

# Safety profile of apixaban for peri-procedural anticoagulation in heart transplant recipients undergoing endomyocardial biopsy

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## BACKGROUND

- Endomyocardial biopsy (EMB) is routinely performed for surveillance of allograft rejection following heart transplantation (HTx).
- HTx recipients who are on anticoagulation are at higher risk for complications such as bleeding at access site, pericardial effusion, and cardiac tamponade.
- The safety profile of apixaban for periprocedural anticoagulation in heart transplant recipients undergoing EMB is not well characterized

## OBJECTIVE

- Assess the safety of periprocedural anticoagulation with apixaban in heart transplant patients undergoing EMBs.

## METHODS

- This was a retrospective cohort study of all EMBs performed within one year from transplant of 102 HTx recipients from 2016 to 2019 at Loyola University Medical Center
- Patients on apixaban were compared to patients not on anticoagulation at the time of EMBs.
- Apixaban was held two days prior to EMB and restarted the evening after EMB if there were no bleeding events.
- Primary endpoint was major bleeding, defined as:
  - Life threatening bleeding resulting in death
  - Cardiac tamponade
  - ≥3 g/dl hemoglobin drop and/or ≥2 units packed red blood cell transfusion.
- Secondary endpoints included minor bleeding events and thromboembolic events.

## RESULTS

Table 1 Patient Baseline Characteristics

	Apixaban (n=30)	No Anticoagulation (n=72)	p-value
Mean Age (SD) (years)	57.89 (11.83)	56.35 (11.82)	0.55
Gender, n (%)			0.82
Male	21 (70)	52 (72)	
Female	9 (30)	20 (28)	
Mean BMI (SD)	27.5 (5.34)	26.86 (7.98)	0.69
Race, n (%)			0.61
Caucasian	17 (57)	38 (53)	
African American	6 (20)	11 (15)	
Asian	1 (3)	0 (0)	
Hispanic	1 (3)	8 (11)	
Other	5 (17)	15 (21)	
Antiplatelet, n (%)			0.55
None	15 (50)	34(48)	
Aspirin	15 (50)	37(51)	
Clopidogrel	0(0)	1 (1)	
Indications for Anticoagulation, n (%)			N/A
Deep venous thrombosis	22 (73)		
Atrial flutter/fibrillation	5 (16.7)		
Pulmonary embolism	3 (10)		
Total EMBs	n=474	n=715	N/A

Table 2 Primary and Secondary Endpoints

	Apixaban (n=30)	No Anticoagulation (n=72)	p-value
<b>Major Bleeding, n (% of total EMBs)</b>	6 (0.01)	14(0.02)	>0.99
Critical site bleeding	1	4	
Bleeding resulting in death	0	0	
New or worsening pericardial effusion	2	6	
Pericardial tamponade	1	2	
Transfusion of ≥2 units of packed red blood cells	2	2	
<b>Minor Bleeding, n (% of total EMBs)</b>	5 (0.01)	6 (<0.01)	0.78
Access site hematoma	3	2	
Readmission for bleeding	2	4	
<b>Thromboembolism, n(% of total EMBs)</b>	11 (0.02)	6 (<0.01)	0.64
Ischemic stroke	0	0	
Deep venous thrombosis	10	5	
Pulmonary embolism	1	1	

## CONCLUSIONS

- Periprocedural anticoagulation with apixaban for patients undergoing EMB following HTx is relatively safe with a very low risk of major or minor bleeding events as well as thromboembolism.

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## Introduction

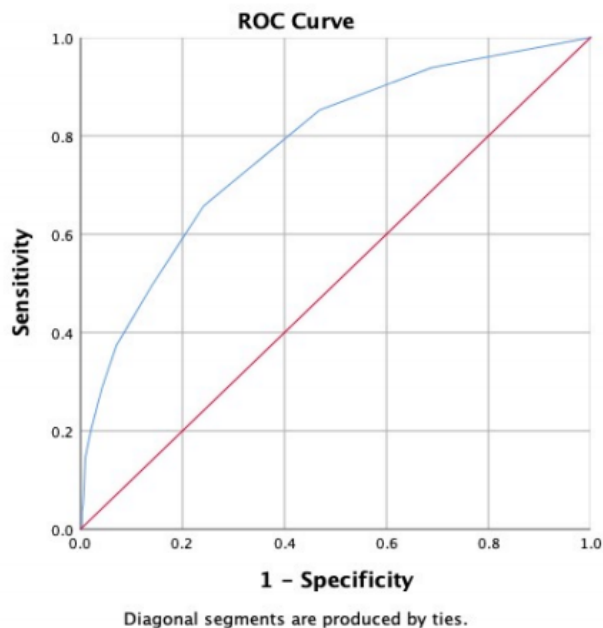
- While the global dissemination of vaccines targeting the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has resulted in a decline in the incidence of infections, the case fatality rates have remained relatively stable.
- A major objective of managing hospitalized patients with documented or suspected COVID-19 infection is the rapid identification of features associated with severe illness using readily available laboratory tests and clinical tools.
- The sequential organ failure assessment (SOFA) score is a validated tool to facilitate the identification of patients at risk of dying from sepsis.

**Objective:** The aim of this study was to assess the discriminatory accuracy of the SOFA score in predicting clinical decompensation in patients hospitalized with COVID-19 infection.

## Methods

- We conducted a retrospective analysis at a three-hospital health system, comprised of one tertiary and two community hospitals, located in the Chicago metropolitan area.
- All patients had positive SARS-CoV-2 testing and were hospitalized for COVID-19 infection.
- The primary outcome was clinical decompensation, defined as the composite endpoint of death, ICU admission, or need for intubation.
- We utilized the most abnormal laboratory values observed during the admission to calculate the SOFA score.
- Receiver Operating Curves (ROC) were constructed to determine the sensitivity and specificity of SOFA scores (figure 1).

## Figure 1



**Figure 1:** Receiver Operating Curve (ROC) analysis of SOFA scores predicting primary composite endpoint of death, ICU admission, and need for intubation.

## Results

- Between March 1<sup>st</sup> and May 31<sup>st</sup> 2020, 1029 patients were included in our analysis with 367 patients meeting the study endpoint.
- The median SOFA score was 2.0 IQR (Q1, Q3 1,4) for the entire cohort.
- Patients who had in-hospital mortality had a median SOFA score of 4.0 (Q1,Q3 3,7).
- In patients that met the primary composite endpoint, the median SOFA score was 3.0, IQR (Q1, Q3 2,6).
- The ROC was 0.776 (95% CI 0.746 – 0.806, p <0.01).

## Conclusions

- The SOFA score demonstrates strong discriminatory accuracy for prediction of clinical decompensation in patients presenting with COVID-19 at our urban hospital system.
- Limitations for this study include reduced generalizability as all patients presented to Chicago hospitals, as well as relatively small sample size compared to prior studies.
- Future studies should focus on development of machine learning prediction models with large patient databases to continue identifying risk factors for decompensation in this heterogenous patient population.



### Introduction

- Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has resulted in a pandemic which has infected more than 128 million people and led to over 2.8 million deaths worldwide.
- Although the introduction of efficacious vaccines has led to overall declines in the incidence of SARS-CoV-2 infection, there has been a recent increase in infections once more due to the appearance of mutant strains with higher virulence.
- It therefore remains vital to identify predictors of poor outcomes in this patient population.

**Objective:** The aim of our study was to identify predictors of prolonged hospitalization, intensive care unit (ICU) admission, intubation, and death in patients infected with SARS-CoV-2.

**Table 1. Baseline Demographics**

Demographic	Patients not meeting primary outcome* (n=650)	Patients meeting primary outcome* (n=379)
Age	59.1 (17)	63.3 (17)
Female (n, %)	284 (43.8)	160 (42.2)
Body mass index (SD)	30.9 (8.5)	31.4 (10.0)
Coronary Artery Disease (% , SD)	74 (11.4)	60 (15.8)
Congestive heart failure (% , SD)	58 (8.9)	45 (11.9)
Hypertension (n,%)	342 (52.7)	245 (64.6)
Diabetes mellitus, type 2 (n, %)	240 (37)	177 (46.7)

\*Primary outcome: composite of death, hospitalization >28 days, ICU admission and need for intubation.

**Table 2. Clinical Variables**

Clinical Variable	Unadjusted Odds Ratio (95% CI)	P Value	Adjusted Odds Ratio (95% CI)	P value
Age	1.0 (1.0-1.02)	0.01		
HTN	1.6 (1.25-2.1)	<0.01		
Alcohol abuse	1.2 (1.01-1.38)	0.04		
Tobacco abuse	1.2 (1.02-1.41)	0.29		
CAD	1.6 (1.07-2.24)	0.02		
Arrhythmia	1.6 (1.2-3.0)	0.01		
Valvular heart disease	2.5 (1.14-5.54)	0.02		
HLD	1.8 (1.35-2.33)	<0.01		
Stroke	2.1 (1.33-3.37)	0.01		
DM 2	1.5(1.16-1.94)	0.02		
VTE	5.8 (2.8-10.03)	<0.01	3.6 (1.3-8.7)	<0.05
Troponin	4.2 (2.1-8.26)	<0.01	2.4 (1.08-5.17)	0.03
CRP	1.0 (1.0-1.11)	<0.01		
ESR	1.01 (1.0-1.02)	0.01		
Ferritin	1.0 (1.0-1.01)	<0.01		
LDH	1.0 (1.0-1.01)	<0.01		
BNP	1.0 (1.0-1.01)	0.05		
D-Dimer >5x ULN	8.5 (6.1-11.9)	0.01	1.5 (1.23-1.98)	<0.01
Lactate	1.8 (1.53-2.15)	<0.01	1.6 (1.28-1.95)	<0.01
RVOT velocity time integral <9.5 cm	1.0 (1.0-1.01)	0.03		

### Methods

- We conducted a retrospective analysis of all patients hospitalized with SARS-CoV-2 at our health system that includes one tertiary care center and two community hospitals located in the Chicago metropolitan area.
- The main outcome was a composite endpoint of hospitalization >28 days, ICU admission, intubation, and death.
- Explanatory variables associated with the primary outcome in the bivariate analysis (p<0.05) were included in the multivariable logistic regression model.
- Statistical analysis was performed using IBM SPSS 25.0.

### Results

- Between March 1, 2020 and May 31, 2020, 1029 patients hospitalized with SARS-CoV-2 were included in our analysis. Of these patients, 379 met the composite endpoint.
- Baseline demographics are described in Table 1. Of note, our cohort consisted of a predominantly minority patient population including 47% Hispanic, 17% African American, 16% Caucasian, and 16% other.
- In bivariate analysis, age, hypertension, tobacco and alcohol abuse, obesity, coronary artery disease, arrhythmias, valvular heart disease, dyslipidemia, hypertension, stroke, diabetes, documented thrombosis, troponin, CRP, ESR, ferritin, LDH, BNP, D-Dimer >5x the upper limit of normal, lactate, and right ventricular outflow tract velocity time integral <9.5 were significant (Table 2).
- After multivariable adjustment, explanatory variables associated with the composite endpoint included troponin (OR 2.36; 95% CI 1.08-5.17, p 0.03), D-Dimer (OR 1.5; 95% CI 1.23-1.98, p <0.01), lactate (OR 1.58; 95% CI 1.28 – 1.95, p <0.01), and documented thrombosis (OR 3.56; 95% CI, p<.05).
- Race was not a predictor of poor outcomes in the bivariate or multivariate analysis.

### Conclusions

- In a large urban cohort with a predominantly minority population, we identified several clinical predictors of poor outcomes.
- While recent literature has demonstrated worse outcomes among racial minorities infected with SARS-CoV-2, race was not a predictor of the primary endpoint in this study. Our data suggests these variations are related to social determinants of health rather than biologic causes.





# Introduction of an Automated Data Extraction Tool to Improve Accuracy of a Heart Failure Registry

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American Heart Association



American Heart Association. Get with the Guidelines. 360°

## Background

- Heart failure readmission remain one of the biggest challenges in health care, with 30-day readmission rates estimated at 22% nationally.
  - Possible explanations include lack of medication optimization, patient education, and failure to schedule follow-up appointment at time of discharge.
- AHA/ACC guidelines state that participation in quality improvement (QI) programs and patient registries can be beneficial in improving quality of heart failure care.

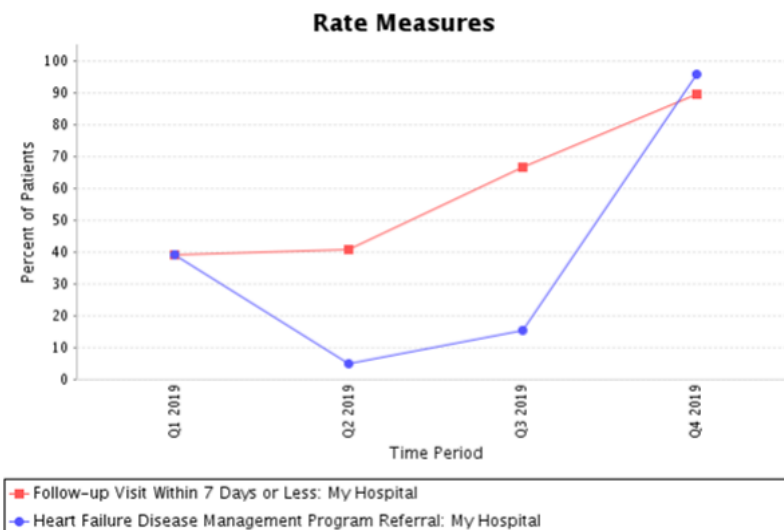
## 2019-2020 Registry

- From January 2019 to December 2019, a team consisting of 3 internal medicine residents, 2 cardiology fellows, and 1 heart failure attending was assembled to collect baseline data on 194 patients discharged for acute heart failure exacerbation.
- Specific adherence measures were collected quarterly on the following: patient demographics, implementation of goal-directed medical therapy, 7-day follow-up, and referral to heart failure disease management programs.
- 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). 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). Heart failure disease management program referral measure improved from 39.1% in Q1 to 95.7% in Q4 (%Δ144.76) (Figure1)
  - This measure defined by the AHA, requires documentation of provider recommendation for patient follow-up with a qualifying heart failure management program

## Lessons Learned

- Baseline data from 2019 indicated apparent inconsistencies in results from Q1 to Q4.
- We believe the results reflect variability in data collection, rather than a true improvement in quality metrics.
- A standardized collection tool should be implemented to increase sample size and improve accuracy of key metric recordings at LUMC.

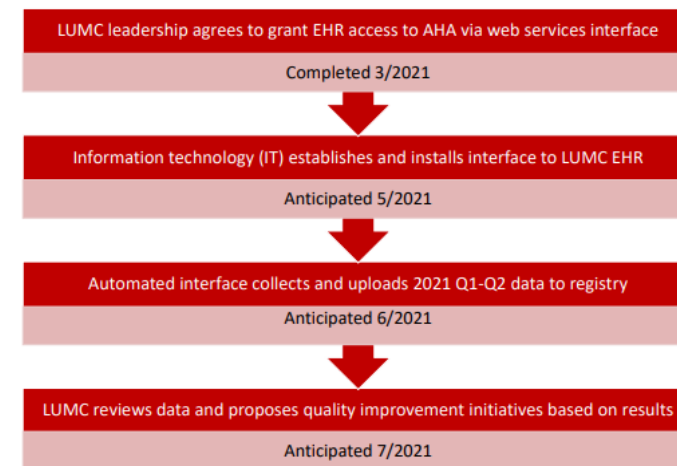
Figure 1.



## Proposed Solution

- Our plan is to introduce an automated software tool provided by the AHA, to securely collect and upload data directly to the Loyola GWTG registry.
  - Patient data is not stored long-term, but instead processed and shared with the hospital through a spreadsheet, which can then be shared into the GWTG portal.
  - Participating hospitals have full control of which patients are abstracted and can also choose specific data elements to abstract.
- The goal of this proposal is to improve accuracy of collection data, and shift time spent by residents towards data analysis and development of quality improvement projects.

## Timeline



## Future Research

- Future projects will utilize baseline data that accurately reflects adherence to goal-directed-medical therapy at LUMC.
- QI projects will then be implemented in real-time based on identified deficiencies in key heart failure metrics.
- Additionally, LUMC data can be compared to regional and national hospitals that partner with the AHA registry.

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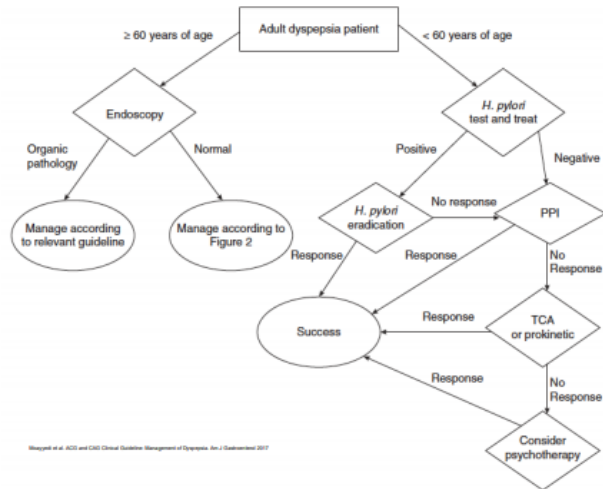
# Diagnostic Yield of Endoscopy for Chronic Abdominal Pain

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## Introduction

- ACG defines Chronic Abdominal Pain as epigastric pain with or without other gastrointestinal symptoms lasting at least one month
- Up to 21% of the general population has complaints of CAP and it is the 8<sup>th</sup> most common complaint of all patient presentations in the primary care setting
- Range in diagnostic yield from EGD and colonoscopy for CAP from 23 and 24-46% respectively
- Moayyedi et al. meta-analysis investigated 15 studies with over 11,000 patients and found no correlation between clinical impression, demographics, risk factors or symptoms in identifying an endoscopic difference between functional and organic dyspepsia.



Regeard et al. ACG and CBO Clinical Guidelines Management of Dyspepsia. Am J Gastroenterol 2017

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## Hypothesis

- Studies have shown the limitations in demographics, clinical impression and history in distinguishing between functional and organic dyspepsia. However, these studies do not look at the chronicity of symptoms. Give n that ongoing GERD or peptic ulcerative disease results in worsening disease and more severe endoscopy findings, chronicity of abdominal pain may be an important tool in predicting diagnostic yield from endoscopy
- Furthermore, more studies investigating correlation between pre-endoscopy assessment and diagnostic outcomes should be explored to help navigate who should receive endoscopic evaluation

### Hypothesis

•Current literature indicates a poor diagnostic yield in organic findings from endoscopy for chronic abdominal pain. However there is a paucity of literature regarding the correlation of chronicity of abdominal pain and diagnostic yield

### Primary Outcome

- Organic findings on endoscopy
- Chronicity of abdominal pain

### Secondary outcomes

- PPI use and response
- Prior Hpylori infection
- Age
- Demographics
- ACG guidelines appropriateness
- Location of pain

## Organic vs. Functional Dyspepsia

- Organic
  - Most common causes: Peptic Ulcer Disease (PUD) and GERD
  - Main causes of PUD: Hpylori and NSAID use
  - Endoscopy: Ulcerative disease or inflammation of the distal esophagus. However, there is also such a thing as non-erosive reflux disease with symptoms of GERD but no endoscopic findings.
  - Of patients with GI symptoms: 20% were found to have esophagitis, 20% with endoscopy negative disease, 10% with peptic ulcer disease, 2% Barrett esophagus and 1% with malignancy
- Functional
  - Multifactorial; gastroparesis, autonomic nervous system dysregulation among other causes

## Methods

- Retrospective chart review January 2018-January 2020
- Centers involved: Burr Ridge Hospital, Loyola University Hospital
- Database created using search terms "Endoscopy" and "abdominal pain" or "dyspepsia"
- Databases used: Provation Endoscopy Database and the EPIC electronic medical records
- Data Collection tool: Redcap Databases
- **Inclusion Criteria**
  - Patients >18
  - Abdominal pain for over 4 weeks
- **Exclusion Criteria**
  - Known history of GI medical diagnosis
  - Other major gastrointestinal complaints such as hematochezia and melena, bleeding, weight loss, jaundice
  - Active Hpylori infection, defined as either untreated or refractory to treatment
  - EGD within the past year

PPI response	<input type="radio"/> Resolution of symptoms <input type="radio"/> No resolution of symptoms <input type="radio"/> Unknown
Prior EGD	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unknown
Date of prior EGD	<input type="radio"/> Within one year <input type="radio"/> > 1 year
ACG Appropriate for EGD	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Other
ACG Appropriate, Other	<input type="text"/>
NSAID use	<input type="radio"/> Yes <input type="radio"/> No
Active smoker (within 6 mos)	<input type="radio"/> Yes <input type="radio"/> No
Alcohol Use	<input type="radio"/> Yes <input type="radio"/> No
Date of Initial Clinic Evaluation	<input type="text"/> Today
Date of EGD	<input type="text"/> Today
Organic findings on EGD	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Other
Findings on EGD	<input type="checkbox"/> Erosions <input type="checkbox"/> Ulcers <input type="checkbox"/> Gastritis <input type="checkbox"/> Duodenitis <input type="checkbox"/> Esophagitis <input type="checkbox"/> Hpylori <input type="checkbox"/> Other



# The Use of an Escape Room to Build Workplace Social Capital in an Internal Medicine Residency Program

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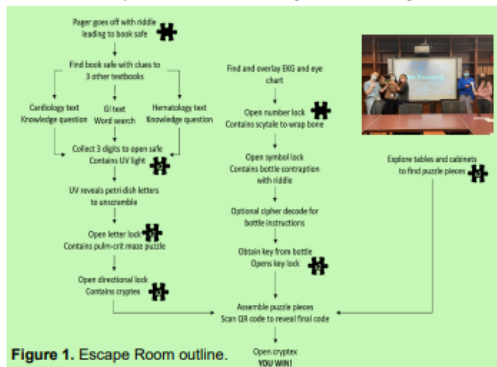


## Introduction

- Workplace social capital (WSC) is the psychosocial environment of the workplace, defined as the camaraderie (mutual trust, shared experience, and bonding) of a work team
- This year's intern group did not have the same opportunities (i.e. retreats, holiday parties, graduation) to form that social capital due to the Covid pandemic
- Medical escape room (ER) simulations have already been shown to strengthen critical thinking, medical knowledge, technical skills, and interprofessionalism
- We hypothesize that interns who participate in a medically-themed ER would build social capital, as measured by higher WSC scores after the activity

## Methods

- Single-center before-and-after survey study
- A medically-themed ER was designed for groups of 4-6 interns at a time, to last up to 1 hour
- Includes 11 puzzles of varying difficulty testing teamwork, skills of observation, medical knowledge, and puzzle solving (Figure 1.)
- All 52 Loyola internal medicine interns were invited to participate in the ER in February-March, 2021
- Baseline WSC measured 1-7 days prior to ER using a modified Kouvonen et al. validated WSC scale (Table 1.)
- Follow-up WSC scores assessed 1-7 days after ER using the identical scale
- Paired t-testing was used for overall scores, individual questions were analyzed ordinally



## Results

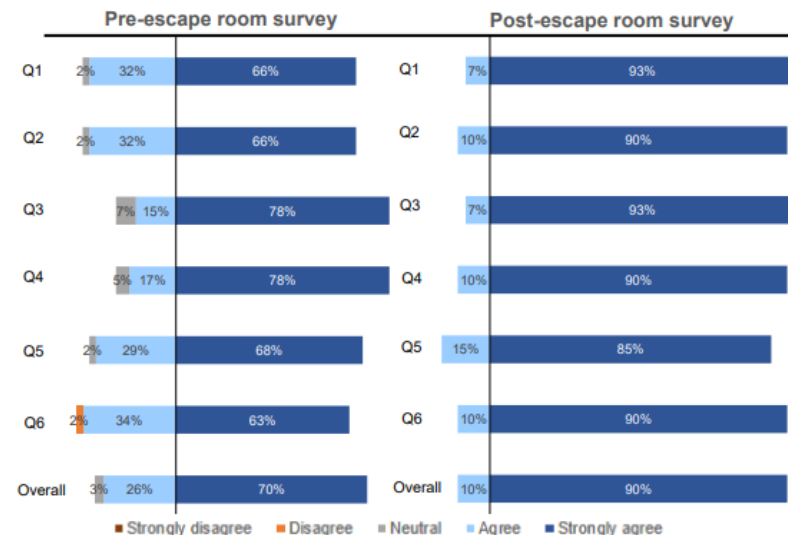
- 51 intern residents participated in the ER in 10 groups, mostly within their firms
- 41 (80%) of interns completed pre- and post-surveys within one week
- All groups escaped, average time of 39 minutes (ranging 32-49 minutes)
- WSC survey scores are shown in Figure 2. There was a significant improvement in scores when comparing pre- to post- ER surveys (Figure 3).

**Table 1. Modified Workplace Social Capital Scale.**

Answer the following questions with a Likert scale (1= strongly disagree, 2= disagree, 3=neutral, 4=agree, 5=strongly agree)

- Residents feel understood and accepted by each other.
- We have a "we are together" attitude.
- In our workplace, there is an atmosphere of helping each other.
- In our workplace, we trust each other.
- Residents build on each other's ideas in order to achieve the best possible outcome.
- Residents cooperate in order to help develop and apply new ideas.

**Figure 2. WSC survey data by question and averaged overall.**



**Figure 3. Statistical analysis of WSC survey results showing statistically significant increase in overall average score from 4.66 to 4.90 out of 5, and increase in percent of responses that were agree or strongly agree.**

## Discussion & Conclusion

- This is the first study to demonstrate that an ER contributed to resident bonding, as demonstrated by a statistically significant improvement in WSC scores
- Free response comments also centered on the ER's positive impact on bonding, teamwork, friendship, and a reprieve from clinical duties (Figure 4.)
- One surprise was that our pre-ER survey scores were higher than expected and limited our room for measurable improvement
- Despite this, we still saw a significant increase in both average scores and percent of responses that were strongly agree, or either agree or strongly agree
- Limitation: the survey is subjective and self-reported
- Confounders: WSC may have been simultaneously bolstered through other FLOURLISH activities
- Overall, our study shows that ERs can strengthen the psychosocial environment of a workplace, which is thought to improve resident mental health. As residency continues to be a challenging time in training, it is important to offer programming that benefits resident well-being. Future activities like this escape room are highly encouraged!
- Next steps: Look for sustained benefit in WSC scores, or impact on PHQ-9 (or other validated tests of MH)

**Figure 4. Sample of resident open-ended feedback after the ER.**

- "A great way to promote camaraderie. Could use more events like this!"
- "Great bonding activity. 10/10!"
- "It was nice to have an activity to do with everyone else that is not work related during Covid"
- "We will remember this all of residency and laugh about it"
- "A great way to mix up the day in peak intern burn-out time"
- "It provided an opportunity to listen to ideas and brainstorm together"
- "This brought colleagues closer together. More games please!"

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# Detecting Hypertension and Improving Healthy Lifestyle in African American Women Attending Community Screening Program

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## Introduction

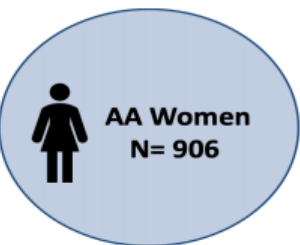
- Hypertension (HTN) is an important modifiable risk factor for cardiovascular disease (CVD).
- Eleven million patients in the United States have undiagnosed HTN and a large population of those diagnosed remain untreated or inadequately treated per guideline recommendations.
- African American (AA) women specifically have the highest prevalence of HTN compared to women from other ethnicities and are at increased risk for CVD.

## Objectives

- To demonstrate the impact of community HTN screening programs on cardiovascular preventive risk factors in AA women.

## Methods

Emory 10,000 Women Community Screening Project (2015-2019)



Medical History



CVD Risk Factor Screening



Educational Handouts

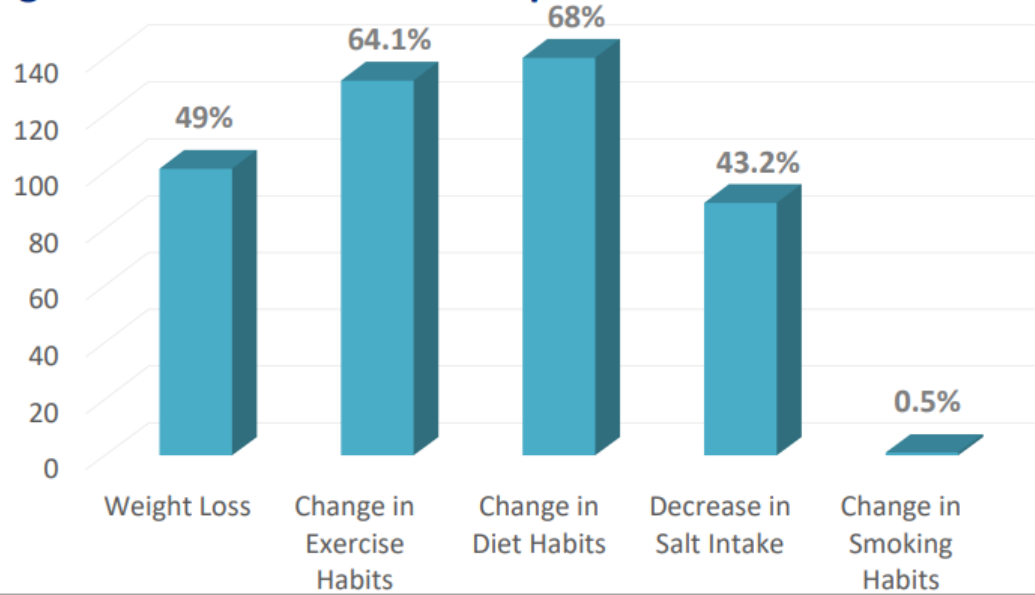


206 Women Responded To Follow Up Phone Call (mean = 6 months)

Table 1. Baseline Characteristics

Variables	Total (N=206)
Age in years (mean)	50.9 ± 14.0
Body mass index (mean)	32.2 ± 7.9
History of hypertension %	34.0
History of diabetes %	9.2
Current smoker %	5.3
Exercise less than 3 times a week %	57.3
Eating fast food > 3 times a week %	22.3

Figure 1. Six Months Follow Up



## Results

- N= 136 had no prior history of diagnosed HTN. 66.2% of these participants had blood pressure of >130/80.
- 15.5% of those with elevated blood pressure were started on at least 1 blood pressure medication within 6 months after following up with a physician.

## Conclusion

- Information from community health CVD screening event prompted previously undiagnosed AA participants to seek care for treatment of HTN within 6 months.
- Community-based screening programs are effective at screening and educating large populations of patients leading to early diagnosis and treatment of HTN.
- Education of healthy lifestyle recommendations may be beneficial to reduce CVD risk in high risk communities.

## Limitations

- These were data collected in a metro-Atlanta area and thus may not be applicable to rural populations
- Susceptible to errors due to using self-report surveys.

## References

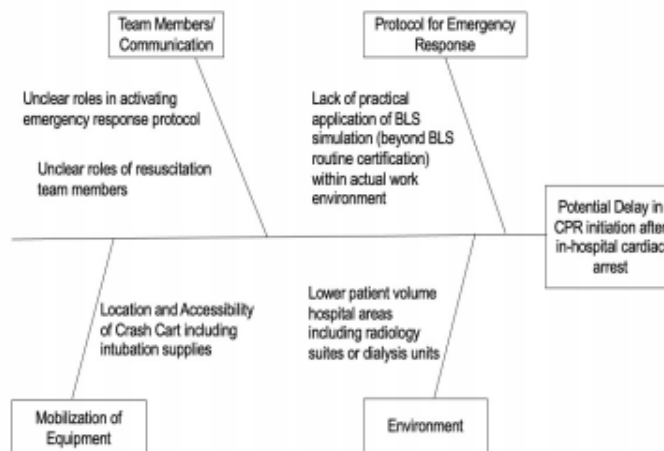
Ciemins EL, Ritchey MD, Joshi VV, Loustalot F, Hannan J, Cuddeback JK. Application of a Tool to Identify Undiagnosed Hypertension - United States, 2016. *MMWR Morb Mortal Wkly Rep.* 2018 Jul 27;67(29):798-802. doi: 10.15585/mmwr.mm6729a2. PMID: 30048423; PMCID: PMC6065206.

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## Background & Problem Statement

- Cardiac arrests can occur anywhere
- Cardiopulmonary resuscitation (CPR), the manual application of chest compressions and ventilations to patients in cardiac arrest, can be lifesaving
- In-hospital cardiac arrests (IHCA) have better outcomes when compared to out-of-hospital cardiac arrests<sup>1,2</sup>
- Good outcomes for in-hospital cardiac arrests depend on:
  - A skilled resuscitation team
  - Prompt initiation of high-quality CPR and defibrillation
  - Organizational structures to support IHCA response<sup>3</sup>
- Delays in cardiopulmonary resuscitation, defibrillation, and epinephrine administration all decrease survival in in-hospital cardiac arrest<sup>4,5</sup>
  - Time to initiation of CPR > 2 minutes were associated with a survival of 14.7% (91 of 618) as compared with 17.1% (9,711 of 56,694) if CPR was begun in 2 min or less (P < 0.002)<sup>4</sup>
- Problem Statement:** Potential delays in CPR initiation after in-hospital cardiac arrests in low patient volume areas may occur in part due to lack of familiarity with emergency response protocols and delay in equipment mobilization.

## Fishbone Diagram: Potential Delay



## Discussion

- Potential delays in CPR initiation can be attributed to:
  - Delayed mobilization of equipment
  - Lack of familiarity of high-quality CPR and defibrillation
  - Unclear roles of resuscitation team members
- Get With the Guidelines Resuscitation:
  - Large prospective, hospital based, multi-center clinical registry that collects resuscitation data from over 300 hospitals nationwide and creates evidence-based guidelines for inpatient IHCA
- Guetterman et al conducted a descriptive qualitative study at nine hospitals in the Get With the Guidelines Resuscitation registry and found that IHCA in higher performing hospitals had:
  - Emphasized training and competency in CPR
  - Provided organizational flexibility and responsiveness in nursing roles
  - Empowered nurses to operate at higher scope of clinical practice (including defibrillation)<sup>6</sup>
- Nallamothu et al found that resuscitation teams at top-performing hospitals had:<sup>5</sup>
  - Dedicated or designated resuscitation teams
  - Participation of diverse disciplines as team members during IHCA
  - Clear roles and responsibilities of team members
  - Better communication and leadership during IHCA
  - In-depth mock code trainings<sup>5</sup>



## Future Considerations

- Increase frequency of simulated application of Basic Life Support (BLS) in hospital areas where codes are a rare event in order to:
  - Establish familiarity with and confidence in performing skills required in protocols
  - Mobilize equipment needed to support such protocols
- Consider consolidation of emergency equipment:
  - Evaluate the cost vs benefit of additional features on emergency equipment in order to augment technological support during CPR

## Next Steps

### Hines Hospital "First Three-Minutes" and Mock Code trainings

- Organized and led by Hines Nursing Professional Development Practitioner
- Performed throughout the hospital, including areas of the hospital where codes are a rare event
- Goal of Three-Minute training: give trainees the tools, skills, and education needed to provide efficient and proficient patient care in the first few minutes of a cardiac arrest before the code team arrives
- Reviewed following items:
  - Equipment education including AED function on defibrillator
  - Proper technique of compressions and defibrillation
  - Prompt mobilization of equipment including crash cart
- Included built-in feedback and debriefing after training sessions
- Implemented environmental and technological changes

### Hines Code Review Committee

- Multi-disciplinary team performs dedicated reviews in-hospital cardiac arrests and helps identify areas for improvement

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## Introduction

- Approximately 900,000 people in the U.S. are affected by deep vein thrombosis (DVT)/pulmonary embolism (PE) each year and upwards of 100,000 will die annually from related complications. 10–30% of people will die within one month of diagnosis and one-third will have recurrence within 10 years.
- CHEST guidelines recommend treatment with anticoagulant (AC) therapy for provoked and unprovoked PE. The standard duration is 3 months with longer treatment courses reserved for recurrent or persistent PE.
- Prior cohort studies show a significant increase in mortality, recurrent venous thromboembolism (VTE), and major bleeding with non-compliance. Non-compliance has also been associated with increased healthcare costs both in the inpatient and outpatient setting.
- AC compliance after acute PE is of utmost importance to prevent mortality and future recurrence. This study analyzed factors affecting compliance of AC after acute PE.

## Methods

- Single-center retrospective study at Loyola University Medical Center, 6/2016-5/2020.
- Inclusion criteria: Age >18, inpatient admission, formal Pulmonary Embolism Response Team (PERT) consult for PE, PE confirmed on CT-PE, patient discharged on AC. Exclusion criteria: patient for whom AC was contraindicated, death prior to discharge, and discharge to long-term care facilities where the patient and primary pharmacy would not be responsible for filling AC.
- Compliance data including AC fill dates from pharmacies, and demographics from chart review (Table 1) were analyzed as covariates in linear regression analysis.
- The primary outcome, Proportion of Days Covered (PDC), calculates compliance as number of days of medication on hand / number of days in time interval.

**Table 1. Demographics**

Mean Age	60 ± 15 yrs
Gender	
Men	54 (45.8%)
Women	64 (54.2%)
Race	
White	52 (44.1%)
Black	20 (16.9%)
Hispanic	11 (9.3%)
Others/Unknown	35 (29.7%)
Anticoagulant	
Warfarin	8 (6.8%)
Apixaban	57 (48.3%)
Rivaroxaban	17(14.4%)
Enoxaparin	6 (5.1%)
Changing/Mixed	30 (25.4%)
30 Day Follow-up Visit	
Yes	110 (93.2%)
No	8 (6.8%)
Insurance	
Private	58 (49.2%)
Medicare	48 (40.7%)
Medicaid	11 (9.3%)
Self-pay	1 (0.8%)
In-hospital Education	
Yes	84 (71.2%)
No	34 (28.8%)

## Result

**Table 2. Univariate and Multivariate Regression of Covariates for Anticoagulant Compliance in PE**

	Univariate			Multivariate		
	Coefficient	CI	p value	Coefficient	CI	p value
Age	0.0029	[0.0005 : 0.0052]	0.018	0.0018	[-0.0019 : 0.0055]	0.34
Female gender	-0.0027	[-0.076 : 0.071]	0.94	-	-	-
Race						
White	Reference			Reference		
Black	-0.17	[-0.26 : -0.091]	0.00	-0.14	[-0.23 : -0.039]	0.006
Hispanic	-0.0051	[-0.11 : 0.10]	0.92	0.00099	[-0.12 : 0.12]	0.99
Others/Unknown	-0.29	[-0.52 : -0.061]	0.014	-0.31	[-0.55 : -0.080]	0.009
Type of AC						
Warfarin	Reference			Reference		
Apixaban	0.16	[0.013 : 0.31]	0.033	0.018	[-0.14 : 0.18]	0.82
Rivaroxaban	0.14	[-0.027 : 0.31]	0.099	-0.032	[0.20 : 0.14]	0.71
Enoxaparin	0.096	[-0.11 : 0.31]	0.37	-0.11	[-0.34 : 0.11]	0.31
Changing / Mixed	0.062	[-0.093 : 0.22]	0.43	-0.056	[-0.22 : 0.11]	0.50
Patients with 30 day Follow-up visit	0.18	[0.041 : 0.32]	0.012	-0.061	[-0.25 : 0.13]	0.53
Insurance Type						
Private	Reference			Reference		
Medicare	-0.038	[-0.11 : 0.034]	0.29	-0.058	[-0.15 : 0.036]	0.22
Medicaid	-0.27	[-0.39 : -0.15]	0.00	-0.049	[-0.22 : 0.13]	0.58
Self-pay	0.076	[-0.29 : 0.45]	0.69	0.097	[-0.24 : 0.43]	0.56
In-hospital Education	0.049	[-0.032 : 0.13]	0.23	-	-	-

## Discussion

- 118 patients of 144 had sufficient data to measure compliance, and were included in analysis. 58 (49.2%) of the 118 had a PDC of 1, indicating 100% compliance. Remaining patients had a PDC range of 0.081 to 0.99. Mean PDC for all 118 patients was  $0.88 \pm 0.19$  (SD). Median PDC was 0.99, and Mode was 1.
- Age, Black race, Medicaid, follow up visit and type of AC (Apixaban) had significant association with PDC in univariate regression.
- Only Black cohorts had 14% reduced compliance (PDC= -0.14, p= 0.006) compared to White population in multivariate regression. This finding is consistent with prior studies exploring the impact of race on medication compliance across different types of medications and diseases, like hypertension, dyslipidemia, and diabetes mellitus.
- Possible underlying driver(s) that a surface reading of race and compliance may be masking include socioeconomic status, health literacy, physical and financial access to healthcare, mental health, and social support. Concern for harmful medication side effects, dependency, adding medication to existing regimens, and mistrust and skepticism of the medical system are other possible drivers.
- Prior studies have demonstrated that Black patients have a higher mortality after pulmonary embolism compared to White patients. Improving anticoagulant compliance in this specific patient population is crucial. Further study is needed to assess if any of these factors play a role.
- In-hospital education may mitigate some factors. Analysis in this study showed no significant differences in compliance after in-hospital education. However, other studies have shown increased compliance. Different outcomes may be due to sample size or types of education used.
- The major strength of this study is that it includes a broad range of AC types, insurance types, and patients (age, race, gender) whereas other studies focus on specific segments of patient populations. Thus, the results of this study encompass many factors affecting patient compliance.
- Selected limitations include:
  - Data was limited to information recorded in medical charts. 35 (29.7%) of the 118 patients did not have a race recorded; if they had, it may have changed the statistical significance of these outcomes.
  - The small sample size of 144 patients, with low power, may limit applicability to the generalized population.
  - Other critiques include human error in gathering data from chart review and pharmacy records, difficulty in calculating PDC for warfarin due to frequent dosing changes based on INR, and unequal time intervals to calculate PDC (i.e., some patients had data for a few months whereas others had data over multiple years).

## Conclusion

- A racial disparity appears to exist in AC compliance in PE patients. Black patients have lower compliance compared to White patients. Further studies are needed to address underlying contributors and improve compliance in this population.

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# Transfer Troubles

“Transport of critically ill patients repeatedly illustrates Murphy’s Law” (1)

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## Background & Problem Statement

- Accepting Interhospital Transfers is a common occurrence at both Hines VA and Loyola University Medical Center
- Adverse Events are common; cardiovascular events occur on up to 24% of transports, respiratory on up to 15% of transports (1)
  - Overnight transfers more dangerous
  - Increased odds of ICU transfer (OR 1.54; 95% CI 1.38, 1.72) (2)
  - Increased 30 day mortality (OR 1.16; 95% CI 1.01, 1.35) (2)
- Transfer Process**
  - Differs between “On Duty” (daytime) and “Off Duty” (Evening/weekends)
  - In both: Outside physician contacts the National Community Care Office, who emails Hines (or other appropriate VA) the patient’s information
- On Duty**
  - Transfer office has a “clinical packet” faxed over
  - Packet emailed to MOD/accepting attending
  - Transfer office sets up transportation and staff per HVA recommendation
- Off Duty**
  - Nurse on Duty (NOD) receives the patient information from national office, verbal discussion with OSH, then pages appropriate attending
  - Accepting physician calls OSH, accepts/rejects
  - Records then sent with patient
- Clinical updates are expected, but not specifically required per policy, and rarely/never happen in practice
- There is a pattern of patients arriving overnight in a different condition than advertised, with many being upgraded to higher level of care or requiring unexpected treatments/interventions

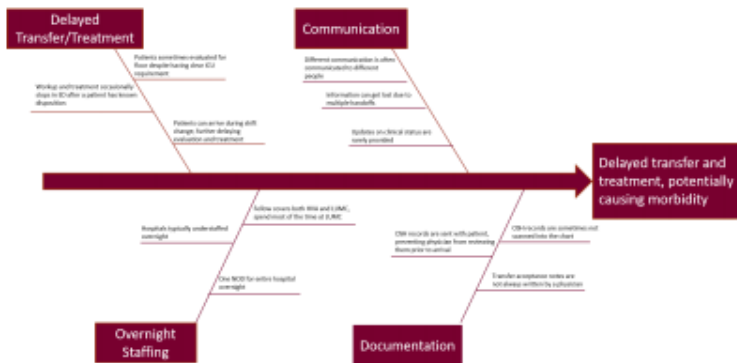
## Discussion

- Interventions to improve the process has yet to be extensively studied
- One study by Theobald et al, published in 2017 examined a simple intervention: introduction of a standardized handoff tool (4)
  - 1 page document, SBAR model (Situation, background, assessment, recommendations)
  - Compared transfers before implementation to after
  - No change in time to admission (4)
  - Reduction in LOS (6.5 days vs. 5.8 days, adjusted  $P = 0.06$ ) (4)
  - Reduction in mortality 12.0% to 8.9% (adjusted odds ratio, 0.68; 95% confidence interval, 0.47 – 0.99,  $P = 0.04$ ) (4)
- Comparison can be made to handoffs/sign-outs
  - Standardization of handoffs and training residents in handoffs has led to reduction in medical errors (5)
- Standardized Checklist Includes
  - Primary Diagnosis
  - Allergies
  - Last dose of anticoagulation
  - Vasopressors, sedatives/paralytics (Vent settings not specifically mentioned in study but I assume it was included as well)
  - Antibiotics
  - Isolation
  - Recent operations, procedures
  - Inwelling Devices
  - Code Status
  - Emergency Contact
  - Problem list
  - Active medication list
  - Lab findings
  - Reason for Transfer

## Conference Follow Up

- Focused Intervention: Standardized Transfer Document**
  - Short, easy to fill out form that contains most pertinent information
    - Would be sent prior to patient physically arriving
  - Would be filled out in addition to documentation sent with the patient
  - Does not cause delays in transfer
  - Reduces LOS
  - Reduces Mortality
- Required Personnel/Committee’s**
  - Critical Care Department
  - Transfer Office
  - MOD, NOD
  - LUMC Residency

## Fishbone Diagram



## Next Steps

- Standardization of Transfer/Transfer Checklist**
  - Variability exists between day and night transfers, overnight transfers have less standardization and are shown to be more dangerous
  - Standardizing transfers overnight and requiring a transfer checklist unlikely to cause delay of transfer (Theobald, et al), while improving outcomes
  - Hines already has the process of obtaining OSH records built into the daytime transfer process
  - May require more staffing overnight
- Routine Clinical Updates**
  - Updates are expected, but rarely (never) provided in practice
  - Many hospitals DO require updates: 81% require routine updates, per Herrigal et al (6)
    - 13% of institutions required updates 2-4 hours, 22% every 8-12 hours, 38% every 24 hours, 9% required updates but did not specify timing
  - Could have different expectations for ICU versus floor patients
  - Could be adjusted based upon accepting physicians comfort level
  - Would allow us to recommend further treatment and workup during the prior to transfer period
- Training on Accepting OSH Transfers**
  - Accepting OSH transfers is performed by attendings at Loyola (both overnight and during the daytime) and by attendings at Hines during the day
  - Fellows accept at Hines overnight, and receive no training or instruction on the process
    - “Just typical learning on the job”
  - Could be as simple as an email prior to the rotation
  - In house residents, while not allowed to accept transfers based on Hines policy, could assist with data collection and chart review of patients if the fellow is busy at LUMC or unable to access the chart

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# Quality Improvement Project to Assess Interfacility Transfers of Patients with STEMI

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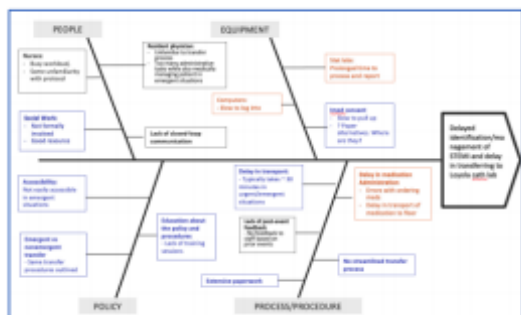
## Background

- Door-to-balloon time (D2B) - time between arrival of STEMI patient to a hospital and first balloon inflation
- ACC/AHA guidelines recommend D2B time of 90 minutes or less
- McNamara et al (1) shows the mortality rate almost doubles in those with D2B times of 121–159 minutes as compared to those with D2B time of 90 minutes or less
- Despite data showing that rapid PCI improves mortality, D2B times for patients, particularly those requiring inter-facility transfer, are still suboptimal.

## Problem Statements

- Lack of regular post-event feedback to staff can decrease an individual's understanding of the whole treatment process and their understanding of their individual role. This can result in a less cohesive and less efficient team.
- The lack of an emergent diagnosis-specific protocol for inter-facility transfer can lead to confusion and unnecessary delays in transferring the patient for the intended procedure such as reperfusion in the setting of a STEMI.

## Fishbone Diagram



Blue boxes – Potential delays in initiating inter-facility transfer after identifying STEMI

Red boxes – Potential delays in identifying and medically managing the STEMI  
Black boxes – Potential delays in both identifying and managing the STEMI, and initiating inter-facility transfer

## Implement a simplified streamlined protocol for interfacility transfer in the setting of a STEMI

- Reimer et al (2) is a retrospective cohort study that showed that the implementation of a streamlined protocol for interfacility transfers of STEMI patients, improved door-to-balloon times when compared to using the traditional protocol
- A single phone call would allow for the dispatch of emergency transportation, and activation of transport coordinator and the accepting facility's cath lab to occur simultaneously
- The aim would be to
  - Use the streamlined protocol during cath lab off-hours
  - Decrease physician's responsibility for administrative tasks so they can focus on patient care.
  - Minimize confusion on how to initiate emergency inter-facility transfers, particularly when physicians are new to the facility.
  - Incorporate a contingency plan in the case there is a delay in one pathway, such as transportation.

## Incorporate Formalized and Interactive Feedback to Staff

- Scholz et al (3) is one of several papers derived from the FITT-STEMI trials that showed that systematic and formalized data assessment and interactive feedback to staff involved with interfacility transfers of STEMI patients, significantly improves D2B times.
- The feedback sessions would be conducted at both the dispatching and accepting hospitals.
- Discussions would include
  - Data on the hospital's average D2B times
  - Open discussion of concerns, barriers and suggestions on how to improve the inter-facility transfer protocols
- The aim would be to:
  - Increase awareness of individual responsibilities and understanding of the whole treatment process thereby improving the efficacy of the team.
  - Allow for regular evaluation of the emergency interfacility transfer process and provide opportunity to make constructive changes.

## Next Steps

- These strategies were implemented at facilities that function differently from Hines VA, but they could be adapted to improve on the current inter-facility transfer process.
- These strategies could be incorporated at the VA by:
  - Scheduling inter-facility feedback sessions during already established interdisciplinary meetings
  - Developing a customized streamlined protocol using the resources available to Hines VA.
- Additional information required
  - Number of STEMI patients requiring inter-facility transfer from Hines VA.
  - Average D2B times when inter-facility transfer is required
  - Understanding of current resources, such as transportation contracts, to better understand how to incorporate them into a streamlined protocol.
- Potential barriers
  - Fewer resources to meticulously track and analyze data
  - Coordinating feedback sessions at dispatching and accepting facilities.
  - Requires extensive planning to develop and implement a streamlined protocol

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# Discordance Among Commercially Available Next-Generation Sequencing Assays to Identify Germline Drivers of Inherited Bone Marrow Failure Syndromes

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## Introduction & context

- Hereditary hematopoietic malignancies (HHMs) are syndromes driven by germline variants that substantially increase an individual's lifetime risk of developing hematologic cancers
- Also included in the HHM spectrum are inherited bone marrow failure syndromes (IBMFS), characterized by development of clinically significant cytopenias, bleeding, and infections that are driven by germline mutations and unrelated to viral, drug, or toxic exposures
- Several IBMFS also harbor risk for clonal progression to acute myeloid leukemia
- We have previously described the diagnostic heterogeneity that exists among commercially available tests marketed to detect germline risk variants for familial leukemias (PMID: 32807974)
- Here we expand our analysis, providing a systematic assessment of the assay characteristics, methodologies and performance attributes of commercial assays intended to detect IBMFS variants

## Description of methods

We analyzed commercially available next-generation sequencing (NGS) assays marketed for evaluation of IBMFS. 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 IBMFS (n=8). Hereditary leukemia/myelodysplasia panels were previously studied and therefore excluded. Companies were contacted, provided a draft manuscript of the data and given the opportunity to review, clarify, or contest any of the information presented herein.

## Performance attributes of commercial NGS assays for IBMFS vary dramatically

Company / Institution	Preferred Specimen	# Genes Included	List Price (USD)	Turnaround (days)	CNV Resolution / Limitations	CNV Confirmation	SNV Confirmation
Laboratory I	WB*	39	250**	10-21	Single exon resolution	MLPA	Long-read sequencing
Laboratory J	WB, purified DNA, saliva*	135	1700	28	May not reliably detect partial exon CNVs or indels > 50 bp May not reliably detect partial-exon CNVs or rearrangements < 400 bp	ddPCR	Upon Review
Laboratory K	SF	63	3000	42	Single exon resolution	MLPA, qPCR	Sanger
Laboratory L	WB, SF, purified DNA	86	3350	28-42	Single exon resolution	Upon Review	Upon Review
Laboratory M	SF, WB, saliva*	116	Not Disclosed	42	Not Detected	Not Detected	Sanger
Laboratory N	SF	133	1450	18	~80% sensitivity for CNVs < 4 exons	aCGH, MLPA	Upon Review
Laboratory O	WB	90	3090.70	42	Reliably detects CNVs of 3+ exons	MLPA/ddPCR	Sanger
Laboratory P	WB, saliva, buccal*	60	Not Disclosed	21-35	Not Detected	MLPA, qPCR	Sanger

**Table 1. Practical and Technical Attributes of Commercial IBMFS Assays.** Eight assays marketed for germline testing related to IBMFS 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 and span numerical codes I-J given that previous study of familial leukemias used A-H labeling schema. 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 IBMFS 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.

## Inconsistent inclusion of IBMFS-associated genes across commercial testing panels

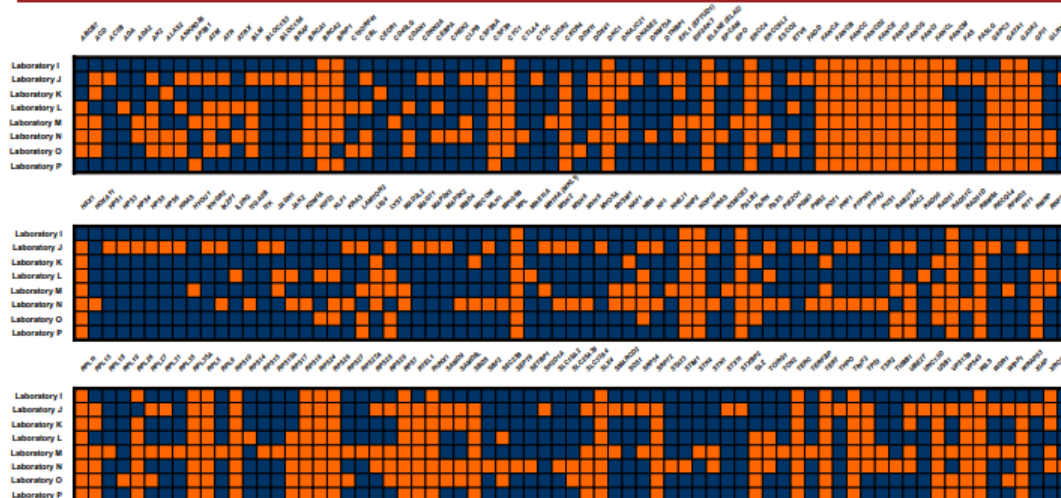
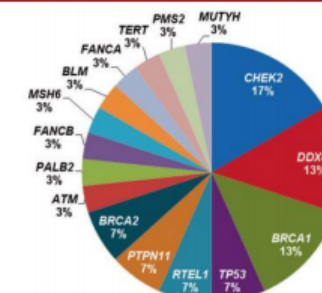


Figure 1 (continued). Cross-panel comparison of genes included in commercial testing. A binary matrix approach was employed wherein any single gene (vertical columns) included on single commercial panel (horizontal rows) is cross-referenced for inclusion on all other assays marketed for detection of IBMFS. Orange depicts the inclusion of a gene, on a particular panel while blue indicates its omission. Of a total of 212 genes studied, only a minority were consistently included across all assays: *BRCA2*, select Fanconi anemia genes, *GATA1*, *GATA2*, and *TP53*.

## Conclusions

- Many of the commercially available assays marketed for the detection of IBMFS fail to detect the majority of genes implicated in IBMFS
- Significant variation between labs was noted. Multiple tissue types accepted for sequencing, with many labs accepting peripheral blood as appropriate germline tissue despite blood representing the involved tissue that harbors additional somatic variants
- Given the gaps in commercial test characteristics, individuals/families harboring germline variants are likely being erroneously reassured by false-negative results

## Future directions



- Ongoing work seeks to identify the prevalence and phenotypic significance of germline mutations traditionally associated with hematologic malignancies across the spectrum of solid tumors. An ongoing analysis of 45 known cancer predisposition genes in germline samples of 202 patients with hematologic malignancies + one or more other independent solid tumors revealed that 13% (26/202) harbored pathogenic germline variants related to HHMs/IBMFS with the gene-by-gene distribution of verified cases shown in the pie chart above.
- Patients identified with germline *BRCA1*, *BRCA2*, and *TP53* mutations did not satisfy currently recommended clinical criteria to warrant germline testing, therefore underscoring the consideration of germline evaluation in patients with multiple cancers regardless of phenotype.



# Predicting Lung Cancer Among Pulmonary Nodules

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## Abstract

It is estimated that the prevalence of pulmonary nodules in the US ranges from 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. The USPSTF recommends screening for lung cancer among patients with 30 pack year history or quit within the past 15 years with a low dose CT scan.

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 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 to risk stratify pulmonary nodules and 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.

A RedCap database has been designed to include information regarding patient demographics, medical history and biopsy results. Additionally, information regarding the location, size and characteristics of pulmonary nodules greater than 4 mm up to 5 nodules will be recorded with their corresponding CT scans. Using the CT images, Convolutional Neural Networks(CNN) can be arranged to create models for feature extraction to create the best model to identify malignancy among pulmonary nodules.

## 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.

The data acquisition phase is still in process with 106 CT Scans and corresponding pulmonary nodule information being entered for the purpose of building a CNN.

## Conclusion

Based on preliminary data, the average pack year history does not correlate with an increased risk of malignancy which is commonly used in most prediction models. Further collection is needed to determine the strength of current risk prediction models among our patient population. Additionally, we have yet to find the number of false positives in our patient sample.

We suspect that improved image analysis techniques using machine learning algorithms may improve current risk prediction models. This may lead to an additional tool for clinicians to use when deciding to pursue invasive diagnostic procedures.

## Acknowledgements

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# Exposure to Disseminated Zoster

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## Background & Problem Statement

**Herpes Zoster is a communicable disease that requires healthcare systems' attention and recognition to prevent transmission within the hospital. Specific attention and different recommendations apply for particular vulnerable populations including immunocompromised patients**

### Zoster

- 1-4% shingles patients require hospitalization (annually)
- 100-150 deaths per year in the US
- Dissemination occurs in 2% of zoster cases

### Isolation Precaution Guideline for Zoster

- Immunocompetent patient
  - Localized: complete cover of all lesions till dry
  - Disseminated: airborne+ contact and cover all lesions
- Immunocompromised patient
  - Localized: airborne+ contact+ cover till dissemination is ruled out
  - Disseminated: airborne+ contact and cover all lesions

## Current Process

### Training module

- Isolation training modules required for all Loyola trainees during orientation
- Part of medical education covers isolation for different diseases
- Isolation training included for all nursing staff

### Isolation procedures

- Loyola
  - MD places order for isolation precautions
  - Sign placed by RN
  - At back of each isolation signs, specific disease is identified
  - Isolation discontinued by MD only
  - Before anyone enters the room, the team looks the back of the sign to confirm the disease
- Hines
  - RN chart reviews and places isolation signs first
  - Primary team paged to place the specific isolation order (delay)
  - No specific diseases are written on the back of the sign

## Next Steps

Point of Care Risk Assessment

Risk	Protection
• Contact with patient as environment expected	• Hand hygiene
• Splash or spray of blood or body fluids/secreta anticipated	• Mask and eye protection
• Contact with mucous membranes	• Perform hand hygiene, then don gloves
• Non-intact skin, blood, body fluids, secretions, excretions or soiled or likely soiled linens/beds anticipated	• Perform hand hygiene after PPE removal and before leaving patient environment



	Contact	Contact Plus	Droplet	Droplet + Contact	Airborne	Antisoon Contact
Organism-based precautions (assume only not complete)	CPO, MGA, VRC, etc. routine	C. difficile	V. meningitidis, mening. mening.	Influenza, measles, group A streptococcus	Varicella (VZV), measles (MM), mumps	Varicella (disseminated), hepatitis B (per contact)
Spore-based precautions	Shaving cream, disinfectant, isolation	Staph aureus, MRSA	MRSA, Clostridia, C. difficile	MRSA, Clostridia, C. difficile	MRSA, Clostridia, C. difficile	Disseminated MRSA (MRSA)
Private room	For patient & caregiver	MRSA, Clostridia, C. difficile	MRSA, Clostridia, C. difficile	MRSA, Clostridia, C. difficile	MRSA, Clostridia, C. difficile	MRSA, Clostridia, C. difficile
Negative pressure room	No	No	No	No	Yes	Yes
Staff PPE	Gown + gloves	Gown + gloves	Respirator with eye protection	Respirator with eye protection + gown + gloves	Respirator	MRSA resistant + gown + gloves
Visitor PPE	Gown + gloves + shoe cover	Gown + gloves	Respirator with eye protection	Respirator with eye protection + gown + gloves	Other MRSA resistant + gown + gloves	MRSA resistant + gown + gloves + shoe cover
Parents of pediatric patients	Do not go into contact areas such as patient visitors, playrooms, school rooms, patient lounges.					
Patient wears a protective mask during treatment	No	No	Yes	Yes	Yes	Yes

- Cost analysis for print new signs for the hospital
- Approval from infectious control
- Analysis of past appropriate of isolation precaution sign usage rate
- Compare appropriate of isolation precaution sign usage after 6 months of new signs are printed

## Fishbone Diagram

### Preventable risks:

- Potential delays in recognition of zoster requiring airborne isolation
- May require recognition and recognition by multiple subspecialties
- Potential implications of additional airborne isolation have impact and higher stakes in setting of emergency airway response



## Proposed Action Items: Precaution signs



- First 2 pictures are current isolation precautions (front and back) at Hines VA hospital
- Propose an easy to understand picture as picture 3 (sample from PICnet hospitals in NY)
- Propose to print CDC isolation guidelines at the back of isolation precaution signs for staff to reference (as picture in next steps)

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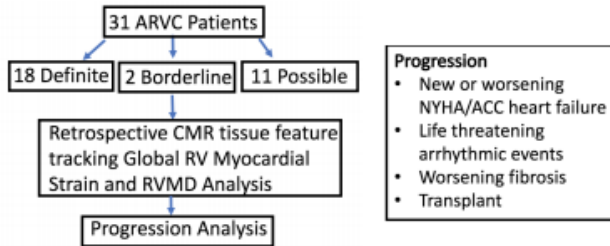
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## Introduction

Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC) is an insidious cardiomyopathy caused by the replacement of the right ventricle with fibro-fatty tissue. ARVC accounts for 11% of sudden cardiac death (SCD) cases(1). Overt structural change does not always precede SCD (2). Novel CMR derived myocardial strain and right ventricular dyssynchrony analysis, which have shown prognostic utility in other cardiomyopathy, has not been well studied in ARVC (3). Right Ventricular Myocardial Dispersion (RVMD) is a RV dyssynchrony measurement defined as the standard deviation in the time to peak strain amongst the segments of the RV.

## Methods



- Progression**
- New or worsening NYHA/ACC heart failure
  - Life threatening arrhythmic events
  - Worsening fibrosis
  - Transplant

Correlation coefficients between progression, RVMD, and myocardial strain were generated.

## Objective

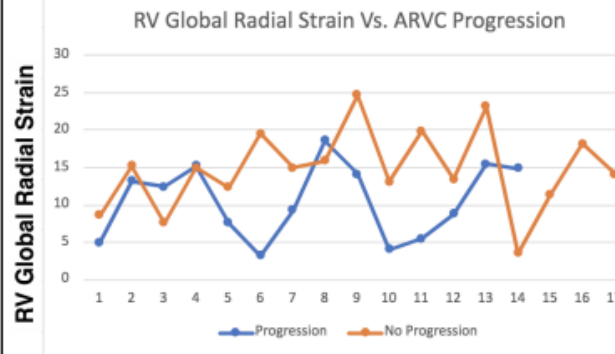
- Evaluate if tissue-feature tracking CMR derived myocardial strain and RVMD serve as prognostic tools in ARVC.

## Results

Clinical Characteristics	N=31	Progression	No Progression	R <sup>2</sup>	P-value
Sex				0.0122	0.469
Male	24	10	14		
Female	7	4	3		
Comorbidity				0.083	0.250
None	24	10	14		
HTN	11	4	7		
DM2	2	0	2		
LVEF				0.75	0.397
<b>RVEF</b>				<b>0.11</b>	<b>0.028</b>

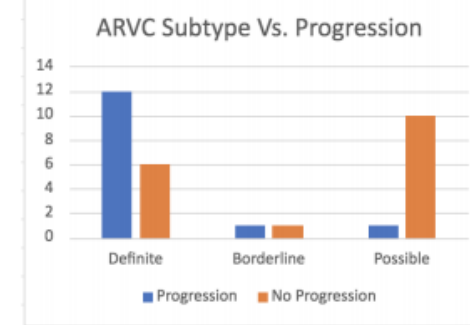
Subgroup analysis showed no correlation between sex, comorbidity, and LVEF. RVEF did show a correlation with ARVC progression.

**ARVC disease progression correlated with an attenuation of RV global radial strain. ARVC prognostication varies amongst the ARVC subtypes with a trend toward adverse outcomes in the definite subtype and a benign course in the possible subtype.** There was no correlation with ARVC progression and RVMD.



The line graph above compares RV global radial strain in ARVC patients who progressed and those who did not progress. RV global radial strain is depicted on the y-axis. Patients are depicted on the x-axis. Progressed ARVC patients are depicted in blue. No progression ARVC patients are depicted in orange. There is a clear separation in the lines between the progression and no progression ARVC subsets with a statistically significant trend for progression in patients with attenuated RV global radial strain.

## Results



ARVC subtype was an independent predictor of ARVC progression ( $\chi^2= 10.29, p=0.0058$ ).

RV Global Strain and RVMD	R <sup>2</sup>	P-value
<b>RV Global Radial Strain</b>	<b>0.11</b>	<b>0.027</b>
RV Global Longitudinal Strain	0.03	0.25
RV Global Circumferential Strain	0.06	0.101
RVMD Radial Axis	0.09	0.055
RVMD Longitudinal Axis	0.02	0.374
RVMD Circumferential Axis	0.07	0.079

RV Global Radial Strain had a statistically significant correlation with progression. RVMD did not statistically correlate significantly with progression.

## Discussion

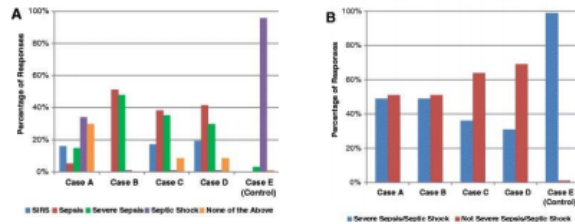
- The strong correlation between the ARVC subtypes and outcomes suggest that ARVC prognostication should be a multi-dimensional approach comprised of CMR and echocardiogram imaging, family history, genetic evaluation, arrhythmia history, and electrocardiogram patterns.
- CMR derived tissue-feature tracking with RV global radial strain analysis may supplement ARVC prognostication.

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## Introduction

- Sepsis is a life-threatening organ dysfunction caused by dysregulated host response to infection
  - Major public health concern, accounting for more than \$20 billion (5.2%) of total US hospital costs in 2011
- Diagnosing sepsis is extremely subjective and variable
  - When surveying practicing intensivists to classify five case vignettes of suspected confirmed infection and organ dysfunction, overall interrater agreement was poor (Fleiss  $\kappa$  of 0.29)
- Sepsis is a syndrome without a validated criterion standard diagnostic test
  - Early identification and appropriate management in the initial hours after sepsis develops improves outcomes
  - Organ dysfunction can be identified as acute change in total Sequential Organ Failure Assessment score (SOFA)  $\geq 2$
  - A quick SOFA score (qSOFA) provides simple bedside criteria to identify adult patients with suspected infection who are likely to have poor outcomes
- "Surviving Sepsis Campaign 2016" recommends that hospital have performance improvement program for sepsis, including sepsis screening for high-risk patients



## Cause and Effect Diagram

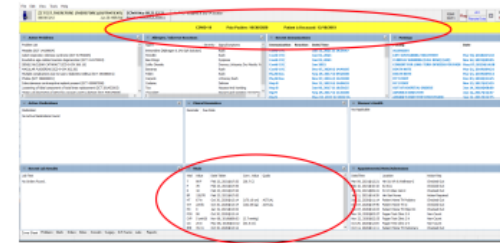


### Areas for Development

- Improving the current process of sepsis screening in hospitalized patients
  - Education of Sepsis Bundle Order Set
  - Automation of Sepsis Screening Score
  - Integration of Sepsis Screening Score into Electronic Health Record
  - Education of Dedicated Rapid Response Team of current Sepsis Guidelines
- Improving supervision of night float residents evaluating patients for possible admission of patients to the Medical Intensive Care Unit

## Analysis

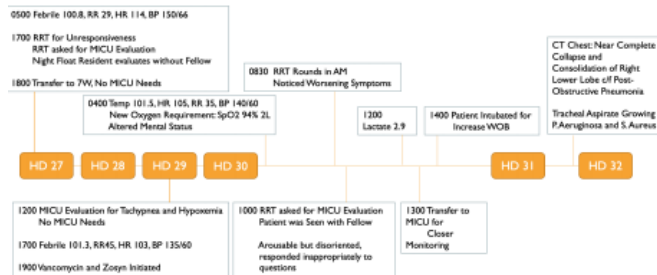
- No sepsis screening score available at time of evaluation
- Potential delay in administration of antibiotics during first rapid response event
- Lack of availability of fellows or attending physicians on night float rotation during MICU evaluations
- Electronic health record lacks automation of sepsis screening during bedside nursing assessment of patient
- Lack of timely and efficient identification of patients at high risk for sepsis
- Lack of visual on the electronic health record to alert clinician of patients that screen positive for sepsis
- No standardized education or training of rapid response team of Surviving Sepsis Campaign Guidelines or of the Sepsis Bundle



## Patient Case

Mr. P is a 70-year-old male with Morbid Obesity, HTN, Diabetes complicated by Peripheral Neuropathy presented to the Emergency Department with weakness. He was found to have Severe hypokalemia (K 2.3), Rhabdomyolysis (CK 2726), and Oliguric AKI

- Admitted to MICU from HD #12 through HD #17 for Acute Encephalopathy, AHRF and Increased Work of Breathing secondary to Aspiration Event in the setting of Ileus
  - Completed Meropenem for Aspiration Pneumonia
- Admitted to MICU HD #19 through HD #22 after a Rapid Response for Fever, Altered Mentation
  - Blood cultures grew *Candida Glabrata* fungemia and he was started on Micafungin
- Transfer to General Medicine Floor HD #23 still significant for fluctuating altered mentation and due to persistent aspiration risk recommendation was to keep NPO after Speech evaluation



## Supervision and Night Coverage

- Clinical supervision in GME emphasizes safety while promoting development of clinical experience
- Overnight rotations for residents are often times of little direct or indirect supervision
- A nocturnist program was established at an academic tertiary medical center and a survey examined house staff perception of night float rotation pre-nocturnist and post-nocturnist program roll out
  - Increased overnight supervision enhanced the clinical value of the night float rotation
  - Increased rates of attending contact during critical clinical decision-making
  - Improved perception of patient care
  - Without decrease in house staff perceived decision-making autonomy

Table 2: Self-Reported Incidence of Overnight Attending Contact During Critical Decision-Making

Scenario	Pre-Nocturnist (n=44) Mean (SD)	Post-Nocturnist (n=9) Mean (SD)	P-value
Received transfer from outside facility	2.09 (2.07)	3.22 (2.90)	0.006
Prior to ordering non-invasive diagnostic procedure	1.09 (2.29)	1.89 (3.04)	0.33
Prior to ordering an invasive procedure	1.75 (3.84)	2.78 (4.42)	0.004
Prior to initiation of intravenous antibiotics	1.11 (3.32)	1.47 (3.70)	0.007
Prior to initiation of vasopressors	1.62 (3.42)	2.42 (3.41)	0.004
Patient experiencing adverse event, regardless of cause	2.51 (3.33)	3.25 (3.54)	0.04

Table 3: Specific vignettes

Scenario	Specific vignettes	P-value
Supervision	"I was not directly supervised by an attending physician during the night float rotation." "I was not directly supervised by an attending physician during the night float rotation." "I was not directly supervised by an attending physician during the night float rotation."	0.0002
Decision-making	"I was not directly supervised by an attending physician during the night float rotation." "I was not directly supervised by an attending physician during the night float rotation." "I was not directly supervised by an attending physician during the night float rotation."	0.0002
Perception of patient care	"I was not directly supervised by an attending physician during the night float rotation." "I was not directly supervised by an attending physician during the night float rotation." "I was not directly supervised by an attending physician during the night float rotation."	0.0002
Decision-making	"I was not directly supervised by an attending physician during the night float rotation." "I was not directly supervised by an attending physician during the night float rotation." "I was not directly supervised by an attending physician during the night float rotation."	0.0002

## Survey of LUMC Residents

Do you have adequate supervision and resources at Hines?

- "If I were by myself as a fresh 2<sup>nd</sup> year and someone needed an emergent HD catheter it would be a problem, but now I feel comfortable with most things here"
- "I like by. But it could have been different if I weren't as lucky, or things happened differently"
- "Supervision has not been an issue"
- "We manage somehow"
- "The MICU fellow at Loyola came within an hour of me calling to help with central line placement"
- "There is a nocturnist in SICU may sometimes be available"

How do you screen for sepsis at Hines?

- "I don't use any scoring system, it's more so the clinical picture"
- "I don't screen for sepsis. If someone is febrile, has leukocytosis, I will see them and decide if I should start antibiotics"
- "I screen patients individually based on vitals and labs using SIRS and qSOFA scores. I do not know if I should start antibiotics"
- "Sepsis screen is your clinical judgement"
- "The sepsis order set does not work currently, so I order labs/tests individually"
- "I didn't know there was a sepsis order set"
- "I had no idea there was a sepsis order set. I just order everything manually"

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## Introduction

- Elderly patients experience a higher risk of morbidity and mortality after the diagnosis of pulmonary embolism (PE).<sup>1</sup>
- Catheter-directed thrombolysis (CDT) has been shown to be an effective treatment modality for acutely reducing pulmonary artery pressures, improving right to left ventricular ratio and right ventricular systolic function with an acceptable safety profile among patients with intermediate and high risk PE.<sup>2,3</sup>
- Elderly patients, however, were excluded from landmark trials, thus the safety of this intervention remains uncertain among those of advanced age.<sup>2,3</sup>

## Objectives

- To examine the safety of CDT for acute PE among elderly patients  $\geq 65$  years old.
- To ascertain whether the safety profile of CDT in elderly patients has changed over time with increased widespread use of this technology.

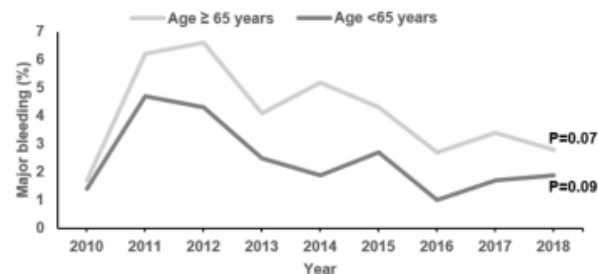


Figure 1: Temporal trends of major bleeding complications among patients  $\geq 65$  versus  $< 65$  years old who had catheter directed thrombolysis

## Methods

- Patients hospitalized between 2010-2017 with acute PE who underwent CDT during same admission were identified using administrative codes within the Nationwide Readmission Database.
- Patients were stratified by age cohorts of  $< 65$  and  $\geq 65$  years old and their demographic data was collected.
- Primary outcome was the rate of major bleeding (gastrointestinal bleeding (GIB) or intracranial hemorrhage (ICH))
- Secondary outcomes included:
  - rate of major bleeding among the following sub-groups 65-75, 76-85, and  $> 85$  years old;
  - the annual trend of major bleeding complications over time
  - rates of in hospital mortality
- Pearson's chi-squared test was used to compare categorical outcomes among groups and multivariate logistic regression was used to identify the effect size of covariates on in hospital mortality.

## Results

- A total of 15,372 patients had CDT for PE, of which 6,705 (43.6%) patients were  $\geq 65$  years old.
- In patients  $\geq 65$  years, there was increased rates of major bleeding (3.5% vs 2.0%,  $p < 0.001$ ), GIB (2.6% vs 1.6%,  $p < 0.001$ ), and ICH (0.9% vs 0.4%,  $p < 0.001$ ).
- After 1:1 matching (5,336 patients in each group), rates for major bleeding and ICH remained higher among patients  $\geq 65$  years old (3.4% vs 2.5%,  $p = 0.009$ ), and (0.9% vs 0.5%,  $p = 0.03$ ), while the rate of GIB was similar (2.5% vs 2.0%,  $p = 0.08$ ).
- Major bleeding rates were not different across age cohorts of 65-75, 76-85, and  $> 85$  years old (3.4%, 3.5%, and 3.8%;  $p = 0.94$ ).
- There was no change in major bleeding complication rates over time in both elderly and non elderly patients (figure 1).
- The 30-day bleeding-related readmission rate was higher among those  $\geq 65$  years (0.4% vs 0.1%,  $p = 0.003$ ).
- Major bleeding was the strongest predictor of in-hospital mortality in the elderly (OR 4.7; 95% CI 3.4-6.5,  $p < 0.001$ ) (figure 2)

## Results CTD

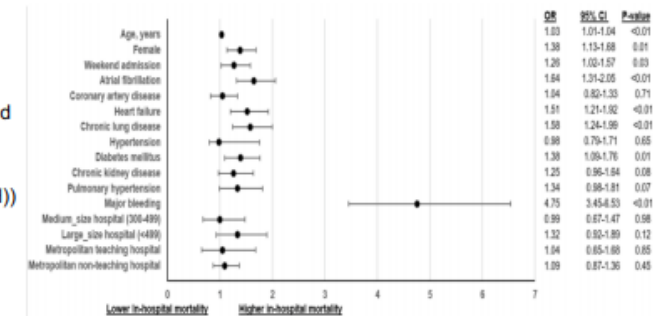


Figure 2: Effect size of each covariate on in-hospital mortality in the elderly.

## Conclusion

- Elderly patients account for nearly half of patients receiving CDT for acute PE.
- Elderly patients suffer higher rates of bleeding complications after CDT.
- A major bleeding event in the elderly was associated with a ~5-fold increase in the odds of in-hospital mortality.
- Further studies are needed to investigate the safety of CDT use among the elderly.

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## Background & Problem Statement

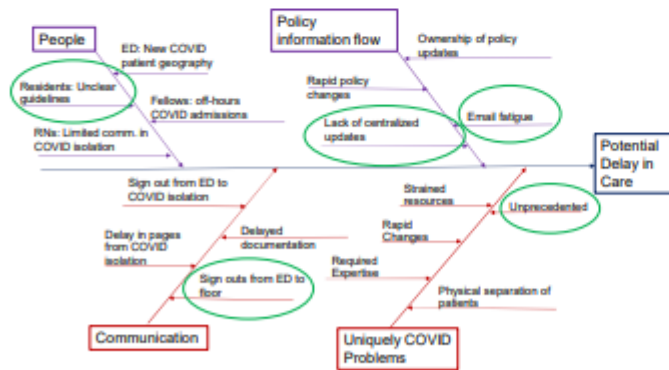
- This year, responding to the COVID-19 crisis presented unprecedented challenges both medically and logistically
- This project reviewed the available literature for understanding effective communication in a crisis, drawing from examples outside of medicine and successful early responses to the crisis
- Potential barriers and areas for development identified included:
  - Unclear guidelines: improved accessibility of policy updates and shared awareness of location
  - Lack of centralized updates/Email fatigue: The potential for rapid changes and need for clear communication as well as updates and maintenance of this information
  - Unprecedented: Often no guiding principles to steer policy

*"While there is no evidence-based medicine...for how to manage a pandemic that presents this combination of challenges, existing management research offers insights...for navigating uncertainty and managing crises."* (3)

### Early mistakes

- Deluge of emails
- Multiple sources of information
- Communication overwhelmingly agent-to-agent without shared framework, often not distinctive or consistent

## Fishbone Diagram



## Discussion

- Better communication tailored for a crisis response could potentially prevent delays in care and many of the other issues encountered during the height of the crisis
- Attribution theory is a well-validated model that posits people are best primed to understand messages that are:<sup>(1,7)</sup>
  - Distinctive**: messages that stand out (not losing the tree for the forest)
  - Consistent**: similar messages are conveyed across different contexts
  - Demonstrate Consensus**: multiple stakeholders send the same information
- Communication in hospitals takes place in two important and distinct mediums<sup>(2)</sup>:
  - Synchronous**: simultaneous, agent-to-agent communication (hand offs, emails)
    - Has the advantage of being impactful and responsive to immediate feedback
    - Is often transient, interruptive, and lacking in standardized semantics
  - Asynchronous**: non-simultaneous (references, intranet)
    - Is permanent, accessible by multiple parties, and often has standardized semantics
    - Lacks the ability to respond re-immediately to questions and feedback
- Ideal communication should be **Distinctive, Consistent, & Demonstrate Consensus**
- Should include a mix of **Synchronous** and **Asynchronous** communications that play to the strength of both
- Effective use of these communication methods can also help avoid communication overload<sup>(2)</sup>

### Later Solutions and Persistent Challenges

- Fewer, more distinct emails
- More asynchronous resources
- Inconsistency in communication unfortunately persists*
- Lack of dissemination of updated resources*

## Proposed Next Steps & Follow Up

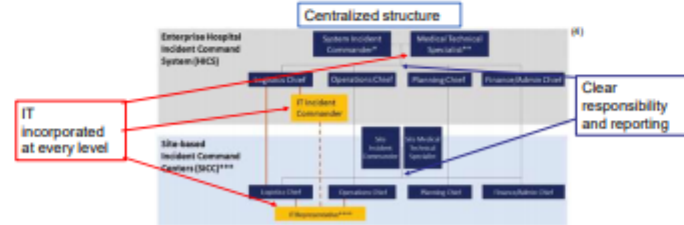
- From the UW Example: Integration of IT with Medicine to facilitate quick, unified updates
  - Centralized oversight for where and how updates are disseminated
  - A task force charged specifically with managing communication and integrating different information flows
- Refined Email distribution lists
  - Distinct titles, logos, formatting (A "Loyola" thread, a "department" thread, etc...)
  - Transparent flowsheets for how messages are disseminated
- One of the key features of successful Asynchronous communication is a set of *shared syntax*, i.e. a common language and understanding—but this understanding isn't automatic<sup>(2)</sup>
- It has been demonstrated that training on how to access health information can greatly increase physicians' health literacy<sup>(8)</sup>
- It's not enough to establish a resource, it has to be accessible, understandable, and the people in the organization have to know it exists.
- Training would ideally take the form of mixed Synchronous (direct huddles, emails and face-to-face communication) as well as Asynchronous (references, literature) information
- Based on post-presentation discussion, successive huddles are already being employed as a communication tool
- There are ongoing efforts to continue to improve long-standing issues such as ED communication so they are less prone to failure during a crisis

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## Successful Responses: The UWashingtton Example

*"The lack of centralized communication capability...resulted in a flood of e-mails that were difficult to process and prioritize by end users. In response, ITS and UW Medicine internal communications collaborated with human resources (HR) and local sites to create more complete distribution lists, including sub-lists targeting specific stakeholder groups for COVID-19 outreach"*(4)



- Among the 10 major action items established, 7 and 8 are: Establishing a centralized intranet site for disaster management and communication & Developing and testing email distribution lists.
- This accomplishes the goal of effectively mixing Synchronous and Asynchronous communication to send messages that are Distinctive, Consistent and Demonstrate Consensus





## Introduction

Prior to cardioversion or ablation for atrial fibrillation many patients undergo a transesophageal echocardiogram (TEE) to rule out a thrombus. This is done because there is a high risk of stroke in patients with known thrombus when converting back into normal sinus rhythm. Typically patients are treated with systemic anticoagulation for 4 weeks and repeat imaging is performed again prior to cardioversion or atrial ablation if a thrombus is seen

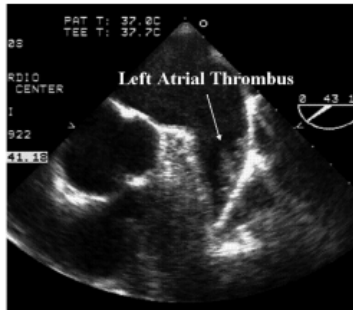
But for a particular group of patients there is persistence of a thrombus even while on systemic anticoagulation. It is not known how to handle these patients and more importantly what happens to this thrombus. It is not known what the stroke risk for these patients might be as well.

Specific strategies for managing these patients may include switching anticoagulants, continuing with current therapy, or performing procedures such left atrial appendage ligation/resection are not known. But knowing which approach leads to a better outcome in terms of thrombus resolution and avoiding CVA's would help guide clinical practice.

## Objectives

We aim to further characterize how to better approach left atrial appendage thrombus that is persistent on repeat TEE despite appropriate anticoagulation for at least 4 weeks prior. Specifically we look to answer:

- 1) Are there specific anticoagulants in which this is more common?
- 2) Is there an increased risk of embolization when it is resistant to anticoagulation
- 3) Does that risk of embolization depend on which anticoagulant was used?



Above is an image of a typical LAA thrombus seen on a TEE prior to cardioversion for a patient with atrial fibrillation

## Hypothesis

The working hypothesis of the project is that there is an increased risk of stroke in patients with persistent atrial thrombi

We expect that stroke risk is higher with those who have thrombus that persists through anticoagulation compared to patients who are not noted to have a thrombus while on anticoagulation.

## Methods

### Inclusion Criteria:

- 1) Patients who underwent a TEE from 2011 – 2019 at LUMC
- 2) Those flagged for having the words "thrombus", "clot", or "spontaneous echo contrast" appear in the report
- 3) Those who have had their LAA surgically excluded or occluded

### Exclusion Criteria

- 1) Those lost to follow up
- 2) Those listed as having "possible" or "potential" thrombus as opposed to being described as definite

Via a retrospective analysis each patient had information obtained through chart review including anticoagulant used, duration of anticoagulation, information on therapeutic levels of anticoagulation if possible, indication for anticoagulation, CHADSVASC score, clinical heart failure, and cardiomyopathy

Notes also made on any confirmatory studies showing left atrial thrombus such as CT, MRI, or surgery

Rates of stroke will be calculated for patients prior to imaging with TEE and rates after

Specific anticoagulants will be analyzed to determine if some drugs are more likely to lead to persistent thrombi than others

Primary outcome for this study would be rate of stroke

Secondary outcomes would be mortality, significant bleeding, thrombus resolution, and other systemic embolus

## Next Steps

Our group is working on obtaining more patients to include in our dataset

Currently there are a total of 1226 patients who have undergone a TEE in the included time interval that are flagged for having either a thrombus or spontaneous echo contrast seen

Of those 129 have a thrombus and a second TEE performed at Loyola

Initial data analysis shows no clear association with persistent thrombus in any particular type of anticoagulant used but a slightly high risk of stroke in those with persistent thrombus than those with subsequent resolution

## Future Research Ideas

Persistent left atrial appendage thrombi are an area of unclear management

Many different approaches are taken to those found to have persistent thrombus including adding an antiplatelet agent, increasing the INR goal for those on warfarin, or switching to a different anticoagulant

The only way to truly look to answer this question would be a randomized controlled trial

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