NEWMICRO
Network di Microbiologia e Virologia del Nord Est

"Infezioni delle basse vie respiratorie (LRTI): aspetti clinici e diagnosi microbiologica "

I percorsi diagnostici microbiologici nel paziente immunocompetente

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Pordenone, 14 dicembre 2012

Il tipo di patogeni coinvolti nelle LRTI è ampio e con varie sensibilità agli antibiotici e costituisce una grande sfida per la diagnostica microbiologica

K. Loens. JOURNAL OF CLINICAL MICROBIOLOGY, Jan. 2009,

- There have been a large number of publications looking at the possibility of predicting the aetiological agent from the clinical features at presentation; however, while certain symptoms and signs are more common with specific pathogens, none allow accurate differentiation.

- There are no characteristic features on the chest radiograph in CAP that allow confident prediction of the causative organism

British Thoracic Society guidelines for the management of community acquired pneumonia in adults: update 2009

1. Identification of pathogens and antibiotic sensitivity patterns permits selection of optimal antibiotic regimens.
2. Targeted and narrow-spectrum antibiotic therapy limits drug costs, the threat of antibiotic resistance and adverse drug reactions such as C difficile-associated diarrhoea.
3. Specific pathogens have public health or infection control significance, including legionella, psittacosis, C burnetii, influenza A and multiresistant organisms.

British Thoracic Society guidelines for the management of community acquired pneumonia in adults: update 2009

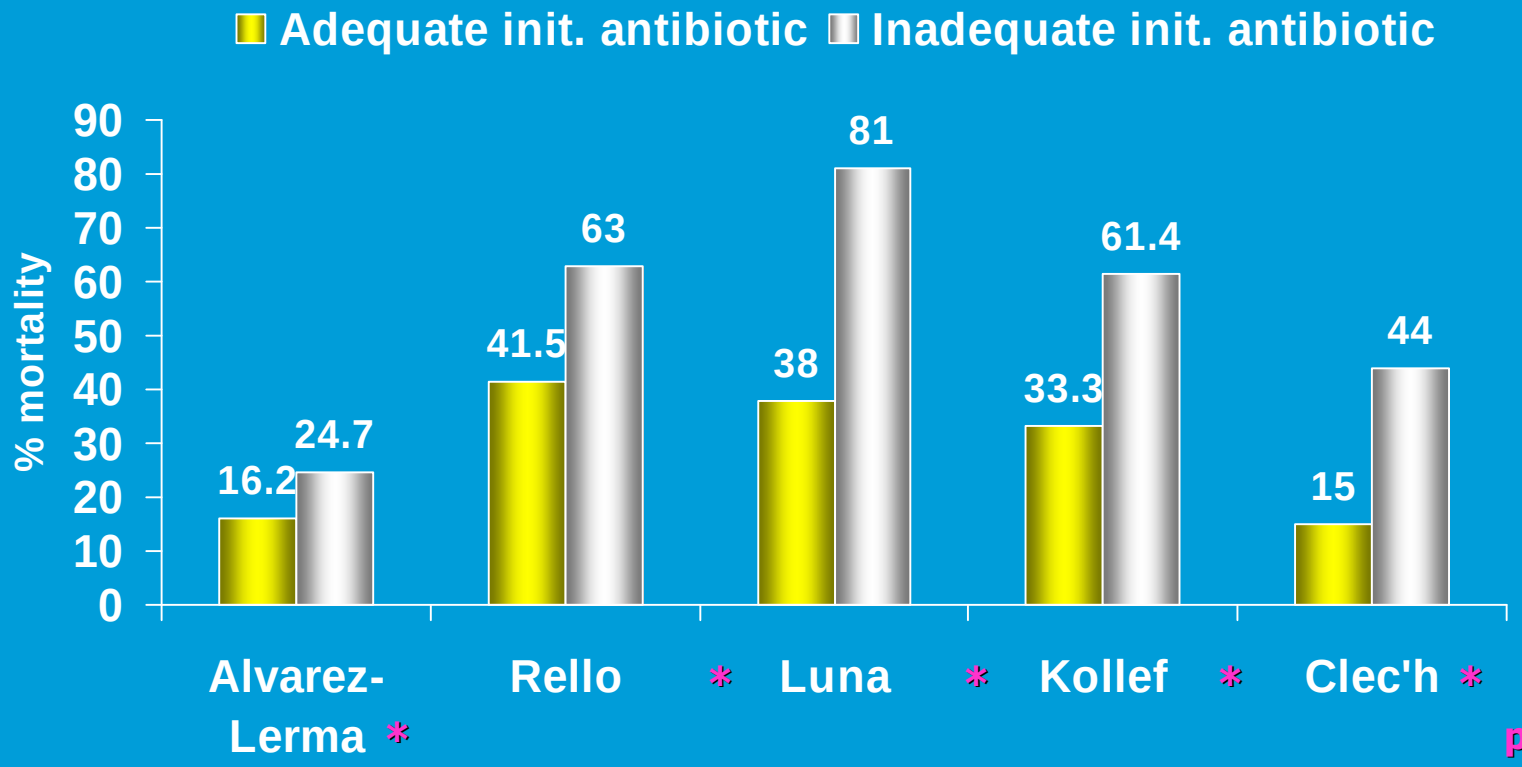
Microbiological investigations allow monitoring of the spectrum of pathogens causing CAP over time.

Without the accumulated information available from these culture results, trends in antibiotic resistance are more difficult to track, and empirical antibiotic recommendations are less likely to be accurate.

IDSA/ATS Guidelines for CAP in Adults • CID 2007:44 (Suppl 2) • S27

Local reccomandations for empiric antibiotic therapy

The Importance of Initial Empiric Antibiotic Selection



p <.05

(Alvarez-Lerma F. Intensive Care Med 1996;22:387-94)

(Rello J, Gallego M, Mariscal D, et al. Am J Respir Crit Care Med 1997;156:196-2000)

(Luna CM, Vujacich P, Niederman MS et al. Chest 1997;111:676-685)

(Kollef MH and Ward S. Chest 1998;113:412-20)

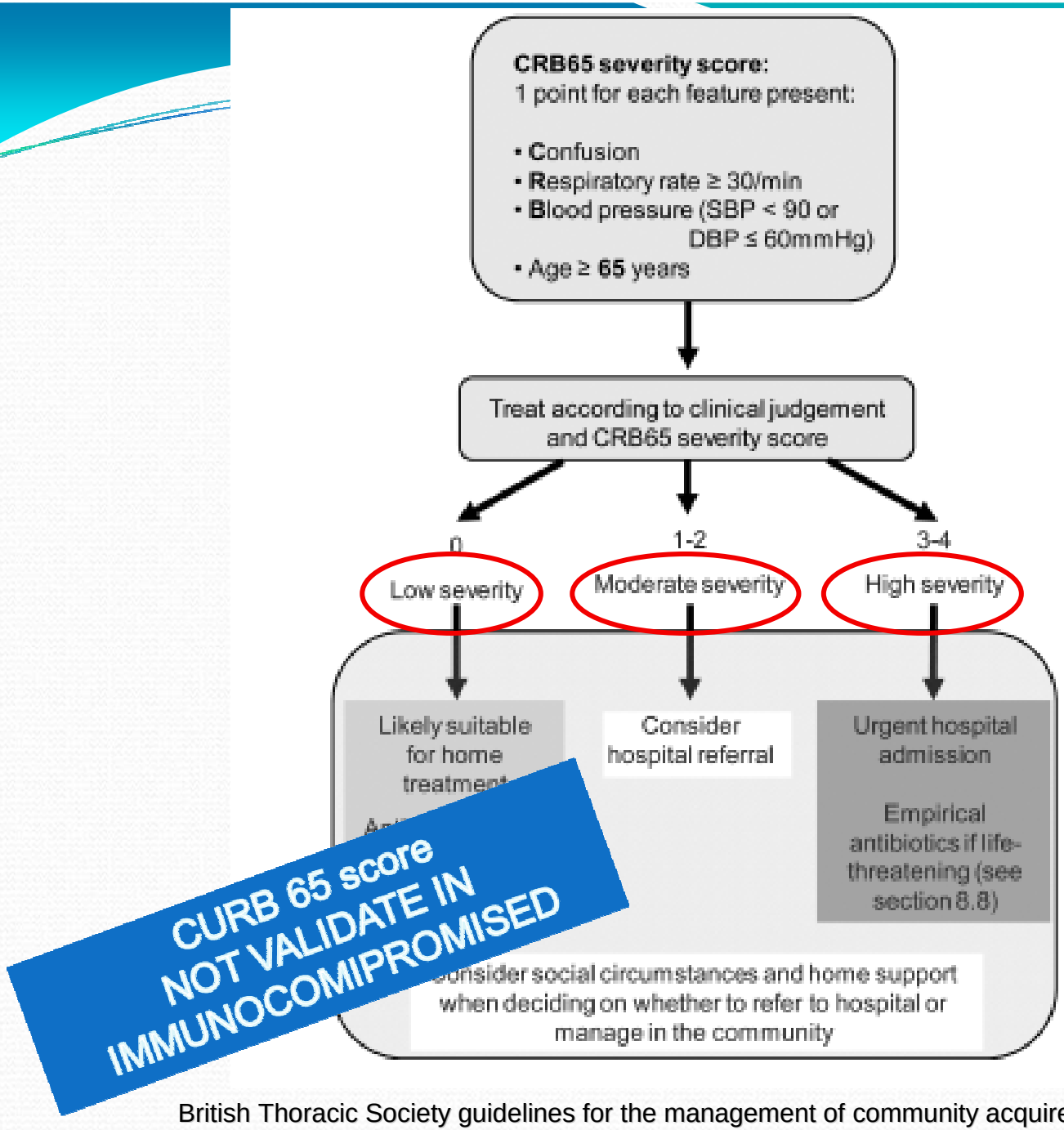
(Clec'h C, Timsit J-F, De Lassence A et al. Intensive Care Med 2004;30:1327-1333)

Almost all of the major decisions regarding management of CAP, including diagnostic and treatment issues, revolve around the initial assessment of severity.

IDSA/ATS Guidelines for CAP in Adults • CID 2007:44 (Suppl 2) • S27

Score per determinare gravità delle CAP

- **PSI**
  - Molto popolare
  - Predittivo della mortalità
  - Necessari più di 20 parametri
  - Difficile da applicare fuori dall'ospedale
- **CRB 65 (confusione, atti Respiratori > 30/min, ipotensione, età > 65)**
  - Più utile e comodo in comunità



British Thoracic Society guidelines for the management of community acquired pneumonia in adults: update 2009

CAP severity assessment should be based in three key points:

- ✓ a pneumonia-specific score,
- ✓ biomarkers,
- ✓ and clinical judgment.

J.M.Pereira. Semin Respir Crit Care Med. 2012 Jun;33(3)

American Journal of Emergency Medicine (2012) 30, 1248–1254

ELSEVIER

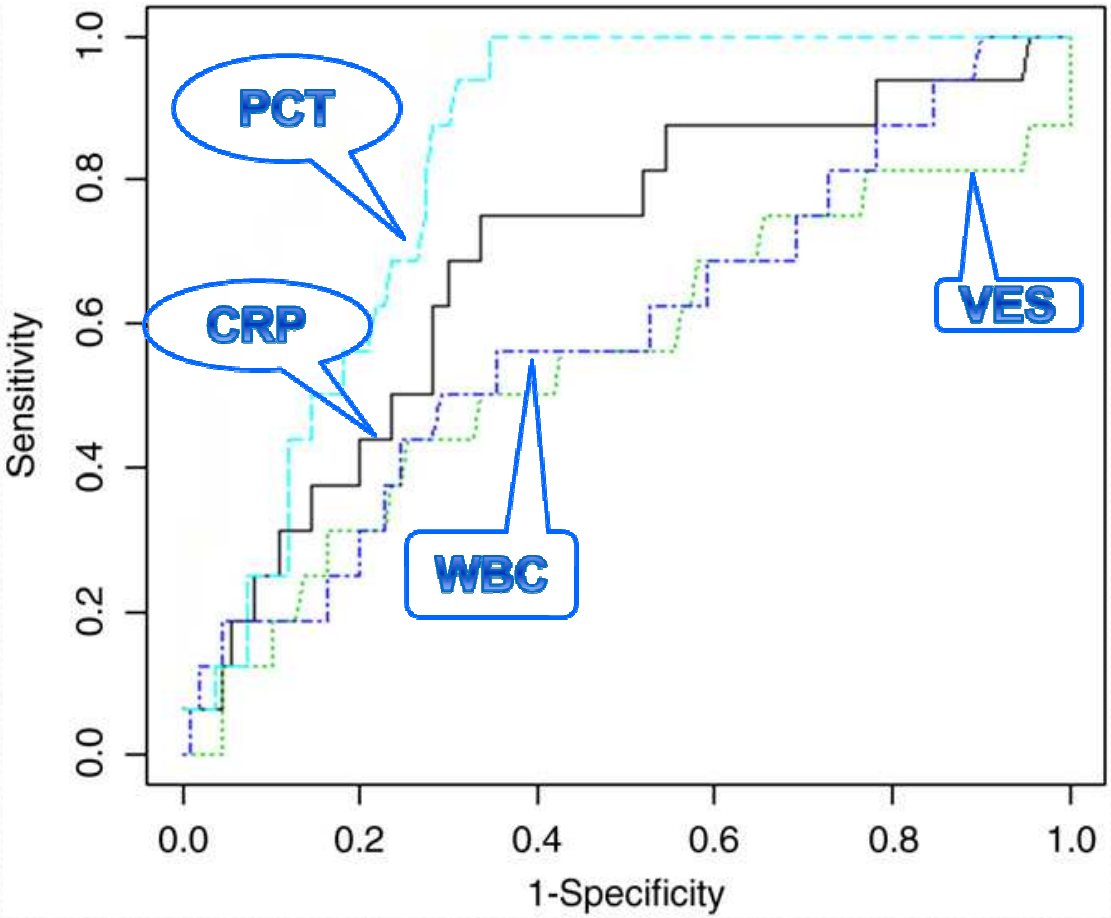
The American Journal of Emergency Medicine

www.elsevier.com/locate/ajem

Brief Report

The value of procalcitonin level in community-acquired pneumonia in the ED☆,☆☆

Jeong Ho Park MD, Jung Hee Wee MD, Seung Pill Choi MD, PhD*, Sang Hoon Oh MD

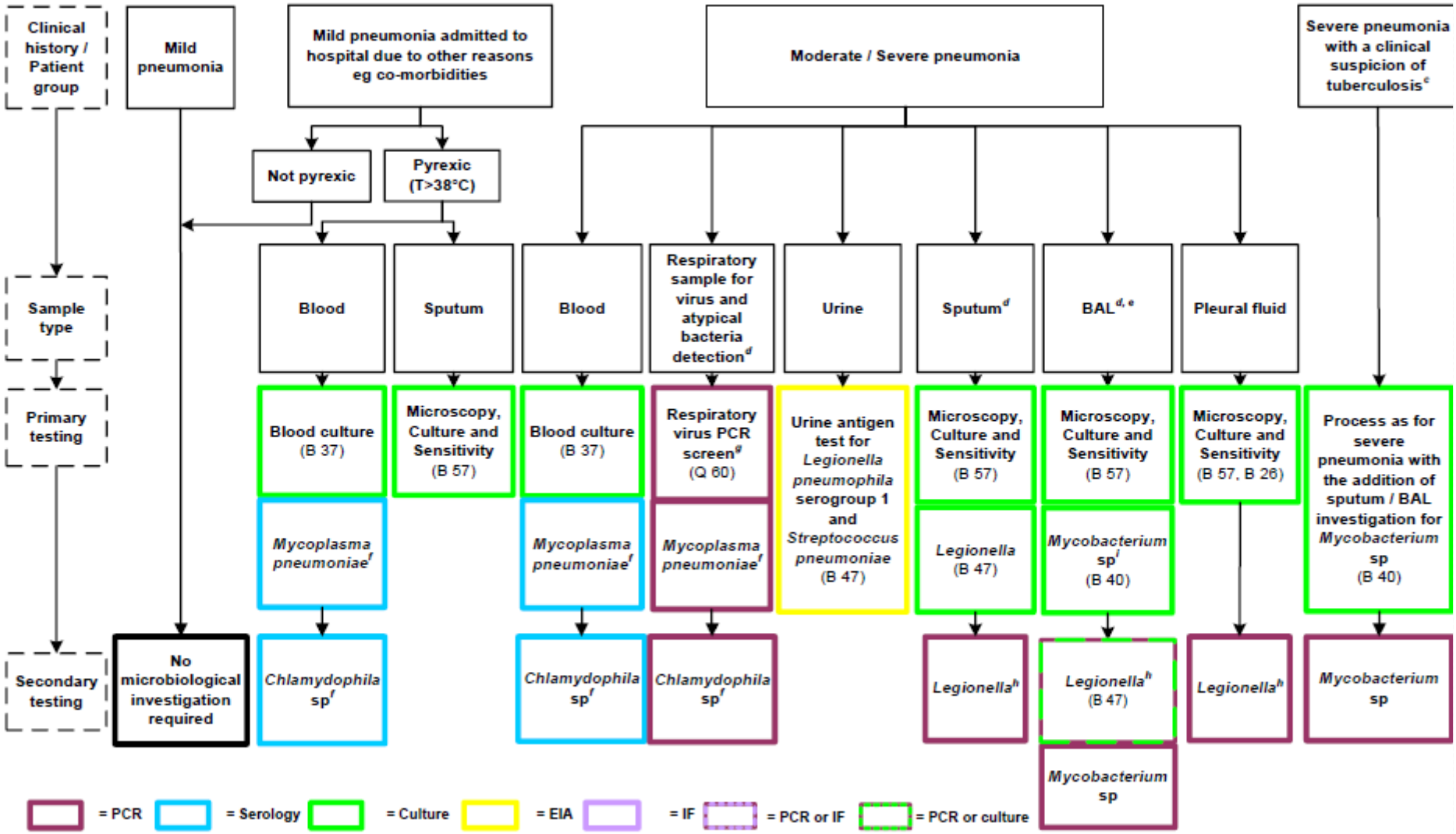


appropriatezza

It has always been recognized that the use of a diagnostic test is an intervention. A diagnostic test should be requested only when a question is being posed and when there is evidence that the result will provide an answer to the question.

C. P. Price. Clin Chem 46, No. 8, 2000

Pneumonia in immunocompetent adults[1-8, b]

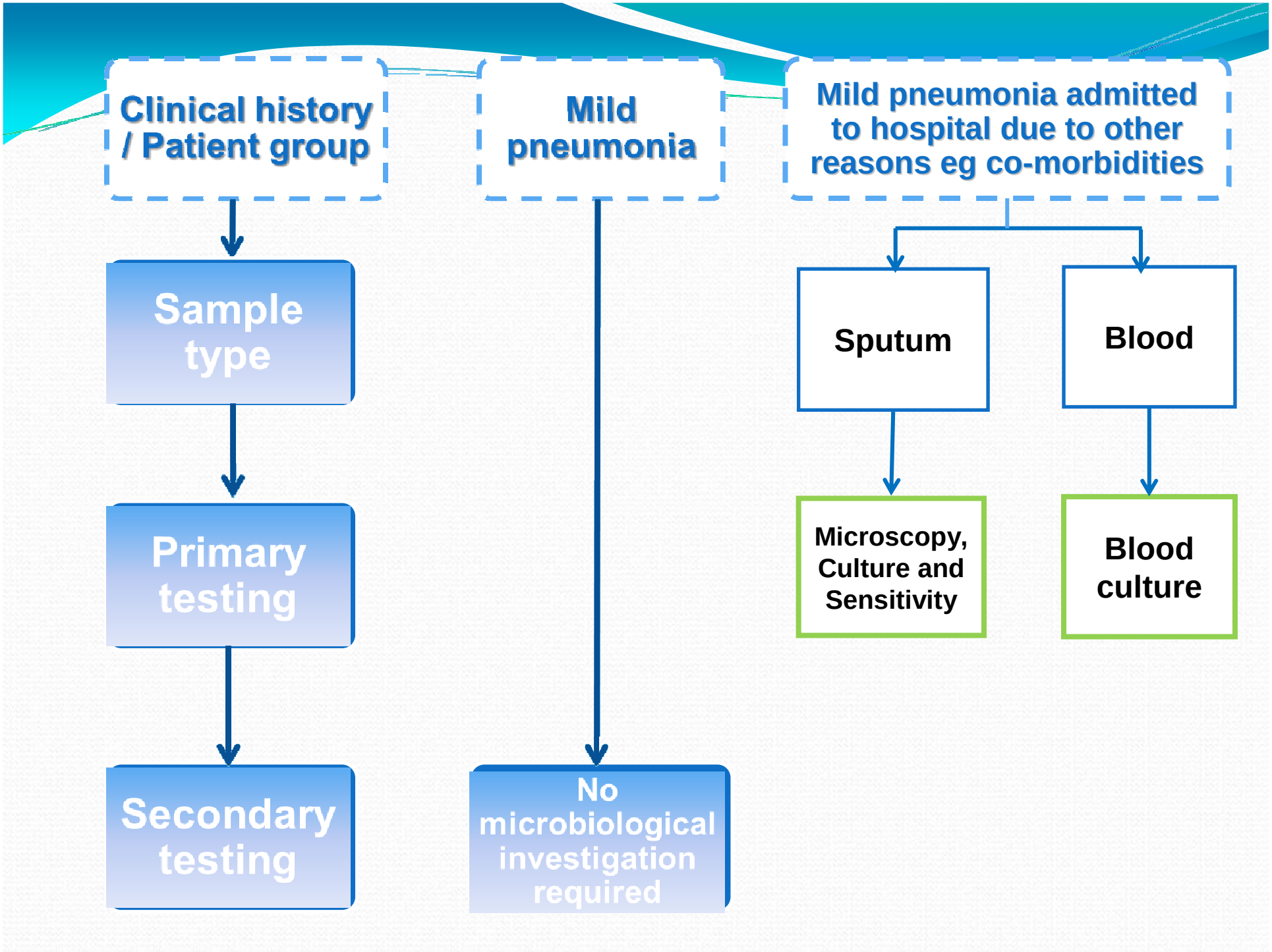


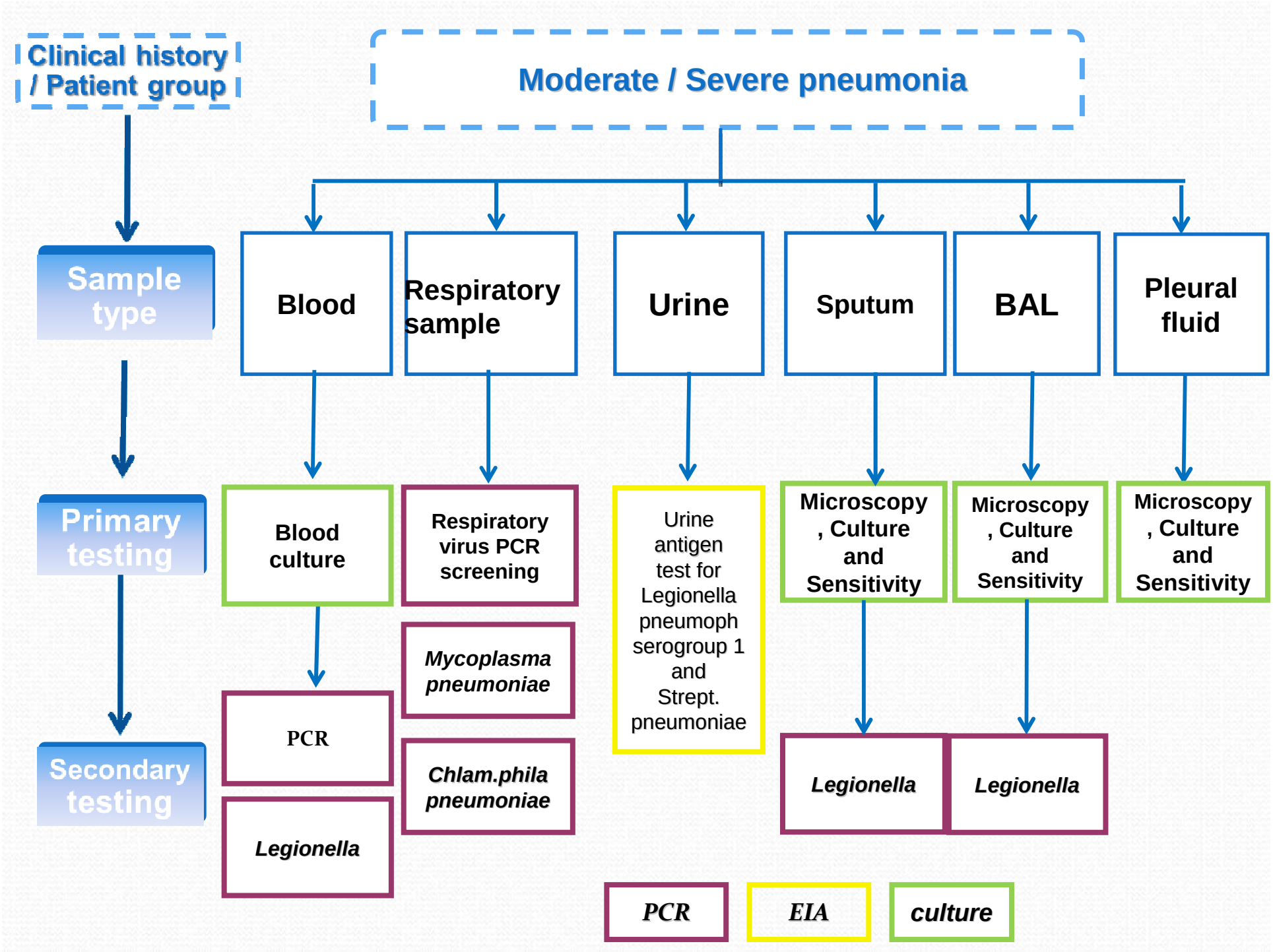
General investigations are not necessary for the majority of patients with CAP who are managed in the community.

British Thoracic Society guidelines for the management of community acquired pneumonia in adults: update 2009

For patients with low severity CAP the extent of microbiological investigations should be guided by clinical factors (age, comorbid illness, severity indicators), epidemiological factors and prior antibiotic therapy. [A]

British Thoracic Society guidelines for the management of community acquired pneumonia in adults: update 2009


Clinical history / Patient group
Mild pneumonia
Mild pneumonia admitted to hospital due to other reasons eg co-morbidities
Sample type
Primary testing
Secondary testing
No microbiological investigation required
Sputum
Blood
Microscopy, Culture and Sensitivity
Blood culture


Clinical history / Patient group
Moderate / Severe pneumonia
Sample type
Primary testing
Secondary testing
Blood
Respiratory sample
Urine
Sputum
BAL
Pleural fluid
Blood culture
Respiratory virus PCR screening
Urine antigen test for Legionella pneumoph serogroup 1 and Strept. pneumoniae
Microscopy , Culture and Sensitivity
Microscopy , Culture and Sensitivity
Microscopy , Culture and Sensitivity
PCR
Mycoplasma pneumoniae
Chlam.phila pneumoniae
Legionella
Legionella
Legionella
PCR
EIA
culture

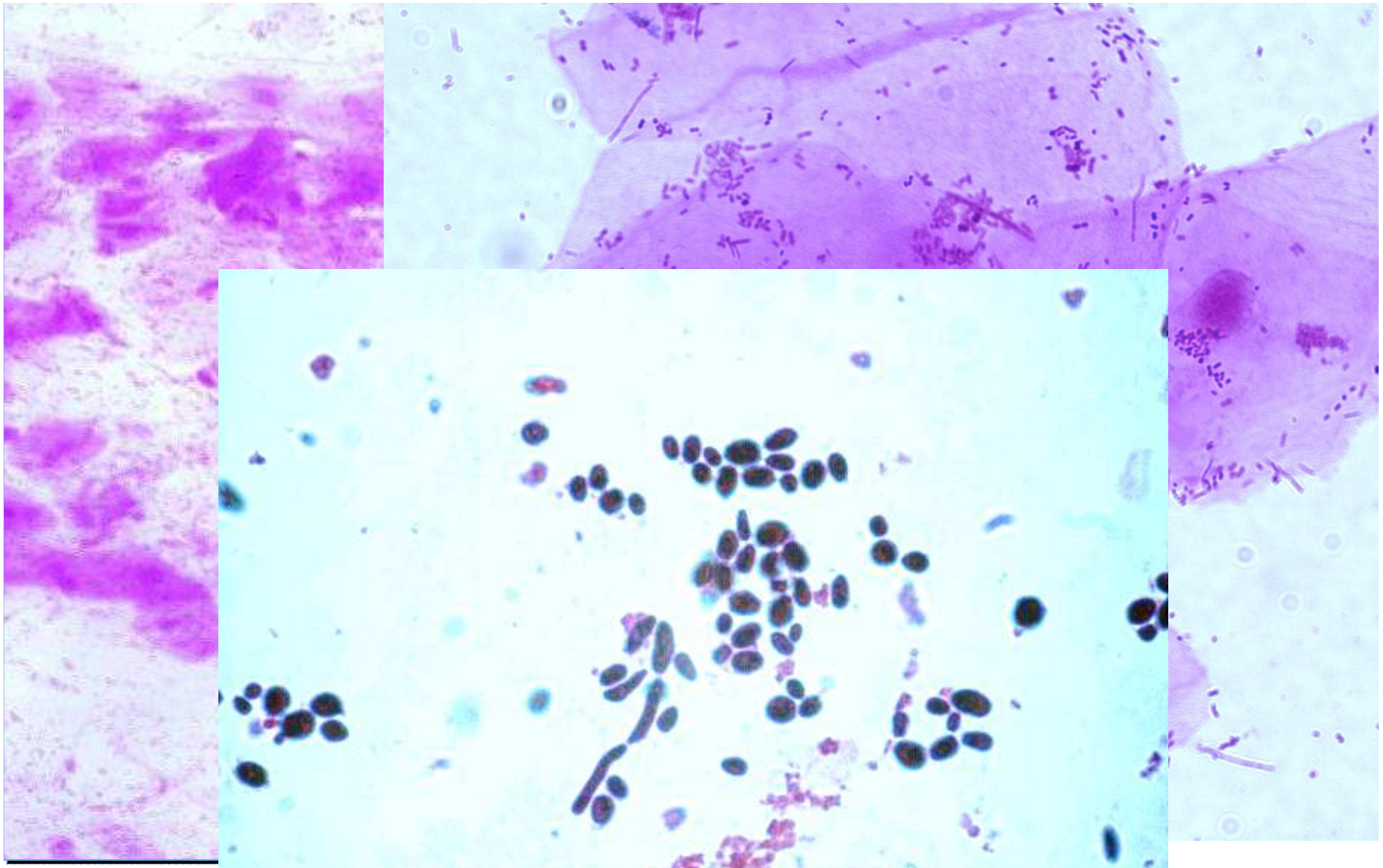
The collection of diagnostic samples (respiratory, urine and blood) should be carried out before the administration of antimicrobials in order to increase the likelihood of a microbiological diagnosis but initiation of treatment should not be delayed in severe cases.

Gram Microscopy

- Gram stains on sputum specimens may be used for determining the quality of the specimen
- It may not be appropriate to identify organisms if gross contamination with oropharyngeal flora is evident.
- The main limitation is the difficulty
  good-quality, purulent s
  pneumonia patients de
  particularly older patien

VALIDAZIONE PREANALITICA

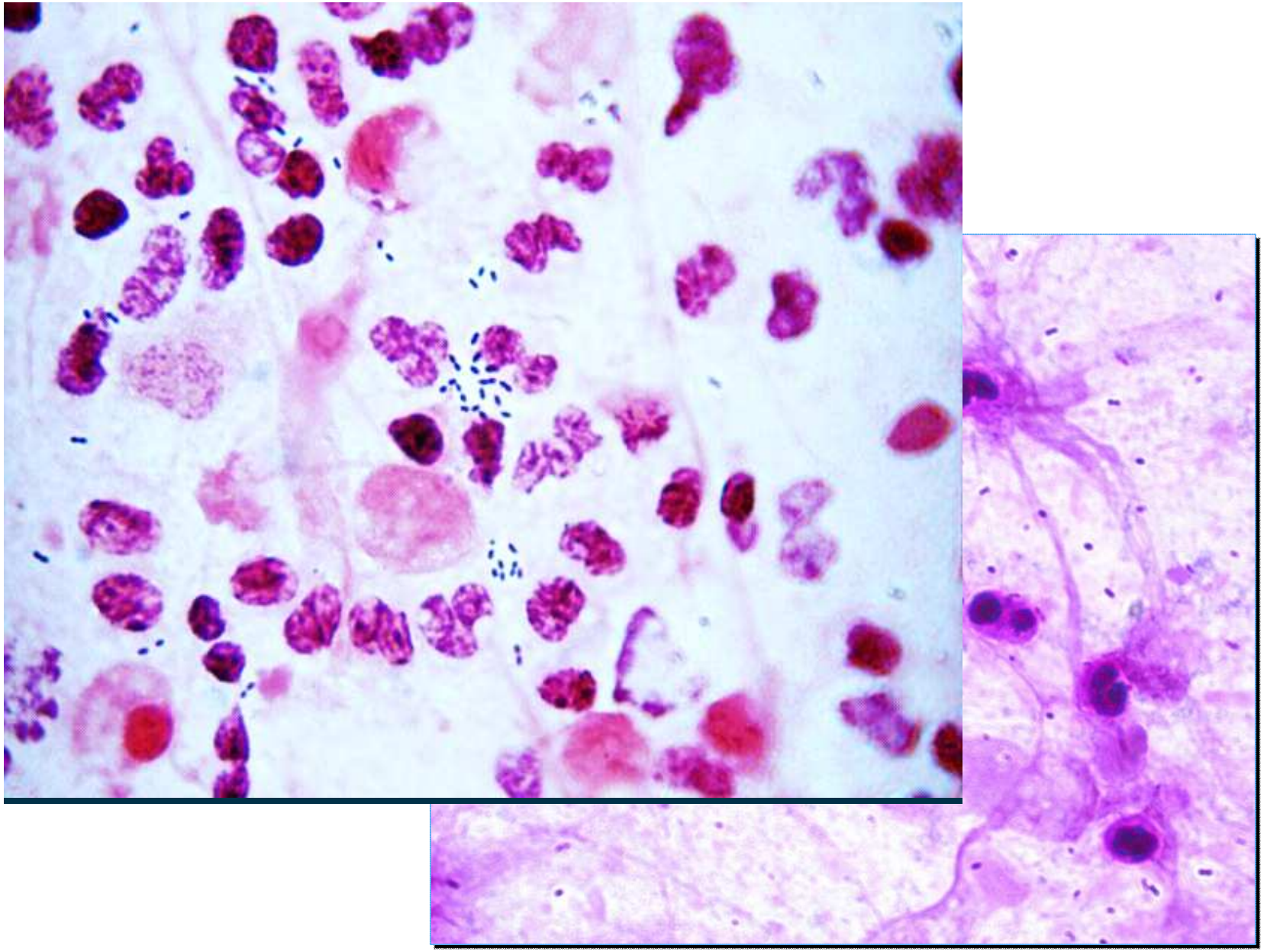
K. Loens. JOURNAL OF CLINICAL MICROBIOLOGY, Jan. 2009



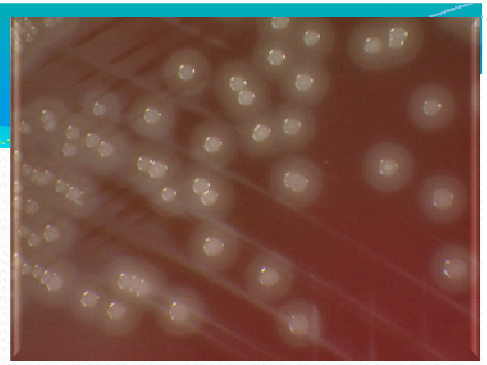
If the patient is immuno-competent,
report poor quality or salivary specimens

Gram Microscopy

- Gram stain can also be used to predict the likely pathogens by their characteristic appearance
- Care must be taken in interpreting a Gram-stained sputum smear as the use of antimicrobials may render organisms, which are visible in the smear, non-viable.
- All aspects of specimen appearance, Gram stain and culture together with the clinical condition of the patient need to be considered.



Culture



Culture remains a cornerstone of the diagnostic techniques, as it can provide information about antibiotic susceptibility.

K. Stralin. International Journal of Antimicrobial Agents 31 (2008)

Microbiological Testing and Outcome of Patients With Severe Community-Acquired Pneumonia*

Jordi Rello, MD, PhD; Maria Bodi, MD; Dolors Mariscal, MD; Marta Navarro, MD; Emili Diaz, MD; Miguel Gallego, MD; and Jordi Valles, MD, PhD

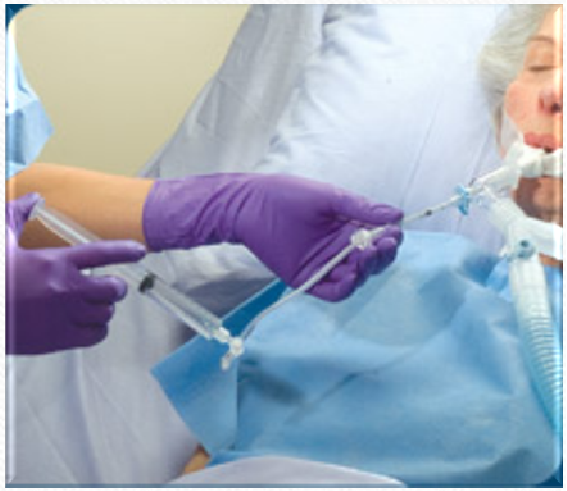
The result of microbiologic investigations in the clinical setting of critically ill patients led to a change in therapy in approximately 40% of cases (and in 75% of patients in whom the etiology was identified).

CHEST / 123 / 1 / JANUARY, 2003

A sterile culture from the lower respiratory tract of an intubated patient, in the absence of a recent change in antibiotic therapy, is strong evidence that pneumonia is not present, and an extrapulmonary site of infection should be considered.

ATS/IDSA. Am J Respir Care Med. 2005.

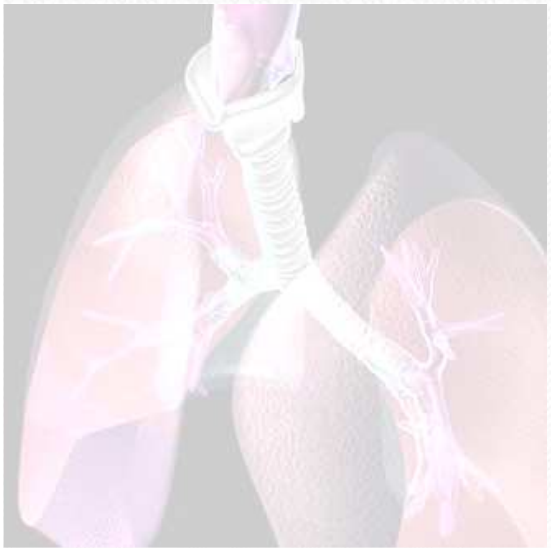
Samples of lower respiratory tract secretions should be obtained from all patients with suspected HAP, and should be collected before antibiotic changes. Samples can include an endotracheal aspirate, bronchoalveolar lavage sample, or protected specimen brush sample (**Level II**).



Guidelines for the Management of Adults with Hospital-acquired, Ventilator-associated, and Healthcare-associated Pneumonia. Am J Respir Crit Care Med Vol 171. 2005

The specificity of bronchoscopy for the diagnosis of LRTI is not high because of contamination with the upper airway flora

Diagnostic accuracy is improved by the use of a protected specimen brush (PSB) and BAL.



K. Loens. JOURNAL OF CLINICAL MICROBIOLOGY, Jan. 2009,

The diagnostic threshold to discriminate infection from colonization varies with the technique used.

Sample	Cut-off	Sensitivity	Specificity
Brush (PSB)	**≥ 10^3**	33 – 100%	50 –100%
BAL	**≥ 10^4**	42 –93%	45 –100%
Endotracheal aspirate more representative samples than the PSB, which samples only a single bronchial segment	**≥ 10^6**	38-82%	72-85%

- ATS/IDSA. Am J Respir Care Med. 2005
- K. Loens. JOURNAL OF CLINICAL MICROBIOLOGY, Jan. 2009

Feature or Organism	Patients Who Received Invasive Management (n = 204)	Patients Who Received Clinical Management (n = 209)
Negative culture, *n (%)*	114 (55.9)	30 (14.4)
Monomicrobial pneumonia, *n (%)*	65 (31.9)	84 (40.2)
Polymicrobial pneumonia, *n (%)*	25 (12.3)	95 (45.5)
Total number of pathogens, *n*	121	312
Bacilli, *n (%)*		
Pseudomonas aeruginosa	27 (22.3)	57 (18.3)
Haemophilus influenzae	9 (7.4)	12 (3.8)
Escherichia coli	6 (5.0)	23 (7.4)
Acinetobacter baumannii	6 (5.0)	11 (3.5)
Enterobacter species	4 (3.3)	12 (3.8)
Proteus species	3 (2.5)	14 (4.5)
Serratia marcescens	3 (2.5)	7 (2.2)
Klebsiella species	2 (1.7)	11 (3.5)
Citrobacter species	1 (0.8)	7 (2.2)
Morganella morganii	1 (0.8)	3 (1.0)
Moraxella species	1 (0.8)	1 (0.3)
Stenotrophomonas maltophilia	0	4 (1.3)
Corynebacterium	0	4 (1.3)
Alcaligenes xylosoxidans	0	1 (0.3)
Cocci, *n (%)*		
Staphylococcus aureus	20 (16.5)	40 (12.8)
Streptococcus species	19 (15.7)	28 (9.0)
Neisseria species	7 (5.8)	6 (1.9)
Streptococcus pneumoniae	3 (2.5)	10 (3.2)
Coagulase-negative staphylococci	3 (2.5)	17 (5.4)
Enterococcus species	1 (0.8)	6 (1.9)
Fungi, *n (%)*	5 (4.1)	38 (12.2)

Fagon JY et al for the VAP Trial Group. Ann Intern Med. 2000

Clinical management: qualitative cultures of endotracheal aspirates

Invasive management: quantitative cultures of protected specimen bronchoalveolar lavage samples

a strategy based on quantitative bronchoscopic specimen cultures has beneficial effects: improved early survival, fewer early organ failures, and less antibiotic use.

Blood cultures

- Two blood cultures should be obtained as early as possible in the disease and before any antibiotic treatment is started.
- A direct correlation was found between the severity of pneumonia and blood culture positivity rate
- S. pneumoniae is identified in approximately 60% of positive blood cultures and Haemophilus influenzae in various percentages from 2 to 13%.

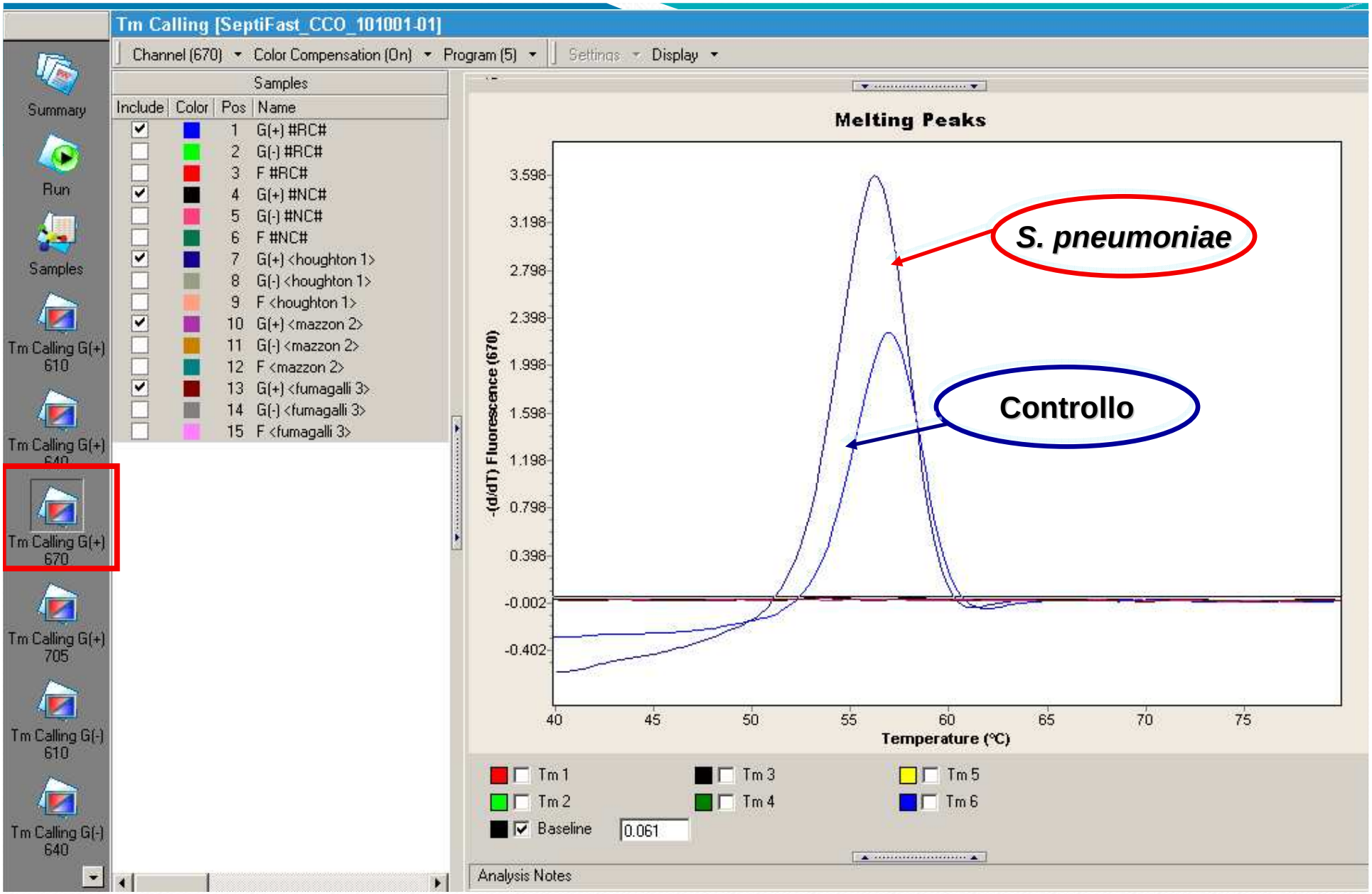
- Waterer, G. W. et al.. Respir. Med. 2001; 95:78–82
- K. Loens. JOURNAL OF CLINICAL MICROBIOLOGY, Jan. 2009.

Multiplex PCR

The SeptiFast test is more sensitive in the detection of relevant blood pathogens in VAP than the blood culture.

VALUE OF LIGHTCYCLER SEPTIFAST® IN DETECTION OF VENTILATOR-ASSOCIATED PNEUMONIA

A. Kalenka, J. Timm, S. Schmid, G. Beck.- ESICM -Vienna 2009


Tm Calling [SeptiFast_CCO_101001-01]
Channel (670)
Color Compensation (On)
Program (5)
Settings
Display
Summary
Run
Samples
Tm Calling G(+) 610
Tm Calling G(+) 640
Tm Calling G(+) 670
Tm Calling G(+) 705
Tm Calling G(-) 610
Tm Calling G(-) 640
Samples
Include
Color
Pos
Name
1 G(+) #RC#
2 G(-) #RC#
3 F #RC#
4 G(+) #NC#
5 G(-) #NC#
6 F #NC#
7 G(+) <houghton 1>
8 G(-) <houghton 1>
9 F <houghton 1>
10 G(+) <mazzon 2>
11 G(-) <mazzon 2>
12 F <mazzon 2>
13 G(+) <fumagalli 3>
14 G(-) <fumagalli 3>
15 F <fumagalli 3>
Melting Peaks
-(d/dT) Fluorescence (670)
3.598
3.198
2.798
2.398
1.998
1.598
1.198
0.798
0.398
-0.002
-0.402
40
45
50
55
60
65
70
75
Temperature (°C)
S. pneumoniae
Controllo
Tm 1
Tm 2
Tm 3
Tm 4
Tm 5
Tm 6
Baseline
0.061
Analysis Notes

S. pneumoniae

Rapid immunochromatographic test detecting the group C polysaccharide cell wall antigen common to all pneumococcal strains in urine and other biological fluids

It can give positive results in healthy children with carriage of pneumococci and of other closely related Streptococcus species

Thus, it is necessary to use this test in conjunction with other diagnostic modalities.

Sensitivity: 77%–88%
Specificity: 67%–100%

A. J. Blaschke. CID 2011:52 (Suppl 4)

Persistence of *S. pneumoniae* urinary antigen excretion after pneumococcal pneumonia

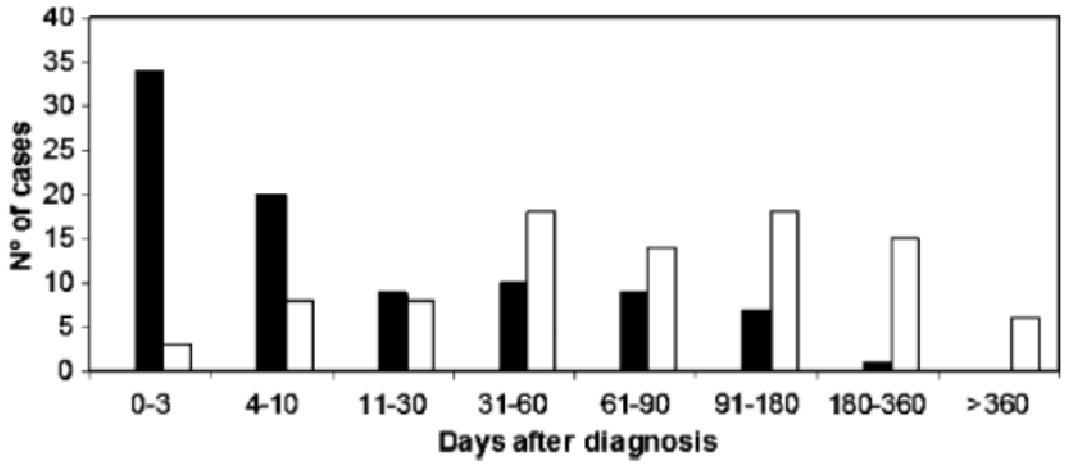
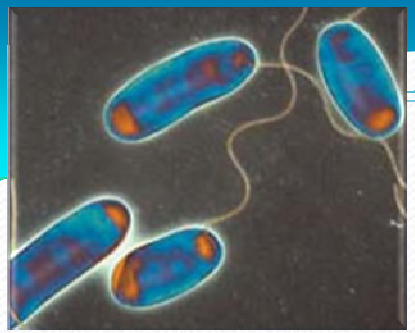


Fig. 1 Distribution of positive (*black*) and negative (*white*) results of *S. pneumoniae* urinary antigen detection in NCU samples collected during the study period

F. Andreo. Eur J Clin Microbiol Infect Dis (2009) 28:197–201



Legionella

- Investigations for legionella pneumonia are recommended for all patients with high severity CAP, for other patients with specific risk factors and for all patients with CAP during outbreaks.

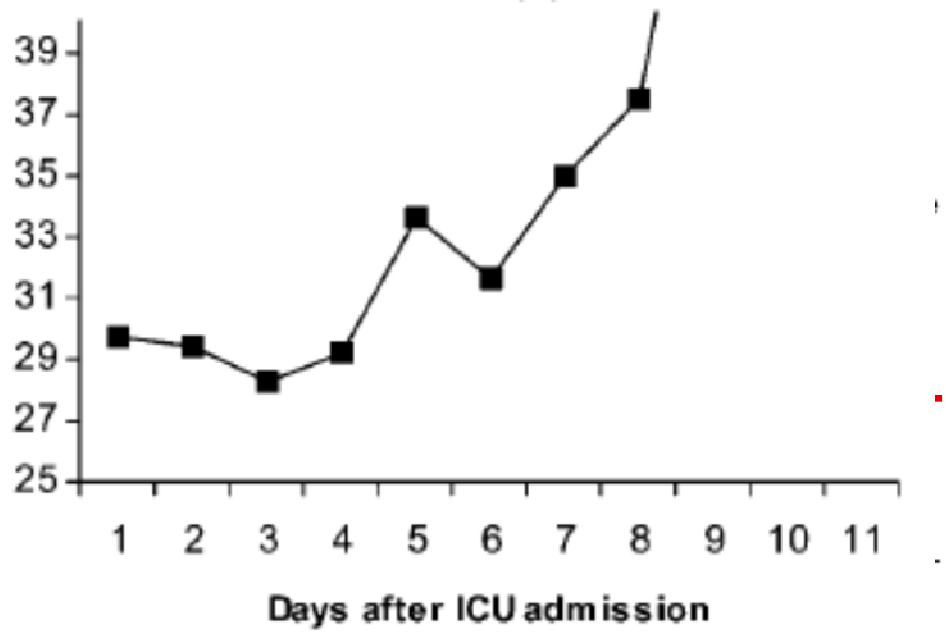
- This assay principally detects infection with *L pneumophila serogroup 1*.

- Antigenuria can be detected as early as 1 day after onset of symptoms and persists for days to weeks.

Table 1. Diagnostic tests for *Legionella* infection.

Test	Turnaround time	Sample type	Sensitivity, %	Specificity, %	Comments
Culture	3–7 Days	LRT	<10–80	100	Detects all species and serogroups
		Blood	<10	100	Too insensitive for clinical use
Direct fluorescent antibody staining	<4 h	LRT	25		
Antigen detection	<1 h	Urine	70		
Serological testing	3–10 Weeks	Serum	60		
PCR	<4 h	LRT	80		
		Serum	30		
		Urine	46		

NOTE. LRT, lower respiratory tract.



Legionella PCR combined with urinary antigen testing is likely to be the best initial testing strategy that will detect all *Legionella* species and provide results within a time frame that will affect clinical management.

D. R. Murdoch. MEDICAL MICROBIOLOGY • CID 2003:36

Atypical pathogens

- *Mycoplasma pneumoniae*: younger patients, prior antibiotics, less multisystem involvement.
- *Chlamydophila pneumoniae*: longer duration of symptoms before hospital admission, headache
- *M. pneumoniae*, and to a lesser extent *C. pneumoniae*, may precipitate an attack of asthma or exacerbate existing asthma.
- Some patients who have recently had *M. pneumoniae* CAP develop post-CAP asthma which may be permanent.

B. A. Cunha. Clin Microbiol Infect 2006; 12 (Suppl. 3): 12–24

Atypical pathogens

- The outpatient setting is the area where atypical pathogens are quantitatively more important than their typical CAP counterparts.
- The atypical pneumonias require a different therapeutic approach than that for typical CAPs.
- The treatment of *M. pneumoniae* and *C. pneumoniae* CAP is important, not because of the severity of the illness, but if for no other reason, to decrease communicability and to decrease post-CAP asthma

B. A. Cunha. Clin Microbiol Infect 2006; 12 (Suppl. 3): 12–24

Atypical pathogens

Given the high sensitivity and specificity of nucleic acid amplification techniques (NAATs), NAATs are the preferred diagnostic procedures for the diagnosis of *M. pneumoniae* and *C. pneumoniae*

The best specimen for *M. pneumoniae* and *C. pneumoniae* detection are nasopharyngeal aspirate or nasopharyngeal swab since inhibitors in sputum occur frequently and may be difficult to eliminate

B. A. Cunha. Clin Microbiol Infect 2006; 12 (Suppl. 3).

Panel: Viruses linked to community-acquired pneumonia in children and adults

- Respiratory syncytial virus
- Rhinovirus
- Influenza A, B, and C viruses
- Human metapneumovirus
- Parainfluenza viruses types 1, 2, 3, and 4
- Human bocavirus*
- Coronavirus types 229E, OC43, NL63, HKU1, SARS
- Adenovirus
- Enteroviruses
- Varicella-zoster virus
- Hantavirus
- Parechoviruses
- Epstein-Barr virus
- Human herpesvirus 6 and 7
- Herpes simplex virus
- Mimivirus
- Cytomegalovirus†
- Measles†

*Mostly in children. †Mostly in developing countries.

	Suggests viral cause	Suggests bacterial cause
Age	Younger than 5 years	Adults
Epidemic situation	Ongoing viral epidemic	..
History of illness	Slow onset	Rapid onset
Clinical profile	Rhinitis, wheezing	High fever, tachypnoea
Biomarkers		
Total white-blood cell count	$<10\times10^9$ cells per L	$>15\times10^9$ cells per L
C-reactive protein concentration in serum	<20 mg/L	>60 mg/L
Procalcitonin concentration in serum	<0·1 µg/L	>0·5 µg/L
Chest radiograph findings	Sole interstitial infiltrates, bilaterally	Lobar alveolar infiltrates
Response to antibiotic treatment	Slow or non-responsive	Rapid

***Table 1*: Variables used to distinguish viral from bacterial pneumonia**

No clinical algorithm exists to discern clearly the cause of pneumonia.

Respiratory viruses usually follow seasonal patterns of activity and are most likely to cause pneumonia during those times.

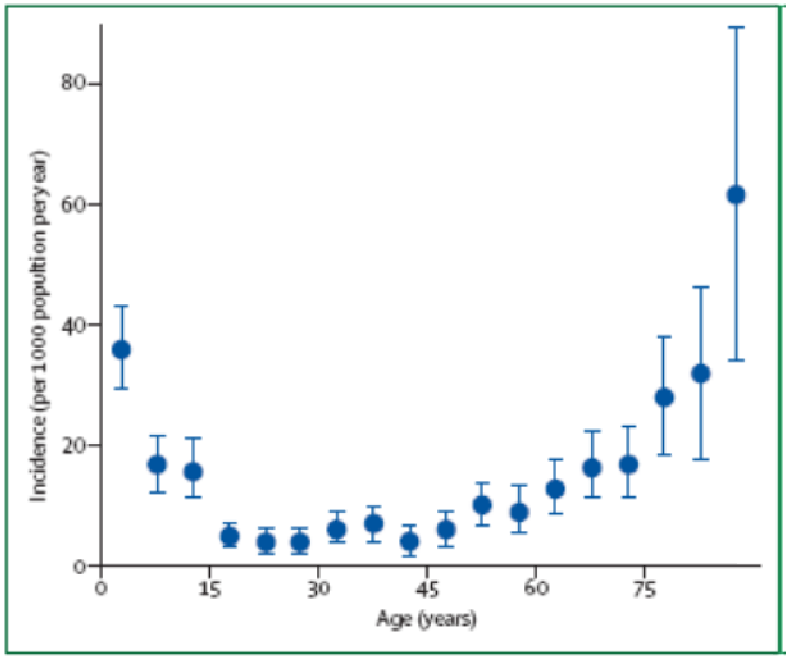


***Figure 1*: Age-specific incidence of community-acquired pneumonia**
Error bars=95% CIs. Modified from reference 8 with permission of Oxford University Press.

Perché diagnosi di infezione virale?

The knowledge of which virus or viruses is/are present and who has had close contact may guide for prophylaxis or use of antiviral agents.

- If a child with chronic cardiac disease has an increased risk of catching RSV, then palivizumab can be administered to prevent more severe complications from RSV infection.
- The treatment of the influenza virus infection increase survival in persons who are at high risk for complications and mortality during influenza.

It is clear that rapid and accurate diagnosis is central to such therapy decisions.

K. TempletonJ ournal of Clinical Virology 40 Suppl. 1 (2007) S2–S4

Optimal samples in viral pneumonia

- In children, for detection by PCR of respiratory viruses nasopharyngeal aspirates are generally deemed the specimen of choice because both nasal and nasopharyngeal mucus samples are gathered.
- In adults, transnasal nasopharyngeal flocked swabs also have high virus detection rates.
- Lower-resp… …ecimens have obvious …blishing the cause of …ey come from the site of …

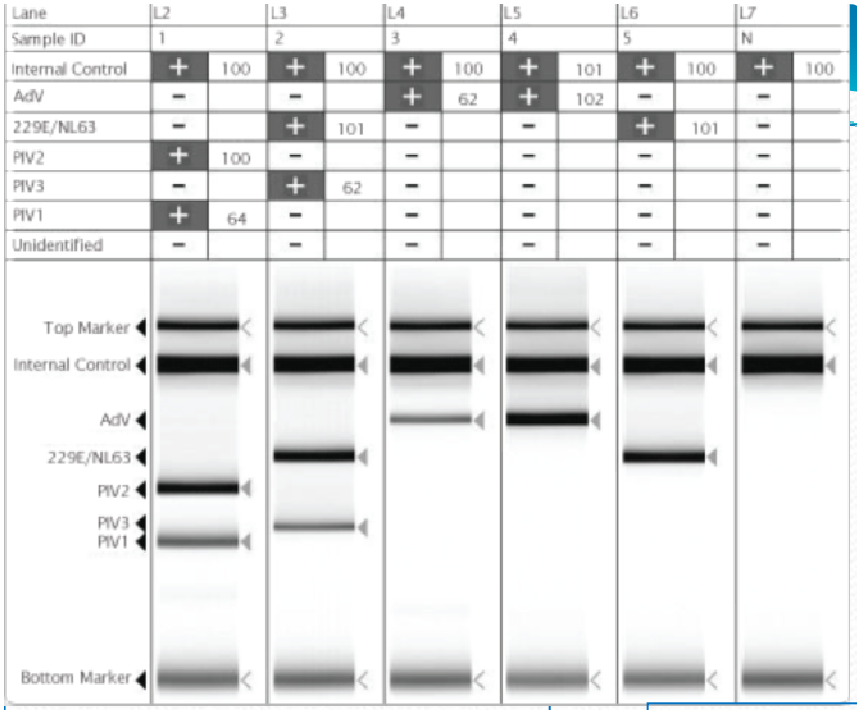
UTM-RT medium are well suited for the detection of respiratory viruses by PCR.

O. Ruuskanen et al. www.thelancet.com Vol 377 April 9, 2011

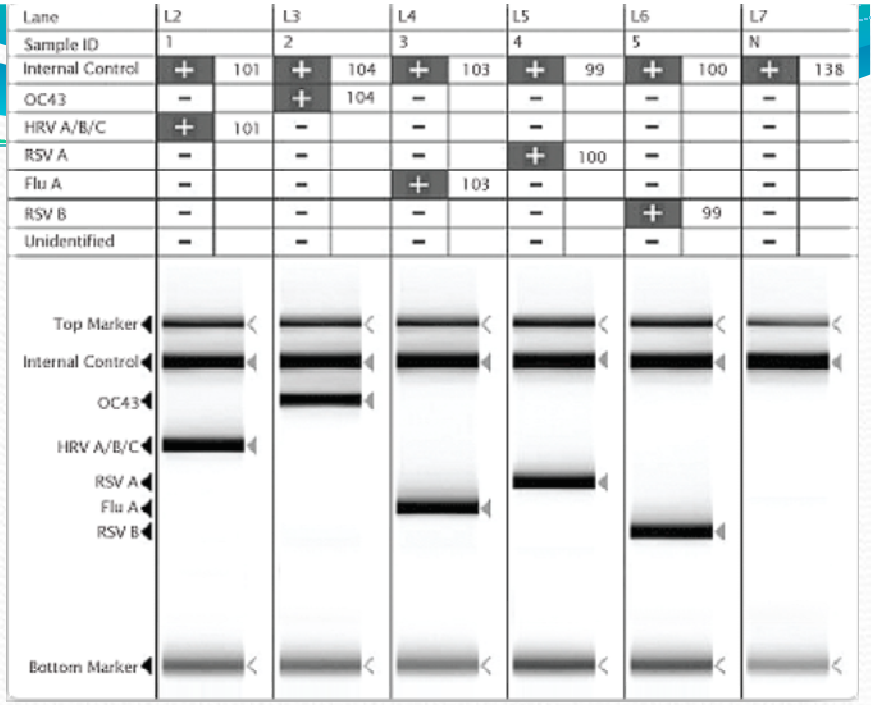
TABLE 1. Comparison of specimens and sampling methods for the detection of different respiratory pathogens[a]

Pathogen	Sample ranking	Method	Age (yr)	Total no. of specimens/ no. of patients	Reference
M. pneumoniae	Sputum > TW > NPS > OPS	PCR	20–93	552/144	31
	OPS > NPS	PCR	NSp	132/66	43
	OPS > BAL > sputum	PCR	NSp	325/197	49
	Sputum > OPS	Gene-probe test	>18	160	57
	Sputum > NPA	Ag-EIA	>18	102/51	56
	Sputum > OPS	Culture, PCR, NASBA	NSp	302/180	61, 62
	NPS = OPS	PCR	NSp	63	69
	Sputum > NPA = OPS	PCR	22–29	96/32	79
	OPS > NPA	PCR	NSp	102	82
C. pneumoniae	NPS > TS	Culture, PCR	3–12	260	10
	Sputum > NPS = OPS	PCR, culture	3–79	319/129	12
	OPS > NPS	PCR	NSp	132/66	43
	Sputum > NPA > OPS	PCR	NSp	105/35	58
	NPS > OPS > sputum	PCR	20–93	468/156	103
RSV	PFS = NPA	DFA	0–5	910/455	1
	NPA > NPFS	PCR	0–18	338/169	19
	NPA > NPFS	DIF	0–18	338/169	19
	NPA = NPS	Culture, IFA	0–16	250/125	38
	NPA > NPS	DIF	0–2	366/183	64
	NPA > NPS	Culture, Ag-EIA, FAT	0–18	242/121	67
Adenovirus	PFS = NPA	DFA	0–5	910/455	1
Parainfluenza virus 1, 2, or 3	PFS = NPA	DFA	0–5	910/455	1
Picornaviruses	Sputum > NS > OPS	Culture	5–15	66/22	50
Influenza virus	PFS = NPA	DFA	0–5	910/455	1
	NPS > NS > NPA	Quidel quickvue	0–18	366/122	2
	NPFS = NPA	PCR	0–18	338/169	19
	NPA > NPFS	DIF	0–18	338/169	19
	Sputum > NA > NPS > OPS	FLU OIA test	0–76	403/184	24
	NA > sputum > NPS > OPS	Culture	0–76	403/184	24
	NPS > NPA > OPS	PCR, Directigen Flu A+B	61–97	85/47	44
	NPS > OPS	Binax Now, Directigen Flu A+B, DIF	NSp	521/448	93
All viruses	NPA>NS = OPS	PCR	0–16	221/178	46
	NPS = NA >unpreserved saline	PCR	0–1.5	543/181	105
	NPA > NS	PCR, culture, DIF	≤5	950/475	97

[a] BAL, bronchoalveolar lavage; DIF, direct immunofluorescence; DFA, direct fluorescent antibody assay; Ag-EIA, antigen enzyme immunoassay; IFA, indirect fluorescent antibody test; FAT, fluorescent antibody test; NA, nasal aspirate; NASBA, nucleic acid sequence-based amplification; NPA, nasopharyngeal aspirate; NPFS, nasopharyngeal flocked swab; NFS, nasal flocked swab; NPS, nasopharyngeal swab; NW, nasal wash; NSp, not specified; NS, nasal swab; OPS, oropharyngeal swab; PFS, pernasal flocked swab; TW, throat wash. (Adapted from reference 111 with permission of the publisher.)

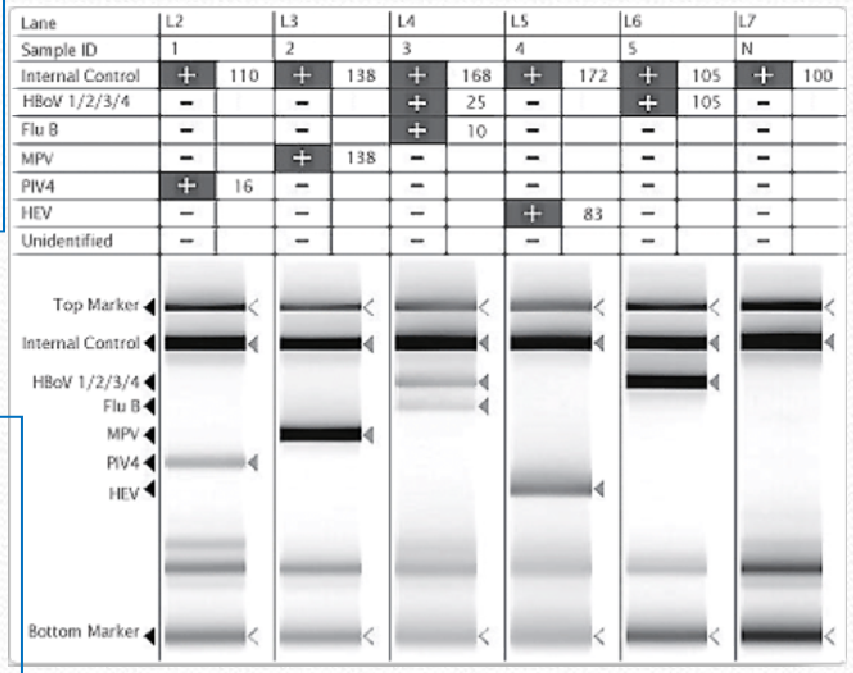


Parainfluenza virus 1
Parainfluenza virus 2
Parainfluenza virus 3
Adenovirus A/B/C/D/E
Coronavirus 229E/NL63

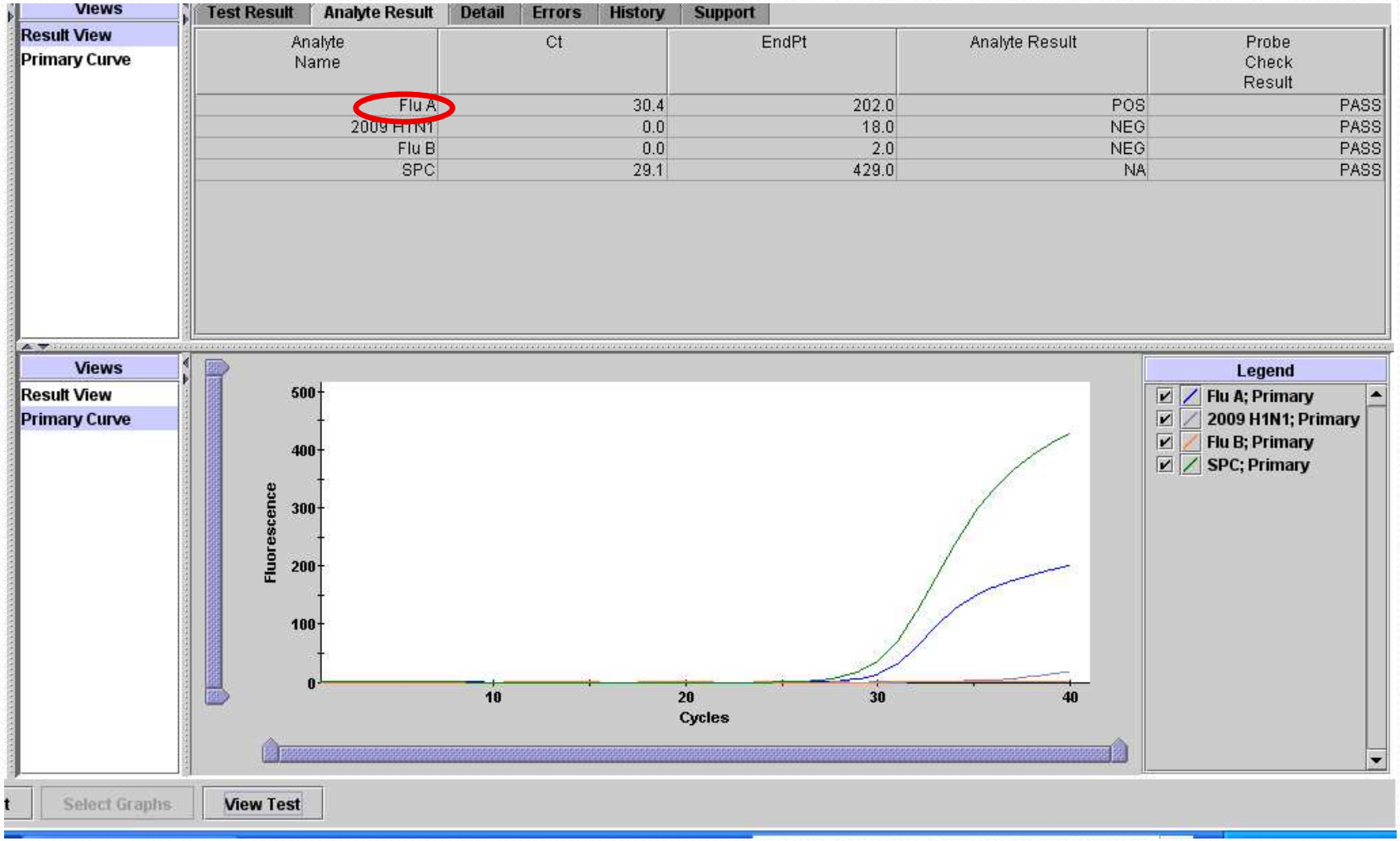


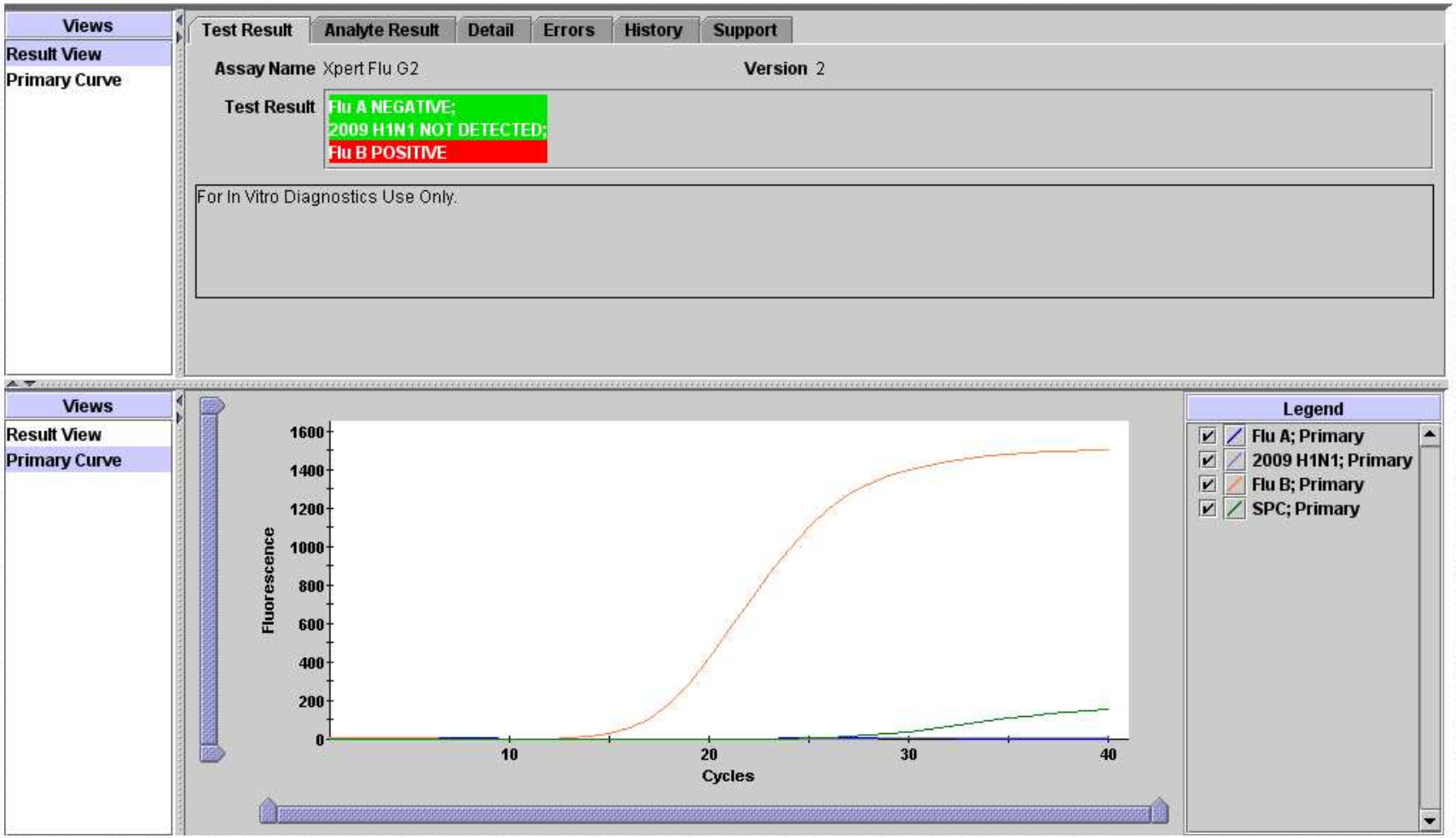
Coronavirus OC43
Rhinovirus A/B/C
Influenza A virus
RSV A
RSV B

Multiplex PCR
Single gene target PCR



Bocavirus 1/2/3/4
Influenza B virus
Metapneumovirus
Parainfluenza virus 4
Enterovirus


Views
Result View
Primary Curve
Test Result
Analyte Result
Detail
Errors
History
Support
Analyte Name
Ct
EndPt
Analyte Result
Probe Check Result
Flu A 30.4 202.0 POS PASS
2009 H1N1 0.0 18.0 NEG PASS
Flu B 0.0 2.0 NEG PASS
SPC 29.1 429.0 NA PASS
Views
Result View
Primary Curve
Fluorescence
500
400
300
200
100
0
10
20
30
40
Cycles
Legend
Flu A; Primary
2009 H1N1; Primary
Flu B; Primary
SPC; Primary
Select Graphs
View Test


Views
Result View
Primary Curve
Test Result
Analyte Result
Detail
Errors
History
Support
Assay Name Xpert Flu G2
Version 2
Test Result
Flu A NEGATIVE;
2009 H1N1 NOT DETECTED;
Flu B POSITIVE
For In Vitro Diagnostics Use Only.
Views
Result View
Primary Curve
Fluorescence
1600
1400
1200
1000
800
600
400
200
0
10
20
30
40
Cycles
Legend
Flu A; Primary
2009 H1N1; Primary
Flu B; Primary
SPC; Primary

Detection of several viruses

- For childhood pneumonia, two or three viruses have been detected in 10–20% of children.
- Specifically, human bocavirus is detected frequently in association with other respiratory viruses
- Detection of a virus in the nasopharynx could represent coincidental upper-respiratory infection or a pneumonia pathogen ?
- In one study, viral co-infe… …re severe pneumonia than w… …rates of admission were looked at

No colonisation for virus

Bacterial co-infection in influenza A H1N1 Pneumonia

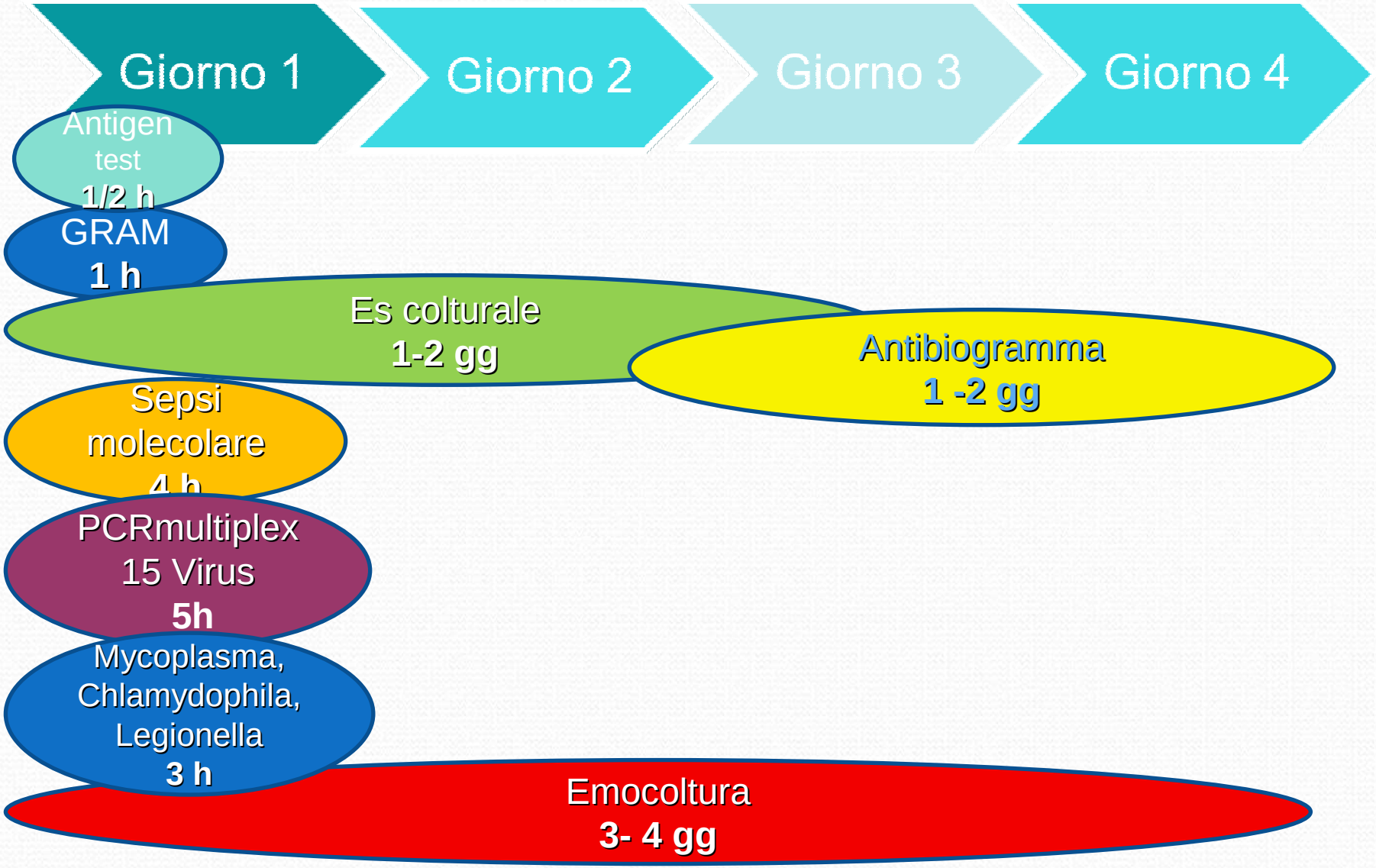
Table 2 Bacterial co-infection in study populations.[a]

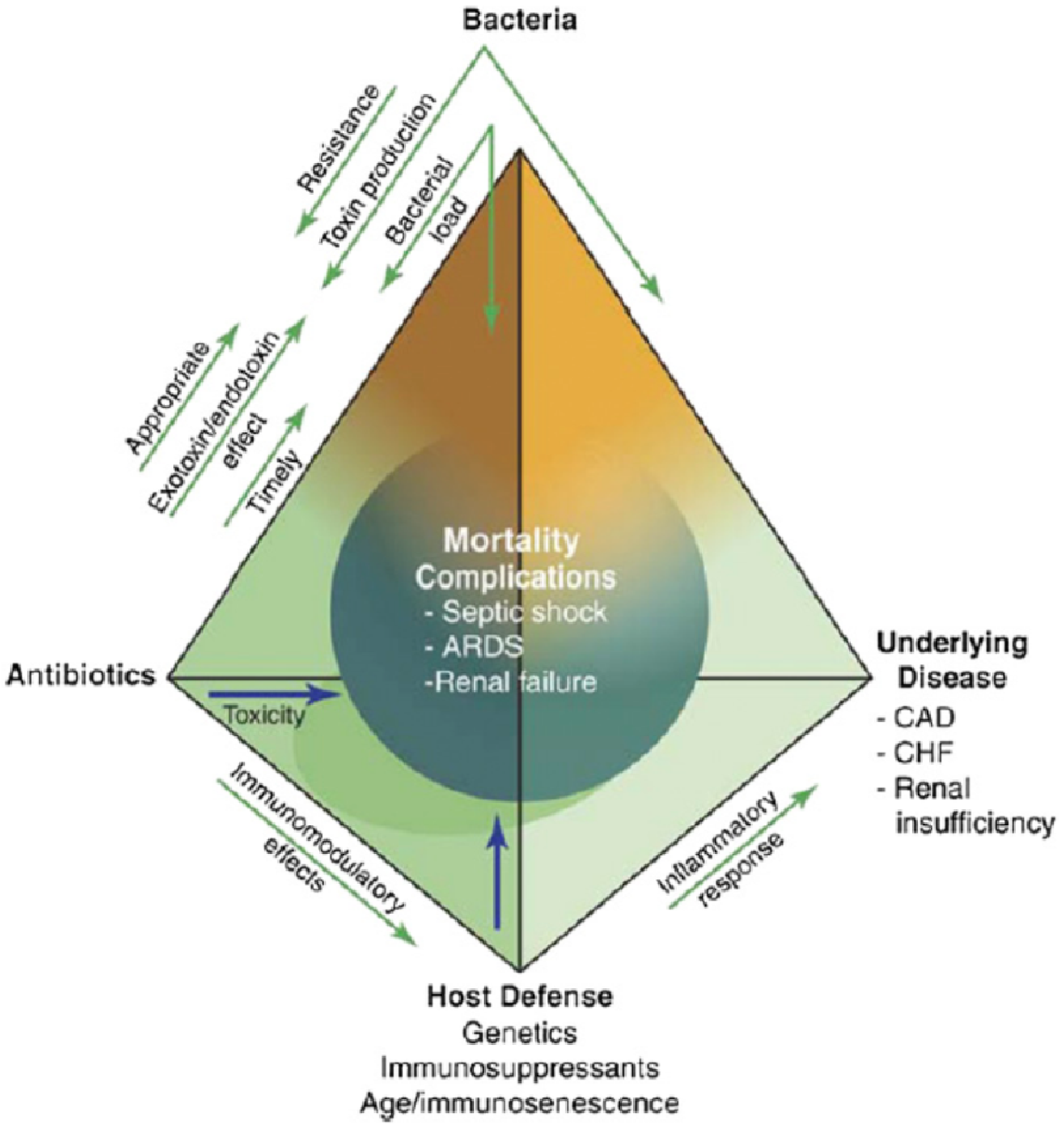
Pathogen	Number of patients[b] ($n = 42$)	Blood culture ($n = 38$)	Sputum culture ($n = 16$)	Urinary antigen ($n = 39$)	BAL/BAS ($n = 9$)	Pleural effusion culture ($n = 3$)	Serology ($n = 30$)
S. pneumoniae	26 (62)	3 (7.8)	7 (43.7)	24 (61.5)	3 (33.3)	–	–
S. pyogenes	1 (2)	–	1 (6.3)	–	–	1 (33.3)	–
S. aureus	2 (5)	–	2 (12.5)	–	–	–	–
M. pneumoniae	3 (7)	–	–	–	–	–	3 (10)
M. catarrhalis	1 (2)	–	1 (6.3)	–	–	–	–
C. burnetti	1 (2)	–	–	–	–	–	1(3.3)
E. coli	1 (2)	–	–	–	1 (11.1)	–	–
P. aeruginosa	6 (14)	–	4 (25.0)	–	5 (55.5)	–	–
Fusobacterium sp.	1 (2)	1(2.6)	–	–	–	–	–

[a] Data are presented as number (percentage).
[b] Total number of patients for each etiologic agent.

C. Cilloniz et al.Journal of Infection (2012) 65, 223e230

TAT diagnosi polmonite





G.W. Waterer. Am J Respir Crit Care Med. 2011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