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The appropriateness of community-acquired pneumonia guideline recommendations for treatment of healthcare-associated pneumonia in countries with low antibiotic resistance

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Background: Since 2005 healthcare-associated pneumonia (HCAP) is distinguished from community-acquired pneumonia (CAP) and hospital-acquired pneumonia (HAP), with HCAP defined as pneumonia in patients with recent hospital admission, nursing home or long-term care residence or having received recent wound care, dialysis, intravenous antibiotic therapy or chemotherapy. As the etiology of HCAP and HAP are considered similar, broad-spectrum antibiotics are recommended for empiric treatment in international guidelines. Yet, it is unknown whether this recommendation is appropriate in countries with low levels of antibiotic resistance where CAP guidelines recommend narrow-spectrum beta-lactam monotherapy for empiric treatment of non-severe CAP. Therefore, we evaluated the diagnostic value of HCAP criteria to identify patients with pneumonia in which narrow-spectrum beta-lactam antibiotics (amoxicillin) are not appropriate.

Material/methods: We used data from the CAP-START trial, performed between February 2011 and August 2013 in 7 hospitals in the Netherlands (Postma, NEJM 2015) in which 2,283 patients with clinically suspected CAP were enrolled. HCAP criteria, microbiologic test results and susceptibility patterns were retrieved from medical records. In case of missing susceptibility testing, missing values

from pathogens with <5% or >95% amoxicillin resistance in national surveillance data were assumed to be sensitive or resistant, respectively. In a sensitivity analysis, remaining pathogens with missing susceptibility were either assumed to be sensitive (best-case scenario) or resistant (worst-case scenario).

Results: 527 of 2283 (23,1%) patients were classified as HCAP. HCAP patients were older (72 vs 70 years) and had higher disease severity (PSI-score 137 vs 132). Predominant identified pathogens causing HCAP and CAP were *Streptococcus pneumoniae* (12% vs 15%), *Haemophilus influenza* (7% vs 6%), *Staphylococcus aureus* (5% vs 2%), *Pseudomonas* species (4% vs 2%) and *Escherichia coli* (6% vs 2%). Sensitivity of HCAP criteria to predict amoxicillin resistance was 33,6%-37,6%; the positive predictive value was 11,8%-15,4% while the negative predictive value was 90,9%-94,1% (Table).

Conclusions: In comparison to CAP, HCAP is more frequently caused by *S. aureus, Pseudomonas species* and *E. coli*, but the absolute risks are low. The prevalence of a pathogen being amoxicillin resistant is 11,8%-15,4% in HCAP versus 5,9%-9,1% in CAP patients. In countries that recommend narrow-spectrum beta-lactam as empiric treatment, it is unknown whether HCAP patients benefit from broader antibiotic coverage. The appropriate empiric therapy for HCAP patients should be investigated in future randomized clinical trials.

Table. Microbiology results and diagnostic value of HCAP criteria

Microbiology (n (%))	**CAP (1756)**	**HCAP (527)**
Amoxicillin sensitive	192 (10,9)	40 (7,6)
Amoxicillin resistant	103 (5,9)	62 (11,8)
Amoxicillin susceptibility missing	57 (3,2)	19 (3,6)
No bacterial pathogen	1404 (80)	406 (77)

HCAP criteria (% (95% CI))	**Best-case scenario**	**Worst-case scenario**
Sensitivity	37,6 (30,2-45,4)	33,6 (27,7-40,0)
Specificity	78,0 (76,2-79,8)	78,2 (76,3-79,9)
Positive predictive value	11,8 (9,1-14,8)	15,4 (12,4-18,7)
Negative predictive value	94,1 (92,9-95,2)	90,9 (89,4-92,1)