CHEST Online Supplement

Risk Factors for In-Hospital Mortality in Smoke Inhalation-Associated Acute Lung Injury

Data From 68 United States Hospitals

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e-Table 1. Comparison of quarterly trends in respiratory system burn injury diagnosis codes[a] among in-patient discharges from 154 AMCs and affiliates (2008-2014)

Year and quarter	Respiratory system burn-injury discharges[b] N	dx 508.2[c] *Respiratory Conditions from smoke inhalation* N	dx 947.0 *Burn of mouth and pharynx* N	dx 947.1 *Burn of larynx, trachea and lung* N	dx 987.9 *Toxic effect of unspecified gas, fume, or vapor* N	All discharges[c] N	Respiratory system burn-injury case-density[d]
2008q4	262	0	48	37	183	932,412	28.1
2009q1	275	0	34	39	209	931,194	29.5
2009q2	241	0	38	47	170	952,038	25.3
2009q3	210	0	36	38	151	964,230	21.8
2009q4	256	0	43	36	189	948,562	27.0
2010q1	307	0	40	59	229	937,115	32.8
2010q2	250	0	43	34	190	960,265	26.0
2010q3	254	0	47	34	186	972,855	26.1
2010q4	263	0	37	26	209	963,998	27.3
2011q1	329	0	32	34	273	956,716	34.4
2011q2	262	0	27	34	209	969,519	27.0
2011q3	229	0	48	22	166	979,395	23.4
2011q4	397	322	36	28	31	960,995	41.3
2012q1	480	407	33	43	29	981,914	48.9
2012q2	356	301	32	27	16	977,162	36.4
2012q3	327	262	44	22	14	991,015	33.0
2012q4	392	308	39	45	19	979,336	40.0
2013q1	450	373	51	42	14	964,806	46.6
2013q2	409	328	53	34	16	979,512	41.8
2013q3	325	261	35	30	14	989,228	32.9
2013q4	370	306	38	30	18	963,248	38.4
2014q1	476	408	41	48	19	940,162	50.6
2014q2	348	290	32	31	13	974,232	35.7
2014q3	312	256	32	24	9	996,846	31.3
2014q4	374	327	28	31	6	954,890	39.2

[a] International Classification of Diseases Version 9 (ICD-9) principal or secondary
[b] In-patient discharges from 154 AMCs and affiliates
[c] Introduced in September 2011
[d] Respiratory system burn-injury discharges*100,000/all discharges
Data Source: University HealthSystem Consortium (Chicago, IL)
AMC=Academic medical center; dx= Diagnosis code (primary of secondary); ICD-9= International Classification of Diseases version 9; q1=Jan-Mar q2=Apr-Jun q3=Jul-Sep q4=Oct-Nov AMC=Academic medical center

e-Table 2. Multivariate logistic regression identifying predictors of in-hospital mortality in SI-ALI subset with 0% body surface burns [N=200; Deaths=23 (11.5%)])

Variable	Odds Ratio	95% Confidence Interval	p-value
Age [years; Ref: 18-40]			
41-50	0.39	0.02-9.74	0.564
51-60	0.45	0.02-12.06	0.632
61-70	1.08	0.04-33.49	0.965
>70	7.10	0.38-134.30	0.191
Sex [Ref: Female]	3.01	0.60-15.01	0.180
Patient Region [Ref: West]			
Midwest	0.22	0.03-1.72	0.149
Northeast	0.70	0.06-8.53	0.777
South	0.18	0.02-1.98	0.163
***3M*™ APR DRG Admission Risk-of-Mortality Assignment [Ref: Extreme]**			
Minor or Moderate	0.04	0.002-0.58	0.019
Major	0.01	0.001-0.23	0.003
Charlson Comorbidity Index [Ref: 0]			
1-2	0.45	0.08-2.66	0.379
>2	2.68	0.20-37.60	0.465
Initial[a] Vasopressor Use [Ref: None]	28.64	4.44-184.82	0.0004
Initial[a] Empiric Systemic Antibacterial Therapy[a] [Ref: None]	0.70	0.12-4.13	0.689
Hospital Bed Capacity [Ref: ≥500 beds]			
<500 beds	0.40	0.04-3.74	0.416
Burn Center Status [Ref: ABA Burn Center]			
Self-reported Burn Center	0.06	0.01-0.43	0.005
Non Burn Center	0.51	0.05-5.33	0.570

[a] Within 2 days of hospitalization Data Source: University HealthSystem Consortium (Chicago, IL)
ABA= American Burn Association; APR DRG= All Patients Refined Diagnosis-Related-Groups; TBSA= Total Burn Surface Area

e-Table 3. Multivariate logistic regression identifying predictors of in-hospital mortality in SI-ALI subset with >=20% body surface burns [N=289; Deaths=144 (49%)])

Variable	Odds Ratio	95% Confidence Interval	p-value
Age [years; Ref: 18-40]			
41-50	1.03	0.45-2.37	0.945
51-60	1.79	0.79-4.02	0.161
61-70	13.68	4.86-38.53	<0.001
>70	8.91	3.21-24.75	<0.001
Sex [Ref: Female]	0.75	0.40-1.41	0.373
Patient Region [Ref: West]			
Midwest	1.15	0.47-2.84	0.761
Northeast	2.63	0.85-8.12	0.093
South	1.34	0.56-3.23	0.511
***3M*™ APR DRG Admission Risk-of-Mortality Assignment [Ref: Extreme]**			
Minor or Moderate	0.13	0.04-0.47	0.002
Major	0.34	0.18-0.65	0.001
Charlson Comorbidity Index [Ref: 0]			
1-2	0.86	0.45-1.66	0.655
>2	0.57	0.19-1.74	0.322
Initial[a] Vasopressor Use [Ref: None]	3.07	1.64-5.77	0.001
Initial[a] Empiric Systemic Antibacterial Therapy [Ref: None]	1.24	0.64-2.40	0.53
Hospital Bed Capacity [Ref: ≥500 beds]			
<500 beds	2.39	1.02-5.60	0.046
Burn Center Status [Ref: ABA Burn Center]			
Self-reported Burn Center	1.33	0.66-2.69	0.431
Non Burn Center	0.82	0.23-2.90	0.757

[a] Within 2 days of hospitalization; Data Source: University HealthSystem Consortium (Chicago, IL)
ABA= American Burn Association; APR DRG= All Patients Refined Diagnosis-Related-Groups

e-Table 4. Multivariate logistic regression identifying predictors of in-hospital mortality in SI-ALI subset in vasopressor-dependent shock within two days of hospitalization [N=231; Deaths=123 (53%)])

Variable	Odds Ratio	95% Confidence Interval	p-value
Age Categories [years; Ref: 18-40]			
41-50	1.37	0.49-3.86	0.550
51-60	2.27	0.86-5.98	0.097
61-70	4.60	1.65-12.83	0.004
>70	3.14	1.11-8.87	0.031
Sex [Ref: Female]	0.80	0.41-1.55	0.511
Patient Region [Ref: West]			
Midwest	0.43	0.15-1.25	0.121
Northeast	1.32	0.38-4.66	0.665
South	0.52	0.19-1.45	0.212
***3M*™ APR DRG Admission Risk-of-Mortality Assignment [Ref: Extreme]**			
Minor or Moderate	0.11	0.03-0.39	<0.001
Major	0.27	0.13-0.56	<0.001
Charlson Comorbidity Index [Ref: 0]			
1-2	1.05	0.51-2.15	0.890
>2	0.48	0.17-1.39	0.177
TBSA category [Ref: 0 %]			
1-19%	0.84	0.31-2.25	0.723
≥20%	3.18	1.31-7.71	0.010
Initial[a] Empiric Systemic Antibacterial Therapy [Ref: None]	0.81	0.42-1.54	0.515
Hospital Bed Capacity [Ref: ≥500 beds]			
<500 beds	2.66	1.03-6.88	0.044
Burn Center Status [Ref: ABA Burn Center]			
Self-reported Burn Center	0.62	0.30-1.29	0.198
Non Burn Center	0.51	0.14-1.83	0.301

[a] Within 2 days of hospitalization Data Source: University HealthSystem Consortium (Chicago, IL)
ABA= American Burn Association; APR DRG= All Patients Refined Diagnosis-Related-Groups; TBSA= Total Burn Surface Area

e-Table 5. Multivariate logistic regression identifying predictors of in-hospital mortality in SI-ALI subset without vasopressor-dependent shock within two days of hospitalization [N=538; Deaths=76 (14.1%)]

	Variable	Odds Ratio	95% Confidence Interval	P value
1.	**Age [Ref: 18-40 years]**			
	40-50	1.13	0.42-3.07	0.807
	50-60	0.87	0.28-2.72	0.806
	60-70	5.64	2.04-15.62	0.001
	>70	12.09	4.25-34.39	<0.001
2.	***3M*™ APR DRG Admission Risk-of-Mortality Assignment [Ref: Extreme]**			
	Minor & Moderate	0.20	0.07-0.61	0.004
	Major	0.29	0.15-0.58	<0.001
3.	**TBSA category [Ref: 20+%]**			
	0%	2.05	0.62-6.82	0.240
	1-19%	34.03	10.21-113.47	<0.001
4.	**Charlson Comorbidity Index [Ref: 0]**			
	1-2	0.80	0.37-1.71	0.557
	>2	1.19	0.42-3.36	0.738
5.	**Burn Center [Ref: ABA Burn Center]**			
	Non Burn Center	1.40	0.40-4.93	0.596
	Non-ABA Burn Center	1.35	0.64-2.88	0.433
6.	**Region [Ref: West]**			
	Midwest	0.94	0.37-2.37	0.887
	Northeast	1.25	0.40-3.94	0.704
	South	2.12	0.77-5.81	0.146
7.	**Sex [Ref: Female]**	0.91	0.46-1.78	0.777
8.	**Initial[a] Empiric Systemic Antibacterial Therapy [Ref: No]**	1.05	0.50-2.20	0.901
9.	**Hospital Bed Capacity [Ref: Extra Large >=500 beds]**			
	Medium & Large	2.42	0.96-6.09	0.061

[a] Within 2 days of hospitalization; Data Source: University HealthSystem Consortium (Chicago, IL)ABA= American Burn Association; APR DRG= All Patients Refined Diagnosis-Related-Groups; TBSA= Total Burn Surface Area

e-Table 6. Multivariate logistic regression identifying predictors of in-hospital mortality in SI-ALI subset with at least 96 consecutive hours of mechanical ventilation [N=426; Deaths=89(20.9%)]

Variable	Odds Ratio	95% Confidence Interval	p-value
Age [years; Ref: 18-40]			
41-50	1.12	0.45-2.79	0.805
51-60	1.62	0.69-3.77	0.267
61-70	5.83	2.35-14.44	<0.001
>70	3.78	1.36-10.50	0.011
Sex [Ref: Female]	0.71	0.40-1.28	0.255
Patient Region [Ref: West]			
Midwest	1.26	0.51-3.12	0.621
Northeast	1.85	0.66-5.24	0.245
South	1.41	0.57-3.49	0.455
***3M*™ APR DRG Admission Risk-of-Mortality Assignment [Ref: Extreme]**			
Minor or Moderate	0.30	0.10-0.87	0.027
Major	0.62	0.34-1.12	0.113
Charlson Comorbidity Index [Ref: 0]			
1-2	1.19	0.63-2.27	0.589
>2	1.16	0.47-2.86	0.755
TBSA category [Ref: 0 %]			
1-19%	1.00	0.37-2.72	0.995
≥20%	6.45	2.51-16.59	<0.001
Initial[a] Vasopressor Use [Ref: None]	3.66	2.01-6.68	<0.001
Initial[a] Empiric Systemic Antibacterial Therapy [Ref: None]	1.13	0.62-2.05	0.696
Hospital Bed Capacity [Ref: ≥500 beds]			
<500 beds	1.56	0.67-3.62	0.302
Burn Center [Ref: ABA Burn Center]			
Non Burn Center	1.14	0.30-4.24	0.851
Self-reported Burn Center	1.25	0.65-2.40	0.504

[a] Within 2 days of hospitalization; Data Source: University HealthSystem Consortium (Chicago, IL)
ABA= American Burn Association; APR DRG= All Patients Refined Diagnosis-Related-Groups; TBSA= Total Burn Surface Area

e-Table 7. Baseline Characteristics of the SI-ALI patients transferred in from other facilities

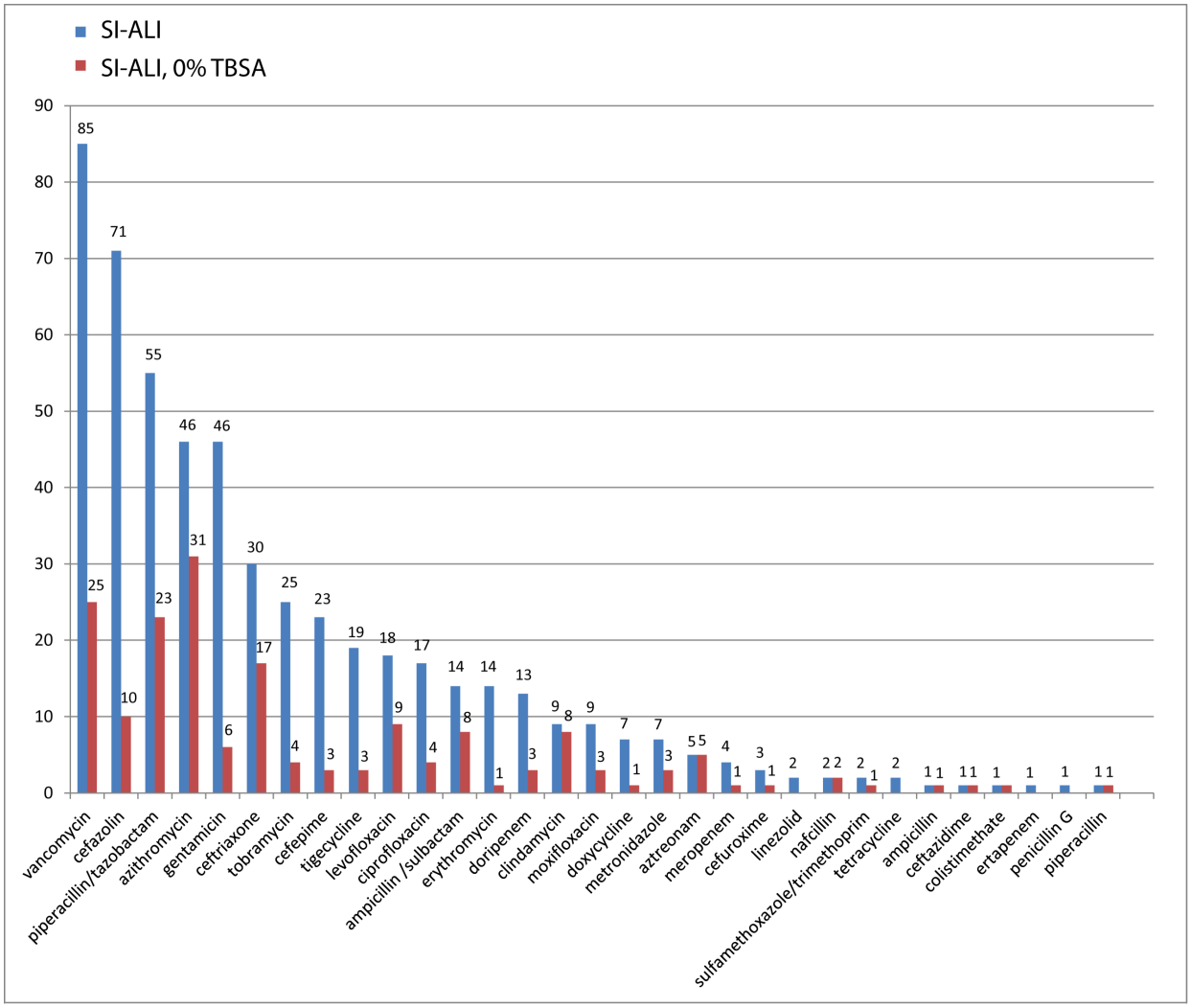
Variable	All SI-ALI N=542 (%)
Age	
18-40	131 (24.2)
41-50	91 (16.8)
51-60	132 (24.4)
61-70	104 (19.2)
>70	84 (15.5)
Sex	
Male	333 (61.4)
Female	209 (38.6)
Patient region	
Midwest	162 (29.9)
Northeast	109 (20.1)
South	148 (27.3)
West	123 (22.7)
***3M*™ APR DRG admission risk-of- mortality assignment**	
Minor	51 (9.4)
Moderate	109 (20.1)
Major	199 (36.7)
Extreme	183 (33.8)
Charlson Comorbidity Index	
0	266 (49.1)
1-2	206 (38.0)
>2	70 (12.9)
TBSA Category	
0%	116 (21.4)
1-19%	237 (43.7)
20% or greater	189 (34.9)
Initial[a] Vasopressor Use	137 (25.3)
Empiric Systemic Antibacterial Therapy[a]	166 (30.6)
Hospital Bed Capacity	
<500	137 (25.3)
≥500	405 (74.7)
Burn Center Status	
ABA-verified Burn Center	117 (21.6)
Self-reported Burn Center	403 (74.4)
Non Burn Center	22 (4.0)

[a] Within 2 days of hospital admission
SI-ALI= Smoke Inhalation Associated Acute Lung Injury; APR DRG= All Patients Refined Diagnoses Related Groups; TBSA= Total Burn Surface Area

e-Table 8. Secondary Analysis: Multivariate logistic regression identifying predictors of in-hospital mortality in excluded SI-ALI subset of patients transferred in from other facilities [N=542; Deaths=130(24%)]

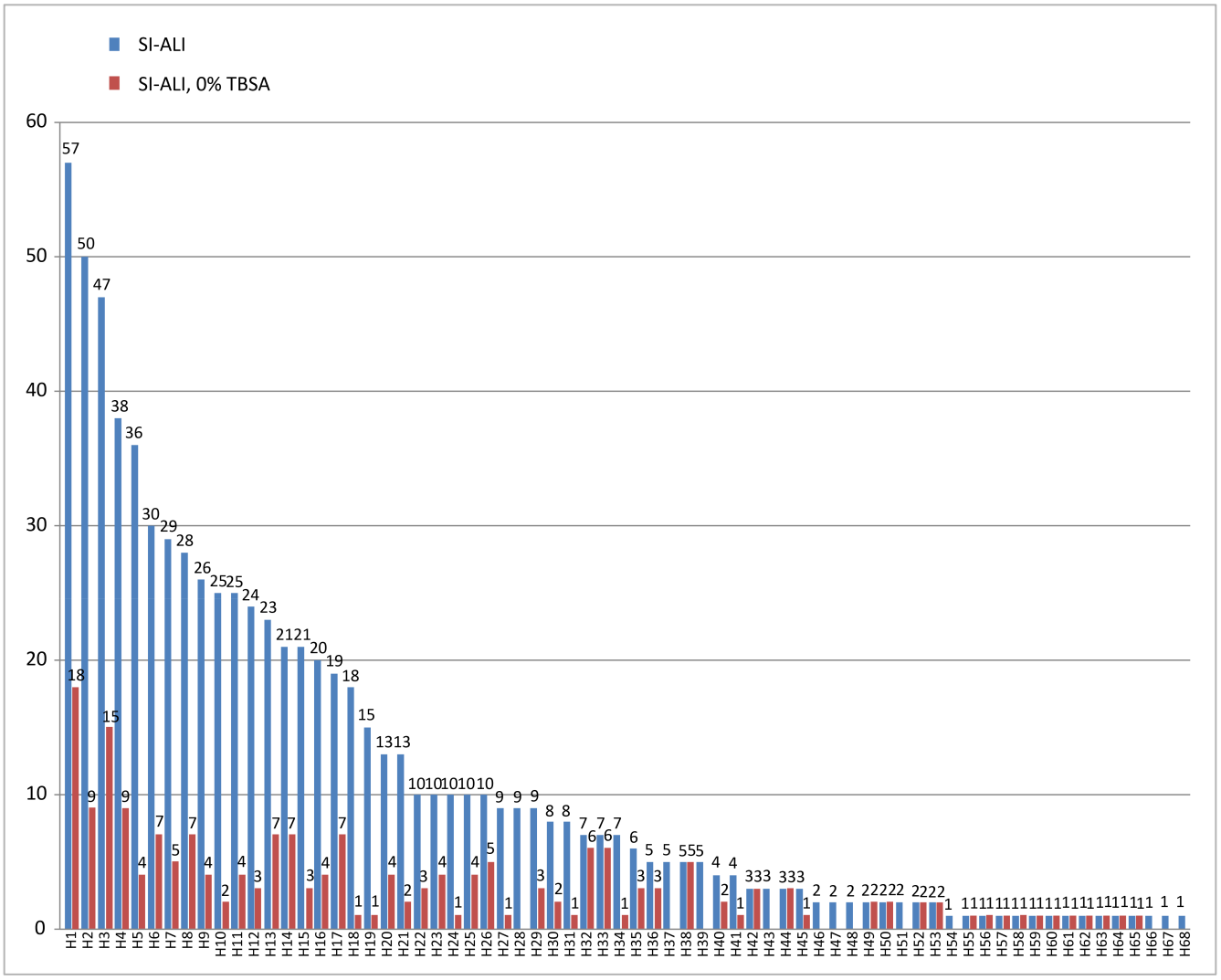
Variable	Odds Ratio	95% Confidence Interval	p-value
Age [years; Ref: 18-40]			
41-50	1.58	0.65-3.83	0.309
51-60	2.65	1.19-5.91	0.017
61-70	4.07	1.73-9.59	0.001
>70	8.93	3.61-22.04	<0.001
Sex [Ref: Female]	0.76	0.46-1.27	0.296
Patient Region [Ref: West]			
Midwest	0.56	0.27-1.17	0.123
Northeast	0.70	0.29-1.67	0.424
South	0.48	0.20-1.15	0.100
***3M*™ APR DRG Admission Risk-of-Mortality Assignment [Ref: Extreme]**			
Minor or Moderate	0.11	0.05-0.26	<0.001
Major	0.23	0.13-0.40	<0.001
Charlson Comorbidity Index [Ref: 0]			
1-2	1.14	0.63-2.06	0.671
>2	0.95	0.43-2.07	0.892
TBSA Category [Ref: 0 %]			
1-19%	0.60	0.29-1.25	0.170
≥20%	1.78	0.84-3.74	0.132
Initial[a] Vasopressor Use [Ref: None]	3.76	2.18-6.46	<0.001
Initial[a] Empiric Systemic Antibacterial Therapy [Ref: None]	0.61	0.35-1.08	0.091
Hospital Bed Capacity [Ref: ≥500 beds]			
<500 beds	1.36	0.68-2.70	0.381
Burn Center [Ref: ABA Burn Center]			
Self-reported Burn Center	0.87	0.45-1.71	0.694
Non Burn Center	0.50	0.15-1.70	0.266

[a] Within 2 days of hospitalization; Data Source: University HealthSystem Consortium (Chicago, IL)
ABA= American Burn Association; APR DRG= All Patients Refined Diagnosis-Related-Groups; TBSA= Total Burn Surface Area



e-Figure 1. Distribution of administration of 31 systemic antibacterial agents administered within two days of hospitalization among all SI-ALI patients and those without surface burns (N= 554 administrations among 241 SI-ALI patients)

The number above each bar represents number of administrations for that agent among 241 SI-ALI patients.
The X-axis depicts individual antibacterial agents by name and the Y-axis depicts the absolute count for systemic antibacterial agent administrations



e-Figure 2. Distribution of systemic antibacterial agent administrations within two days of hospitalization across 68 hospitals among all SIALI patients as well as those with isolated inhalation injury.

The X-axis depicts individual hospitals numbered H1 to H68 and the Y-axis depicts the absolute count for systemic antibacterial agent administrations per center

Smoke Exposure	Likely SI-ALI	Confirmed SI-ALI
Closed space exposure to hot gases, steam or products of combustion, OR burns sustained in a closed space, OR unconscious at burns scene, OR prolonged extrication from burns scene		
OR **Carbonaceous deposits in oropharynx or sputum, OR facial burn**	Intubated within 4 days of admission but for ≤ 3 consecutive days	Intubated within 4 days of admission but for > 3 consecutive days
No evidence of lower respiratory tract Involvement	At least 1 within 4 days of injury: Death/Hospice OR Carboxyhemoglobin > 10% OR Cyanide > 0.5mg/L OR Carbonaceous endobronchial debris/ mucosal ulcerations on bronchoscopy OR Tracheobronchial cytology or biopsy evidence OR Bronchial wall thickening on CT OR Evidence of Infiltrates on serial chest x-rays	
		PaO_2/FiO_2 < 300 (worse within 72 hours) or SaO_2/FiO_2 < 142

e-Figure 3. Smoke Inhalation-Associated Acute Lung Injury (SI-ALI) clinical definition: The proposed definition provides 3 strata based on likelihood of SI-ALI, It is based on expert opinion with the objective of introducing uniformity in diagnostic criteria among providers and investigators to facilitate benchmarking, prognostication and assessments of novel therapies.