

Association between neighborhood socioeconomic and mortality in community acquired sepsis

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Introduction

Sepsis is a significant driver of mortality, with many patients presenting to emergency departments already with widespread infections acquired from outside the hospital. While sepsis related mortality is influenced by factors such as age, disease burden, and chronic conditions, the role of social determinants, including socioeconomic status, remains less explored. This study aimed to investigate the association between community-level socioeconomic deprivation, as measured by the Area Deprivation Index (ADI), on sepsis-related mortality.

Table 1: CMS SEP-1 Sepsis Criteria

Criteria	Description
1. Suspected or Confirmed Infection	Evidence or strong clinical suspicion of infection.
2. ≥2 SIRS (Systemic Inflammatory Response Syndrome) Criteria	• Temperature >38.3°C (100.9°F) or <36°C (96.8°F) • Heart rate >90 beats/min • Respiratory rate >20 breaths/min • White blood cell count >12,000/μL or <4,000/μL
3. ≥1 Sign of Organ Dysfunction*	• Lactic acid >2 mmol/L • Hypotension** • Acute respiratory failure • Creatinine >2 mg/dL • Urine output <0.5 mL/kg/h for 2 hours • Bilirubin >2 mg/dL • Platelet count <100,000/μL - INR >1.5 or aPTT >60 seconds • New need for invasive or noninvasive mechanical ventilation (eg, ETT, BiPAP)

** Persistent hypotension despite adequate fluid resuscitation may indicate septic shock.

Methods

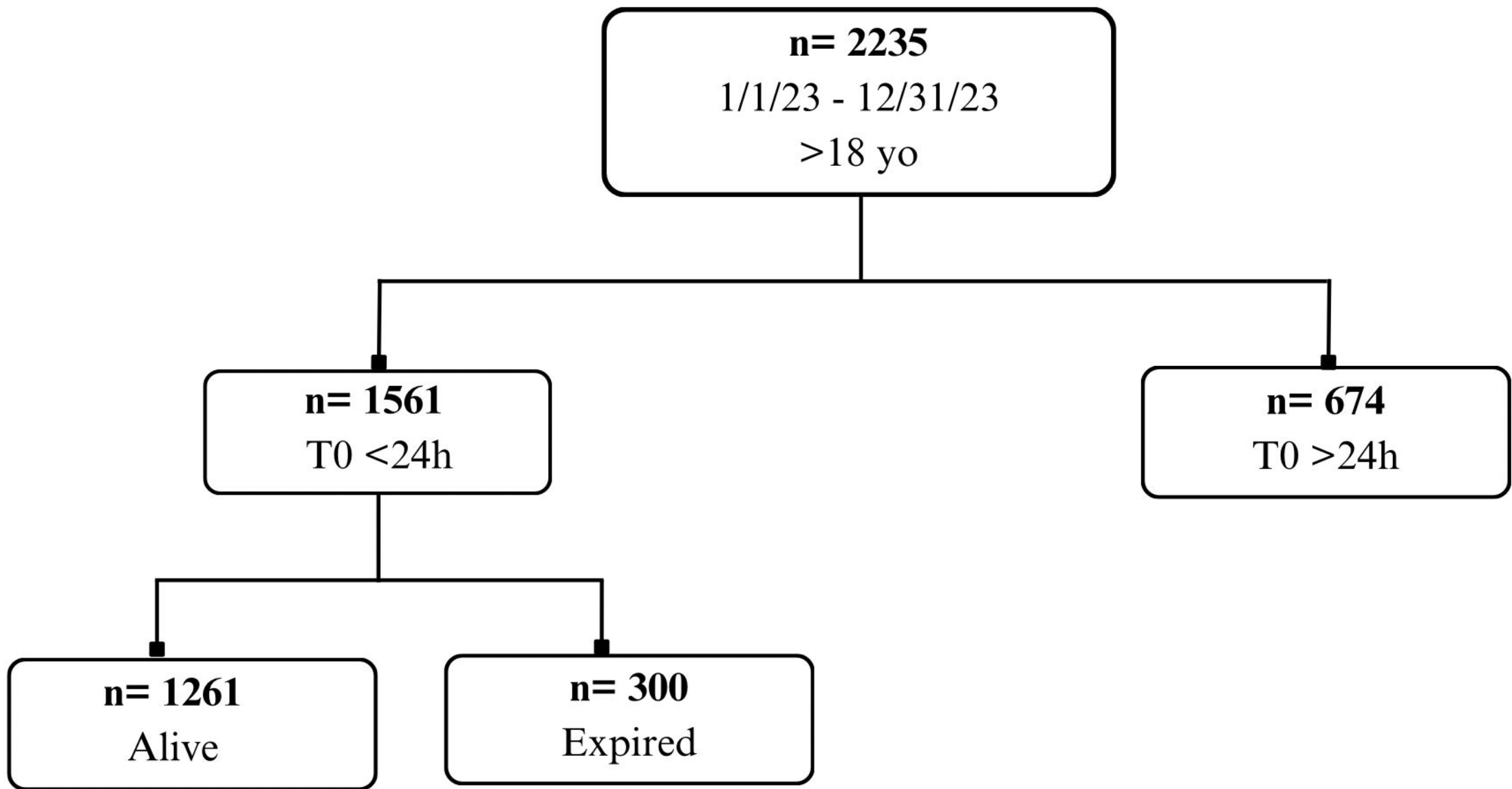
A retrospective chart analysis was conducted for 1,561 patients aged 18 years or older with sepsis onset within 24 hours of emergency department (ED) arrival at a major academic hospital in metro Detroit between January and December 2023.

Sepsis “time zero” (T0) was determined using an algorithm that included a rule-based natural language processing (NLP) method to analyze unstructured clinical notes.

Patients were classified as having “community-acquired” sepsis if T0 occurred within 24 hours of ED arrival. Area Deprivation Index (ADI) was chosen to measure socioeconomic depression as it is among the most heavily independently verified neighborhood-level measures of disadvantage.

ADI was derived from the patients’ 5-digit ZIP codes, averaged for each area, and divided into quintiles for analysis, with higher numbers representing more deprived areas. Multivariate linear regression was performed to assess the association between ADI quintiles and 30-day mortality, adjusting for age, race, gender, and 27 chronic conditions.

Figure 1: Inclusion and Exclusion criteria for study cohort



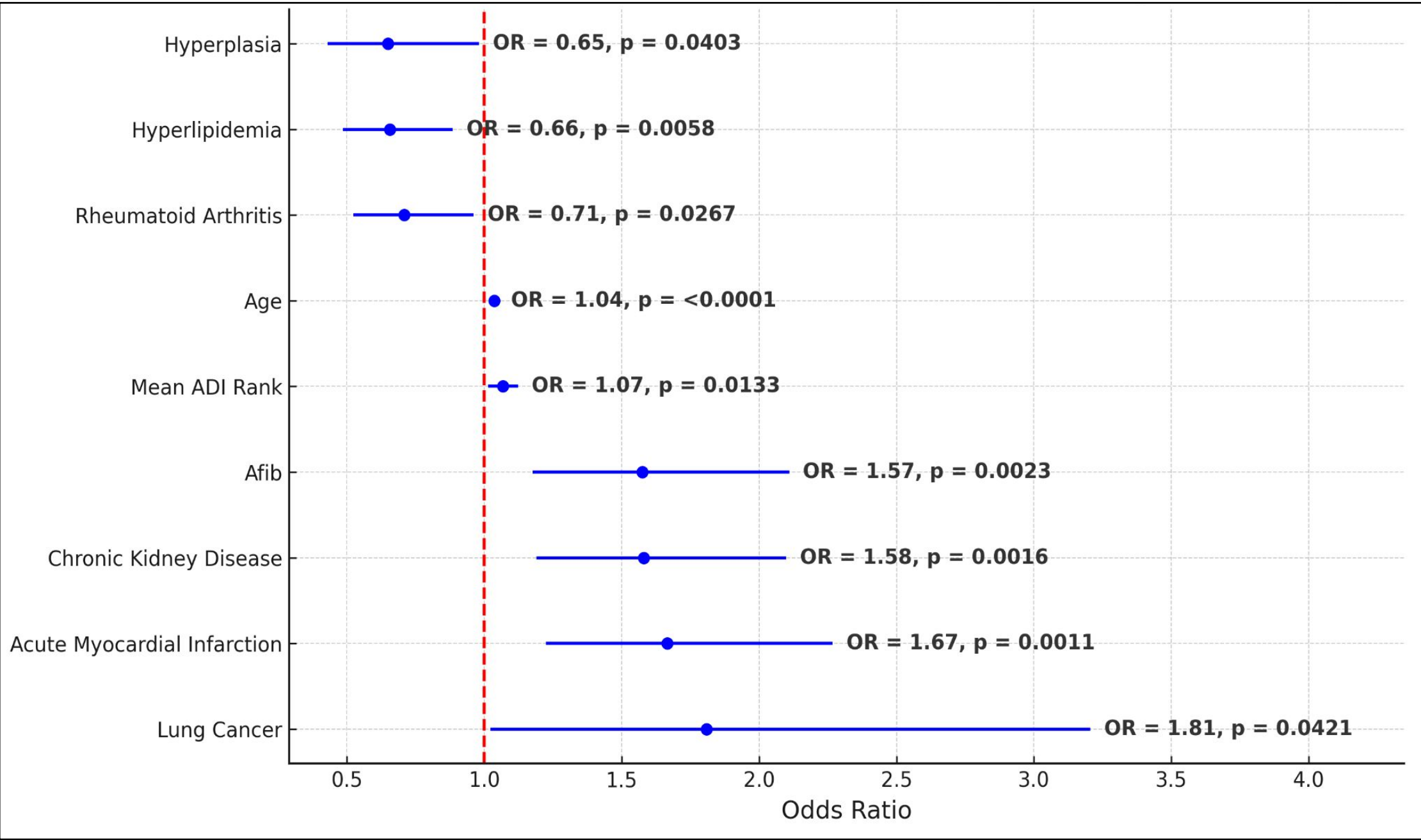
Results

Table 2: Baseline Characteristics of the Study Population with Univariate Significance

Characteristic	Presumed Alive (n=1261)	Expired (n=300)	Total (N=1561)	P Value
Age, years				<0.0001
Median (IQR)	67 (55–78)	75 (65–83)	69 (57–79)	
Race, No. (%)				0.0407
Asian	35 (2.78%)	3 (1.00%)	38 (2.43%)	
Black or African American	331 (26.25%)	72 (24.00%)	403 (25.82%)	
ND	5 (0.40%)	5 (1.67%)	10 (0.64%)	
Other	75 (5.95%)	15 (5.00%)	90 (5.77%)	
White or Caucasian	815 (64.63%)	205 (68.33%)	1020 (65.34%)	
Gender, No. (%)				0.0668
Female	569 (45.12%)	153 (51.00%)	722 (46.25%)	
Male	692 (54.88%)	147 (49.00%)	839 (53.75%)	
Mean (SD) of Michigan ADI (5-digit zip)	4.54 (2.93%)	4.82 (2.95%)	4.59 (2.93%)	0.2014
ADI Quintiles, No. (%)				0.0229
1–2	476 (37.75%)	102 (34.00%)	578 (37.03%)	
3–4	242 (19.19%)	50 (16.67%)	292 (18.71%)	
5–6	205 (16.26%)	46 (15.33%)	251 (16.08%)	
7–8	171 (13.56%)	55 (18.33%)	226 (14.48%)	
9–10	137 (10.86%)	30 (10.00%)	167 (10.70%)	
Comorbidities, No. (%)				
Acute Myocardial Infarction	244 (19.3%)	97 (32.3%)	341 (21.8%)	<0.0001
Atrial Fibrillation	376 (29.8%)	149 (49.7%)	525 (33.6%)	<0.0001
Breast Cancer	54 (4.3%)	24 (8.0%)	78 (5.0%)	0.0122
Lung Cancer	48 (3.8%)	22 (7.3%)	70 (4.5%)	0.0126
Chronic Kidney Disease	526 (41.7%)	166 (55.3%)	692 (44.3%)	<0.0001
Depressive Disorder	437 (34.7%)	80 (26.7%)	517 (33.1%)	0.0073
Non Ischemic Heart Disease	426 (33.8%)	155 (51.7%)	581 (37.2%)	<0.0001
Hip/Pelvic Fracture	28 (2.2%)	14 (4.7%)	42 (2.7%)	0.0282
Hypertension	982 (77.9%)	251 (83.7%)	1233 (79.0%)	0.0235
Ischemic Heart Disease	452 (35.8%)	144 (48.0%)	596 (38.2%)	0.0001
Non Alzshheimers Dementia	236 (18.7%)	76 (25.3%)	312 (20.0%)	0.0118

Results continued

Figure 2: Adjusted Odds Ratios for ADI and chronic conditions with respect to mortality



- Of 1561 individuals with community acquired sepsis, 300 expired, with a median age of 75 (IQR 65-83).
- Of those who expired, the majority were white (68%) and women (51%).
- Acute myocardial infarction, atrial fibrillation, lung cancer, and chronic kidney disease (OR 1.66, 1.57, 1.81, and 1.58 respectively) were significantly associated with **increased** risk of mortality.
- Benign prostatic hyperplasia, hyperlipidemia, and rheumatoid arthritis (OR 0.65, 0.66, and 0.71 respectively) were significantly associated with **decreased** risk of mortality.
- Age (OR 1.04) and ADI quintile (OR 1.07), but not race or gender, were significantly associated with 30-day mortality.

Conclusions

- ADI is significantly associated with post-sepsis mortality after adjusting for age, chronic conditions, race, and gender.
- Further research is needed to understand how socioeconomic factors influence sepsis clinical care and mortality outcome.
- Further research is needed to understand why certain chronic comorbidities decrease the risk of mortality in sepsis.

Limitations

- The retrospective design and use of data from a single institution over a one-year period may limit the generalizability of our findings.
- The study relied on the accuracy of an electronic health record-based sepsis algorithm to define T0. The sensitivity and specificity of the algorithm are currently being evaluated and will be reported in a separate publication.

Acknowledgements

Support for this work was provided by Oakland University William Beaumont School of Medicine and Corewell Health Research Institute. We are grateful to Quire Inc. for developing the Sepsis algorithm.