Moderate Risk Chest Pain in the ED Observation Unit

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COI Declaration(s)

- Funding from ACEP/Pfizer: Low-risk pulmonary embolism in rural EDs
  - Not relevant to this work

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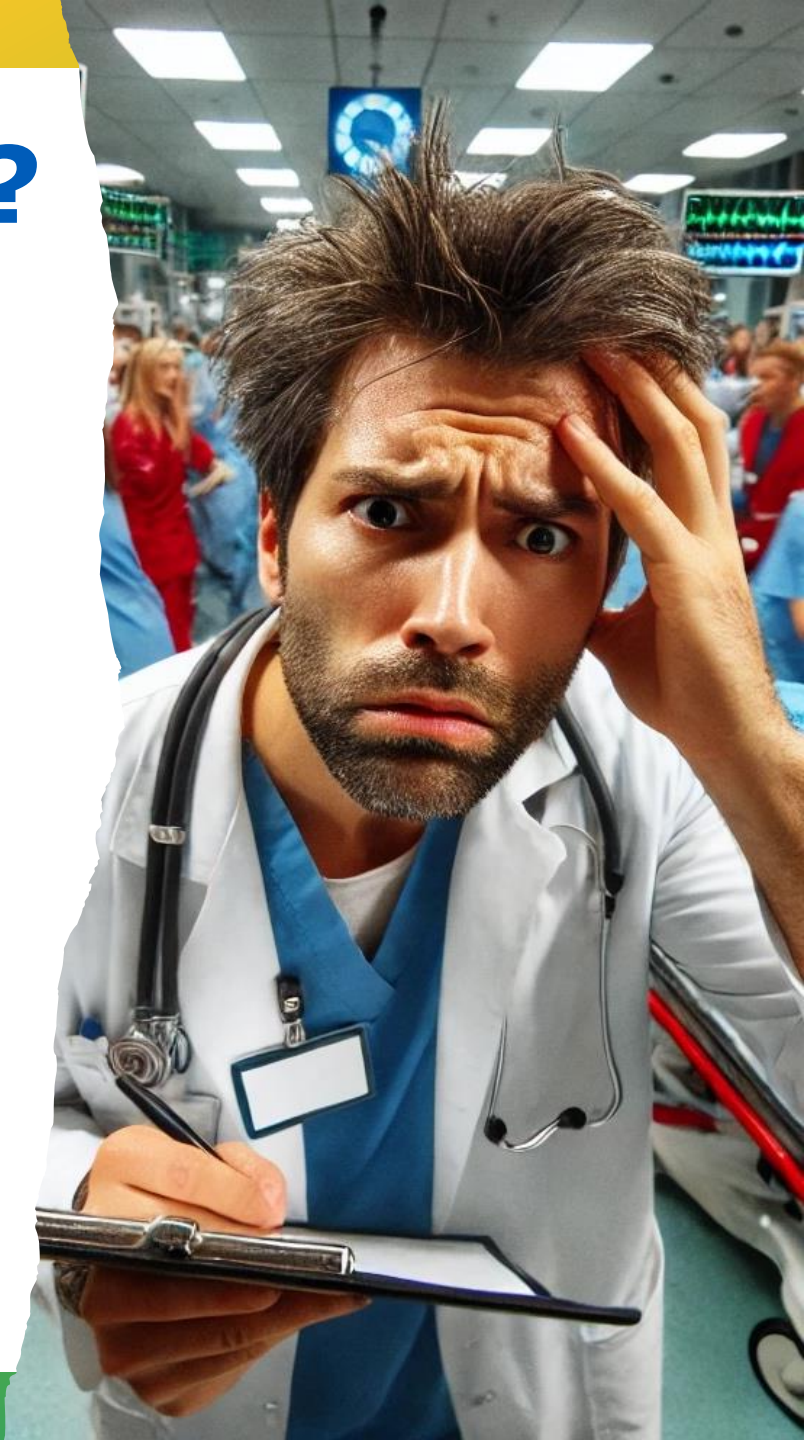
Goals & Objectives

1. Briefly review the evolution of ED chest pain evaluations in the past few decades
2. Present data on practice & outcomes for chest pain patients in our ED observation unit
3. Present data from a survey of chest pain patients in our ED observation unit
4. Briefly discuss possible future directions for research

Why all the Fuss?

- The “Big 5” for ED evaluation of adults with non-traumatic chest pain
  - Acute Myocardial Infarction
  - Aortic Dissection
  - Pulmonary Embolism
  - Tension Pneumothorax
  - Esophageal Rupture
- Orientation of ED is “ruling out” these conditions
  - Studies in 1980’s & 1990’s emphasizing “missed” MI [1,2,3]
  - Malpractice concerns [4,5]

[1]Pope *NEJM* 2000. [2]McCarthy *Ann Emerg Med* 1993. [3]Lee *Am J Cardiol* 1987. [4]Quinn *Am J Med Open* 2023. [5]Katz *Ann Emerg Med* 2005



Chest Pain Visits to ED Increase

1970s: Finding AMI	1980s: Coronary Care Units	1990s: Biomarkers	2000s: Observation Units	2010s: Risk Stratification
• Assessment: History, exam, ECG • Cardiac testing: Invasive • Dispo: Hospital admission	• Assessment: CK, CK-MB • Cardiac testing: Stress echo, SPECT • Dispo: Hospital admission (CCU)	• Assessment: Troponins (1st Gen) • Cardiac testing: Pharmacologic stress testing • Dispo: Hospital admission, early observation units	• Assessment: Troponins (2nd and 3rd Gen) • Cardiac testing: Rapid diagnostic protocols emphasizing non-invasive testing Dispo: Observation Unit	• Assessment: High-sensitivity troponins, accelerated diagnostic protocols • Cardiac testing: stress tests, CTCA • Dispo: Observation Unit (2 midnight rule), Discharge for low-risk patients

Hospital Admissions Increase

Hospital Admissions Decrease

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Chest Pain Evaluation in the 2020's

Situation

- Risks better defined
  - About 5% ED chest pain patients have life-threatening cause[1]
  - Many ED observation unit (EDOU) patients have benign courses
- Cooling of malpractice lawsuits over this issue[2]
- Recognition of unsustainable spending
  - Focus on value
  - Cuts in reimbursement

Improved risk-stratification tools

- High-sensitivity troponin
- Clinical prediction rules
- CTCA

Opportunities for further improvement

- Emphasis on patient autonomy / shared decision-making
- Telehealth expansion
- Growing acceptance of outpatient management protocols

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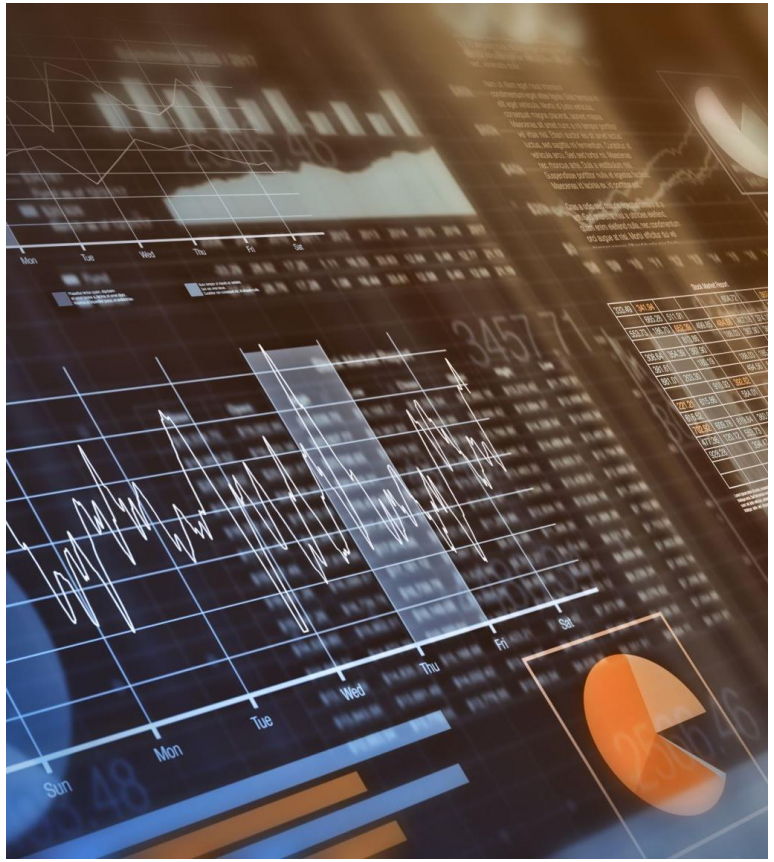
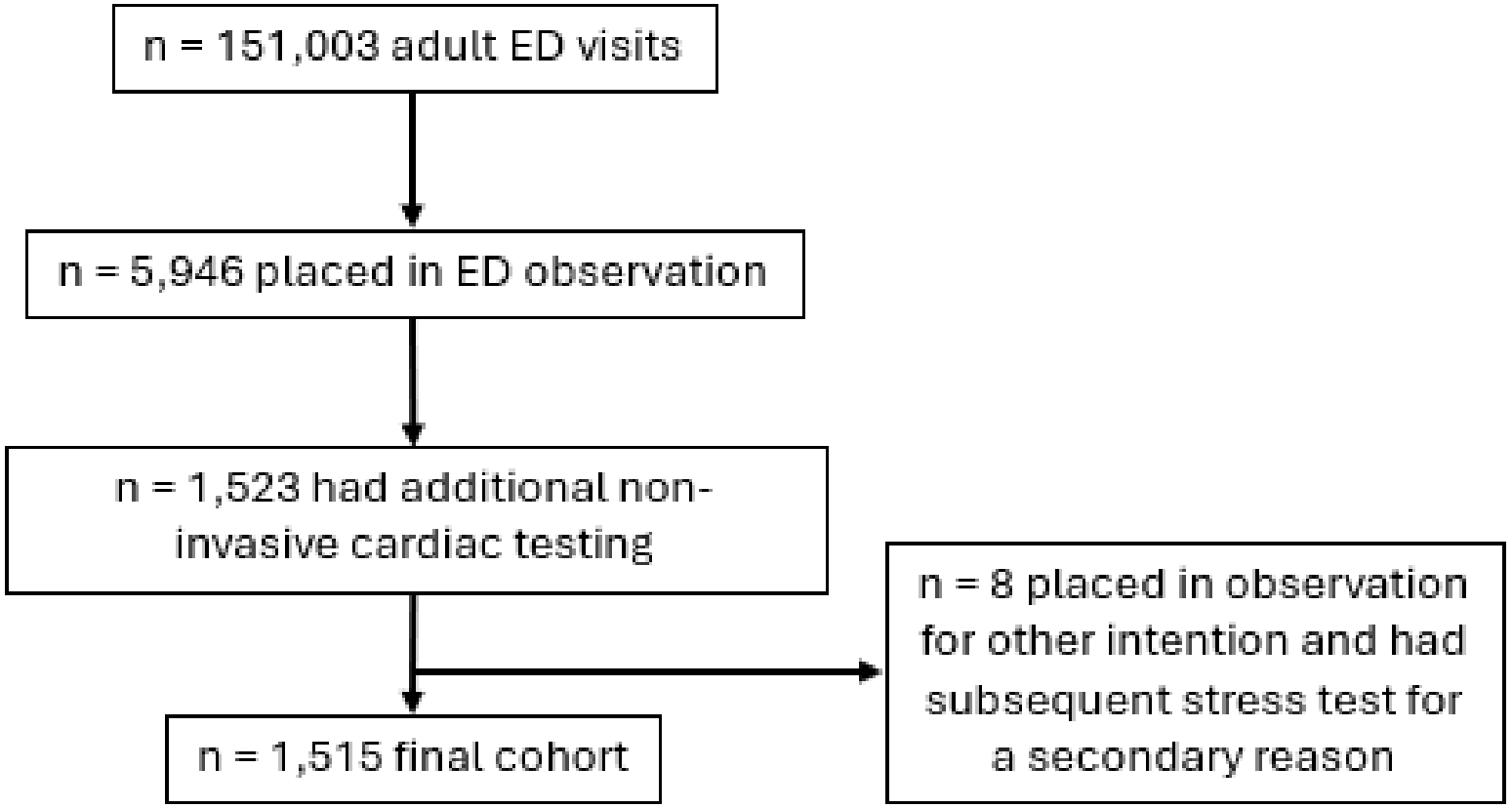
Q1: What is the short-term risk of major adverse cardiac events (MACE) in our EDOU patients?

Short-Term Risk of MACE in ED Observation Patients



- Retrospective cohort of patients admitted to EDOU for cardiac testing
  - Dates: January 2022 - June 2023
  - Identified from Epic
  - Data abstracted from Epic by Honest Broker
- Exposures of Interest
  - Time
  - Demographics
  - Clinical Characteristics
- Primary outcome: 72-hour risk of MACE
  - Outcomes manually validated
  - AMI = high-sensitivity troponin T > 99th percentile plus abnormal delta value (> 8 ng/L absolute or 20% relative if initial troponin > 99th percentile) [a]
- Sensitivity analyses to further risk-stratify beyond HEART score

[a] adapted from 4th Universal Definition of MI



Final cohort of subjects (1/1/22 - 6/30/23)

	TOTAL COHORT (N=1,515)	NO MACE-72 (N=1,494)	MACE-72 (N=21)	P-VALUE
Charlson Comorbidity Index	7 (4-10)	7 (4-10)	6 (5-9)	0.99
Comorbidities (%)				
Chronic ischemic heart disease	791 (52.2%)	782 (52.3%)	9 (42.9%)	0.39
Hypertension	603 (39.8%)	595 (39.8%)	8 (38.1%)	0.87
Hyperlipidemia	1,246 (82.2%)	1,227 (82.1%)	19 (90.5%)	0.56
Diabetes mellitus	608 (40.1%)	601 (40.2%)	7 (33.3%)	0.52
Smokes tobacco	191 (12.6%)	189 (12.7%)	2 (9.5%)	1.0
Prior Revascularization (%)	280 (18.5%)	277 (18.5%)	3 (14.3 %)	0.78
HEART score				0.15
0-3 (Low)	142 (9.4%)	141 (9.4%)	1 (4.8%)	
4-6 (Moderate)	1,293 (85.4%)	1,276 (85.4%)	17 (80.9%)	
≥ 7 (High)	80 (5.3%)	77 (5.2%)	3 (14.3%)	
Elapsed time since most recent stress test (years) n=586	2.3 (1.4 – 3.6)	2.3 (1.4 – 3.6)	3.0 (1.8 – 4.0)	0.43
Elapsed time since most recent echocardiogram (years) n=927	1.9 (0.9 – 4.3)	1.9 (0.9 – 4.4)	3.9 (2.8 – 4.4)	0.17
ED arrival-to-disposition (hours)	4.3 ± 1.5	4.3 ± 1.5	4.0 ± 1.4	0.33

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Results

Outcomes	All Subjects (n=1,515)	Risk Stratified			p-value
		HEART 0-3 (n=142)	HEART 4-6 (n=1,293)	HEART ≥ 7 (n=80)	
Major Adverse Cardiac Events – 72 hours	21 (1.4%)	1 (0.7%)	17 (1.3%)	3 (3.8%)	0.27
Acute Myocardial Infarction	6 (0.4%)	1 (0.7%)	3 (0.2%)	2 (2.5%)	0.02
Revascularization	17 (1.2%)	0 (0%)	15 (1.2%)	2 (2.5%)	0.18
PCI	12 (0.8%)	0 (0%)	11 (0.9%)	1 (1.3%)	0.40
CABG	5 (0.3%)	0 (0%)	4 (0.3%)	1 (1.3%)	0.30
Cardiac arrest	1 (0.1%)	0 (0%)	1 (0.1%)	0 (0%)	1.0
Inpatient death	1 (0%)	0 (0%)	0 (0%)	0 (0%)	1.0

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	Total Cohort (n=1,515)	Risk Stratified			p-value	Missing Data
		HEART 0-3 (n=142)	HEART 4-6 (n=1,293)	HEART ≥ 7 (n=80)		
Cardiology consultation (%)	423 (27.9%)	33 (23.2%)	355 (27.5%)	35 (43.8%)	0.003	0 (0%)
Non-invasive Testing (%)						0 (0%)
Exercise stress test	7 (0.5%)	1 (0.7%)	6 (0.5%)	0 (0%)	0.67	
Stress echocardiogram	255 (16.8%)	61 (43.0%)	192 (14.9%)	2 (2.5%)	< 0.001	
Pharmacologic MPI	1,241 (81.9%)	76 (53.5%)	1,087 (84.1%)	78 (97.5%)	< 0.001	
Cardiac stress MRI	23 (1.5%)	5 (3.5%)	18 (1.4%)	0 (0%)	0.09	
Analgesia	648 (42.8%)	58 (40.9%)	550 (42.5%)	40 (50.0%)	0.38	0 (0%)
Nitroglycerin (%)	123 (8.1%)	6 (4.2%)	105 (8.1%)	12 (15.0%)	0.02	
PO acetaminophen (%)	510 (33.7%)	47 (33.0%)	437 (33.8%)	26 (32.5%)	0.09	
PO NSAID (%)	45 (3.0%)	6 (4.2%)	37 (2.9%)	2 (2.5%)	0.52	
IV acetaminophen (%)	22 (1.5%)	2 (1.4%)	18 (1.4%)	2 (2.5%)	0.84	
IV NSAID (%)	102 (6.7%)	17 (12.0%)	79 (6.1%)	6 (7.5%)	0.01	
IV opioids (%)	123 (8.1%)	11 (7.7%)	22 (7.9%)	10 (12.5%)	< 0.001	

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	Total Cohort (n=1,515)	Risk Stratified			p-value	Missing Data
		HEART 0-3 (n=142)	HEART 4-6 (n=1,293)	HEART ≥ 7 (n=80)		
Intravenous Medications						0 (0%)
Nitroglycerin infusion (%)	21 (1.4%)	2 (1.4%)	14 (1.1%)	5 (6.3%)	0.005	
Median elapsed hours (IQR)	39 (17-66)	87 (39-135)	47 (24-71)	11 (7-17)	0.11	
Heparin infusion (%)	36 (2.4%)	2 (1.4%)	29 (2.2%)	5 (6.3%)	0.07	
Median elapsed hours (IQR)	24 (17-44)	40 (25-54)	27 (19-41)	12 (9-19)	0.16	
Anti-dysrhythmics (%) *	6 (0.4%)	0 (0%)	5 (0.4%)	1 (1.3%)	0.36	
Median elapsed hours (IQR)	149 (124-188)	–	162 (124-188)	137 (–)	0.77	
Vasopressors / Inotropes (%) **	13 (0.9%)	0 (0%)	11 (0.9%)	2 (2.5%)	0.16	
Median elapsed hours (IQR)	142 (108-161)	–	149 (119-178)	107 (106-108)	0.17	
Procedures						
Left heart catheterization (%)	91 (6.0%)	4 (2.8%)	76 (5.9%)	11 (13.8%)	0.01	
Median elapsed hours (IQR)	44 (34-64)	50 (46-71)	44 (33-61)	49 (28-70)	0.47	
Electrical cardioversion (%)	3 (0.2%)	0 (0%)	3 (0.2%)	0 (0%)	1.0	
Median elapsed hours (IQR)	82 (51-82)	–	82 (51-82)	–	–	

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72-hour Risk MACE
n=1,515 subjects

	Proportion of Sample	72-hour risk MACE	Timing of MACE
HEART low	9%	0.7% (95% CI 0.02-3.9%)	56 (IQR 31-122) hours
HEART moderate	85%	1.4% (95% CI 0.8-2.1%)	
HEART high	5%	3.8% (95% CI 0.8-10.6%)	
High-sensitivity troponin T normal/flat x2 **PLUS** non-high-risk HPI [a]	80%	0.7% (95% CI 0.3-1.4%)	100 (IQR 43-131) hours

[a] Sensitivity analyses from variables with adjusted $p<0.05$ in multiple variable logistic regression model. Model adjusted for age; sex; race/ethnicity; HEART score HPI, ECG, and risk factors sub-scores; comorbidities; prior coronary revascularization; and high-sensitivity troponin T values consistent with study definition of AMI.

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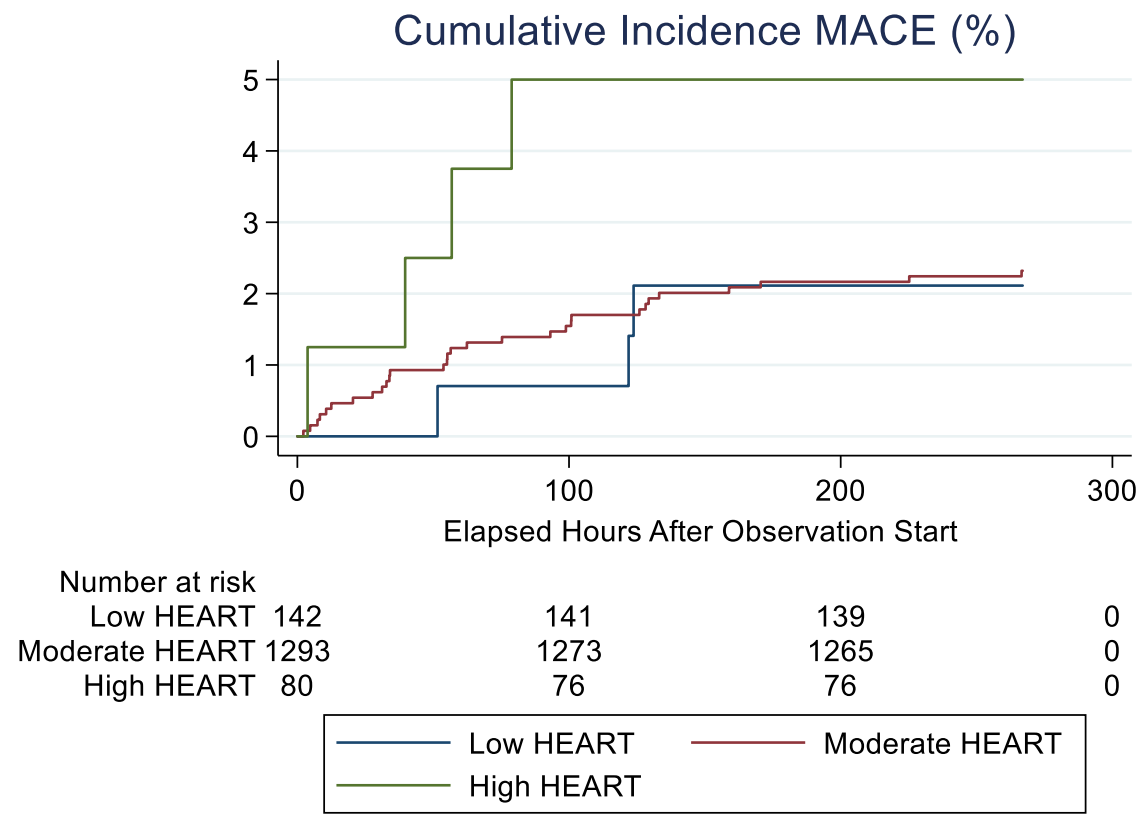
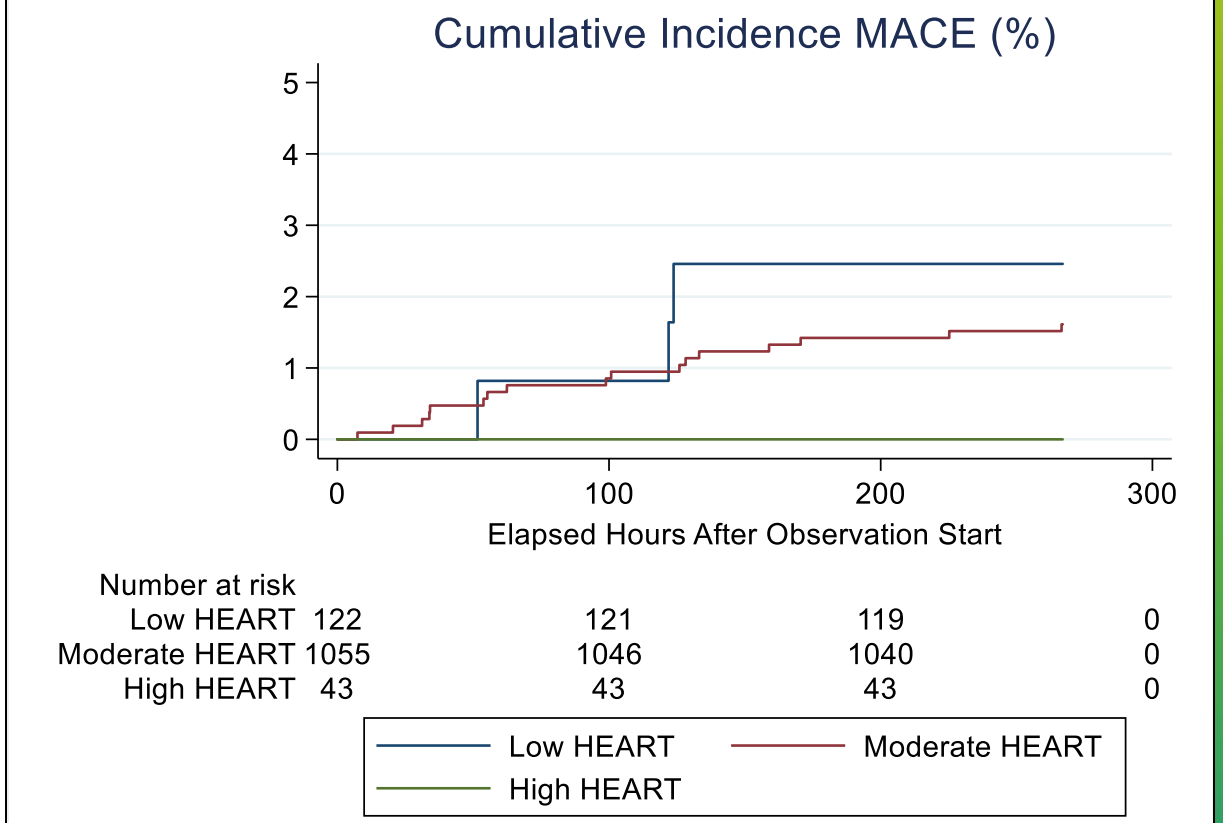
Cumulative Incidence of MACE



All Subjects



Subjects with 2 negative troponins + non-high-risk HPI

Interpretations

Risk of MACE in the 72 hours following ED evaluation for CP is low	HEART score still predicts risk
Troponin and non-high-risk history are reassuring	1055/1293 (**81.6%**) met both criteria 72-hour risk of MACE **0.7% (0.3-1.4%)**
If follow up could be assured, outpatient management might be reasonable for many intermediate risk chest pain patients	

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Q2: What do our chest pain patients think about staying in the EDOU?

Cross-sectional survey of chest pain patients in the ED Observation Unit (EDOU)

- Population: Patients admitted to EDOU for chest pain evaluation
  - Convenience sample
  - Informed consent
- Electronic survey instrument administered by iPad
  - Research nurses present to assist with data entry if necessary
- Domains of EDOU experience
  - Initial presentation
  - Benefits of EDOU
  - Experience in EDOU
  - Drawbacks/barriers to staying in EDOU
  - Openness to outpatient management program

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Who took the survey?	All (n=100)
Age (median)	
<60	28
61-69	38
70+	34
Female sex	50
Race	
NH White	87
NH Black	8
Hispanic Ethnicity	3
American Indian/Alaska Native	1
No Response	1
Insurance	
Private	36
Medicare	28
Combination	23
Medicaid	7
None	1
No Response	5
Income	
Under $25K	11
$25K to $50K	31
$50K to $75K	24
$75K to $100K	15
Over $100K	8
No response	11

Medical Comorbidities	All (n=100)
Prior Diagnoses	
Hyperlipidemia	61
HTN	60
CAD	31
DM	26
Current Smoking	15
BMI	31 (27 to 36)
Prior Workup	
Stress Test	57
Time elapsed (years)	3.7 (1.9 to 7.0)
CTCA	9
Time elapsed (years)	6.2 (1.5 to 11.8)
Echo	59
Last EF	62% (56 to 66%)
PCI	29
CABG	6
HEART Score	4 (4 to 5)
1 to 3	7
4 to 6	85
7 or 8	8

Response rate: 85% (100/118)

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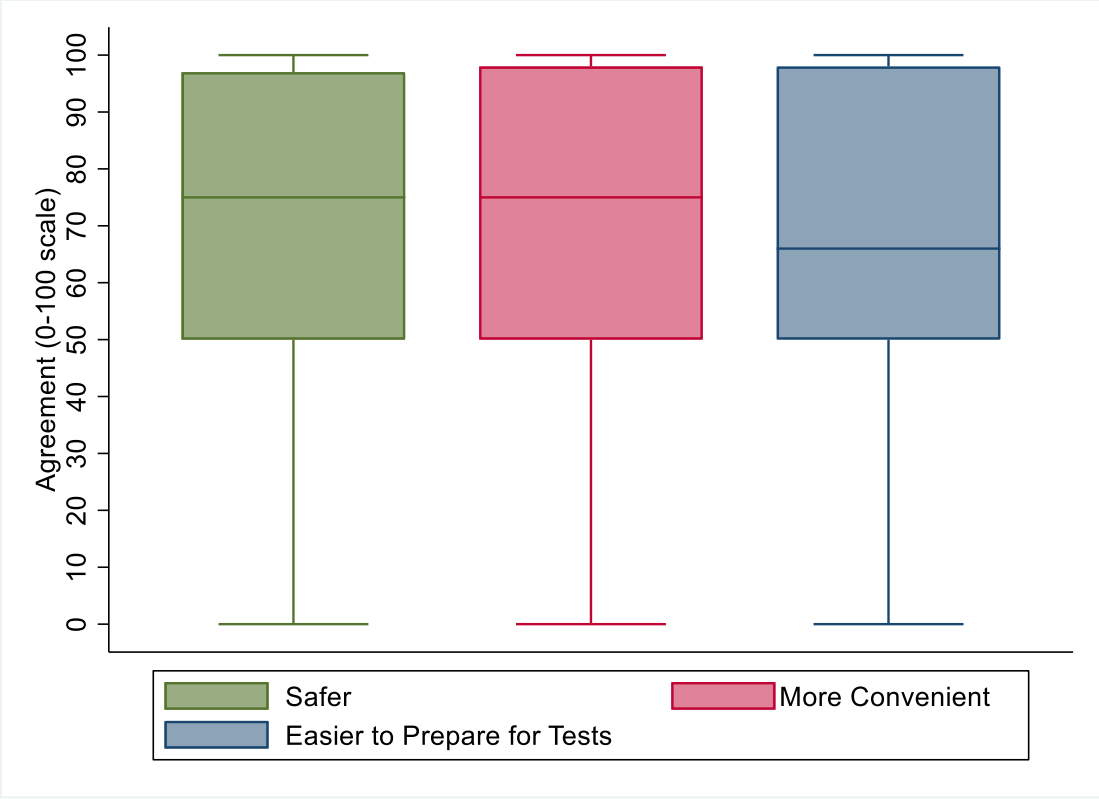
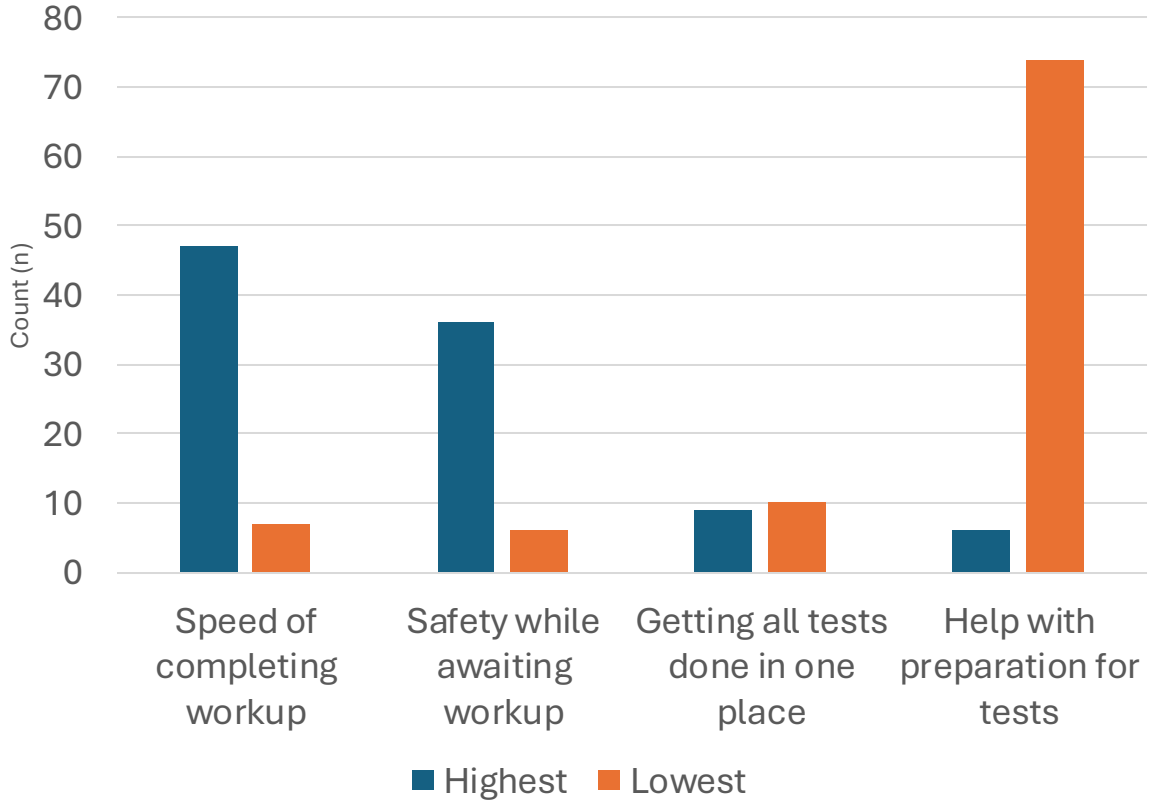
Patient-Level Context & Expectations

Question	Response (n=100)
Transferred from outside hospital ED	0%
Somebody accompanied to ED visit	38%
Somebody accompanied to EDOU	57%
Visitor while in EDOU	45%
Expected to stay in Hospital	23%
Attitude toward staying (scale of 10)	
Worry level about symptoms	7 (5 to 8)
Perceived control over ED disposition	7 (4 to 9)
Felt staying in hospital was important	7 (5 to 9)

Perceived Benefits of EDOU Stay



Level of agreement with prospect of EDOU stay in lieu of outpatient testing



Rank order of candidate benefits of EDOU stay

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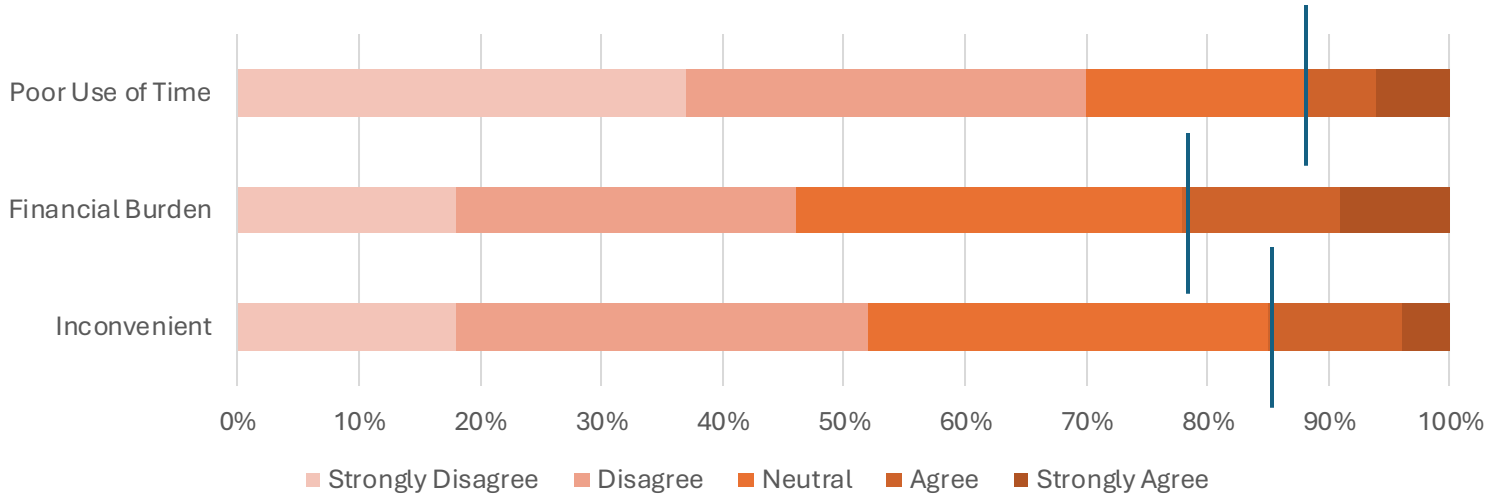
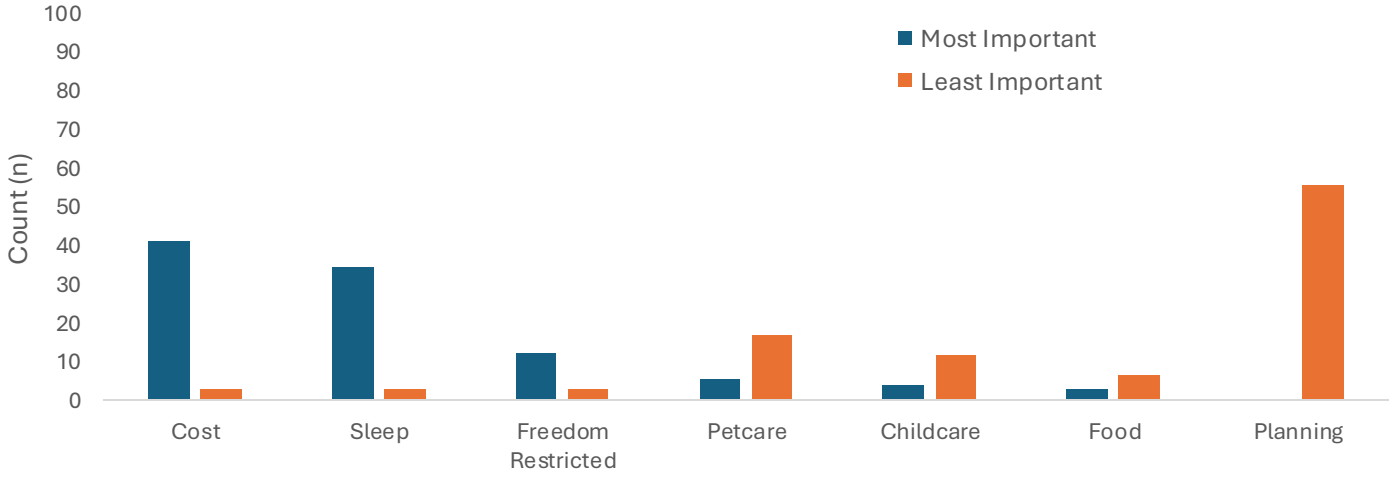
Perceived Drawbacks of EDOU Stay

Perceived drawback of EDOU stay in lieu of outpatient testing (Likert Scale)



Rank order of candidate drawbacks of EDOU stay in lieu of outpatient testing



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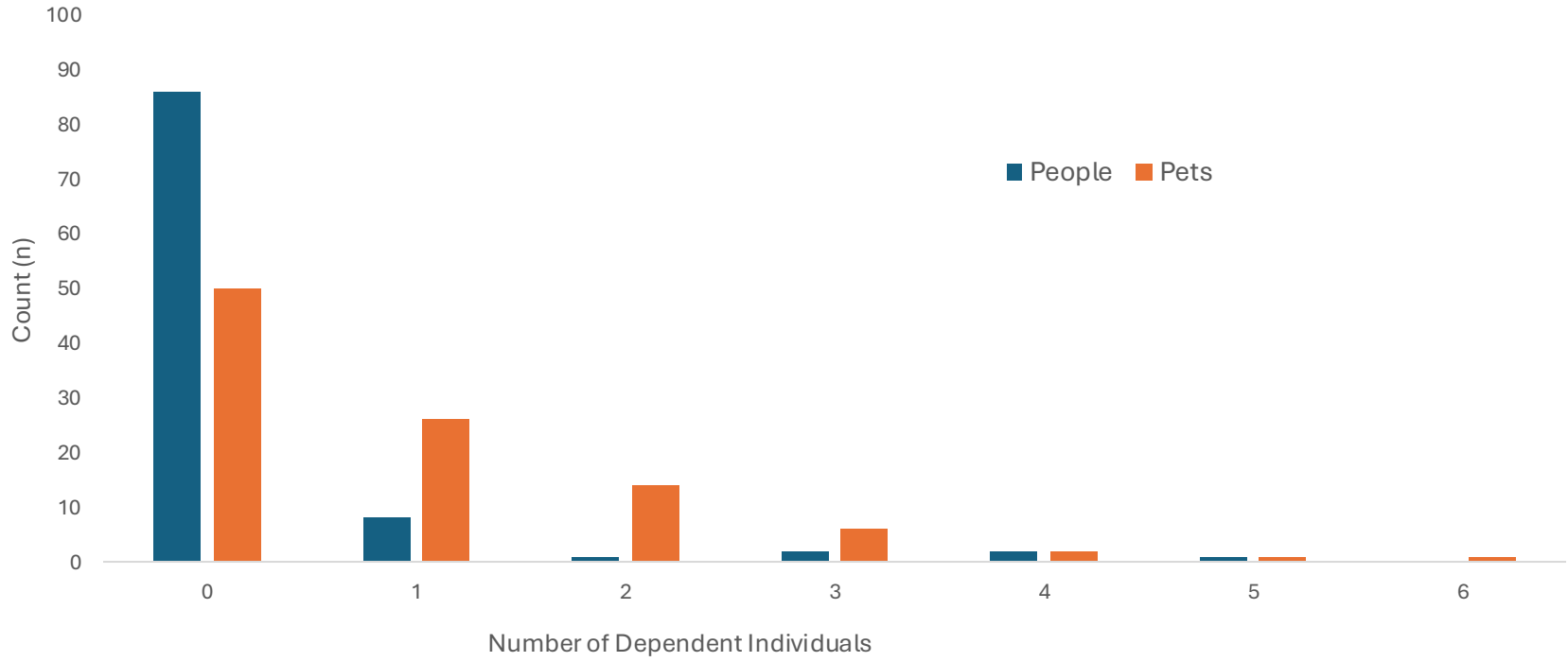
Perceived Drawbacks of EDOU Stay



Number of dependents (person & pets) for which subjects report being the primary caregiver

EDOU Quality of Life

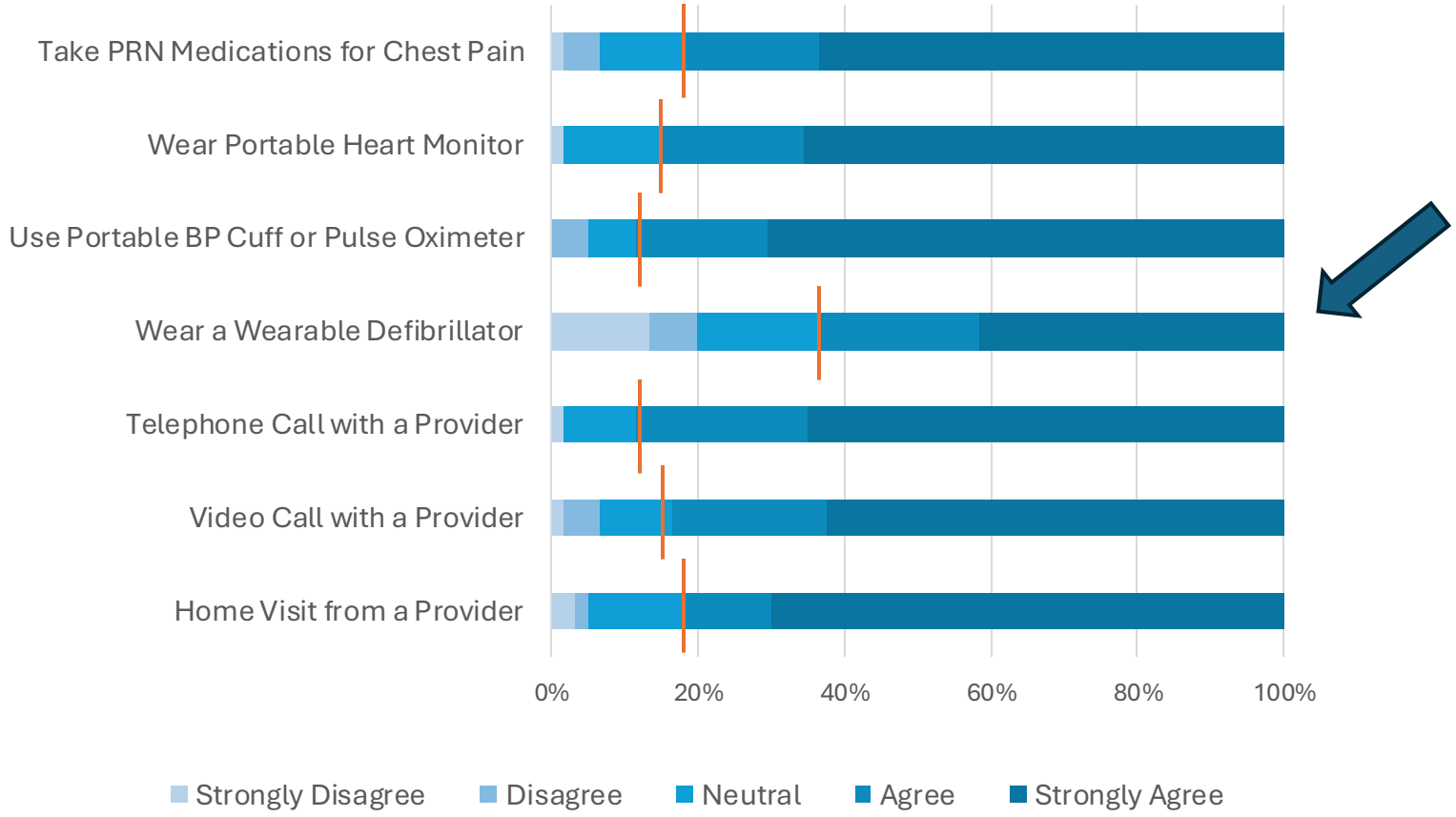
Question	Response (n=100)
How many hours of sleep last night?	5 (3 – 6.5)
How many interruptions in sleep last night?	2 (1-3)
Sleep quality the prior night? (scale 0-10)	5 (2 – 7)
Did you eat hospital food?	66%
Food quality? (scale 0-10)	5 (5 – 7)
Cell signal quality (Likert 1-5)	71% excellent/good
Wi-Fi signal quality (Likert 1-5)	55% excellent/good
Entertainment options (Likert 1-5)	58% excellent/good
Freedom of movement (Likert 1-5)	69% excellent/good

Openness to an Outpatient Testing Pathway

Subject willingness (Likert 1-5) to utilize candidate components of a home-based observation medicine program for chest pain

61% of subjects willing to hypothetically participate in a home-based program

- More likely to have had prior cardiac testing
- More likely to consider the prospect convenient
- Transportation concerns inversely correlated with perceived convenience



Interpretations

Patients are concerned about their chest pain symptoms and see the value of rapid evaluation

Speed and cost are most important considerations

Staying in the EDOU generally received high marks for quality

Sleep a notable exception!

Most patients would be willing to pursue an outpatient treatment plan

Subjects with prior cardiac testing less interested

Primary drivers are perceived convenience (directly correlated) and transportation barriers (inversely correlated)

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Future Directions?

SHARED DECISION MAKING

EXPEDITED OUTPATIENT TESTING

OBSERVATION AT HOME

Questions?

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