

How can we decrease the length of hospital stay in community-acquired pneumonia?

Jordi Carratalà

Department of Infectious Diseases

Bellvitge Hospital-IDIBELL

University of Barcelona



Magnitude of the problem

UNITED STATES

>4,000,000 people develop CAP every year

>1.3 million hospitalizations

Cost of care for patients with CAP: \$40 billion

Niederman MS. Semin Respir Crit Care Med 2009

EUROPE

CAP results in an annual expenditure of €10 billion,
of this amount inpatient care account for €5.7 billion

ERS. European Lung White Book 2003

LOS is the most important component of the cost of CAP
The duration of iv antibiotic therapy is a major determinant of LOS

A population-based study of the costs of care for CAP

- 2-yr period; 74610 inhabitants (Maresme, Catalonia)
- 292 episodes of CAP (224 were analyzed)
- Inappropriate admissions: 16%
- Mean direct cost of hospital treatment: €1,553
- Excess length of stay: 3.5 days

A reduction in inappropriate admissions and LOS would result in a decrease in cost of 17.4%

Estimating the economic impact of a half-day reduction in LOS among patients with CAP in the US

A half-day reduction in costs associated with LOS was \$724/hospitalization,
with estimated savings of \$500-\$900 million annually

Raut M. Curr Med Res Opin 2009

Economic benefit of a 1-day reduction in hospital stay for CAP in the US

Eliminating a day during the course of a CAP admission is potentially
worth \$2273 in economic benefits (2009 dollars)

Kozma CM. J Med Econ 2010

Factors associated with length of hospital stay in CAP

Advanced age

Alcohol abuse

High-risk PSI class

Functional impairment

Comorbid conditions

Aspiration pneumonia

Pleural effusion

Hypoxemia

Hypoalbuminemia

Time to first ATB dose

Bacteremia

Use of urinary catheter

Menéndez R. Eur Respir J 2003

Huang JQ. Can Respir J 2006

Garau J. Clin Microbiol Infect 2008

Garcia-Vidal C. EIMC 2009

LOS in CAP in Spain. NACER Study (n= 3233)

Hospital, city	LOS (days)
H. Meixoeiro, Vigo	10.7
H. Mútua Terrassa, Barcelona	8.9
H. Virgen Arrixaca, Murcia	11.1
H. Dr. Peset, Valencia	14.8
H. Clínico, Valladolid	13.3
H. Ramón y Cajal, Madrid	10.0
H. Virgen de las Nieves, Granada	7.8
H. Son Dureta, Palma de Mallorca	12.8
H. Insular, Las Palmas Gran Canaria	17.3

Length of stay in CAP by attending physician Bellvitge Hospital (2005)

Physician	days	Physician	days
A	4.7	F	7.3
B	6.2	G	8.8
C	6.7	H	9.5
D	7.0	I	10.2
E	7.3	J	10.3

Time to clinical stability in patients hospitalized with CAP

- The median time to stability was

2 days for:

heart rate ≤ 100 /min; systolic blood pressure ≥ 90 mmHg

3 days for:

RR ≤ 24 /min; oxygen saturation $\geq 90\%$; temperature $\leq 37.2^\circ\text{C}$

- The median time to overall stability was 3 days
- Once stability was achieved, clinical deterioration occurred in $\leq 1\%$ of pts
- Between 65% to 86% of pts stayed in the hospital more than 1 day after reaching stability and fewer than 29% to 46% were converted to oral ATB within 1 day of stability

Early switch and early discharge strategies in patients with CAP: a meta-analysis

- Search of the literature databases for CAP studies that included specific switch criteria (1980 – 2000)
- 121 articles reviewed:
 - 9 studies applied an **early switch** from iv to oral antibiotics
 - 5 also applied criteria for early discharge
- The **mean LOS** was not significantly reduced in studies of early switch and early discharge (**-1.64 days; 95% CI, -3.3 to 0.02 days**)
- When the 2 studies in which the recommended LOS was longer than the control LOS were excluded, the mean LOS was reduced by 3 days (**-3.04 days; 95% CI, -4.90 to -1.19 days**)

Effectiveness of early switch from intravenous to oral antibiotics in severe CAP: a multicentre randomised trial

Objective: to compare the effectiveness of an early switch to oral antibiotics with 7 day course of iv antibiotics in severe CAP

Design: multicentre randomised controlled trial (NCT00273676)

Setting: 7 teaching hospitals in the Netherlands

Participants: 265 pts in non-intensive care wards with severe CAP

Intervention: 3 days of iv antibiotics followed, when clinically stable, by oral antibiotics or 7 days of iv antibiotics

Main outcome measures: clinical cure and length of stay

Effectiveness of early switch from intravenous to oral antibiotics in severe CAP: a multicentre randomised trial

Intention to treat analysis (n= 265)

Outcome	Intervention (n= 132)	Control (n= 133)	Mean difference (95% CI)
Clinical cure	110 (83)	113 (85)	2% (-7% to 10%)
Mean (SD) LOS, days	9.6 (5.0)	11.5 (4.9)	1.9 (0.6 to 3.2)

Per protocol analysis (n= 229)

Outcome	Intervention (n= 108)	Control (n= 121)	Mean difference (95% CI)
Clinical cure	93 (86)	121 (83)	-3% (-12% to 7%)
Mean (SD) LOS, days	9.0 (4.7)	11.3 (4.7)	2.3 (1.0 to 3.6)

Effect of a 3-step critical pathway to reduce duration of intravenous antibiotic therapy and length of stay in CAP

Objective: to determine whether the use of a 3-step critical pathway is safe and effective in reducing duration of iv antibiotic therapy and length of stay in hospitalized adults with CAP

Design: randomized controlled trial (ISRCTN 17875607)

Setting: 2 tertiary hospitals in Barcelona

Intervention: 3-step critical pathway or usual care

Primary end point: length of stay

Secondary end points: duration of iv antibiotic therapy, adverse drug reactions, need for readmission, and overall case-fatality rate

3-Step Critical Pathway in CAP

1 EARLY MOBILIZATION

Movement out of bed:

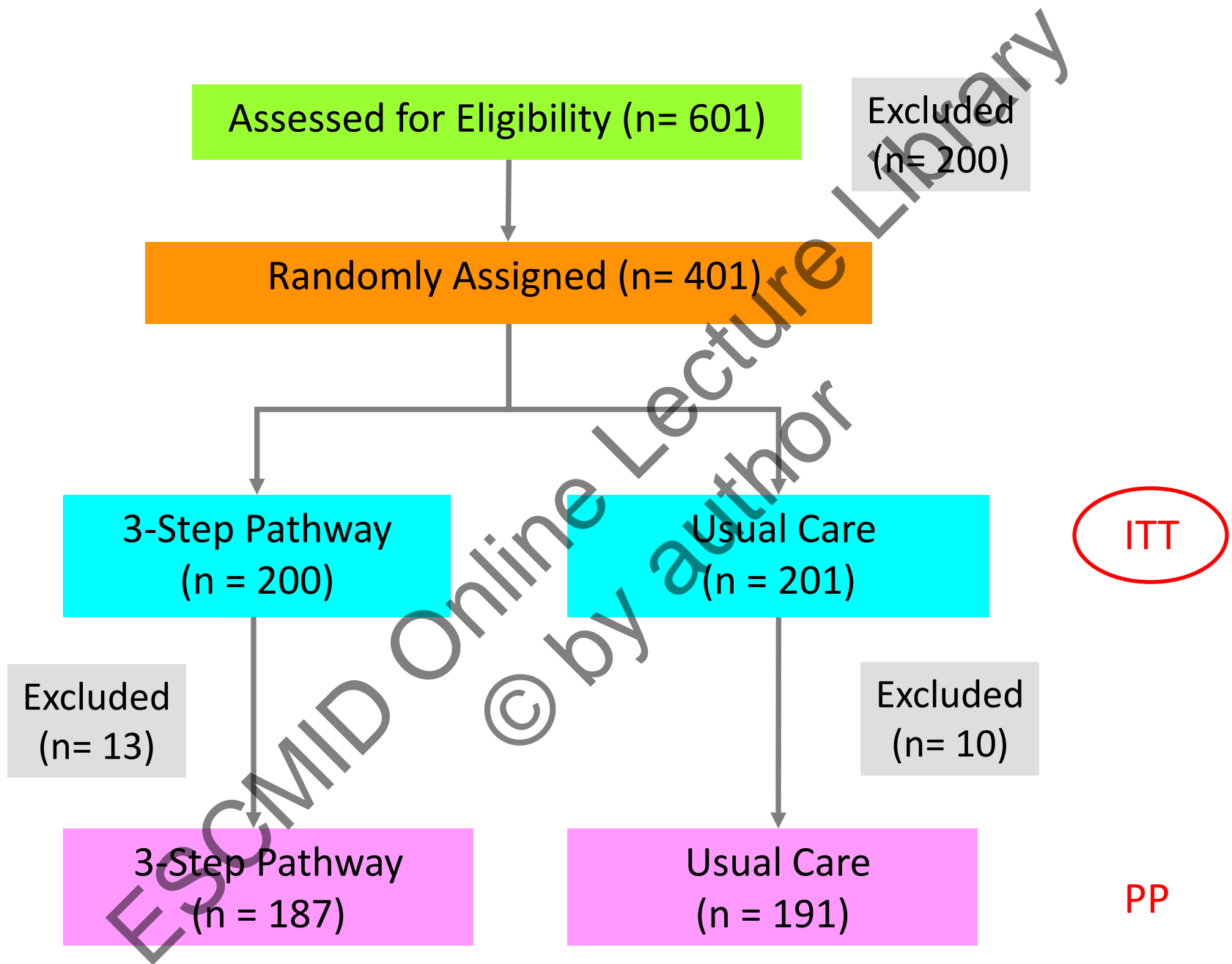
> 20° during the first 24 hours of hospitalization
progressive movement each subsequent day

2 SWITCH TO ORAL ANTIBIOTIC THERAPY

Ability to maintain oral intake, stable vital signs (temperature $\leq 37.8^{\circ}\text{C}$, RR ≤ 24 , SBP ≥ 90 mmHg) and absence of exacerbated comorbidities

3 HOSPITAL DISCHARGE

Meeting criteria for oral antibiotic therapy, baseline mental status, and adequate oxygenation on room air (PaO₂ ≥ 60 mmHg or pulse oximetry $\geq 90\%$)



Effect of a 3-step critical pathway to reduce duration of intravenous antibiotic therapy and length of stay in CAP

Outcomes	3-step pathway (n= 200)	Usual care (n= 201)	P
Primary end point			
Length of stay, median, days	3.9	6.0	<.001
Secondary end points			
Length of iv antibiotic therapy	2.0	4.0	<.001
Adverse drug reactions	5 %	16 %	<.001
Phlebitis	4 %	10 %	.02
Subsequent admission	9 %	8 %	.59
Overall case-fatality rate	2 %	1 %	.45

Meta-analysis and systematic review of procalcitonin (PCT)-guided therapy in respiratory tract infections

- Meta-analysis of randomized controlled trials
- Eight studies randomizing 3,431 patients
- Pooled analysis showed a significant reduction in number of antibiotic prescriptions and duration of antibiotic use in patients with PCT-guided therapy
- However, PCT-guided therapy **did not impact** mortality, ICU admission, or **length of stay**

Dexamethasone and length of hospital stay in patients with community-acquired pneumonia

Objective: to assess effect of addition of dexamethasone on length of stay in CAP

Design: randomised, double-blind, placebo-controlled trial (NCT00471640)

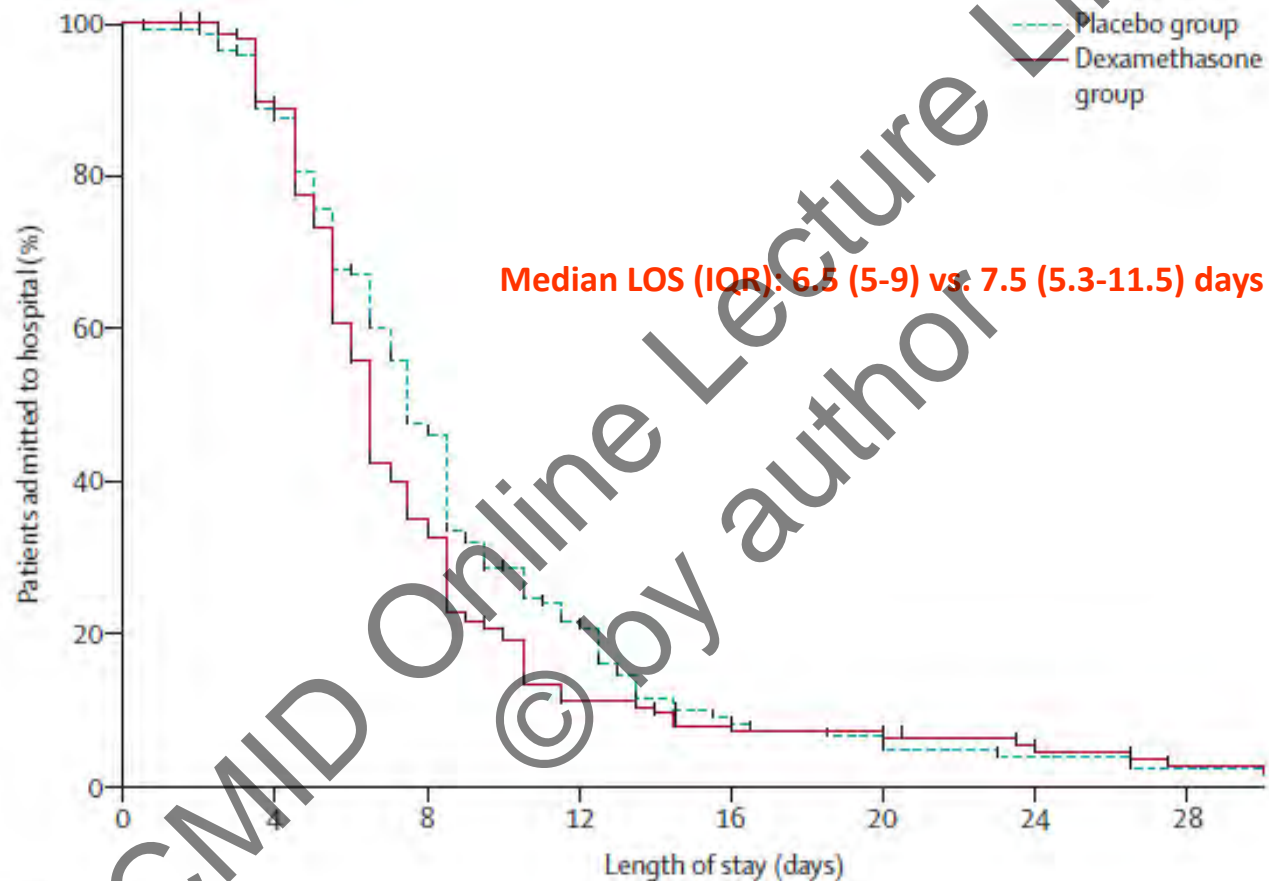
Setting: 2 teaching hospitals in the Netherlands

Participants: 304 patients (151 allocated to the dexamethasone group and 153 to the placebo group)

Intervention: iv dexamethasone (5 mg once a day) or placebo

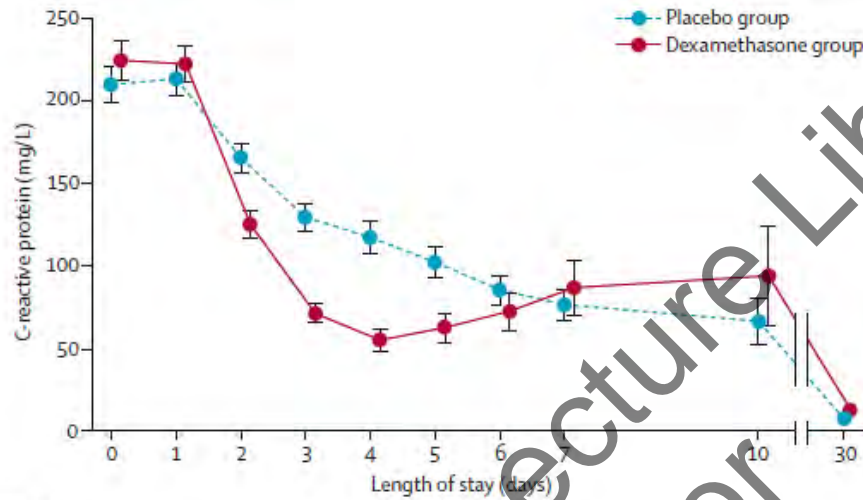
Main outcome measure: length of stay

Dexamethasone and length of hospital stay in CAP



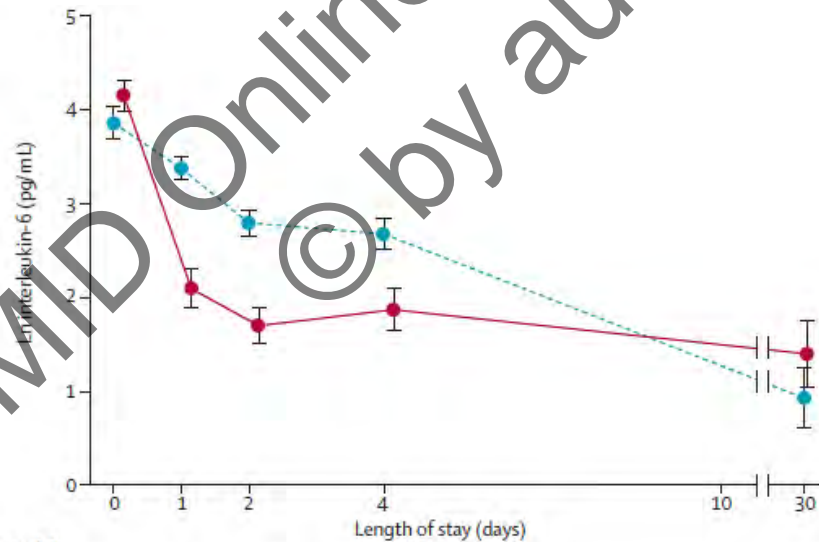
Number at risk

	0	4	8	12	16	20	24	28
Placebo group	153	127	68	28	11	8	6	5
Dexamethasone group	151	127	47	18	10	9	6	4



Number at risk

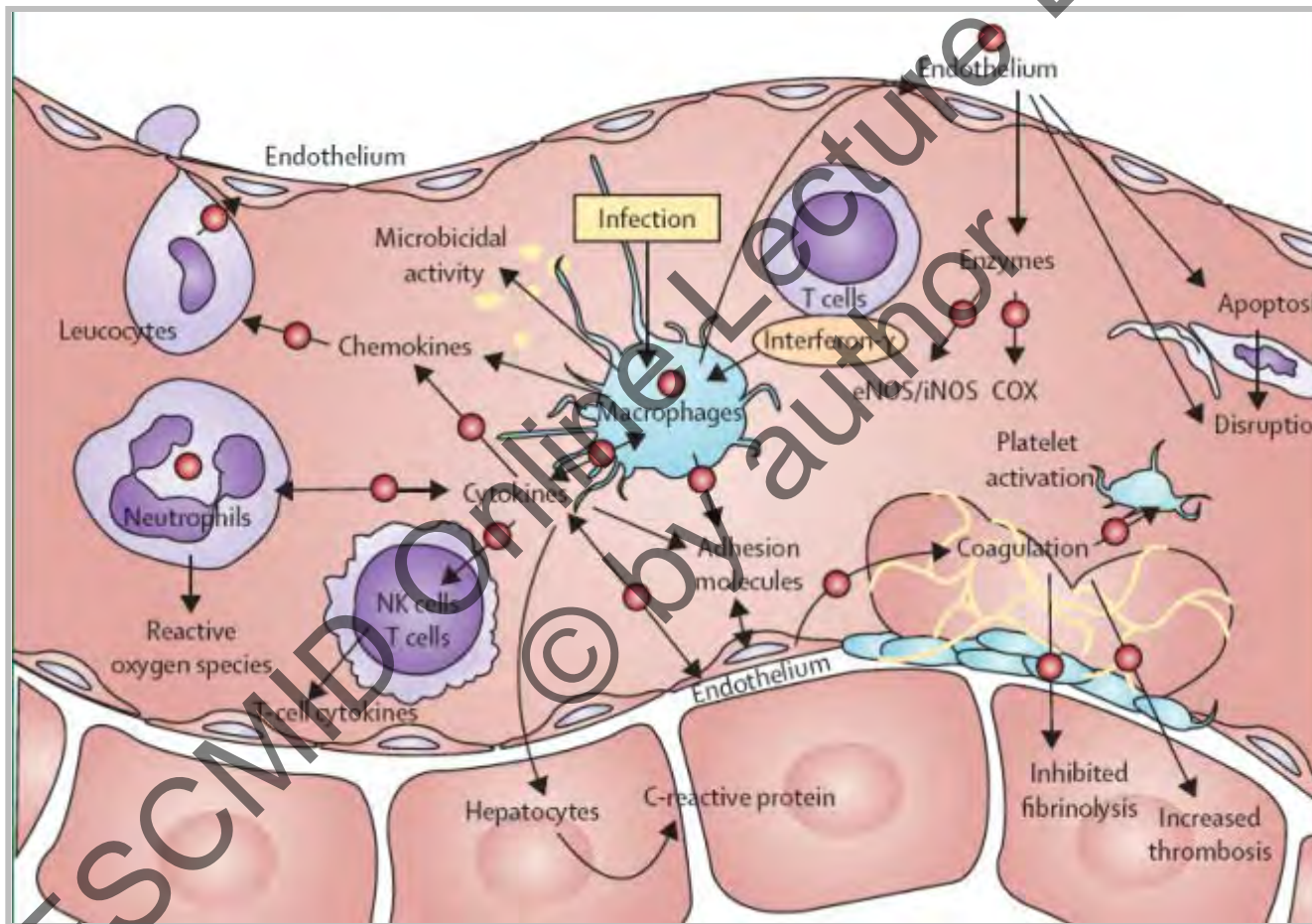
Placebo group	153	141	135	131	104	84	75	53	39	112
Dexamethasone group	151	130	126	121	91	70	49	33	23	115



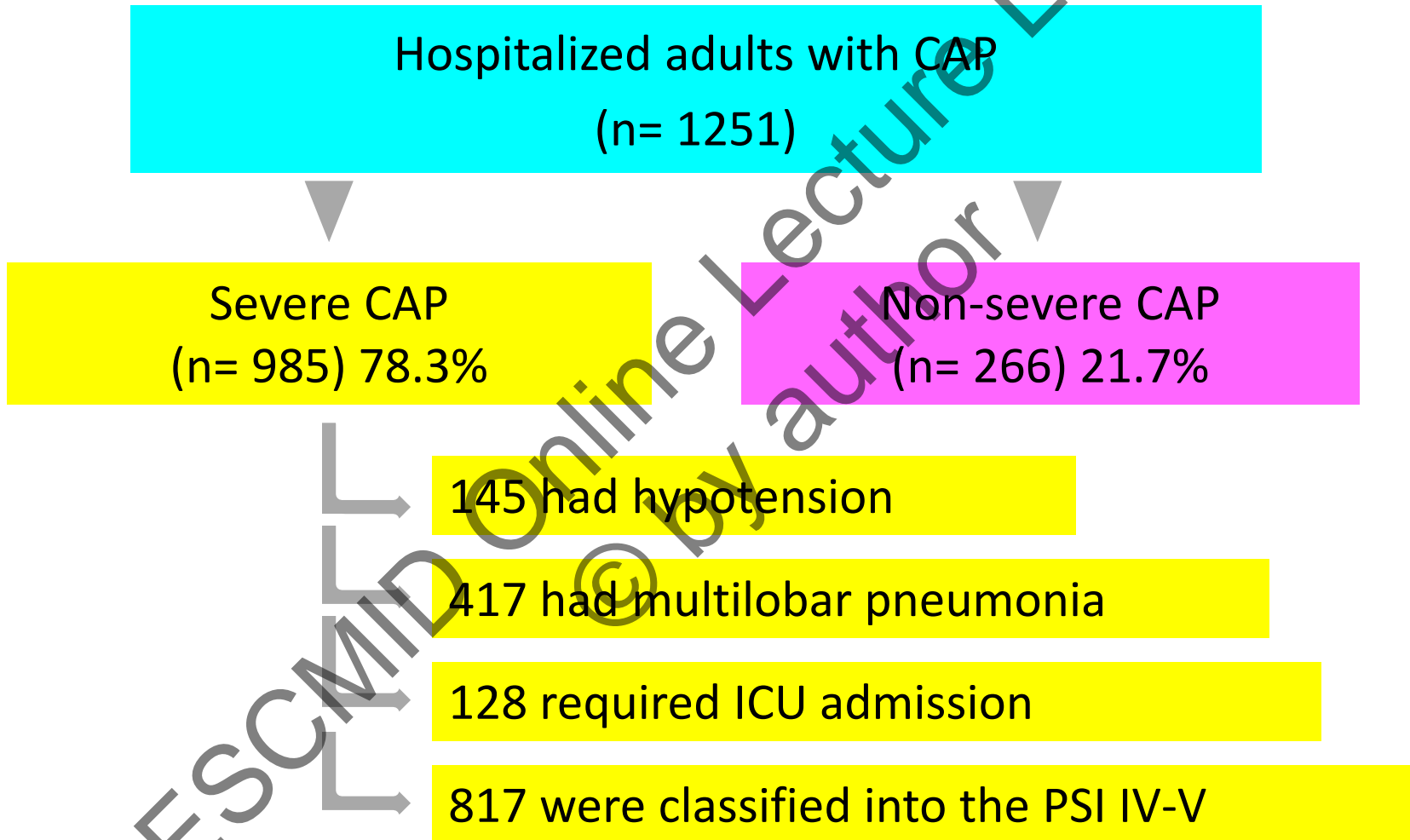
Number at risk

Placebo group	146	127	118	88	45
Dexamethasone group	133	93	80	75	36

Pleiotropic effects of statins



Effect of statin use on outcomes of patients with CAP according to severity of illness



Effect of statin use on LOS according to severity of illness

Severe CAP: prolonged LOS (median ≥ 8 days)

Characteristic	OR (95% CI)	P
Statin use	0.41 (0.24 – 0.71)	<.001

Other variables analyzed : age, male sex, current smoker, comorbid conditions, influenza vaccine, pneumococcal vaccine, altered mental status, septic shock at presentation, multilobar pneumonia, ICU admission.

Non-severe CAP: prolonged LOS (median ≥ 6 days)

Characteristic	OR (95% CI)	P
Statin use	0.86 (0.33 – 2.19)	.75

Other variables analyzed: age, sex, current smoker, comorbid conditions, influenza vaccine, pneumococcal vaccine.

Summary

- CAP is one of the most common inpatient medical conditions.
- The costs associated with managing hospitalized pts with CAP are particularly high.
- The most important component of these costs is LOS.
- The duration of intravenous antibiotic therapy is a major determinant of LOS.
- Substantial variation in the duration of intravenous antibiotic therapy and LOS for CAP has been well documented.

Summary

- Early mobilization of pts and use of objective criteria of clinical stability for switching to oral antibiotic therapy and for deciding on hospital discharge is safe and effective in decreasing LOS in CAP and would reduce costs.
- The use of immunomodulatory and antinflammatory drugs might help reduce LOS in pts with severe CAP and merits further research.

Thank you for your attention!



Santa Caterina Market, Barcelona