Critical Review Form
Therapy

PGY-2

Webb BJ, Sorensen J, Mecham I, Buckel W, Ooi L, Jephson A, Dean NC. Antibiotic Use and Outcomes After Implementation of the Drug Resistance in Pneumonia Score in ED Patients With Community-Onset Pneumonia. Chest. 2019 May 8. pii: S0012-3692(19)31012-8.

Objectives: **To "report the impact of integrating the DRIP [Drug-Resistance in Pneumonia] score into ePNa on broad-spectrum antibiotic use and clinical outcomes." (p. 2)**

Methods: **This observational before and after study was conducted at four Salt Lake County Intermountain Healthcare hospitals in Utah over two periods from December 1, 2011 to November 30, 2012 and October 24, 2014 to September 30, 2015. Patients with radiographically confirmed pneumonia admitted through the ED were eligible for inclusion. During the initial study period (ePNa-HCAP), a web-based, real-time, electronic support tool called ePNa was programmed to guide admission decisions and make antibiotic recommendations for patients diagnosed with pneumonia based on HCAP criteria. Prior to the second study period (ePNa-DRIP), this support tool was reprogrammed using the DRIP score. Patients in the two time periods were further divided into two subgroups: those in whom the treating providers used ePNa and those in whom providers opted out of using ePNa. The DRIP score was not available outside of ePNa use.**

For patients with a DRIP score < 4, ePNa recommended ceftriaxone and azithromycin whereas for those with a DRIP score ≥ 4, an antipseudomonal beta-lactam, vancomycin, and azithromycin were recommended. The primary outcome was use of broad-spectrum antibiotics (antipseudomonal or MRSA coverage) within 12 hours of ED presentation. Secondary outcomes included total vancomycin dose (days of therapy), 30-day all-cause mortality, hospital length of stay, and total direct cost. Inadequate initial antibiotics were defined by an identified respiratory pathogen (positive blood, sputum, tracheal, BAL fluid, or pleural fluid cultures or positive testing specifically for *Mycoplasma pneumoniae*, *Legionella pneumophilia*, or *Streptococcus pneumoniae*) not covered by the administered antibiotics.

A total of 2169 patients were included, with 1122 in the ePNa-HCAP group and 1047 in the ePNa-DRIP group. The mean ages were 65 and 67, respectively, and 52.5% and 50.6% were female.

Guide		Comments
I.	**Are the results valid?**	
A.	**Did experimental and control groups begin the study with a similar prognosis?**	
1.	Were patients randomized?	No. Group allocation was determined based on the time period during which the patient presented to the ED. This was a before-and-after study and hence has the potential for inherent biases associated with such studies. Specifically, there is a propensity to other interventions being employed in the interim which could affect outcomes.
2.	Was allocation concealed? In other words, was it possible to subvert the randomization process to ensure that a patient would be "randomized" to a particular group?	N/A. Patients were not randomized.
3.	Were patients analyzed in the groups to which they were randomized?	Yes. Patients were not randomized, but they were analyzed based on the time period during which they presented to the ED, regardless of whether ePNa was used by the treating physician.
4.	Were patients in the treatment and control groups similar with respect to known prognostic factors?	Yes. Patients were similar with respect to age, gender, presence medical comorbidities, eCURB mean predicted 30-day mortality, need for vasopressors, need for intubation, lab values, and ePNa use. Fewer patients met HCAP criteria in the ePNa-HCAP group (15.3%) than in ePNa-DRIP group (20.8%).
B.	**Did experimental and control groups retain a similar prognosis after the study started?**	
1.	Were patients aware of group allocation?	No. Patients were likely unaware of the computer-assisted support tool or the HCAP criteria and DRIP scores. They may have been aware of what antibiotics they received, but this would be unlikely to affect the outcomes.
2.	Were clinicians aware of group allocation?	Yes, although they may not have been aware of the study being conducted. They would have been aware of the support tool and the criteria being used to guide antibiotic therapy, and were certainly aware of whether they used this tool or not. It seems unlikely, given the nature of the study, that performance bias on the part of the clinicians would have affected outcomes.

3.	Were outcome assessors aware of group allocation?	Yes. The authors do not mention blinding of outcome assessors, though this would have been possible. The primary outcome (broad-spectrum antibiotic administration) is fairly objective, as were secondary outcomes.
4.	Was follow-up complete?	
II.	**What are the results ?**	

1.	How large was the treatment effect?	• An initial broad-spectrum antibiotic was administered in 40.1% of admissions in the ePNa-HCAP group compared to 33.0% in the ePNa-DRIP group: ARR 7.2%, 95% CI 3.1% to 11.2%.
		  ○ Antipseudomonal coverage decreased from 29.8% to 20.9% (ARR 8.9%, 95% CI 5.2% to 12.5%) and anti-MRSA coverage decreased from 34.8% to 29.4% (ARR 5.3%, 95% CI 1.4% to 9.2%).
		• There was no significant difference between the groups with respect to mortality (OR 0.84, 95% CI, 0.43-1.6), length of stay (OR 0.98, 95% CI, 0.82-1.2), or cost (OR 0.93, 95% CI, 0.75-1.1).
		• The rate of drug-resistant pathogen recovery was similar in the two groups: 3.2% of ePNa-HCAP patients and 2.8% of ePNa-DRIP patients.
		  ○ Inadequate initial empirical antibiotics were prescribed in 1.1% of ePNa-HCAP patients compared with 0.5% of ePNa-DRIP patients (p = 0.12).

2.	How precise was the estimate of the treatment effect?	See above.
III.	**How can I apply the results to patient care?**	
1.	Were the study patients similar to my patient?	Likely yes, though there were some clear differences. A rather large proportion of patients had blood cultures (84%) which seems quite high, and the majority of patients in both groups had a history of COPD (65.4% and 69.9%). These facts suggest this may have been an overall sicker patient population, though given that only admitted patients were enrolled this may not be so different from our institution.
2.	Were all clinically important	Yes. The authors looked not only at antibiotic

	outcomes considered?	prescribing patterns, but also considered potential adverse effects of decreasing broad-spectrum antibiotic use (i.e mortality and length of stay). Direct adverse effects (drug allergy, rash, kidney injury) were not assessed.
3.	Are the likely treatment benefits worth the potential harm and costs?	Yes. In this study, the use of the DRIP score, assisted by a computer-based support tool, appeared to decrease broad-spectrum antibiotic use compared to HCAP criteria, with no apparent adverse effects.

Limitations:

1. **The authors do not provide any inclusion or exclusion criteria, and do not specifically state that only admitted patients were included (though this appears to be the case).**

2. **Authors excluded those without "radiographic confirmation" of pneumonia despite previously reports of low sensitivity.**

3. **It appears that only admitted patients were included in this study, with very high rates of COPD in both cohorts; the vast majority of patients (84%) had blood cultures ordered. This appears to be a relative sick patient population (external validity).**

4. **This was a before-and-after study and hence has the potential for inherent biases associated with such studies.**

Bottom Line:

This observational, before and after study found that implementation of an electronic support system based on the DRIP score, compared to previous system based on HCAP criteria, resulted in a decrease in broad-spectrum antibiotic usage (ARR 7.2%, 95% CI 3.1% to 11.2%) with no difference in mortality, length of stay, or cost.