

Supplementary Material

Supplementary Tables

Supplementary Table S1. Largest covariate imbalances before and after overlap weighting

Covariate	Type	Unweighted SMD	Weighted SMD
prop.score	Distance	0.342	-0.003
ed_los_h	Contin.	-0.232	0.000
dbp	Contin.	-0.172	0.000
resprate	Contin.	-0.146	0.000
arrival_transport_WALK IN	Binary	0.070	0.000
sbp	Contin.	-0.070	0.000
arrival_transport_AMBULANCE	Binary	-0.064	0.000
o2sat	Contin.	0.054	0.000
acuity	Contin.	-0.034	0.000
shock_triage	Binary	-0.022	0.000
race_BLACK/AFRICAN AMERICAN	Binary	-0.017	0.000
heartrate	Contin.	-0.011	0.000
race_PORTUGUESE	Binary	0.011	0.000
race_HISPANIC/LATINO - PUERTO RICAN	Binary	0.010	0.000
race_WHITE - OTHER EUROPEAN	Binary	-0.009	0.000

Note. The table displays the 15 covariates with the largest absolute unweighted standardized mean differences. The complete balance file is available from the analysis output.

Supplementary Table S2. Effective sample size before and after overlap weighting

Sample	Control	Treated
Unadjusted	14869.0	791.0
Adjusted	12635.6	790.1

Note. Effective sample sizes are reported for control and treated groups before and after overlap weighting.

Supplementary Table S3. Distribution of overlap weights

Statistic	Overlap weight
Minimum	0.0000
1st percentile	0.0107
5th percentile	0.0230
Median	0.0490
Mean	0.0950
95th percentile	0.8106
99th percentile	0.9593
Maximum	0.9902

Note. Overlap weights were derived from the propensity-score model for early ultrasound within 2 hours.

Supplementary Table S4. Cohort flow counts

Cohort step	No. of encounters
Emergency department encounters	425,087
Hospitalized ED encounters	201,695
Sepsis-3-inspired suspected infection	18,144
Complete covariate data for propensity-score model	15,660
Early ultrasound within 2 h	791
No early ultrasound within 2 h	14,869

Note. Counts describe the derivation of the complete-case propensity-score cohort.

Supplementary Table S5. Missingness of baseline covariates

Variable	Missing, n	Missing, %
gender	0	0.0
race	0	0.0
arrival_transport	0	0.0
acuity	752	4.1
temperature	2,232	12.3
heartrate	1,766	9.7
resprate	2,012	11.1
o2sat	2,014	11.1
sbp	1,776	9.8
dbp	1,847	10.2
shock_triage	0	0.0
ed_los_h	0	0.0

Note. Missingness was assessed before complete-case restriction for the propensity-score model.

Supplementary Table S6. Crude outcome rates by early-ultrasound status

Group	N	Antibiotics ≤3 h	Antibiotics ≤6 h	Vasopressors ≤6 h	Any ICU admission	Hospital mortality
No early ultrasound	17,223	9343 (54.2%)	14936 (86.7%)	1166 (6.8%)	7011 (40.7%)	1154 (6.7%)
Early ultrasound ≤2 h	921	535 (58.1%)	849 (92.2%)	66 (7.2%)	384 (41.7%)	66 (7.2%)

Note. Values are n (%) unless otherwise indicated. Crude rates are descriptive and are not adjusted for confounding.

Supplementary Table S7. Sensitivity analyses using alternative early-ultrasound windows: binary outcomes

Exposure window	Outcome	Odds ratio (95% CI)	P value
Early ultrasound ≤1 h	Antibiotics ≤3 h	1.37 (1.07–1.76)	0.012
Early ultrasound ≤1 h	Antibiotics ≤6 h	1.37 (0.90–2.08)	0.148
Early ultrasound ≤1 h	Any ICU admission	1.09 (0.85–1.39)	0.510
Early ultrasound ≤1 h	Hospital mortality	0.73 (0.39–1.39)	0.338
Early ultrasound ≤6 h	Antibiotics ≤3 h	0.89 (0.81–0.98)	0.021
Early ultrasound ≤6 h	Antibiotics ≤6 h	1.16 (1.01–1.33)	0.035
Early ultrasound ≤6 h	Any ICU admission	1.17 (1.06–1.29)	0.002
Early ultrasound ≤6 h	Hospital mortality	1.15 (0.93–1.43)	0.201

Note. Overlap-weighted odds ratios compare early ultrasound within the specified time window with no early ultrasound within that window.

Supplementary Table S8. Sensitivity analyses using alternative early-ultrasound windows: continuous outcomes

Exposure window	Outcome	Mean difference (95% CI)	P value
Early ultrasound ≤1 h	Time to first antibiotic	-0.44 (-0.71 to -0.18)	0.001
Early ultrasound ≤1 h	Hospital length of stay	1.84 (0.21 to 3.46)	0.027
Early ultrasound ≤6 h	Time to first antibiotic	-0.13 (-0.24 to -0.01)	0.038
Early ultrasound ≤6 h	Hospital length of stay	0.70 (0.28 to 1.11)	<0.001

Note. Negative values indicate shorter time among patients receiving early ultrasound.

Supplementary Table S9. Effective sample size in sensitivity analyses

Exposure window	Sample	Control	Treated
Early ultrasound ≤1 h	Unadjusted	15387.0	273.0
Early ultrasound ≤1 h	Adjusted	11095.9	272.9
Early ultrasound ≤6 h	Unadjusted	13670.0	1990.0
Early ultrasound ≤6 h	Adjusted	12797.3	1986.3

Note. Effective sample sizes are reported before and after overlap weighting for each exposure-window sensitivity analysis.

Supplementary Table S10. Distribution of overlap weights in sensitivity analyses

Exposure window	Statistic	Overlap weight
Early ultrasound ≤1 h	Minimum	0.0000
Early ultrasound ≤1 h	1st percentile	0.0000
Early ultrasound ≤1 h	5th percentile	0.0055
Early ultrasound ≤1 h	Median	0.0156
Early ultrasound ≤1 h	Mean	0.0340
Early ultrasound ≤1 h	95th percentile	0.0417
Early ultrasound ≤1 h	99th percentile	0.9790
Early ultrasound ≤1 h	Maximum	0.9961
Early ultrasound ≤6 h	Minimum	0.0000
Early ultrasound ≤6 h	1st percentile	0.0460
Early ultrasound ≤6 h	5th percentile	0.0778
Early ultrasound ≤6 h	Median	0.1302
Early ultrasound ≤6 h	Mean	0.2196
Early ultrasound ≤6 h	95th percentile	0.8745
Early ultrasound ≤6 h	99th percentile	0.9029
Early ultrasound ≤6 h	Maximum	0.9626

Note. Weights were derived from propensity-score models for each early-ultrasound exposure window.

Supplementary Table S11. Shock-triage subgroup analysis

Subgroup	N	Early US	Control	Outcome	Odds ratio (95% CI)	P value
Shock-triage positive	9,905	484	9,421	Antibiotics ≤3 h	0.89 (0.74–1.08)	0.233
Shock-triage positive	9,905	484	9,421	Antibiotics ≤6 h	1.52 (1.05–2.20)	0.026
Shock-triage positive	9,905	484	9,421	Any ICU admission	1.07 (0.89–1.28)	0.502
Shock-triage positive	9,905	484	9,421	Hospital mortality	0.96 (0.66–1.39)	0.822
Shock-triage negative	5,755	307	5,448	Antibiotics ≤3 h	1.35 (1.07–1.71)	0.011
Shock-triage negative	5,755	307	5,448	Antibiotics ≤6 h	1.36 (0.96–1.93)	0.084
Shock-triage negative	5,755	307	5,448	Any ICU admission	1.36 (0.99–1.87)	0.056
Shock-triage negative	5,755	307	5,448	Hospital mortality	1.83 (0.83–4.02)	0.132

Note. Subgroup analyses are exploratory. Models were re-estimated within each subgroup using overlap weighting.

Supplementary Figures

Figure S1. Covariate balance before and after overlap weighting.

Love plot showing standardized mean differences (SMDs) for all covariates included in the propensity-score model. The largest baseline imbalances were observed for ED length of stay (SMD -0.232), diastolic blood pressure (SMD -0.172), and respiratory rate (SMD -0.146). After overlap weighting, all SMDs were approximately 0.00, indicating excellent covariate balance.

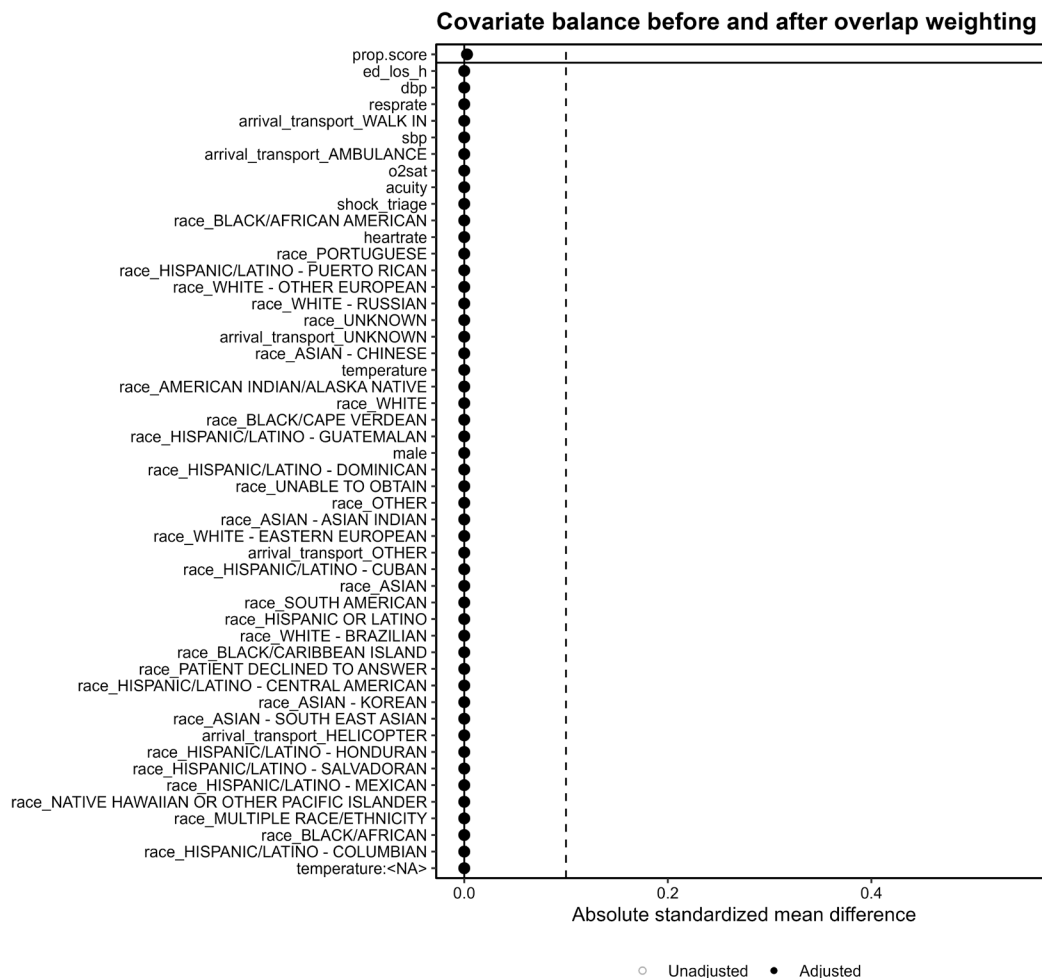


Figure S2. Propensity-score distributions before overlap weighting.

Distribution of estimated propensity scores among patients receiving and not receiving early ultrasound before overlap weighting. The unadjusted cohort included 791 exposed and 14,869 unexposed patients.

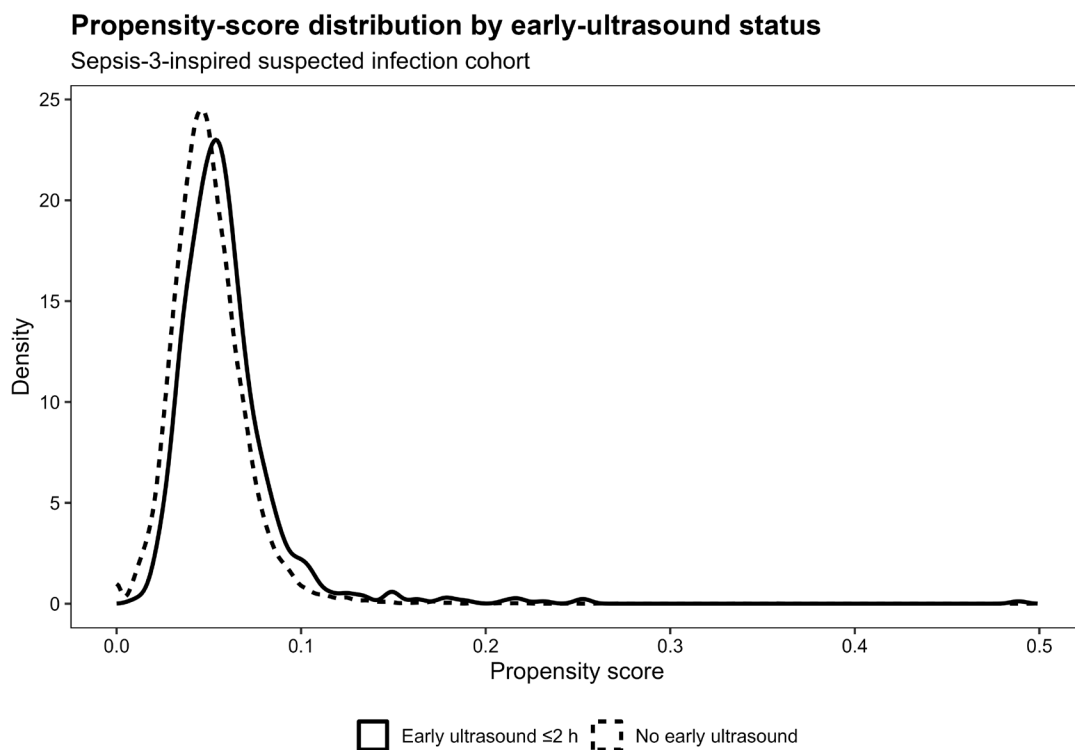


Figure S2b. Propensity-score distributions after overlap weighting.

Weighted propensity-score distributions after overlap weighting demonstrating substantial overlap between treatment groups and improved comparability of exposed and unexposed patients.

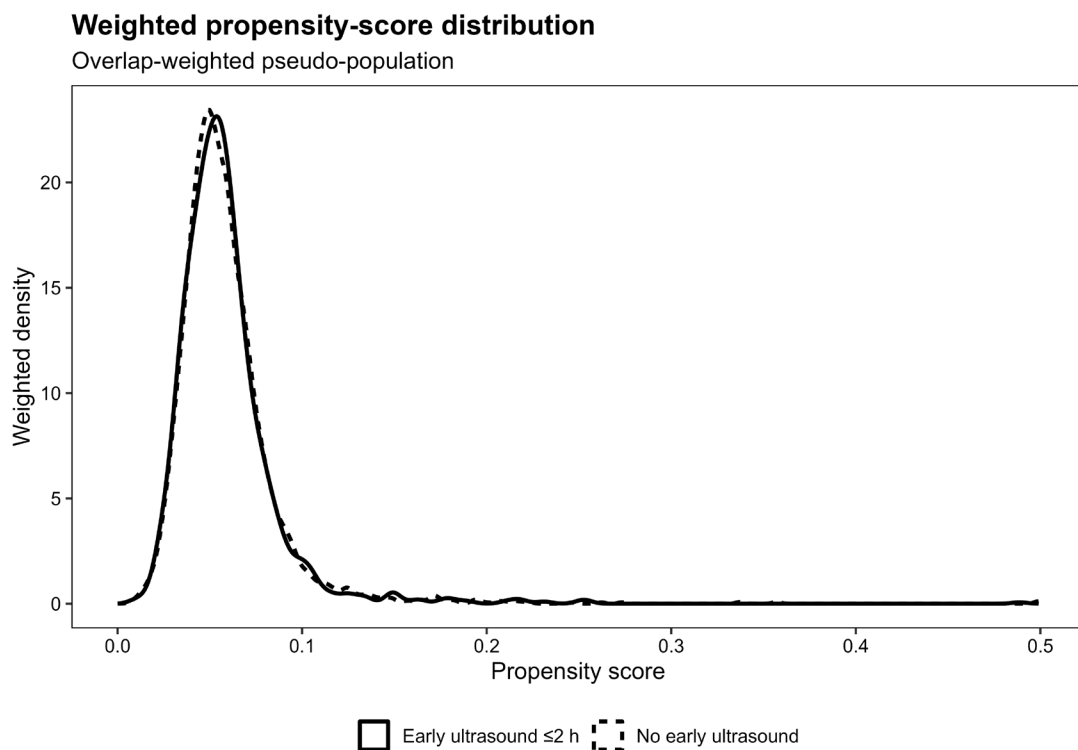


Figure S3. Distribution of overlap weights.

Histogram showing the distribution of overlap weights used to construct the weighted pseudo-population. Median overlap weight was 0.049, with a maximum weight of 0.990.

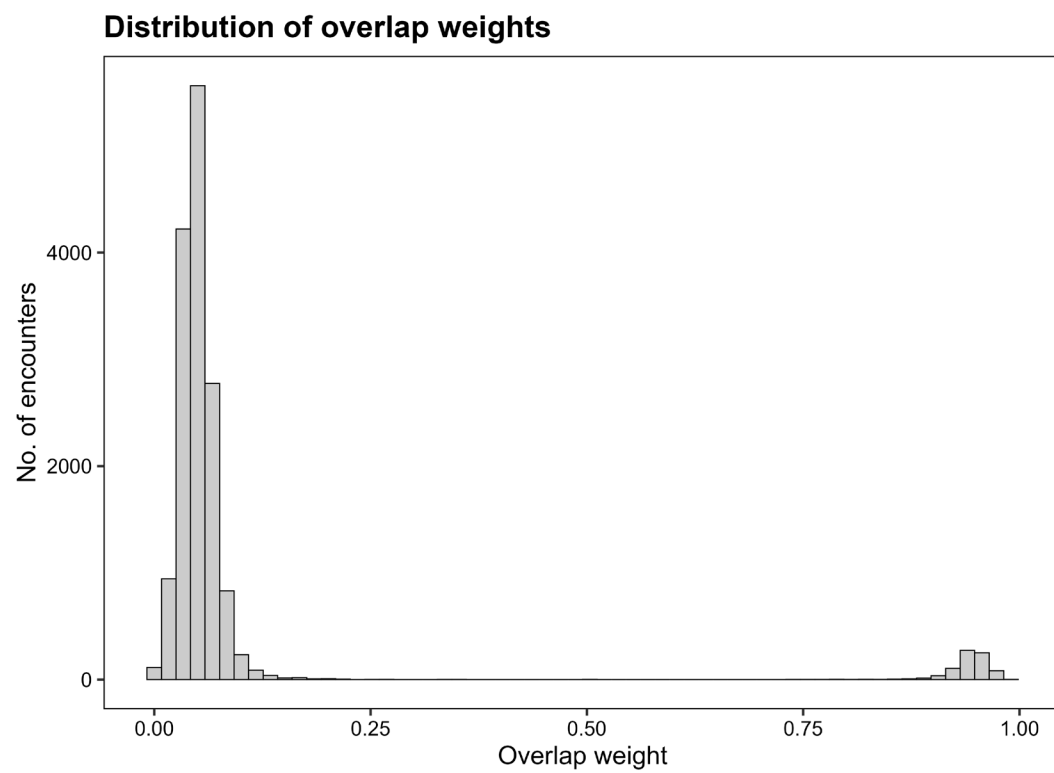


Figure S4. Sensitivity analyses using alternative ultrasound exposure windows.

Forest plot summarizing sensitivity analyses using alternative exposure definitions. Ultrasound within 1 hour was associated with antibiotic administration within 3 hours (OR 1.37, 95% CI 1.07–1.76), whereas ultrasound within 6 hours remained associated with antibiotic administration within 6 hours (OR 1.16, 95% CI 1.01–1.33).

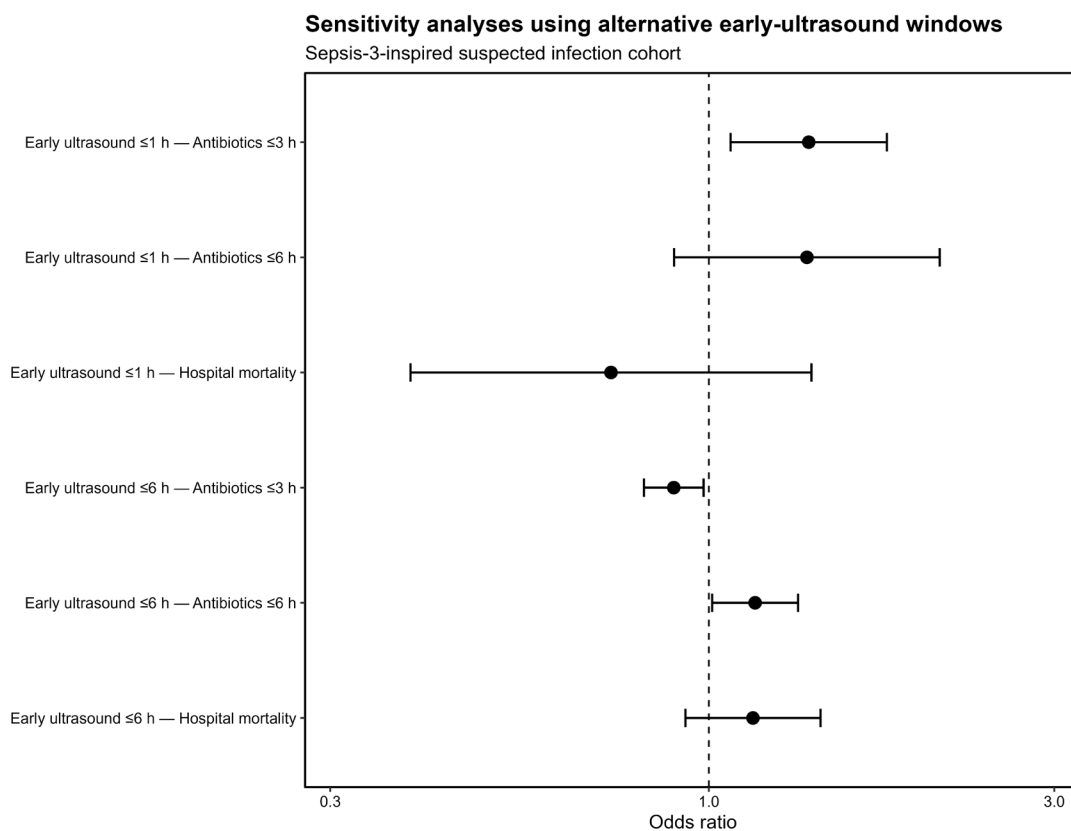


Figure S5. Shock-triage subgroup analyses.

Forest plot showing subgroup analyses according to shock-triage status. Among shock-triage–positive patients (n=9,905), early ultrasound was associated with antibiotic administration within 6 hours (OR 1.52, 95% CI 1.05–2.20). No significant mortality association was observed in either subgroup.

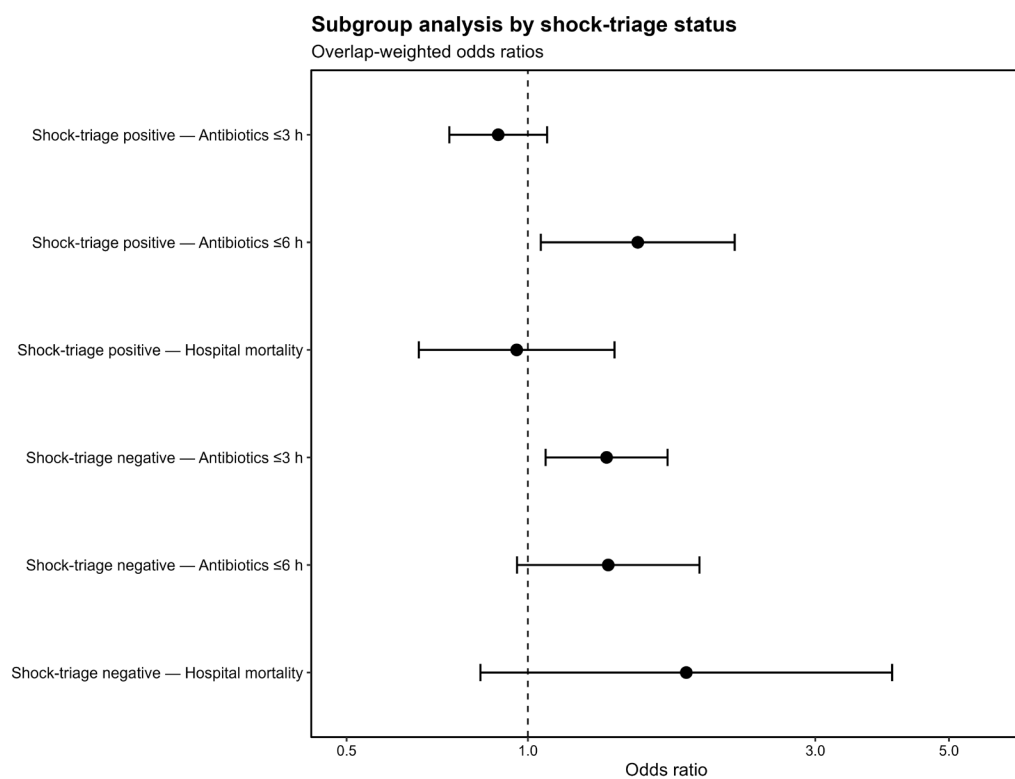


Figure S6. Association between ultrasound timing and antibiotic administration.

Restricted cubic spline illustrating the association between time from emergency department arrival to ultrasound examination and the probability of antibiotic administration within 6 hours. Shaded areas represent 95% confidence intervals.

