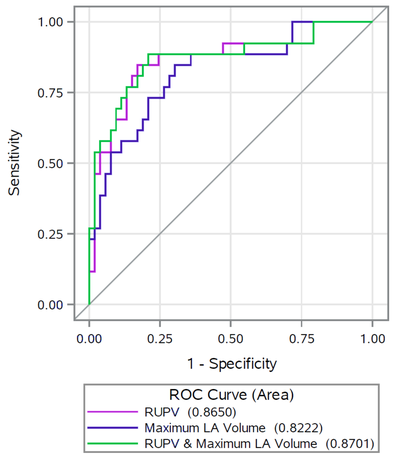


Figure 3: ROC Curve for multivariable models to predict AF recurrence

Adjusted odds ratios for pre-ablation characteristics to predict recurrence	Adjusted odds ratio (95% CI)	p-value
LAVol max (10 ml increase)	1.21 (1.02-1.48)	0.041
LAVol min (10 ml increase)	1.20 (0.99-1.49)	0.08
LA EF % Total (5% increase)	0.99 (0.78-1.26)	0.9
RA Volume (10 ml increase)	1.07 (0.92-1.26)	0.38
RUPV area (100 mm² increase)	1.33 (1.13-1.61)	0.001
RLPV area (100 mm² increase)	1.03 (0.90-1.21)	0.65

Conclusions

•RFA was not associated with improvement in LA strain and LAEF despite significant reductions in LA volume.
•On multivariable analysis, the LA max volume and RUPV area are independent predictors for recurrence of AF post RFA.
•Lack of improvement in LA strain and LAEF post ablation can possibly be related to the increased LA scaring.

Disclosures: None.

Increasing User Engagement with Order Entry for Echocardiograms

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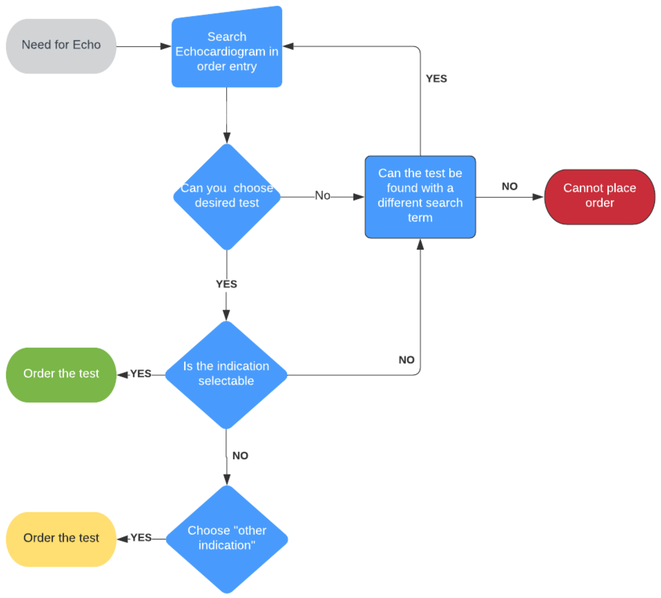
Computerized Provider Order Entry

- Clinical decision support systems (CDSS) and the Computerized Provider Order Entry (CPOE) are an integral part of EHRs and a focal point noted in the ACA's Meaningful Use Program (1).
- The adoption rate and satisfaction for these ubiquitous systems have been low across a spectrum of physicians regardless of in age, specialty, or level of training (2,3).
- Multiple studies have been published trying to examine the barriers to adoption and have attempted to create guidelines for CDS/CPOE creation to increase their utility and adoption (7,10,11,13).
- Barries that have been theorized are: alert fatigue, Increased Total Workload, Lack of Flexibility, Timing of Reminders, Poor interface with the CDS, and lack of planned coordination of a CDS with the workflow between different healthcare team members.
- Barriers typically encourage providers to create work-arounds.

Loyola ordering patterns: Echocardiogram

- Echocardiogram CPOE is a simple CDSS aimed at increasing the physician compliance with evidence-based cost-effective care according to the ACR/ACC imaging criteria and to facilitate more automated billing accuracy.
- Loyola's engagement with support systems appear to have similarly low adoption across the spectrum of our providers.
- Internal reports describe that ~15-20% of imaging orders are entered in the desired fashion with detail which is similar to published adoption rates at other institutions (2,3,5).
- Additional analysis has also demonstrated high alignment between the ordering indications and ACR/ACC guideline recommended indications.
- This would suggest that the low adoption rate of the CDSS may be related to physician workarounds that bypass the goals of the CDSS.
- The current order does not reflect the most recent clinical indication guidelines published by the ACC/AHA leading to a disconnect between mapped indications available for selection and guideline directed reasons to order imaging.

Current Imaging Order Process



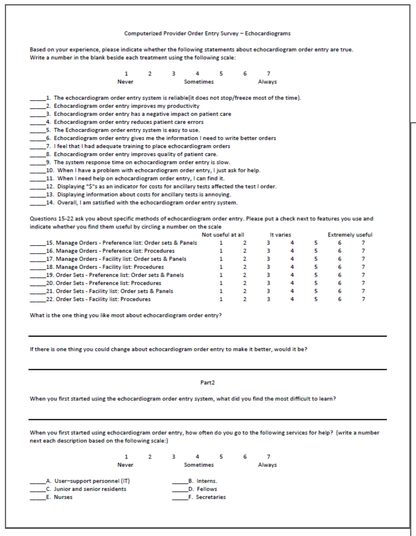
Hypothesis

Hypothesis: A redesign, remapped, and more user-friendly CPOE will increase physician adoption and engagement with the CDSS.

Aims

1. Gather the existing qualitative perspectives of echocardiogram order entry as an existing baseline
2. Determine provider engagement with available listed indications when ordering an echocardiogram
3. Align ordering indications to the ACC echocardiogram indications
4. Gather existing qualitative perspectives of new echocardiogram order entry
5. Determine provider engagement with available listed indications when ordering an echocardiogram after the listed indications are aligned with the ACC guidelines
6. Determine if there is a relationship between qualitative perspectives reported by residents and the global ordering patterns of the institution
7. Determine if alignment of the available ordering indications to the recommended guidelines from the overseeing specialty organization would increase adoption of the clinical

Current Progress



Computerized Provider Order Entry Survey – Echocardiograms

Based on your experience, please indicate whether the following statements about echocardiogram order entry are true.
Write a number in the blank beside each treatment using the following scale:

1 2 3 4 5 6 7
Never Sometimes Always

____1. The echocardiogram order entry system is reliable(it does not stop/freeze most of the time).
____2. Echocardiogram order entry improves my productivity
____3. Echocardiogram order entry has a negative impact on patient care
____4. Echocardiogram order entry reduces patient care errors
____5. The Echocardiogram order entry system is easy to use.
____6. Echocardiogram order entry gives me the information I need to write better orders
____7. I feel that I had adequate training to place echocardiogram orders
____8. Echocardiogram order entry improves quality of patient care.
____9. The system response time on echocardiogram order entry is slow.
____10. When I have a problem with echocardiogram order entry, I just ask for help.
____11. When I need help on echocardiogram order entry, I can find it.
____12. Displaying "()"s as an indicator for costs for ancillary tests affected the test I order.
____13. Displaying information about costs for ancillary tests is annoying.
____14. Overall, I am satisfied with the echocardiogram order entry system.

Questions 15-22 ask you about specific methods of echocardiogram order entry. Please put a check next to features you use and indicate whether you find them useful by circling a number on the scale

Not useful at all — It varies — Extremely useful

____15. Manage Orders - Preference list: Order sets & Panels 1 2 3 4 5 6 7
____16. Manage Orders - Preference list: Procedures 1 2 3 4 5 6 7
____17. Manage Orders - Facility list: Order sets & Panels 1 2 3 4 5 6 7
____18. Manage Orders - Facility list: Procedures 1 2 3 4 5 6 7
____19. Order Sets - Preference list: Order sets & Panels 1 2 3 4 5 6 7
____20. Order Sets - Preference list: Procedures 1 2 3 4 5 6 7
____21. Order Sets - Facility list: Order sets & Panels 1 2 3 4 5 6 7
____22. Order Sets - Facility list: Procedures 1 2 3 4 5 6 7

What is the one thing you like most about echocardiogram order entry?

If there is one thing you could change about echocardiogram order entry to make it better, would it be?

Part2

When you first started using the echocardiogram order entry system, what did you find the most difficult to learn?

When you first started using echocardiogram order entry, how often do you go to the following services for help? (write a number next each description based on the following scale:)

1 2 3 4 5 6 7
Never Sometimes Always

____A. User–support personnel (IT) ____B. Interns.
____C. Junior and senior residents ____D. Fellows
____E. Nurses ____F. Secretaries
____G. User documentation ____H. Help screens
____I. Online feedback ____J. Other (please specify):

Now that you are familiar with it, how often you the following services for help with echocardiogram order entry? (write a number next to each group using the same scale as above:)

1 2 3 4 5 6 7
Never Sometimes Always

____A. User-support personnel ____B. Interns.
____C. Junior and senior residents ____D. Fellows
____E. Nurses ____F. Secretaries
____G. User documentation ____H. Help screens
____I. Online feedback ____J. Other (please specify):

Your responses are completely anonymous, but we would like to ask you if you have questions about who you are:
1. Gender: ____Female ____Male ____Prefer not to answer
2. Position: ____Intern ____Senior Resident ____Fellow ____Attending
3. Have been a team member on a primary service with a cardiology attending at Loyola.
____Yes ____No
4. If you answered yes question 3, were you the provider with the majority of the responsibility ordering echocardiograms on that service.
____Yes ____No
5. Have you entered orders (through EMRs) before starting residency
____Yes ____No

- Survey adapted from previously validated POE-SUS Survey. (Provider Order Entry User Satisfaction and Usage Satisfaction Survey)
- Survey is designed to quantify various aspect of Provider satisfaction on a Likert Scale and gather qualitative responses of dissatisfaction and areas for improvement

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