

Improving Antibiotic Stewardship at JCMC Through Utilization of the PEN-FAST Screening Tool for Surgical Patients with Documented Penicillin Allergy

Russell Lynn Memorial Student Lecture Series

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Background and Significance

- **12.8%** of patients have a penicillin (PCN) allergy documented in their EHR (Zhou et al., 2016)
- **20%** of entries documenting ADRs for penicillin included no reaction description at all (Inglis et al., 2017)
- **95%** of patients labeled as PCN allergic can be safely de-labelled (Blumenthal et al., 2019), though many providers do not ever investigate the allergy further as a true IgE mediated reaction



Risks to Patients

- Patients with a PCN allergy label face increased risks of developing:
 - *C difficile* by **26%**
 - VRE by **30%**
 - MRSA by **69%**
- A patient with a PCN allergy label receiving a second-line antibiotic has a **50%** increased risk of developing a surgical site infection.



Synthesis of Evidence

- True anaphylactic reactions to PCN are rare → **0.001%** with IV PCN (Blumenthal, et al., 2018)
- **90%** of allergic patients can safely tolerate PCN (Blumenthal, et al., 2018)
- Baseless link between PCN and cephalosporin → only **3%** of patients are cross sensitive (Blumenthal et al., 2017)

PCN allergy label treated with a second-line antibiotic leads to:

- Increased lengths of hospital stay
- Increased rates of hospital readmission (Inglis et al., 2017)

Traditional PCN allergy testing is resource intensive:

- **\$220** for PCN skin test
- **3 hours** to administer (Blumenthal et al., 2018)
- **99%** negative predictive value (Stone et al., 2019).

PEN-FAST tool offers a cheaper alternative:

- **\$0** cost per survey
- **<4 minutes** to administer (Copaescu et al., 2022)
- **96%** negative predictive value (Trubiano et al., 2020)



PEN-FAST: Penicillin Allergy Risk



PEN	<i>Penicillin</i> allergy reported by patient	<input type="checkbox"/>	<i>If yes, proceed with assessment</i>	Interpretation	
F	Five years or less since reaction	<input type="checkbox"/>	2 points	Points	
A	Anaphylaxis or angioedema	<input type="checkbox"/>	2 points	0	Very low risk of positive penicillin allergy test (<1%)
OR				1-2	Low risk of positive penicillin allergy test (5%)
S	Severe cutaneous adverse reaction	<input type="checkbox"/>	1 point	3	Moderate risk of positive penicillin allergy test (20%)
T	Treatment required for reaction	<input type="checkbox"/>	1 point	4	High risk of positive penicillin allergy test (50%)
			<input type="checkbox"/>		
			Total points		

***Total points ≤ 2 → low or very low risk → recommend proceeding with cephalosporin administration**

The Mission

- Educate anesthesia providers on how to utilize the penicillin allergy screening tool and encourage its use when caring for adult, non-obstetrical patients with a documented PCN allergy for surgery.
- In doing so, we aim to reduce the amount of second-line antibiotics used in patients with reported penicillin allergies by utilizing the PEN-FAST antibiotic screening tool.



Methodology: An Overview



- **Setting:** 348 bed tertiary care teaching center
- **Population:** anesthesia providers caring for adult surgical patients reporting a penicillin allergy
- **Inclusion Criteria:** all physician anesthesiologists and CRNAs providing care to adult, non-obstetrical, surgical patients with documented penicillin allergy
- **Exclusion Criteria:** anesthesia providers providing care to patients with history of an IgE-mediated reaction or serious drug rash with systemic symptoms, blistering disorders (i.e. Stevens-Johnson syndrome, toxic epidermal necrolysis) and acute interstitial nephritis
- **Sampling Type:** plan to utilize convenience sampling to identify anesthesia providers and to perform retrospective chart review
- **Participant Recruitment:** no active recruitment is required
- **Consent Procedure:** no formal consent is expected since investigators are conducting an education in-service and chart review
- **Participant Costs & Compensation:** no financial compensation will be given to participants and there are no costs required

Plan for Data Collection & Analysis

- After 8 weeks of implementation, PI and co-investigators will conduct a retrospective chart review to collect post-implementation data and compare to baseline data
- Goal is to determine if there is an increase in first line (i.e. cefazolin) antibiotic use within the population of patients that have documented penicillin allergy **AND** score 2 or less on PEN-FAST
 - PCN allergy status
 - PEN-FAST score
 - Antibiotic administered intraoperatively
- Data will be statistically analyzed using SPSS software to compare baseline and post implementation data



Clinical Example #1



- Scenario: A 35 year-old female reports having a reaction to PCN 2 years ago where she experienced severe diarrhea and GI upset. No treatment or IV fluids were required.
- Thoughts?

PEN	Penicillin allergy reported by patient	<input type="checkbox"/>	If yes, proceed with assessment
F	Five years or less since reaction	<input type="checkbox"/>	2 points
A	Anaphylaxis or angioedema	<input type="checkbox"/>	2 points
	OR		
S	Severe cutaneous adverse reaction		
T	Treatment required for reaction	<input type="checkbox"/>	1 point
		<input type="checkbox"/>	Total points

Interpretation

Points

- | | |
|------------------------------|--|
| <input type="checkbox"/> 0 | Very low risk of positive penicillin allergy test (<1%) |
| <input type="checkbox"/> 1-2 | Low risk of positive penicillin allergy test (5%) |
| <input type="checkbox"/> 3 | Moderate risk of positive penicillin allergy test (20%) |
| <input type="checkbox"/> 4 | High risk of positive penicillin allergy test (50%) |

Clinical Example #1



- Scenario: A 35 year-old female reports having a reaction to PCN 2 years ago where she experienced severe diarrhea and GI upset. No treatment or IV fluids were required.
- Thoughts?
- This patient scores a **2** and would be recommended to receive cefazolin as surgical prophylaxis.

PEN	Penicillin allergy reported by patient	<input type="checkbox"/>	<i>If yes, proceed with assessment</i>
F	Five years or less since reaction	<input type="checkbox"/>	2 points
A	Anaphylaxis or angioedema	<input type="checkbox"/>	2 points
	OR		
S	Severe cutaneous adverse reaction		
T	Treatment required for reaction	<input type="checkbox"/>	1 point
		<input type="checkbox"/>	Total points

Interpretation

Points

- | | |
|------------------------------|--|
| <input type="checkbox"/> 0 | Very low risk of positive penicillin allergy test (<1%) |
| <input type="checkbox"/> 1-2 | Low risk of positive penicillin allergy test (5%) |
| <input type="checkbox"/> 3 | Moderate risk of positive penicillin allergy test (20%) |
| <input type="checkbox"/> 4 | High risk of positive penicillin allergy test (50%) |

Clinical Example #2



- Scenario: A 56 year old male reports having a reaction to PCN 20 years ago where he experienced a mild skin rash without other symptoms or treatment.
- Thoughts?

PEN	Penicillin allergy reported by patient	<input type="checkbox"/>	If yes, proceed with assessment
F	Five years or less since reaction	<input type="checkbox"/>	2 points
A	Anaphylaxis or angioedema	<input type="checkbox"/>	2 points
	OR		
S	Severe cutaneous adverse reaction		
T	Treatment required for reaction	<input type="checkbox"/>	1 point
		<input type="checkbox"/>	Total points

Interpretation

Points

- | | |
|------------------------------|--|
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| <input type="checkbox"/> 1-2 | Low risk of positive penicillin allergy test (5%) |
| <input type="checkbox"/> 3 | Moderate risk of positive penicillin allergy test (20%) |
| <input type="checkbox"/> 4 | High risk of positive penicillin allergy test (50%) |

Clinical Example #2



- Scenario: A 56 year-old male reports having a reaction to PCN 20 years ago where he experienced a mild skin rash without other symptoms or treatment.
- Thoughts?
- This patient scores a **0** and would be recommended to receive cefazolin as surgical prophylaxis.

PEN	Penicillin allergy reported by patient	<input type="checkbox"/>	If yes, proceed with assessment
F	Five years or less since reaction	<input type="checkbox"/>	2 points
A	Anaphylaxis or angioedema	<input type="checkbox"/>	2 points
	OR		
S	Severe cutaneous adverse reaction		
T	Treatment required for reaction	<input type="checkbox"/>	1 point
		<input type="checkbox"/>	Total points

Interpretation

Points

- | | |
|------------------------------|--|
| <input type="checkbox"/> 0 | Very low risk of positive penicillin allergy test (<1%) |
| <input type="checkbox"/> 1-2 | Low risk of positive penicillin allergy test (5%) |
| <input type="checkbox"/> 3 | Moderate risk of positive penicillin allergy test (20%) |
| <input type="checkbox"/> 4 | High risk of positive penicillin allergy test (50%) |

Clinical Example #3



- Scenario: A 40 year old male reports having a reaction to PCN 10 years ago where he experienced wheezing and swelling in the back of his throat. He required hospitalization for treatment.
- Thoughts?

PEN	Penicillin allergy reported by patient	<input type="checkbox"/>	If yes, proceed with assessment
F	Five years or less since reaction	<input type="checkbox"/>	2 points
A	Anaphylaxis or angioedema	<input type="checkbox"/>	2 points
	OR		
S	Severe cutaneous adverse reaction		
T	Treatment required for reaction	<input type="checkbox"/>	1 point
		<input type="checkbox"/>	Total points

Interpretation

Points

- | | |
|------------------------------|--|
| <input type="checkbox"/> 0 | Very low risk of positive penicillin allergy test (<1%) |
| <input type="checkbox"/> 1-2 | Low risk of positive penicillin allergy test (5%) |
| <input type="checkbox"/> 3 | Moderate risk of positive penicillin allergy test (20%) |
| <input type="checkbox"/> 4 | High risk of positive penicillin allergy test (50%) |

Clinical Example #3



- Scenario: A 40 year old male reports having a reaction to PCN 10 years ago where he experienced wheezing and swelling in the back of his throat. He required hospitalization for treatment.
- Thoughts?
- This patient displayed signs of anaphylaxis and/or angioedema and scores a **3**. He would **NOT** be recommended to receive cefazolin.

PEN	Penicillin allergy reported by patient	<input type="checkbox"/>	<i>If yes, proceed with assessment</i>
F	Five years or less since reaction	<input type="checkbox"/>	2 points
A	Anaphylaxis or angioedema	<input type="checkbox"/>	2 points
	OR		
S	Severe cutaneous adverse reaction		
T	Treatment required for reaction	<input type="checkbox"/>	1 point
		<input type="checkbox"/>	Total points

Interpretation

Points

- | | |
|------------------------------|--|
| <input type="checkbox"/> 0 | Very low risk of positive penicillin allergy test (<1%) |
| <input type="checkbox"/> 1-2 | Low risk of positive penicillin allergy test (5%) |
| <input type="checkbox"/> 3 | Moderate risk of positive penicillin allergy test (20%) |
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Recording PEN-FAST Scores



PEN-FAST Allergy Risk Screening Tool

PEN	Penicillin allergy reported by patient	<input type="checkbox"/>	If yes, proceed with assessment
F	Five years or less since reaction	<input type="checkbox"/>	2 points
A	Anaphylaxis or angioedema	<input type="checkbox"/>	2 points
	OR		
S	Severe cutaneous adverse reaction	<input type="checkbox"/>	1 point
T	Treatment required for reaction	<input type="checkbox"/>	Total points

Interpretation

Points	
<input type="checkbox"/> 0	Very low risk of positive penicillin allergy test (<1%)
<input type="checkbox"/> 1-2	Low risk of positive penicillin allergy test (5%)
<input type="checkbox"/> 3	Moderate risk of positive penicillin allergy test (20%)
<input type="checkbox"/> 4	High risk of positive penicillin allergy test (50%)

Today's Date: _____

Antibiotic Administered in OR: _____

- Hospital site switched EHR to Epic in April 2023, PEN-FAST tool was launched on EPIC in October 2023
- When interviewing a PCN allergic patient, mark and tally the patient's PEN-FAST score and decide which antibiotic to give based on the score
- Information stripped of patient identification and stored securely in a password protected Excel spreadsheet

What Can the Data Tell Us?

- Is there an increase in first line (i.e. cefazolin) antibiotic use within the population of patients that have documented penicillin allergy **AND** score less than 3 on PEN-FAST?
- How frequently was the PEN-FAST screening tool used and how many patients were given a first line antibiotic as surgical prophylaxis?



Data Collection & Analysis

- Baseline data collected in a retrospective chart review of from August to October 2023.
- Post-implementation data collected from October to December 2023
- Excel and SPSS used to assess impact of implementation on use of PEN-FAST tool and administration rates of appropriate first line antibiotics by anesthesia providers



Results

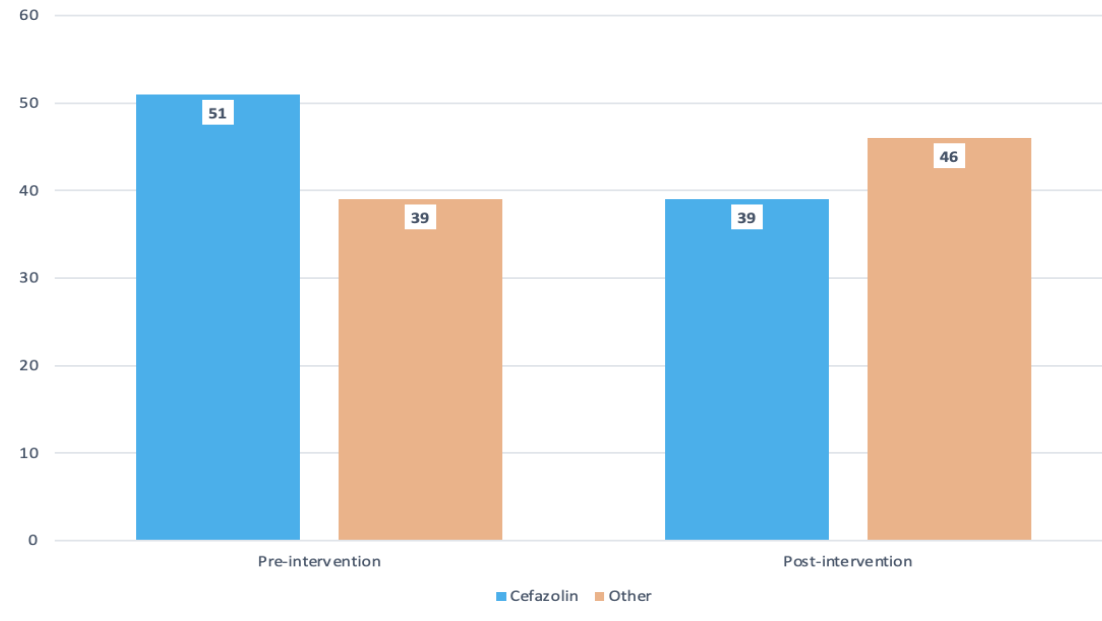
Baseline

- Data revealed **56.7%** of PCN allergic patients received cefazolin

Post-intervention

- Data showed **45.9%** of PCN allergic patients received cefazolin
- Pearson chi-squared test: no statistically significant change in cefazolin administration rates (p=0.154).

Rates of Antibiotic Administration Among Penicillin Allergic Surgical Patients

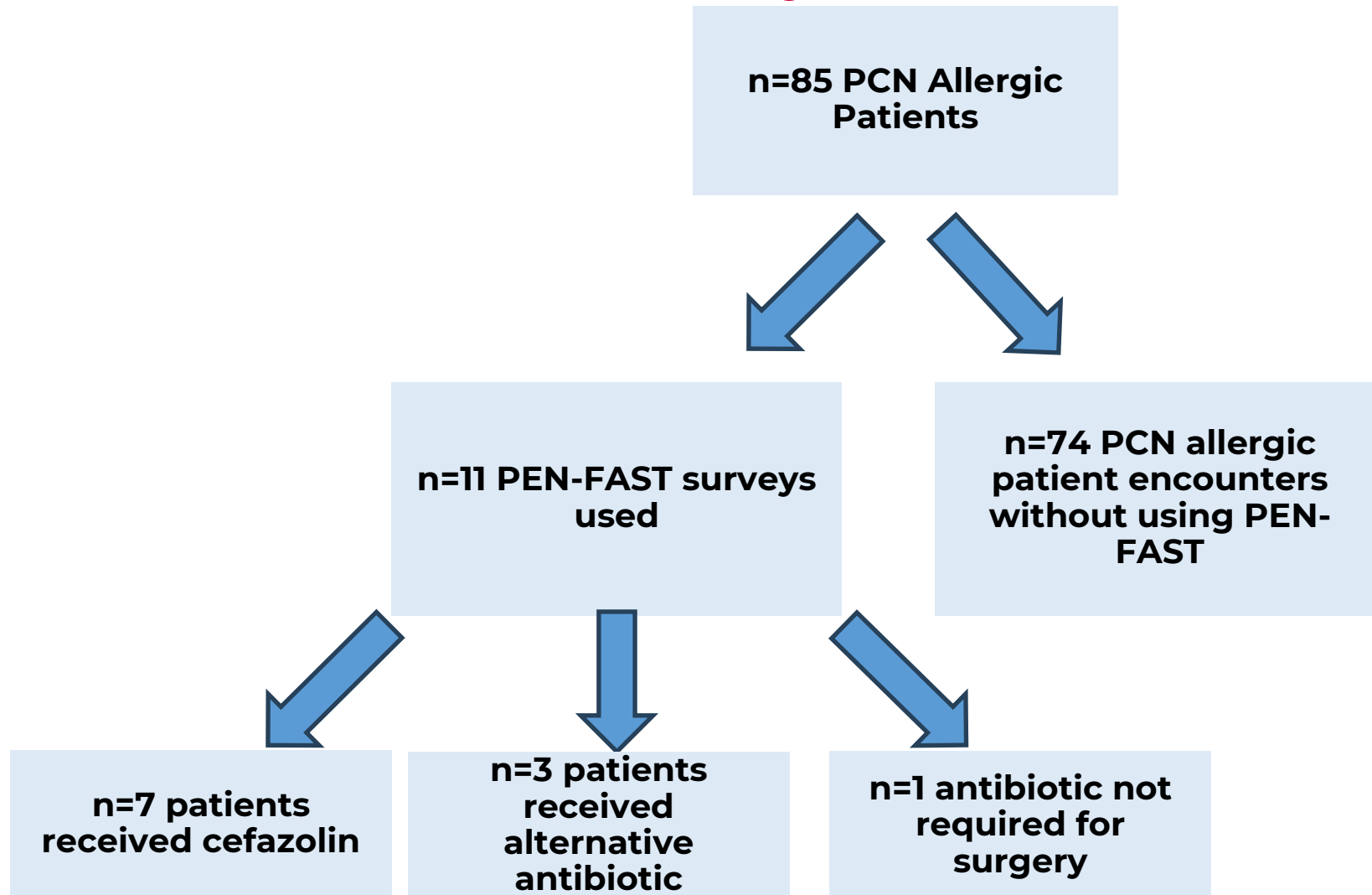


Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.035 ^a	1	.154		
Continuity Correction ^b	1.626	1	.202		
Likelihood Ratio	2.039	1	.153		
Fisher's Exact Test				.175	.101
N of Valid Cases	175				



PEN-FAST Analysis



Discussion

- More data is needed
- Surprisingly high rate of cefazolin administration by anesthesia providers at baseline - still viewed as a positive finding
- Results of this QI project were not statistically significant
- Using a new tool takes time



Limitations

- Short timeframe
- Small sample size
- Limited scope of “appropriate antibiotic”
- Newly adopted EHR



Implications & Recommendations

- Close the gap between knowledge and practice
- Continue to improve patient outcomes and reduce cost
- Continue staff education
- Increase timeframe and sample size
- Make PEN-FAST a hard stop



Future Scholarship



- Include all cephalosporin administration in data analysis
- Future investigators can replicate this project using a larger sample size spanning a longer time frame
- Education can expand to include additional departments such as clinical pharmacy and perioperative nursing
- Investigate incidence of adverse outcomes - SSI rates or reactions to cefazolin administration in this population

Thank you for your participation! Questions?



Contact Us



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***Thank you for your
time!***

