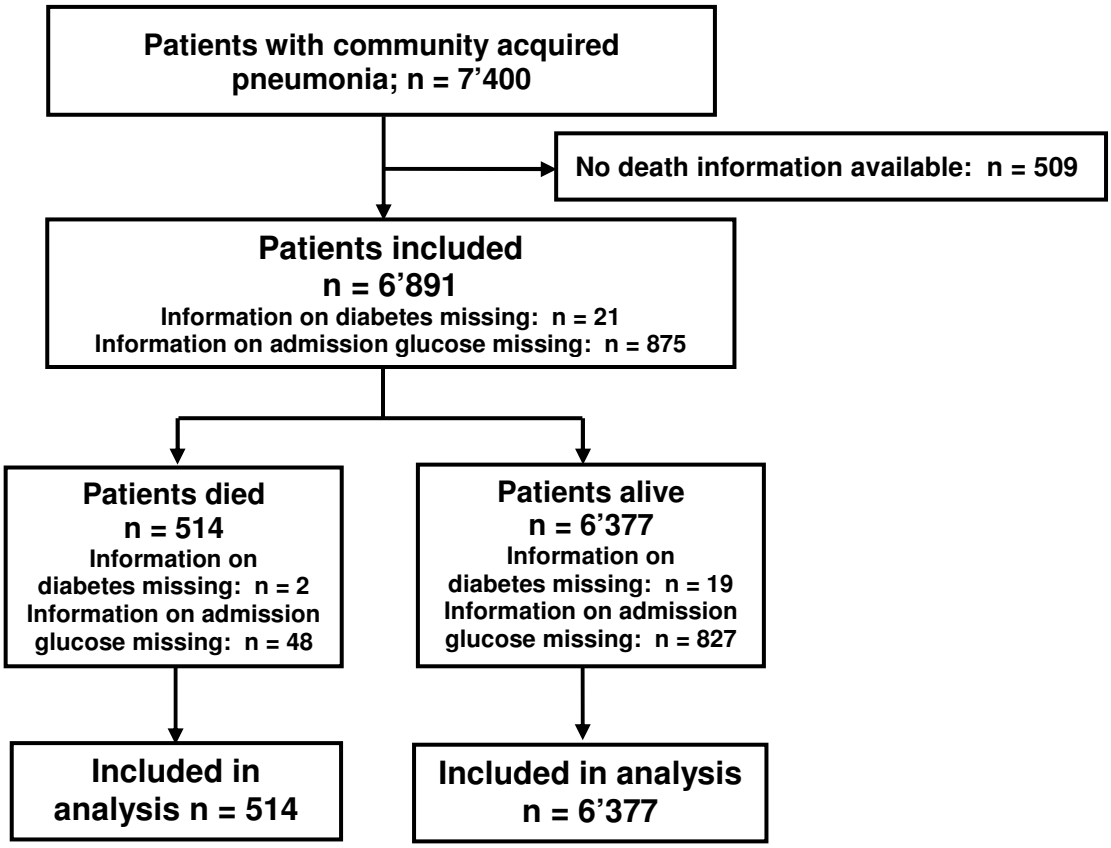
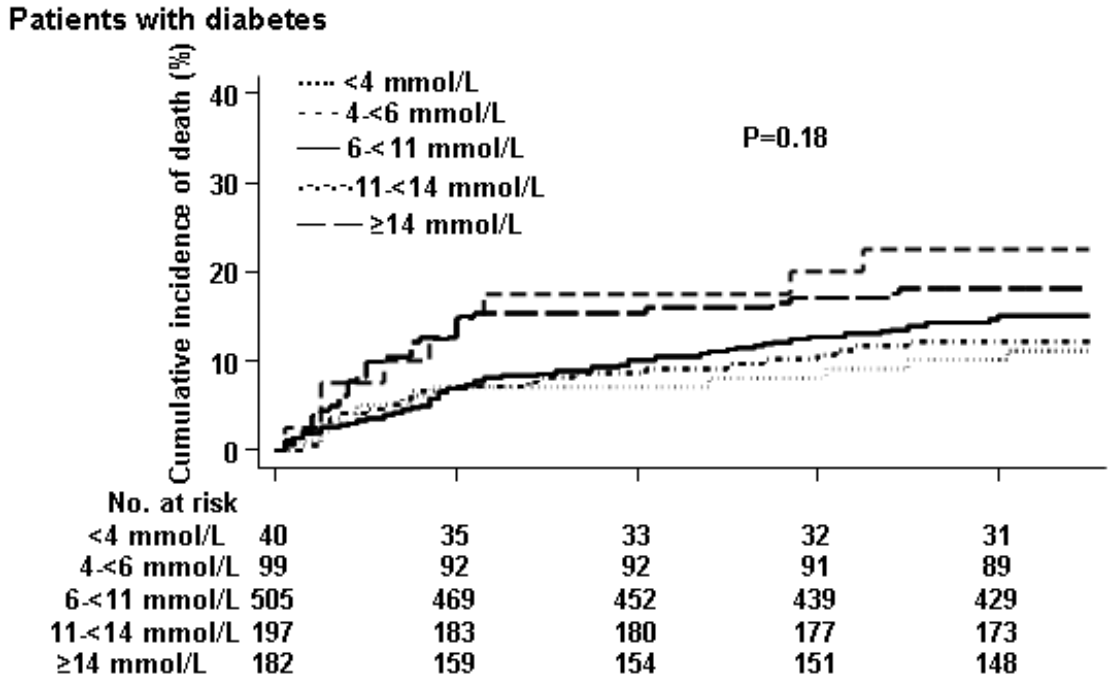
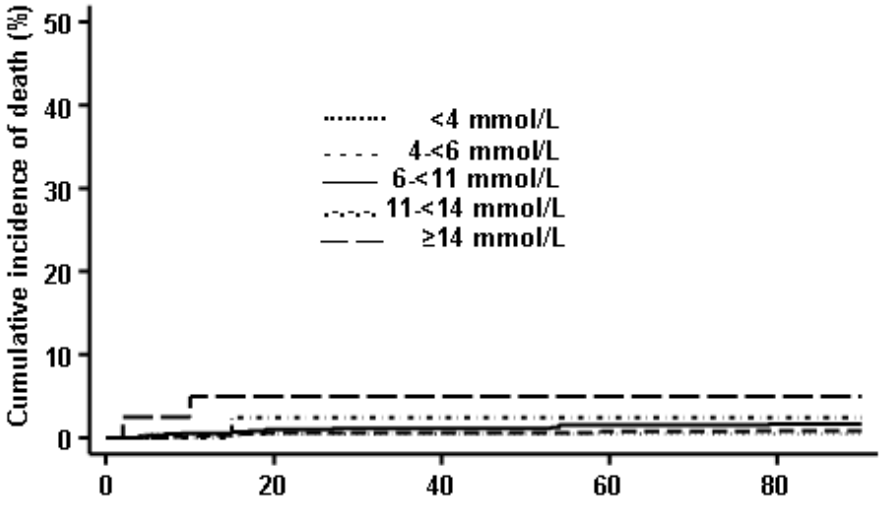
Figure 1



Supplementary Figure 1: Flow chart demonstrating patients included in this study and how they were stratified for the analysis (data is derived from mortality at 90 days). For statistical analyses, missing data on glucose levels on admission from 875 patients was accounted for in the covariates by using multiple imputation to create 20 imputed datasets (see text).

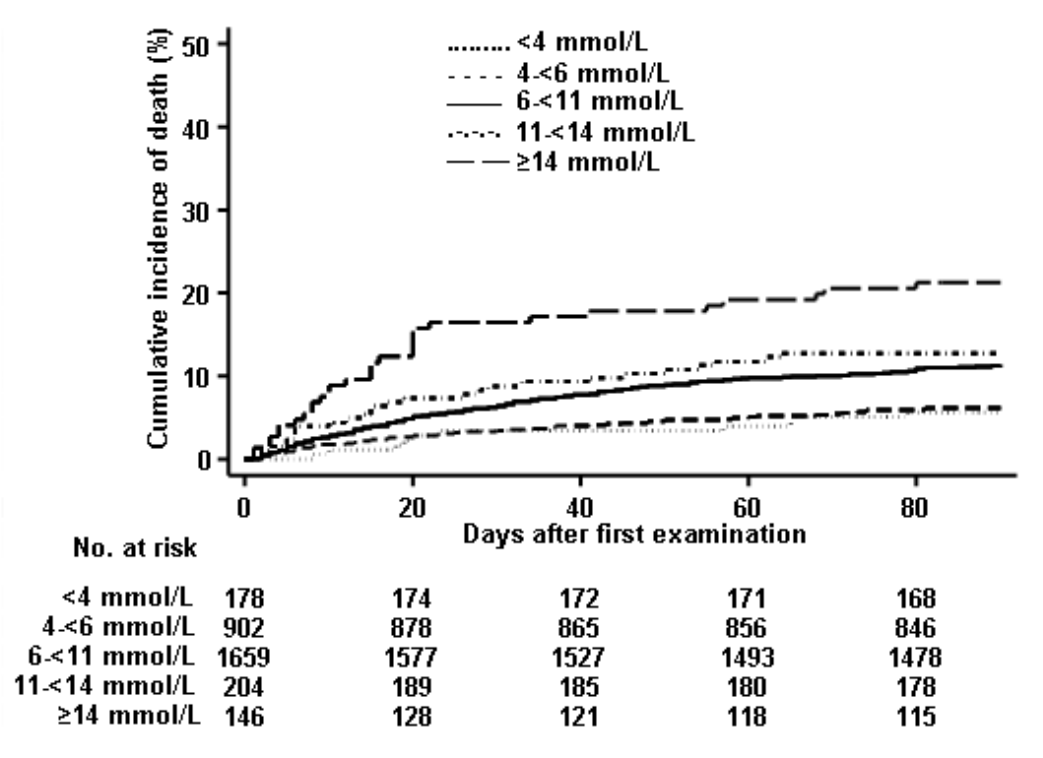


Supplementary Figure 2: Depiction of cumulative incidence of death (%) in patients with diabetes. In patients with diabetes there was no statistically significant association between serum glucose levels on admission and mortality after 90 days (P = 0.18).

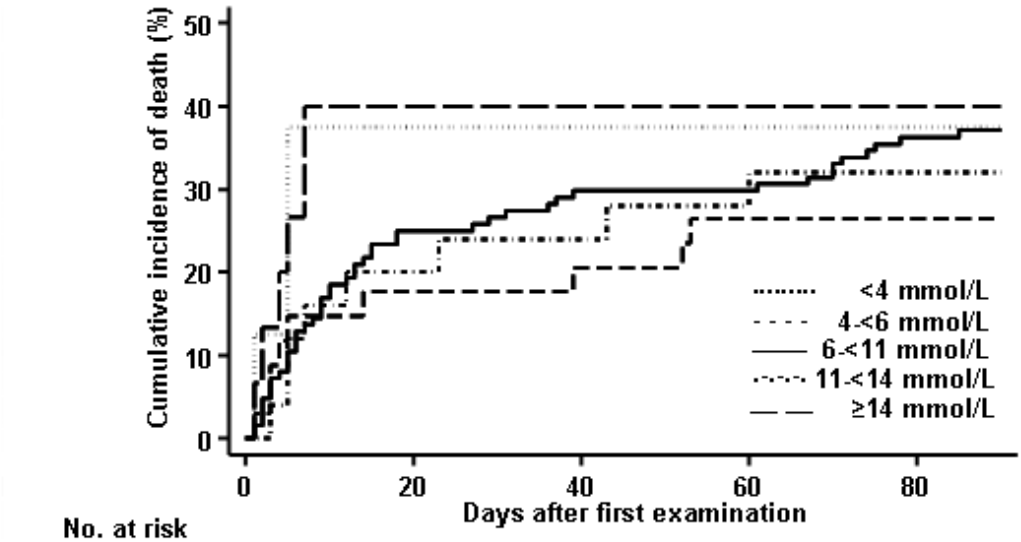


No. at risk					
<4 mmol/L	241	240	240	240	240
4-<6 mmol/L	1047	1040	1040	1037	1036
6-<11 mmol/L	729	722	719	715	714
11-<14 mmol/L	42	41	41	41	41
≥14 mmol/L	40	38	38	38	38

Supplementary Figure 3 A: Depiction of cumulative incidence of death (%) in patients with a CRB-65 score of 0. In patients with a low CRB-65 score there was borderline statistically significant association between serum glucose levels on admission and mortality after 90 days (P = 0.035).



Supplementary Figure 3 B: Depiction of cumulative incidence of death (%) in patients with a CRB-65 score of 1 or 2. In patients with a moderate CRB-65 score there was a statistically significant association between serum glucose levels on admission and mortality after 90 days ($P \leq 0.001$).



No. at risk					
<4 mmol/L	8	5	5	5	5
4-<6 mmol/L	34	28	27	25	25
6-<11 mmol/L	124	93	87	87	79
11-<14 mmol/L	25	20	19	18	17
≥14 mmol/L	15	9	9	9	9

Supplementary Figure 3 C: Depiction of cumulative incidence of death (%) in patients with a CRB-65 score of 3 or 4. In patients with a high CRB-65 score there was no statistically significant association between serum glucose levels on admission and mortality after 90 days (P = 0.70).

Supplementary Table 1A: 28-day mortality in all patients with CAP.

	Crude analyses Hazard ratio	P-value	Adjusted analyses Hazard ratio	P-value
Diabetes		<0.001		0.042
No	1.00 (ref)		1.00 (ref)	
Yes	2.56 (2.02 to 3.23)		1.29 (1.01 to 1.65)	
Glucose levels		<0.001*		<0.001*
<4 mmol/L	1.07 (0.59 to 1.97)		1.27 (0.69 to 2.34)	
4-<6 mmol/L	1.00 (ref)		1.00 (ref)	
6-<11 mmol/L	2.88 (2.11 to 3.94)		1.52 (1.10 to 2.10)	
11-<14 mmol/L	4.56 (2.86 to 7.26)		1.51 (0.93 to 2.46)	
≥14 mmol/L	8.29 (5.43 to 12.7)		2.99 (1.91 to 4.67)	
Combined		<0.001		0.001
No diabetes, low glucose	1.00 (ref)		1.00 (ref)	
No diabetes, high glucose	3.45 (2.49 to 4.76)		1.71 (1.22 to 2.40)	
Diabetes	5.43 (3.89 to 7.60)		1.92 (1.34 to 2.75)	

Each Cox proportional hazards models adjusted for sex, CRB-65 class, co-morbidities and smoking status. High glucose defines as glucose levels ≥ 6 mmol/L. *P values for trend across glucose levels

Supplementary Table 1B: 90-day mortality in all patients with CAP.

	Crude analyses Hazard ratio	P-value	Adjusted analyses Hazard ratio	P-value
Diabetes		<0.001		0.022
No	1.00 (ref)		1.00 (ref)	
Yes	2.47 (2.05 to 2.98)		1.26 (1.04 to 1.54)	
Glucose levels		<0.001*		<0.001*
<4 mmol/L	0.83 (0.49 to 1.39)		0.99 (0.59 to 1.66)	
4-<6 mmol/L	1.00 (ref)		1.00 (ref)	
6-<11 mmol/L	2.89 (2.27 to 3.69)		1.56 (1.22 to 2.01)	
11-<14 mmol/L	4.01 (2.78 to 5.81)		1.43 (0.97 to 2.09)	
≥14 mmol/L	6.04 (4.18 to 8.74)		2.37 (1.62 to 3.46)	
Combined		<0.001		<0.001
No diabetes, low glucose	1.00 (ref)		1.00 (ref)	
No diabetes, high glucose	3.35 (2.61 to 4.31)		1.72 (1.33 to 2.23)	
Diabetes	5.14 (3.95 to 6.68)		1.88 (1.42 to 2.47)	

Each Cox proportional hazards models adjusted for sex, CRB-65 class, co-morbidities and smoking status. High glucose defines as glucose levels ≥ 6 mmol/L. *P values for trend across glucose levels

Supplementary Table 1C: 180-day mortality in all patients with CAP.

	Crude analyses Hazard ratio	P-value	Adjusted analyses Hazard ratio	P-value
Diabetes		<0.001		0.004
No	1.00 (ref)		1.00 (ref)	
Yes	2.48 (2.10 to 2.93)		1.29 (1.08 to 1.54)	
Glucose levels		<0.001*		<0.001*
<4 mmol/L	0.70 (0.44 to 1.14)		0.84 (0.52 to 1.35)	
4-<6 mmol/L	1.00 (ref)		1.00 (ref)	
6-<11 mmol/L	2.54 (2.07 to 3.12)		1.41 (1.14 to 1.75)	
11-<14 mmol/L	3.73 (2.71 to 5.13)		1.39 (0.99 to 1.94)	
≥14 mmol/L	4.99 (3.59 to 6.94)		1.98 (1.40 to 2.81)	
Combined		<0.001		<0.001
No diabetes, low glucose	1.00 (ref)		1.00 (ref)	
No diabetes, high glucose	2.88 (2.32 to 3.57)		1.52 (1.21 to 1.91)	
Diabetes	4.61 (3.68 to 5.77)		1.74 (1.36 to 2.21)	

Each Cox proportional hazards models adjusted for sex, CRB-65 class, co-morbidities and smoking status. High glucose defines as glucose levels ≥ 6 mmol/L. *P values for trend across glucose levels

Supplementary Table 2: 90-day mortality according to standard cut-off values for normal fasting (<7.0 mmol/L) and normal non-fasting glucose levels (< 11.1 mmol/L) in all patients.

	Crude analyses Hazard ratio	P-value	Adjusted analyses Hazard ratio *	P-value
Glucose levels		<0.001		<0.001
<7 mmol/L	1.00 (ref)		1.00 (ref)	
7-<11 mmol/L	2.63 (2.16 to 3.21)		1.41 (1.15 to 1.73)	
≥11 mmol/L	3.76 (2.90 to 4.87)		1.53 (1.17 to 2.00)	

* **Each Cox proportional hazards models adjusted for sex, CRB-65 class, co-morbidities and smoking status.**

Supplementary Table 3: Association of glucose levels with 90-day mortality, stratified according to low (CRB-65 of 0), moderate (CRB-65 score of 1 or 2) or high (CRB-65 score of 3 or 4) severity of pneumonia.

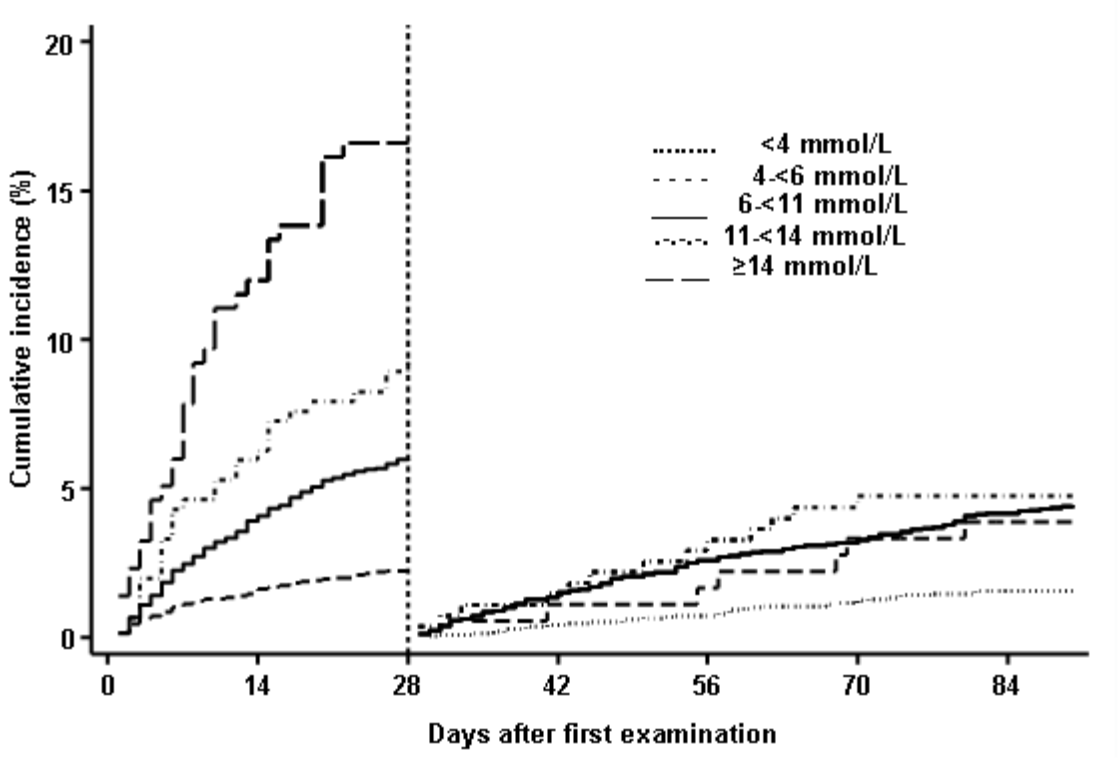
	Crude analyses Hazard ratio					
	CRB-65 Score					
	0 (n=2461)		**1 or 2 (n=3463)**		**3 or 4 (n=218)**	
Glucose levels						
<4 mmol/L	0.45 (0.06 to 3.28)	0.004	0.87 (0.46 to 1.63)	<0.001	1.68 (0.48 to 5.88)	0.47
4-<6 mmol/L	1.00 (ref)		1.00 (ref)		1.00 (ref)	
6-<11 mmol/L	1.99 (0.88 to 4.49)		2.01 (1.52 to 2.66)		1.46 (0.73 to 2.93)	
11-<14 mmol/L	2.44 (0.31 to 19.03)		2.35 (1.53 to 3.62)		1.26 (0.51 to 3.10)	
≥14 mmol/L	5.40 (1.19 to 24.52)		3.88 (2.54 to 5.93)		1.87 (0.70 to 5.04)	
	Adjusted analyses Hazard ratio *					
	CRB-65 Score					
	0 (n=2461)		**1 or 2 (n=3463)**		**3 or 4 (n=218)**	
Glucose levels						
<4 mmol/L	0.55 (0.08 to 4.01)	0.035	0.94 (0.50 to 1.78)	<0.001	1.35 (0.38 to 4.76)	0.70
4-<6 mmol/L	1.00 (ref)		1.00 (ref)		1.00 (ref)	
6-<11 mmol/L	1.79 (0.78 to 4.15)		1.65 (1.24 to 2.19)		1.37 (0.66 to 2.81)	
11-<14 mmol/L	2.21 (0.24 to 20.22)		1.74 (1.12 to 2.70)		0.90 (0.43 to 2.76)	
≥14 mmol/L	5.79 (0.74 to 45.25)		3.00 (1.96 to 4.61)		1.61 (0.55 to 4.12)	

* each Cox proportional hazards models adjusted for sex, CRB-65 class, co-morbidities and smoking status.
P values for interaction between trend across glucose levels and CRB-65 scores were 0.051 for crude and 0.036 for adjusted analyses.

Supplementary Table 4: Landmark analysis using multiple imputation

	Crude hazard ratios				***Adjusted hazard ratios***			
	0 to 28d mortality	***P for trend***	*28 to 90d mortality, excluding events within 28 days*	***P for trend***	*0 to 28d mortality*	***P for trend***	*28 to 90d mortality, excluding events within 28 days*	***P for trend***
Glucose levels	*1.07 (0.59 to 1.97)*	***0.001***	*0.49 (0.17 to 1.37)*	***0.65***	*1.26 (0.68 to 2.32)*	***0.003***	*0.57 (0.20 to 1.61)*	***0.57***
4-<6 mmol/L	*1.00 (reference)*		*1.00 (reference)*		*1.00 (reference)*		*1.00 (reference)*	
6-<11 mmol/L	*2.88 (2.11 to 3.94)*		*2.95 (2.04 to 4.28)*		*1.52 (1.10 to 2.10)*		*1.70 (1.17 to 2.49)*	
11-<14 mmol/L	*4.56 (2.86 to 7.26)*		*3.27 (1.76 to 6.07)*		*1.49 (0.92 to 2.42)*		*1.33 (0.70 to 2.52)*	
≥14 mmol/L	*8.29 (5.43 to 12.7)*		*2.52 (1.13 to 5.64)*		*2.93 (1.88 to 4.58)*		*1.12 (0.49 to 2.56)*	

P values for interaction between trend across glucose levels and time (0 to 28 days versus 21 to 90 days) were 0.13 for crude and 0.08 for adjusted analyses.



Supplementary Figure 4: Kaplan-Meier-Plot for the Landmark analysis (crude analysis). Mortality is truncated at 28 days. After 28 days mortality increases but this increase is independent from glucose levels in an adjusted analysis.

Supplementary Table 5: Comparison of patients with and without complete mortality data.

	Complete data on vital status (n=6891)	Missing data on vital status (n=509)	P-value
Gender			0.07
Female	3086 (45%)	207 (41%)	
Male	3805 (55%)	302 (59%)	
CRB-65			<0.001
0	2461 (36%)	90 (18%)	
1	2513 (36%)	93 (18%)	
2	950 (14%)	139 (27%)	
3	195 (3%)	75 (15%)	
4	23 (0%)	11 (2%)	
Missing	749 (11%)	101 (20%)	
Glucose level			<0.001
<4 mmol/L	484 (7%)	17 (3%)	
4-<6 mmol/L	2244 (33%)	121 (24%)	
6-<11 mmol/L	2768 (40%)	232 (46%)	
11-<14 mmol/L	303 (4%)	45 (9%)	
≥14 mmol/L	217 (3%)	34 (7%)	
Missing	875 (13%)	60 (12%)	
Diabetes mellitus			<0.001
No	5756 (84%)	369 (73%)	
Yes	1114 (16%)	133 (26%)	
Missing	21 (0%)	7 (1%)	
Chronic respiratory disease			0.04
No	4394 (64%)	340 (67%)	
Yes	2466 (36%)	156 (31%)	
Missing	31 (0%)	13 (3%)	
Malignant tumor			0.79
No	6204 (90%)	441 (87%)	
Yes	648 (9%)	48 (9%)	
Missing	39 (1%)	20 (4%)	
Chronic liver disease			<0.001
No	6644 (96%)	465 (91%)	
Yes	214 (3%)	31 (6%)	
Missing	33 (0%)	13 (3%)	
Congestive heart failure			<0.001
No	5596 (81%)	341 (67%)	
Yes	1265 (18%)	159 (31%)	
Missing	30 (0%)	9 (2%)	
Cerebrovascular disease			<0.001
No	6140 (89%)	322 (63%)	
Yes	722 (10%)	177 (35%)	
Missing	29 (0%)	10 (2%)	
Chronic renal disease			<0.001
No	6291 (91%)	415 (82%)	
Yes	566 (8%)	83 (16%)	
Missing	34 (0%)	11 (2%)	
Current smoking			0.09
No	4656 (68%)	327 (64%)	
Yes	2072 (30%)	121 (23%)	
Missing	163 (2%)	61 (12%)	

Supplementary Table 6: Comparison of all patients with complete death data, with and without complete glucose data.

	Patients with complete covariate data (n=5231)	Patients with missing covariate data (n=1660)	P-value
Mortality			0.001
No	4872 (93%)	1505 (91%)	
Yes	359 (7%)	155 (9%)	
Gender			0.044
Female	2307 (44%)	779 (47%)	
Male	2924 (56%)	881 (53%)	
CRB-65			0.001
0	2066 (40%)	395 (43%)	
1	2197 (42%)	316 (35%)	
2	789 (15%)	161 (18%)	
3	162 (3%)	33 (4%)	
4	17 (0%)	6 (1%)	
Glucose level			0.51
<4 mmol/L	420 (8%)	64 (8%)	
4-<6 mmol/L	1943 (37%)	301 (38%)	
6-<11 mmol/L	2422 (46%)	346 (44%)	
11-<14 mmol/L	255 (5%)	48 (6%)	
≥14 mmol/L	191 (4%)	26 (3%)	
Diabetes mellitus			0.002
No	4343 (83%)	1413 (86%)	
Yes	888 (17%)	226 (14%)	
Chronic respiratory disease			0.10
No	3323 (64%)	1071 (66%)	
Yes	1908 (36%)	558 (34%)	
Malignant tumor			0.061
No	4717 (90%)	1487 (91%)	
Yes	514 (10%)	134 (8%)	
Chronic liver disease			0.65
No	5065 (97%)	1579 (97%)	
Yes	166 (3%)	48 (3%)	
Congestive heart failure			0.54
No	4275 (82%)	1321 (81%)	
Yes	956 (18%)	309 (19%)	
Cerebrovascular disease			<0.001
No	4723 (90%)	1417 (87%)	
Yes	508 (10%)	214 (13%)	
Chronic renal disease			0.005
No	4772 (91%)	1519 (93%)	
Yes	459 (9%)	107 (7%)	
Current smoking			0.41
No	3633 (69%)	1023 (68%)	
Yes	1598 (31%)	474 (32%)	

Supplementary Table 7: Complete case analysis of 90-day mortality in all patients with CAP and complete covariate data.

	Crude analyses Hazard ratio	P-value	Adjusted analyses Hazard ratio	P-value
Diabetes		<0.001		0.011
No	1.00 (ref)		1.00 (ref)	
Yes	2.40 (1.92 to 3.00)		1.38 (1.08 to 1.76)	
Glucose levels		<0.001		<0.001
<4 mmol/L	0.83 (0.45 to 1.53)		0.94 (0.49 to 1.79)	
4-<6 mmol/L	1.00 (ref)		1.00 (ref)	
6-<11 mmol/L	2.68 (2.04 to 3.53)		1.54 (1.15 to 2.06)	
11-<14 mmol/L	3.59 (2.34 to 5.53)		1.65 (1.04 to 2.63)	
≥14 mmol/L	5.35 (3.51 to 8.15)		2.21 (1.37 to 3.57)	
Combined		<0.001		<0.001
No diabetes, low glucose	1.00 (ref)		1.00 (ref)	
No diabetes, high glucose	3.10 (2.33 to 4.12)		1.69 (1.24 to 2.30)	
Diabetes	4.90 (3.75 to 6.39)		2.01 (1.44 to 2.80)	

Each Cox proportional hazards models adjusted for sex, CRB-65 class, co-morbidities and smoking status. High glucose defines as glucose levels ≥ 6 mmol/L. *P values for trend across glucose levels