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LOW-DOSE CT SCAN FEATURES ARE ASSOCIATED WITH ANNUAL RISK OF HOSPITALIZATIONS

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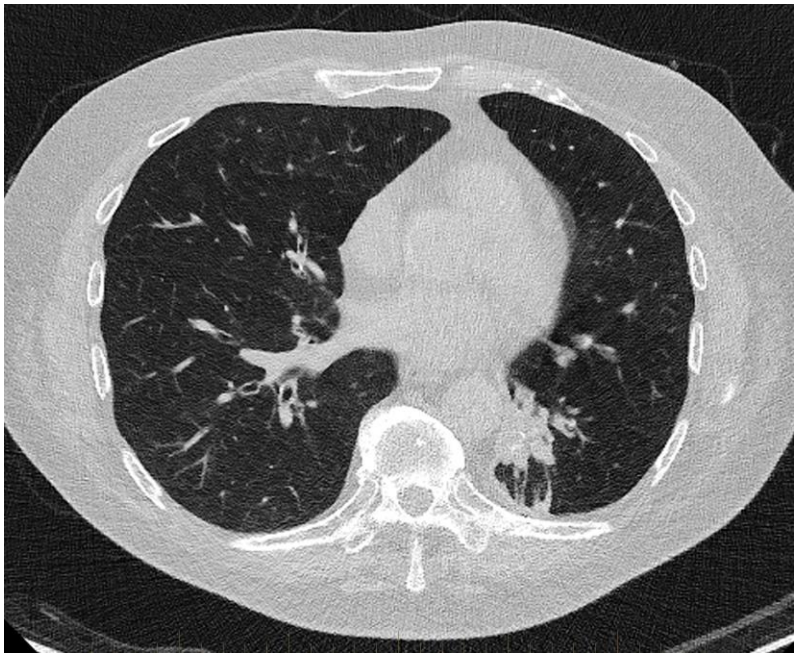
The authors have no financial interest in the subject matter of this presentation

BACKGROUND

- LDCT identifies early cancer
- Mortality benefit
- Other benefits?

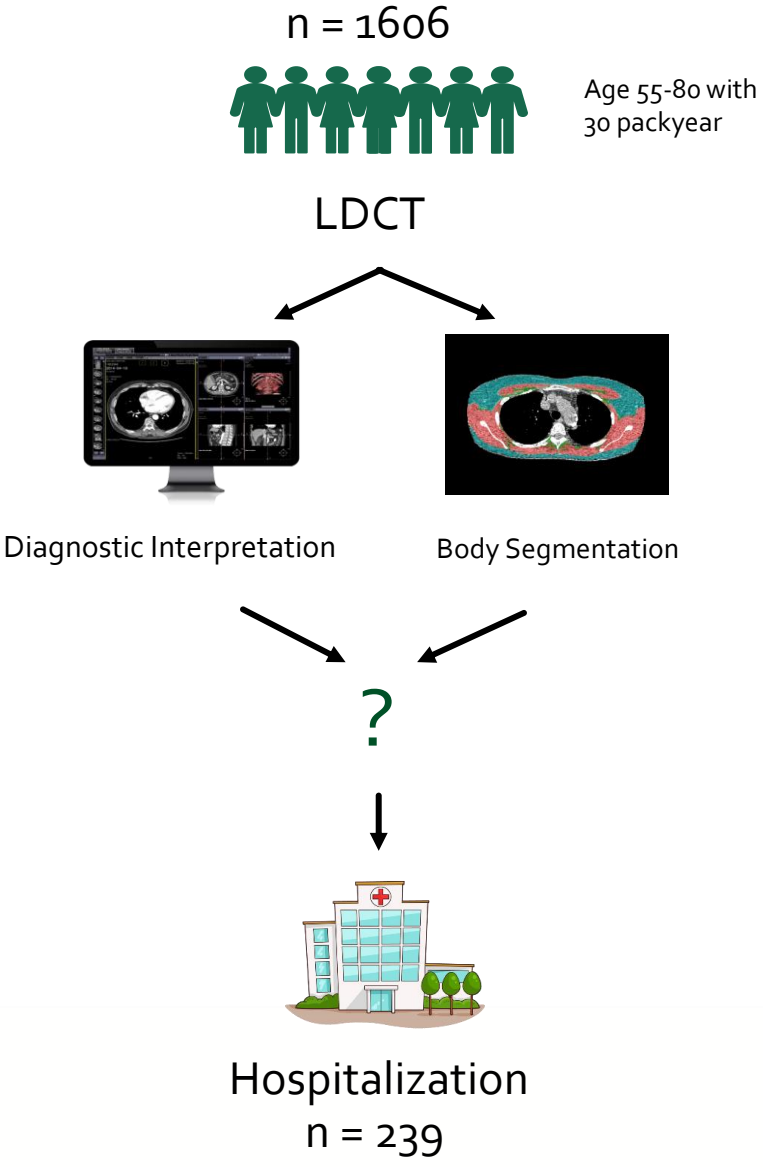


OBJECTIVE

Can LDCT scans be used to identify features associated with increased risk of hospitalization over the subsequent year?

METHODS

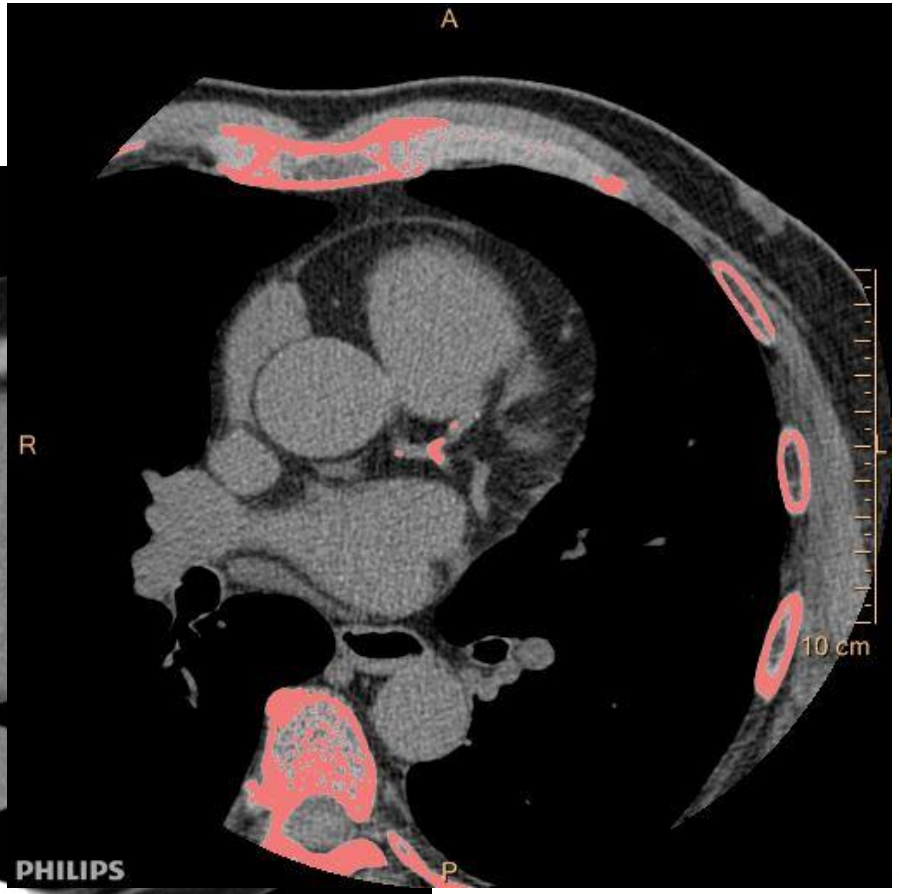
- Retrospective analysis
- Hospitalizations recorded
- Covariates selected
- Logistic Regression



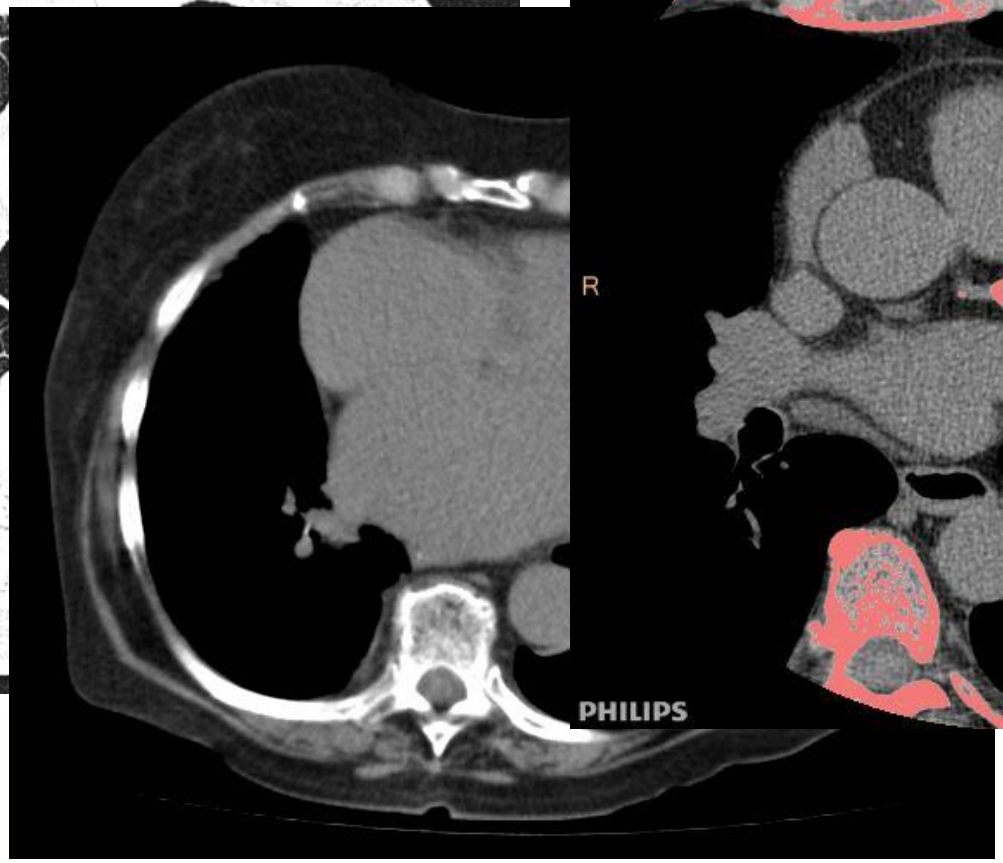
METHODS

EMPHYSEMA

CORONARY ARTERY CALCIFICATIONS

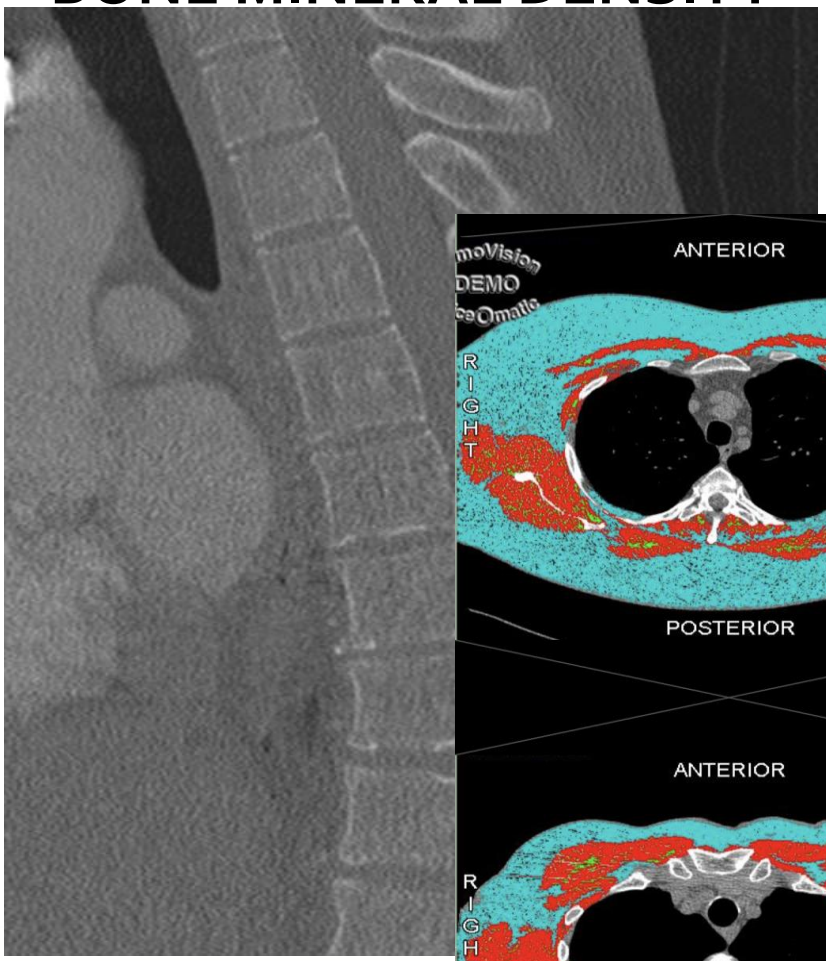


CARDIOMEGALY

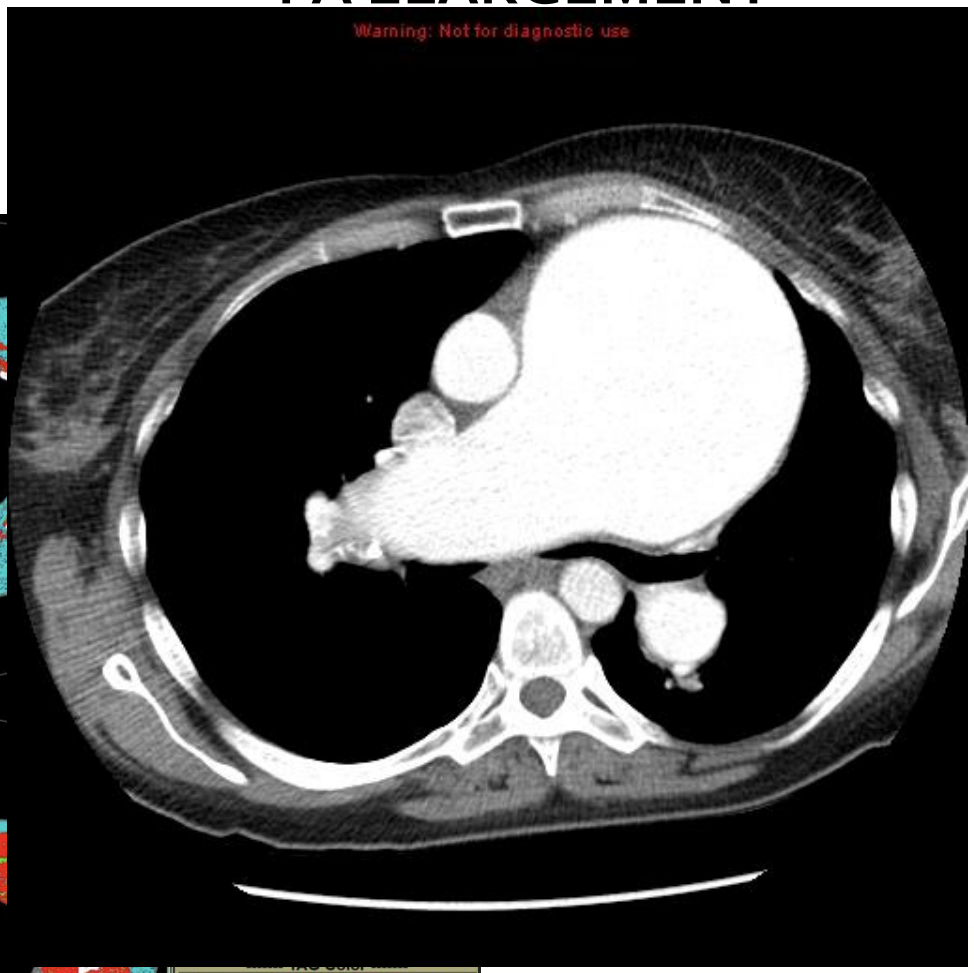


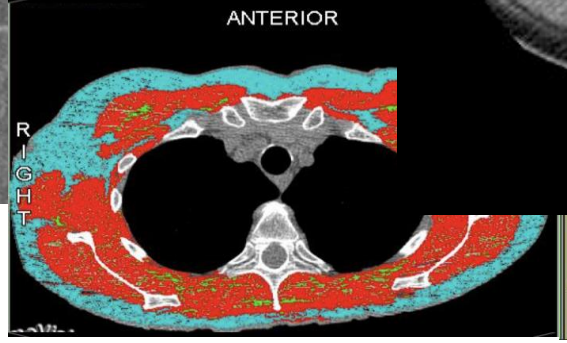
METHODS

BONE MINERAL DENSITY



PA ELARGEMENT





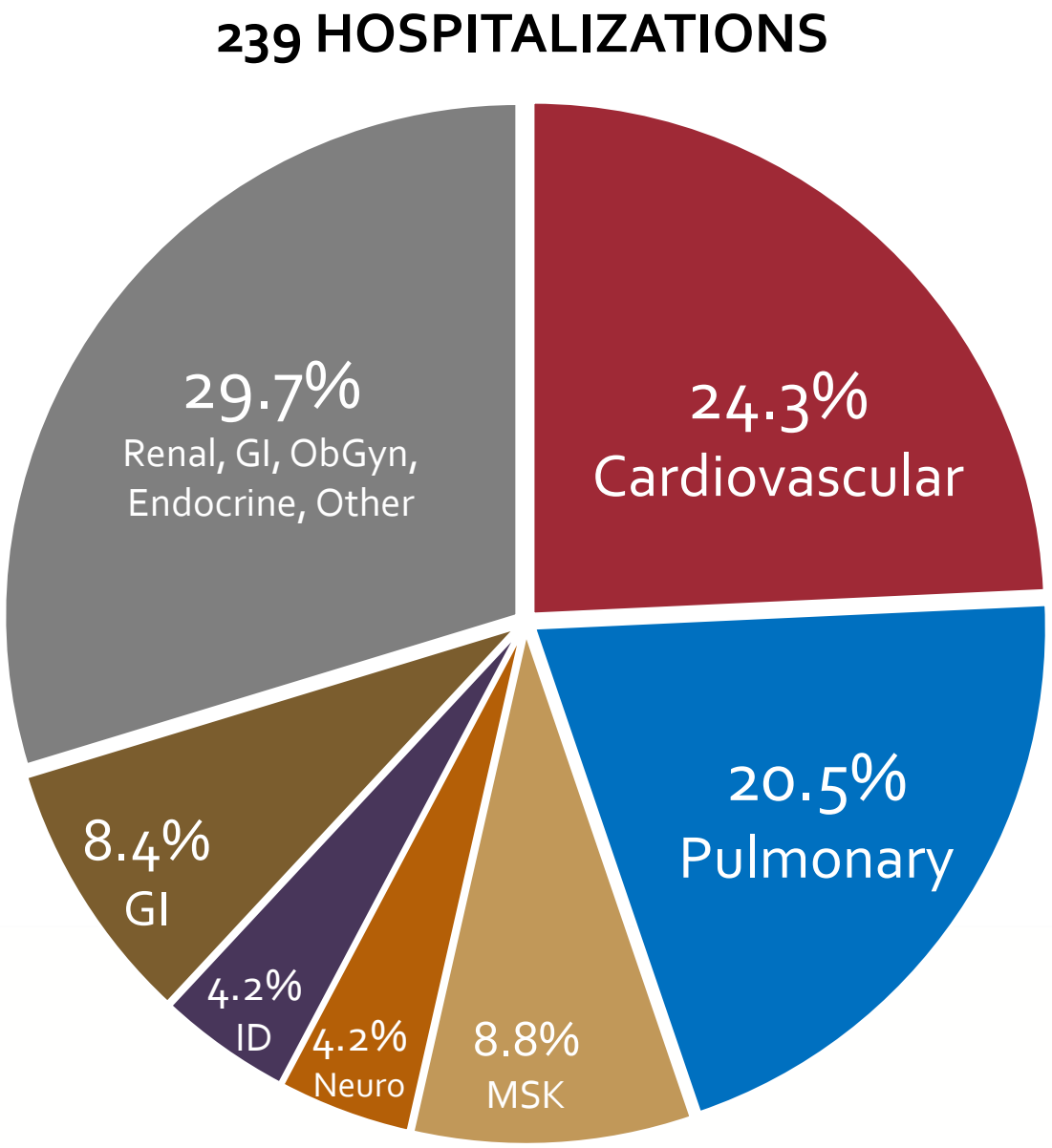
SARCOPENIA

RESULTS

Demographics	Values
No. of Scans	1606
Median Age (IQR)	65 (61-70)
Female (%)	875 (54%)
Race – Black or African American (%)	558 (35%)
Race – White (%)	951 (59%)
Race – Other (%)	97 (6%)
Current Smoker (%)	804 (50%)
Median Pack-year (IQR)	40 (34-50)

1606 scans came from 1066 unique patients. Some patients met eligibility criteria more than 1 year in a row.

RESULTS


239 HOSPITALIZATIONS
29.7%
Renal, GI, ObGyn, Endocrine, Other
24.3%
Cardiovascular
20.5%
Pulmonary
8.8%
MSK
4.2%
Neuro
4.2%
ID
8.4%
GI

RESULTS

	Unadjusted OR (95% CI)	*p*-value	Adjusted OR (95% CI)	*p*-value
Cardiomegaly	**2.16 (1.16, 3.96)**	**0.02**	**1.92 (1.00, 3.51)**	**0.04**
Sarcopenia	1.29 (0.96, 1.72)	0.09	**1.47 (1.08, 1.98)**	**0.01**
Severe Emphysema	1.29 (0.94, 1.76)	0.11	**1.43 (1.03, 1.97)**	**0.03**
BMI > 30	1.19 (0.90, 1.58)	0.23	1.29 (0.96, 1.73)	0.09
PA Enlargement	1.54 (0.64, 3.46)	0.25	1.28 (0.53, 2.77)	0.55
Bone Mineral Density > 120	1.08 (0.75, 1.59)	0.72	1.12 (0.79, 1.64)	0.53
Severe Coronary Artery Calcifications	**1.51 (1.08, 2.08)**	**0.02**	1.16 (0.87, 1.55)	0.30

Abbreviations: OR, odds ratio; CI, confidence interval; BMI, body mass index; PA, pulmonary artery; BMD, bone mineral density; CAC, coronary artery calcium

CONCLUSION

- Hospitalization associations
- Powerful screening tool

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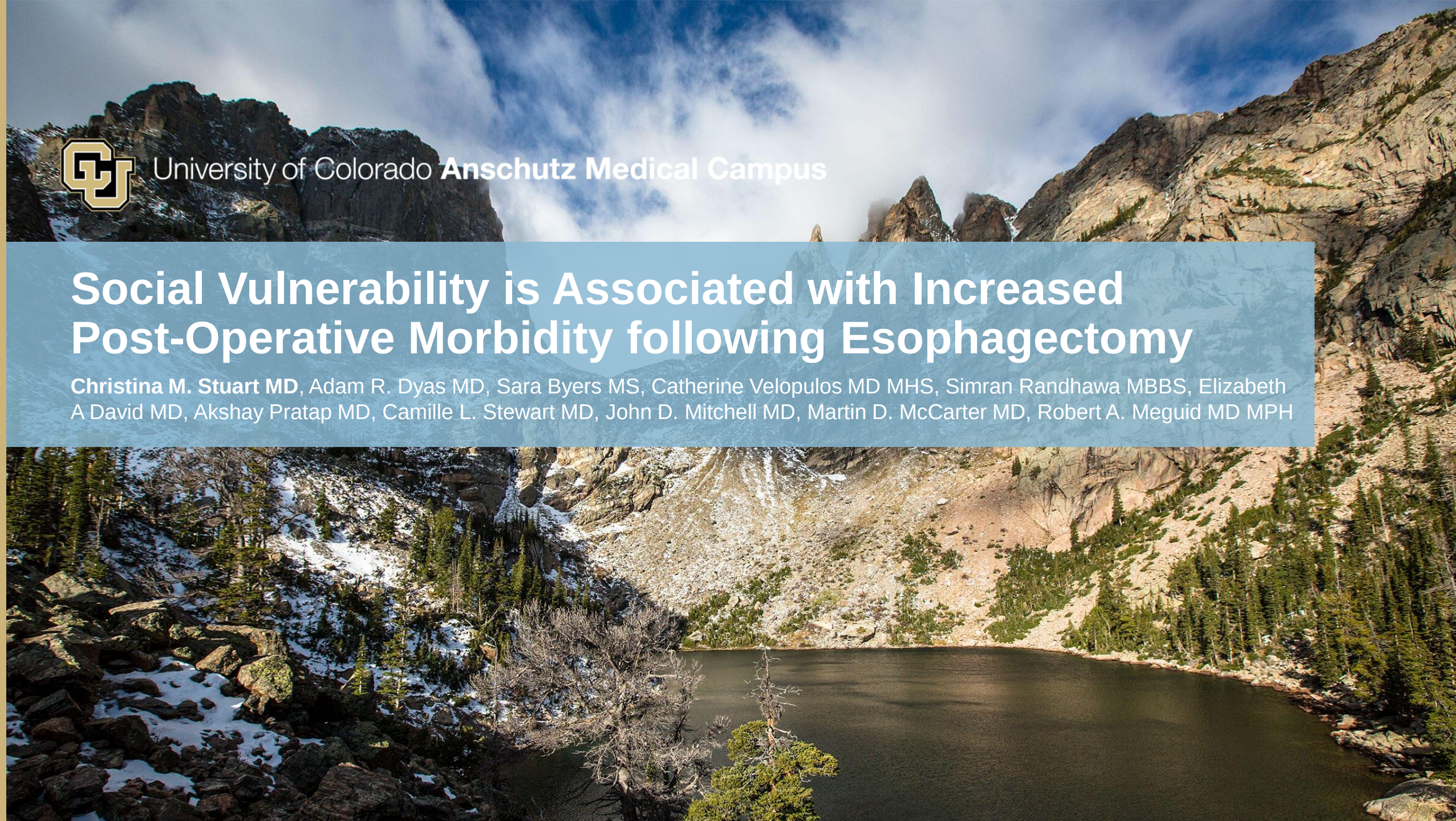
QUESTIONS?

SUPPLEMENTAL INFORMATION

	Coronary Artery Calcium	Emphysema	Bone Mineral Density
Mild *Normal for BMD*	Agatston Score of 1-99	Emphysema which comprises 0.5%-5.0% of the lung zone	Quantitative CT BMD >120 mg/cm^3
Moderate *Low for BMD*	Agatston Score of 100-299	Emphysema which comprises more than 5% of lung zone	Quantitative CT BMD of 80-120 mg/cm^3
Severe *Very low for BMD*	Agatston Score of > 300	Advanced destructive emphysema with vascular distortion	Quantitative CT BMD < 80 mg/cm^3

SI1: Stratification for Coronary Artery Calcium, Emphysema, and Bone Mineral Density



University of Colorado **Anschutz Medical Campus**

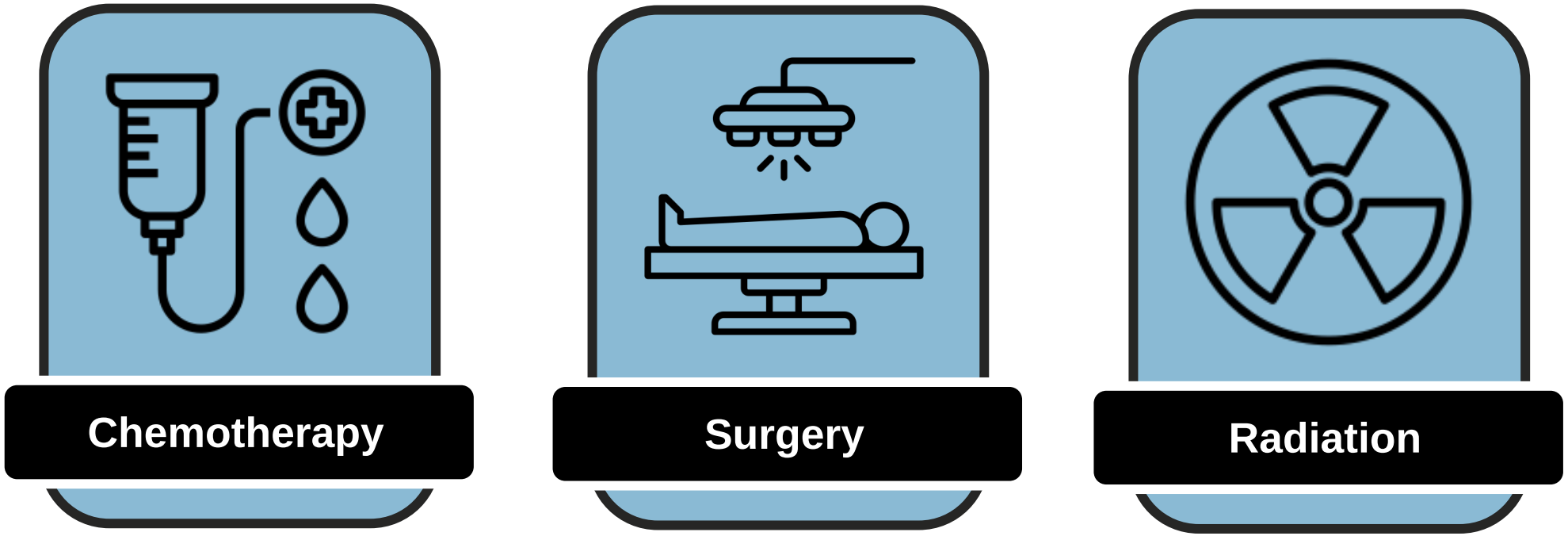
Social Vulnerability is Associated with Increased Post-Operative Morbidity following Esophagectomy

Christina M. Stuart MD, Adam R. Dyas MD, Sara Byers MS, Catherine Velopulos MD MHS, Simran Randhawa MBBS, Elizabeth A David MD, Akshay Pratap MD, Camille L. Stewart MD, John D. Mitchell MD, Martin D. McCarter MD, Robert A. Meguid MD MPH

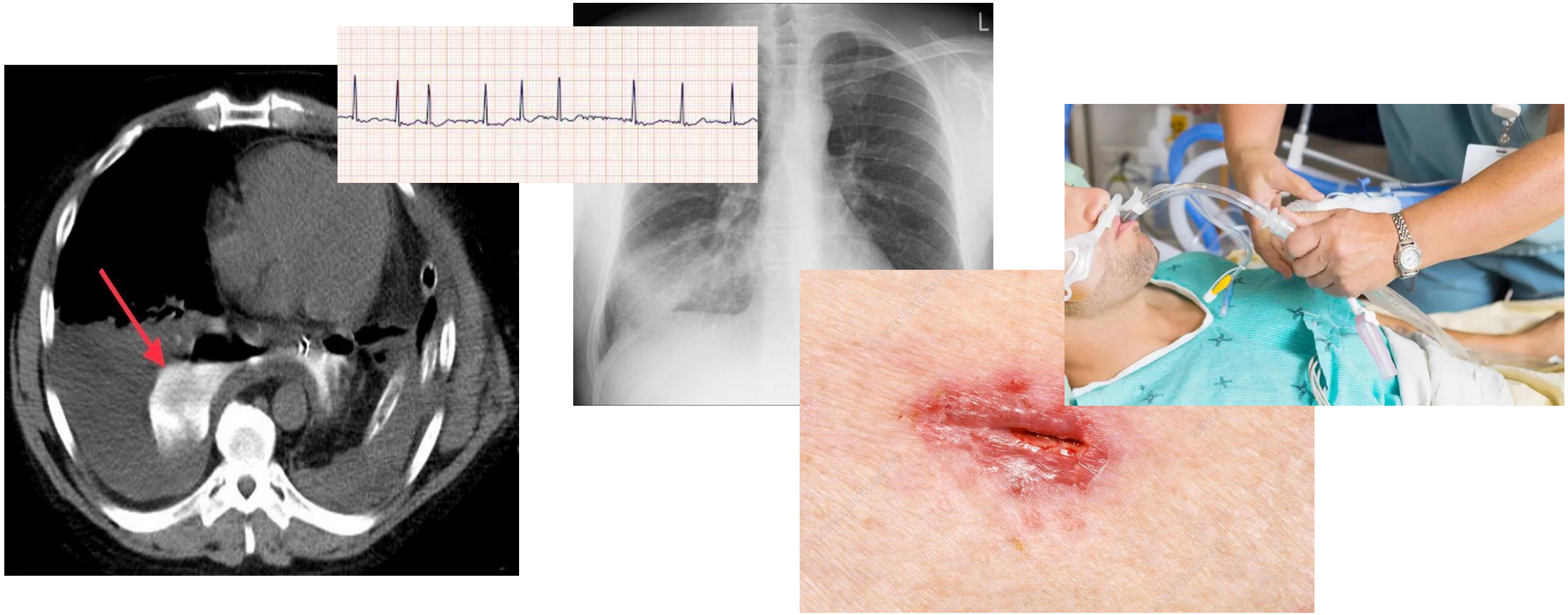
Disclosures

CMS is supported by the National Institutes of Health, under Ruth L. Kirschstein National Research Service Award **T32CA17468**. This presentation's contents are solely the responsibility of the authors and do not necessarily represent the official views of the NIH.

Management of esophageal cancer is multimodal and often includes surgery.



Incidence of post-operative morbidity following esophagectomy is 20-60%.



Unpublished Data, 2023

Complications have negative impact on **patient quality of life** and **long-term oncologic outcomes**.

Continued **efforts to improve post-esophagectomy outcomes** are ongoing.

There is a link between social determinants of health and esophagectomy outcomes.

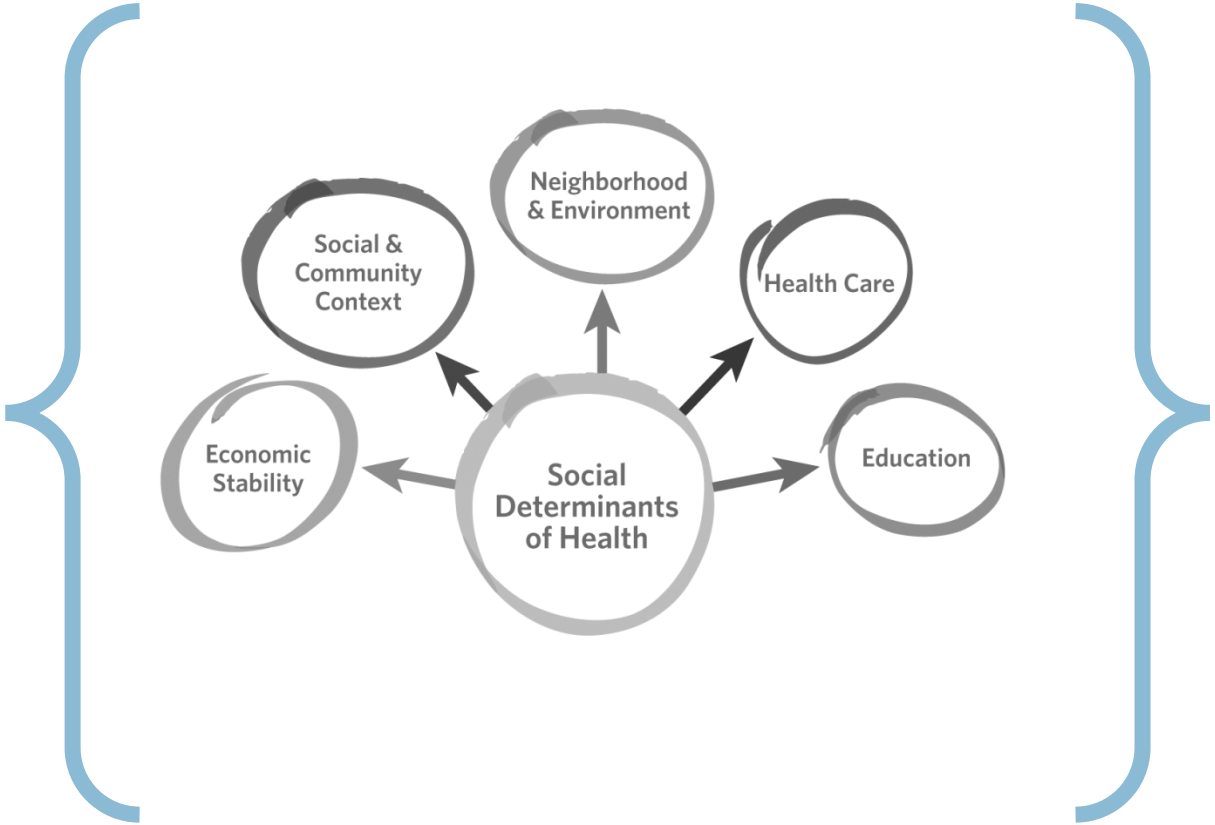
Revels et al. and Savitch et al. → African-American patients with esophageal cancer have higher mortality than white counterparts.

Hypotheses: *Differences in tumor histology and location*

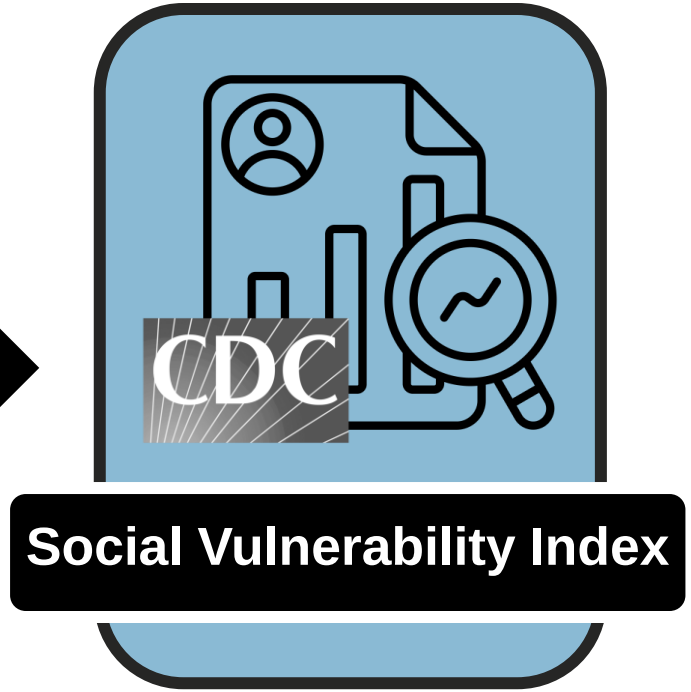
Sun et al., Al-Refaie et al. and Erhunmwunsee et al. → Socioeconomic status is associated with poor surgical outcomes and lower quality of care.

Hypotheses: *Financial barriers and access to care*

Social Vulnerability Index is a quantitative and composite metric of SDOH.



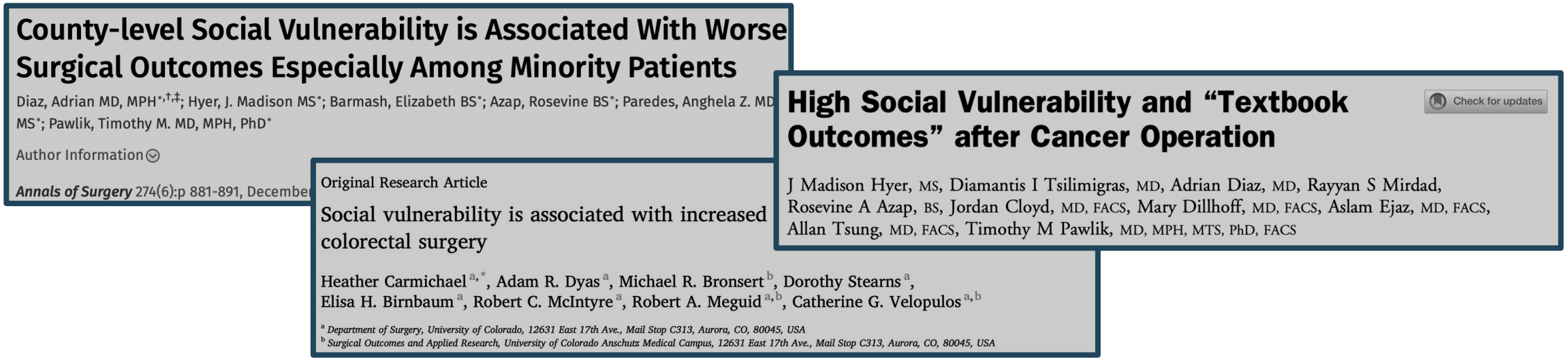
Quantitative and Composite



Unpublished Data, 2023


1
Socioeconomic Status
2
Household Composition
3
Minority Status and Language
4
Housing and Transportation
Overall Social Vulnerability

Emerging literature suggestion an association between SVI and surgical outcomes.



County-level Social Vulnerability is Associated With Worse Surgical Outcomes Especially Among Minority Patients

Diaz, Adrian MD, MPH*,†,‡; Hyer, J. Madison MS*; Barmash, Elizabeth BS*; Azap, Rosevine BS*; Paredes, Anghela Z. MD MS*; Pawlik, Timothy M. MD, MPH, PhD*

Author Information

Annals of Surgery 274(6):p 881-891, December

High Social Vulnerability and "Textbook Outcomes" after Cancer Operation

Check for updates

J Madison Hyer, MS, Diamantis I Tsilimigras, MD, Adrian Diaz, MD, Rayyan S Mirdad, Rosevine A Azap, BS, Jordan Cloyd, MD, FACS, Mary Dillhoff, MD, FACS, Aslam Ejaz, MD, FACS, Allan Tsung, MD, FACS, Timothy M Pawlik, MD, MPH, MTS, PhD, FACS

Original Research Article

Social vulnerability is associated with increased colorectal surgery

Heather Carmichael[a,*], Adam R. Dyas[a], Michael R. Bronsert[b], Dorothy Stearns[a], Elisa H. Birnbaum[a], Robert C. McIntyre[a], Robert A. Meguid[a,b], Catherine G. Velopulos[a,b]

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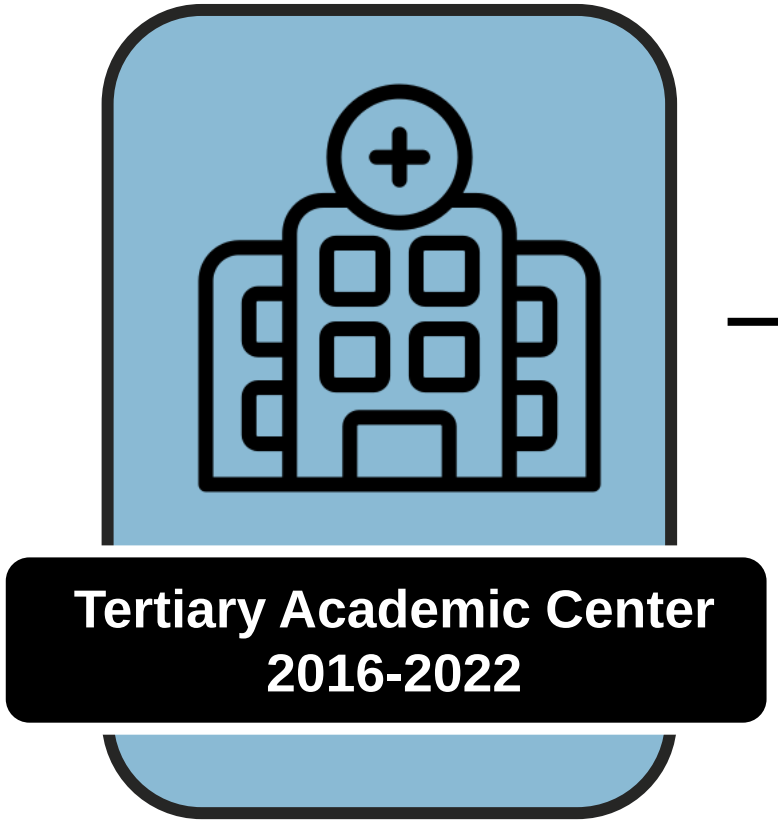
[b] *Surgical Outcomes and Applied Research, University of Colorado Anschutz Medical Campus, 12631 East 17th Ave., Mail Stop C313, Aurora, CO, 80045, USA*

Study Aim: Identify if association exists between Social Vulnerability and post-esophagectomy outcomes.

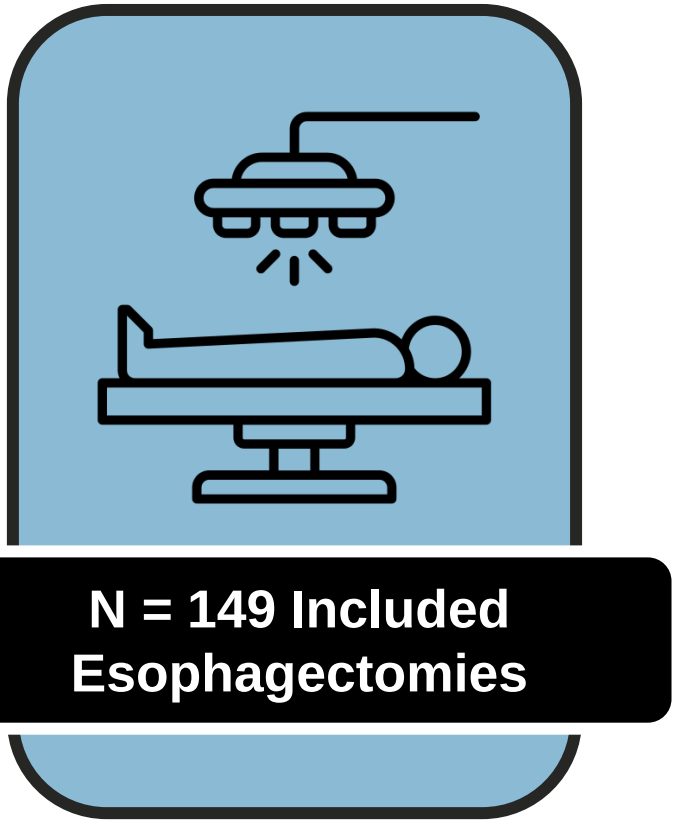
Methods



Tertiary Academic Center
2016-2022

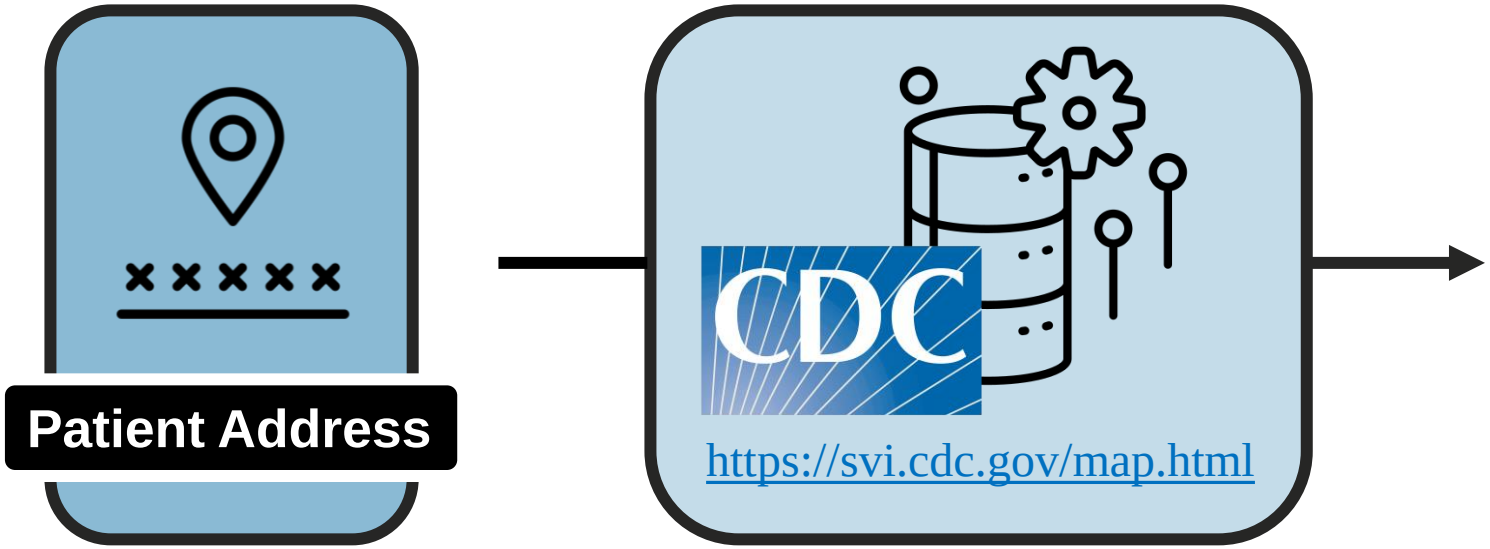
Inclusion Criteria
Resectable cancer
Surgery w/ curative intent

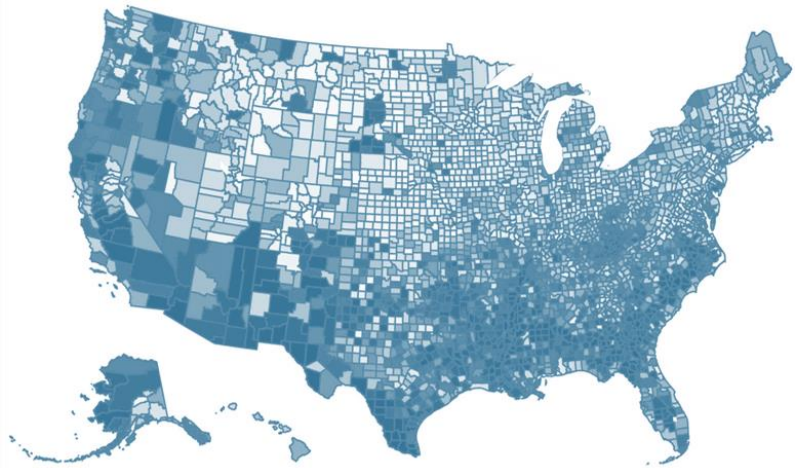
Exclusion Criteria
Aborted surgery
Concomitant gastrectomy
Non-gastric conduit



N = 149 Included Esophagectomies

Methods

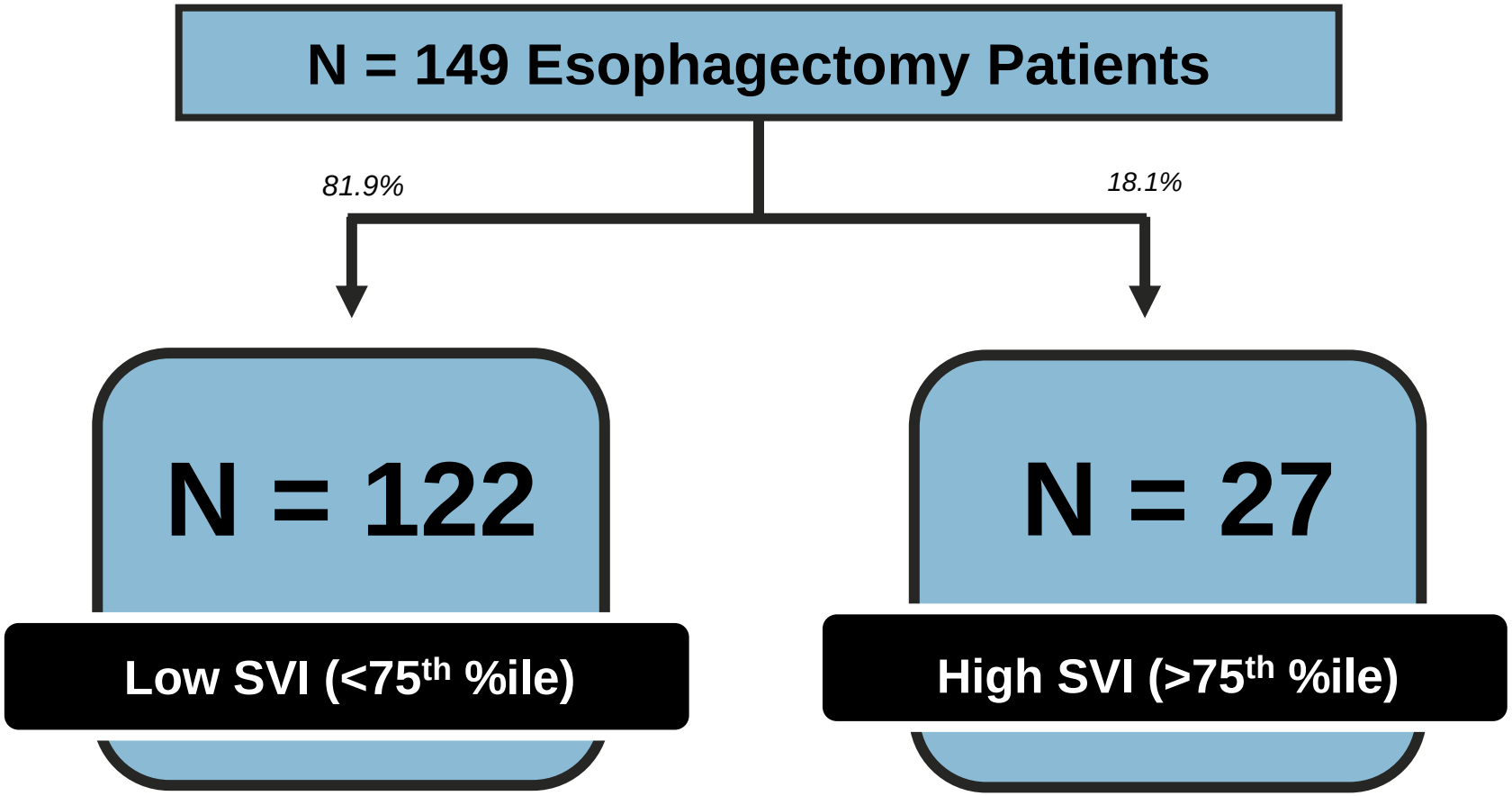




High SVI vs Low SIV
Based on 75th %ile

Primary Outcome: Overall postoperative morbidly
Secondary Outcome: Individual postoperative complication rates

Results: Cohort Selection



Results: Demographic Characteristics

Table 1A — Demographic Characteristics

	Low SVI (N=122)	High SVI (N=27)	All (N=149)	P-Value
Age	64.9 ± 10.4	61.1 ± 11.2	64.2 ± 10.6	*0.124*
Sex				*0.365*
Male	107 (87.7%)	22 (81.5%)	129 (86.6%)	
Female	15 (12.3%)	5 (18.5%)	20 (13.4%)	
Race				*1.000*
Black / African American	1 (0.8%)	0 (0.0%)	1 (0.7%)	
White	121 (99.2%)	27 (100.0%)	148 (99.3%)	
Ethnicity				***0.029***
Hispanic	6 (4.9%)	5 (18.5%)	11 (7.4%)	
Non-Hispanic	116 (95.1%)	22 (81.5%)	138 (92.6%)	
BMI	27.0 ± 5.2	26.0 ± 5.9	26.8 ± 5.3	*0.368*
ASA Class				*0.804*
2	17 (14.3%)	5 (19.2%)	22 (15.2%)	
3	98 (82.4%)	20 (76.9%)	118 (81.4%)	
4	4 (3.4%)	1 (3.8%)	5 (3.4%)	

Table 1B — Demographic Characteristics

	Low SVI (N=122)	High SVI (N=27)	All (N=149)	P-Value
Comorbidity				
Any Comorbidity	59 (48.4%)	11 (40.7%)	70 (47.0%)	*0.473*
Number of Comorbidities	0.7 ± 0.8	0.5 ± 0.6	0.6 ± 0.8	*0.247*
Medical History				
CHF	1 (0.8%)	0(0.0%)	1 (0.7%)	*1.000*
MI	3 (2.5%)	1 (3.7%)	4 (2.7%)	*0.555*
HTN	55 (45.1%)	9 (33.3%)	64 (43.0%)	*0.264*
COPD	4 (3.3%)	0 (0.0%)	4 (2.7%)	*1.000*
Dialysis-Dependent	0 (0.0%)	0 (0.0%)	0 (0.0%)	—
Diabetes	18 (14.8%)	2 (7.4%)	20 (13.4%)	*0.532*
CVA/TIA	1 (0.8%)	1 (3.7%)	2 (1.3%)	*0.331*
Liver Disease	1 (0.8%)	0 (0.0%)	1 (0.7%)	*1.000*
Smoker (Prior or Current)	58 (47.5%)	16 (59.3%)	74 (49.7%)	*0.270*
Surgical History				
Prior Abdominal Surgery	52 (42.6%)	12 (44.4%)	64 (43.0%)	*1.000*
Prior Thoracic Surgery	12 (9.8%)	2 (7.4%)	14 (9.4%)	*1.000*

High SVI pts were more likely to be **Hispanic** (18.5% vs 4.9%, p=0.029), but no differences in ASA, comorbidity history or other demographics.

Results: Cancer / NAT Characteristics

Table 2 — Cancer and Treatment Characteristics				
	Low SVI (N=122)	High SVI (N=27)	All (N=149)	P-Value
Neoadjuvant Chemotherapy	97 (79.5%)	18 (66.7%)	115 (77.2%)	0.150
Neoadjuvant Chemoradiation	105 (86.1%)	19 (70.4%)	124 (83.2%)	0.083
Tumor Location				0.392
Upper Thoracic	2 (1.6%)	0 (0.0%)	2 (1.3%)	
Middle Thoracic	6 (4.9%)	0 (0.0%)	6 (4.0%)	
Lower Thoracic	114 (93.4%)	27 (100.0%)	141 (94.6%)	
Histopathologic Type				0.592
Adenocarcinoma	116 (95.1%)	27 (100.0%)	143 (96.0%)	
Squamous Cell	6 (4.9%)	0 (0.0%)	6 (4.0%)	
Preoperative Clinical Stage				0.188
Stage I	12 (9.8%)	6 (22.2%)	18 (12.1%)	
Stage II	12 (9.8%)	4 (14.8%)	16 (10.7%)	
Stage III	83 (68.0%)	13 (48.1%)	96 (64.4%)	
Stage IV	15 (12.3%)	4 (14.8%)	19 (12.8%)	

No difference in neoadjuvant therapy or cancer characteristics *(all p>0.05).*

Results: Operative Characteristics

Table 3 — Operative Characteristics				
	Low SVI (N=122)	High SVI (N=27)	All (N=149)	P-Value
Operative Time	409.8 ± 85.3	432.7 ± 89.1	413.9 ± 86.1	0.213
Esophagectomy Type				0.181
Ivor-Lewis	108 (88.5%)	27 (100.0%)	135 (90.6%)	
McKeown	11 (9.0%)	0 (0.0%)	11 (7.4%)	
Transhiatal	3 (2.5%)	0 (0.0%)	3 (2.0%)	
Abdominal Approach				0.681
Laparoscopic	70 (57.4%)	13 (48.1%)	83 (55.7%)	
Open	4 (3.3%)	1 (3.7%)	5 (3.4%)	
Robotic	48 (39.3%)	13 (48.1%)	61 (40.9%)	
MIS Approach (n=144)	118 (96.7%)	26 (96.3%)	144 (96.6%)	1.000
Conversion to Open (n=144)	2 (1.7%)	0 (0.0%)	2 (1.4%)	1.000
Thoracic Approach				0.447
Cervical Incision	3 (2.5%)	0 (0.0%)	3 (2.0%)	
Open	3 (2.5%)	0 (0.0%)	3 (2.0%)	
Robotic	23 (18.9%)	8 (29.6%)	31 (20.8%)	
Thoracoscopic	93 (76.2%)	19 (70.4%)	112 (75.2%)	
MIS Approach (n=143)	116 (95.1%)	27 (100.0%)	143 (96.0%)	1.000
Conversion to Open (n=143)	9 (7.8%)	2 (7.4%)	11 (7.7%)	1.000
Estimated Blood Loss	269.7 ± 239.7	194.4 ± 209.1	256.1 ± 235.6	0.134

No difference in operative characteristics *(all p>0.05).*

Results: Pathologic Characteristics

Table 4 – Final Pathologic Characteristics				
	Low SVI (N=122)	High SVI (N=27)	All (N=149)	P-Value
Postoperative Pathologic Stage				0.375
Complete Response	28 (23.0%)	5 (18.5%)	33 (22.1%)	
Stage I	31 (25.4%)	9 (33.3%)	40 (26.8%)	
Stage II	11 (9.0%)	5 (18.5%)	16 (10.7%)	
Stage III	37 (30.3%)	7 (25.9%)	44 (29.5%)	
Stage IV	15 (12.3%)	1 (3.7%)	16 (10.7%)	
Margin Status				0.209
Positive	10 (8.2%)	0 (0.0%)	10 (6.7%)	
Negative	112 (91.8%)	27 (100.0%)	139 (93.3%)	
Greater Than 15 Nodes Harvested	98 (80.3%)	24 (88.9%)	122 (81.9%)	0.411
Upstaged	15 (12.3%)	2 (7.4%)	17 (11.4%)	0.739

No difference in final pathologic characteristics *(all p>0.05).*

Results: Post-Operative Outcomes

Table 5 — Post-Operative Outcomes				
	Low SVI (N=122)	High SVI (N=27)	All (N=149)	P-Value
Hospital Length of Stay	13.5 ± 10.0	18.2 ± 14.0	14.3 ± 10.8	**0.046**
ICU Length of Stay	3.0 ± 5.2	3.7 ± 5.0	3.1 ± 5.2	0.561
Discharge Destination				0.121
Home	112 (91.8%)	23 (85.2%)	135 (90.6%)	
Facility	6 (4.9%)	4 (14.8%)	10 (6.7%)	
Expired During Index Admission	4 (3.3%)	0 (0.0%)	4 (2.7%)	
Other Complications				
Stroke	0 (0.0%)	0 (0.0%)	0 (0.0%)	—
MI	1 (0.8%)	0 (0.0%)	1 (0.7%)	1.000
Pneumonia	8 (6.6%)	7 (25.9%)	15 (10.1%)	**0.007**
Reintubation	8 (6.6%)	3 (11.1%)	11 (7.4%)	0.420
Septic Shock	3 (2.5%)	1 (3.7%)	4 (2.7%)	0.555
DVT	3 (2.5%)	1 (3.7%)	4 (2.7%)	0.555
PE	4 (3.3%)	1 (3.7%)	5 (3.4%)	1.000
Surgical Site Infection	9 (7.4%)	3 (11.1%)	12 (8.1%)	0.456
Chylothorax	5 (4.1%)	1 (3.7%)	6 (4.0%)	1.000
Tracheostomy	2 (1.6%)	1 (3.7%)	6 (4.0%)	1.000
J-Tube Complication	4 (3.3%)	4 (14.8%)	8 (5.4%)	**0.036**
Unplanned ICU Readmission	15 (12.3%)	8 (29.6%)	23 (15.4%)	**0.037**
Anastomotic Leak	22 (18.0%)	6 (22.2%)	38 (18.8%)	0.594
Any Complication	45 (36.9%)	18 (66.7%)	63 (42.3%)	**0.005**
Mortality				
In-Hospital Mortality	4 (3.3%)	0 (0.0%)	4 (2.7%)	1.000
30D Mortality	3 (2.5%)	0 (0.0%)	2 (2.0%)	0.711

***After adjusting for perioperative factors*, high SVI continues to be associated with increased overall complications.**

<u>Overall Morbidity</u>

OR 3.854

(95% CI 1.45 – 10.254, p=0.007)

Unpublished Data, 2023

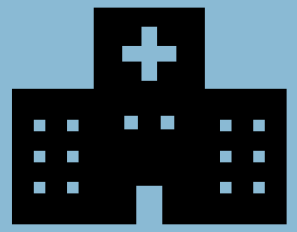
Summary of Findings

In a study of 149 esophagectomy patients, those with **high social vulnerability** had…

Increased Morbidity

66.7% vs 36.9%
p = 0.005

Increased LOS



18.2 vs 13.5 days
p = 0.046

Increased ICU Use

29.6% vs 12.3%
p = 0.037

… when compared to their less vulnerable counterparts.

How does SVI mediate outcomes?

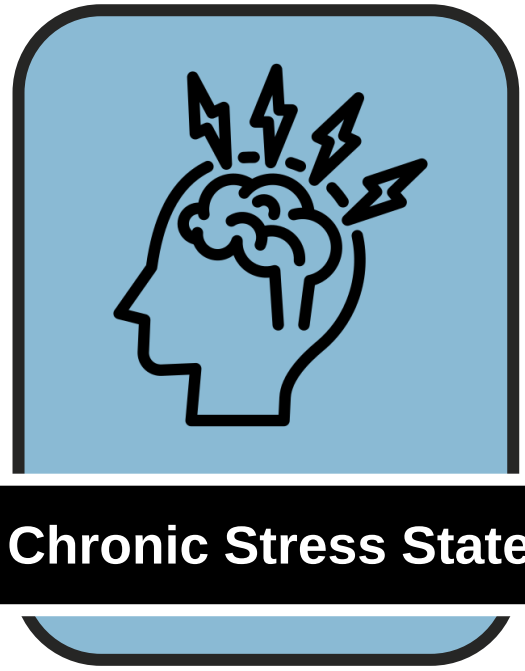
The influence of social vulnerability on health outcomes is highly complex!

Healthcare Literacy

e.g., language + formal education

Healthcare Access

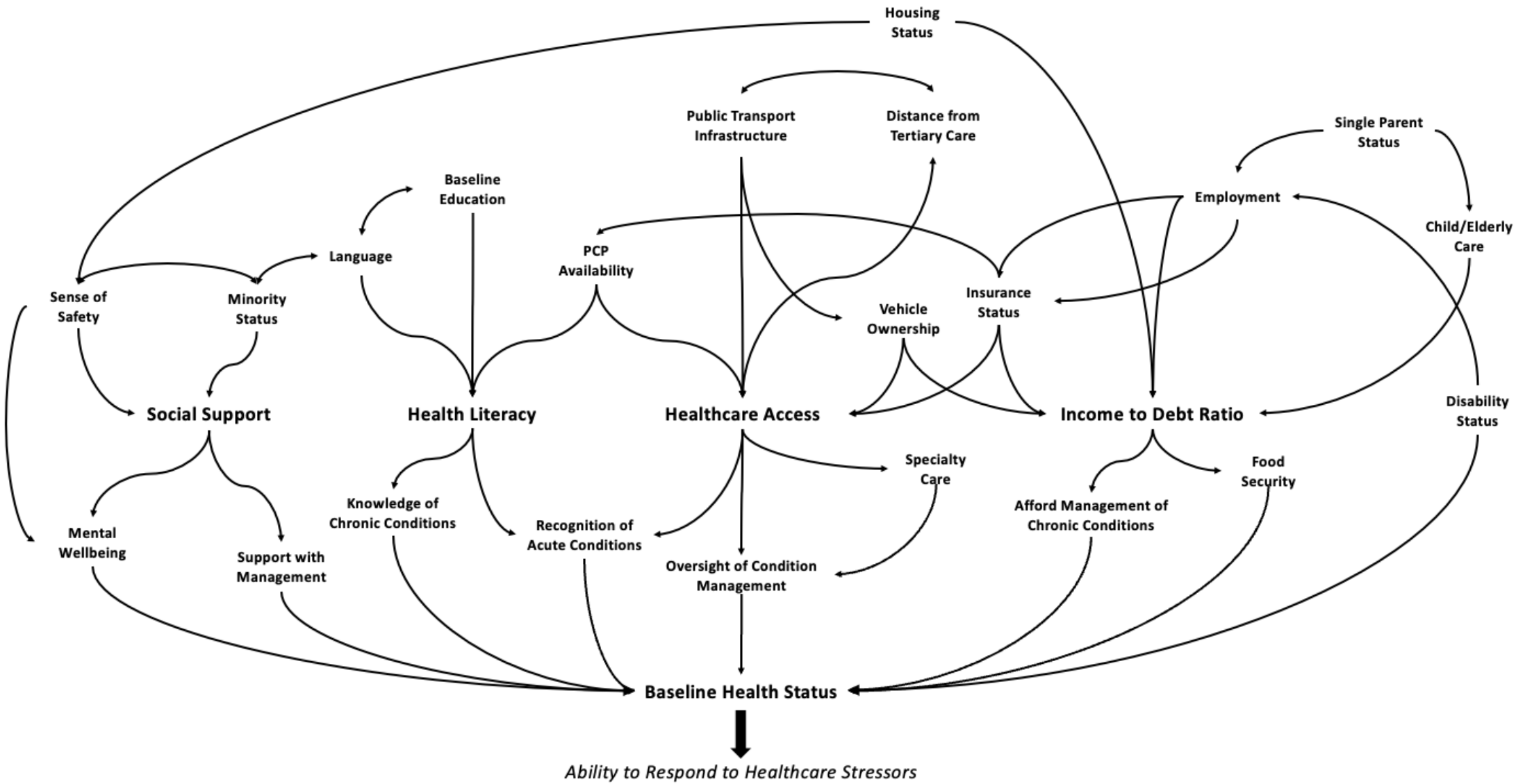
e.g., transportation + insurance status



Chronic Stress State

e.g., income vs debt + food security

Ability to respond to health stressors, *including cancer and surgery.*


Housing Status
Public Transport Infrastructure
Distance from Tertiary Care
Single Parent Status
Baseline Education
Employment
Child/Elderly Care
Language
PCP Availability
Insurance Status
Sense of Safety
Minority Status
Vehicle Ownership
Social Support
Health Literacy
Healthcare Access
Income to Debt Ratio
Disability Status
Specialty Care
Food Security
Knowledge of Chronic Conditions
Afford Management of Chronic Conditions
Mental Wellbeing
Recognition of Acute Conditions
Support with Management
Oversight of Condition Management
Baseline Health Status
Ability to Respond to Healthcare Stressors

Important Limitations

1. **Single-institution, observational design with small cohort.**
   Limits generalizability and underpowers study for rare outcomes (e.g., mortality)

2. **Attribution of a population-based metric to an individual.**
   However, studies exist demonstrating non-inferiority of SVI models versus complex demographic based models.

3. **Opportunities for more advanced analysis.**
   Future directions include potential repeat analysis using propensity matching; sub-group analysis by esophagectomy technique.

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Questions and Discussion?

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