Background
Procalcitonin (PCT) is a biomarker present during tissue injury and inflammation, and is strongly associated with acute bacterial infections. While PCT can be elevated in several non-infectious situations, including severe trauma, major surgery, major burns, and end-stage renal disease, it is used clinically to distinguish between bacterial and viral infections, as well as to help determine antimicrobial treatment duration.\(^1\) It can be detected within four hours of infectious onset, usually peaks within six hours, and undergoes renal elimination with a half-life of 22-35 hours.\(^2 \sim 3\) The 2019 IDSA community-acquired pneumonia (CAP) guidelines recommend initiating antibiotics for clinically suspected CAP regardless of the serum PCT.\(^4\) However, the new guidelines stop short of recommending utilization of PCT to guide antibiotic duration.

Emerging studies have evaluated the association of PCT levels in various types of infections. Most notably randomized, controlled trials have demonstrated efficacy of using PCT to help guide antibiotic decision-making for respiratory tract infections and sepsis.\(^1,5\) Other studies have followed, analyzing its use in other systemic bacterial infections, but many of these studies are limited by being observational in nature.\(^6\)

Additionally, few studies have evaluated the utility of PCT in ESRD patients, including those receiving hemodialysis (HD) or peritoneal dialysis (PD). Studies suggest baseline PCT may be higher in chronic kidney disease (CKD) without the presence of bacterial infection.\(^7\) What is known is PCT is eliminated through the kidneys, and it is used clinically as a biomarker for bacterial infections. Based on the available literature, there has yet to be clear guidance on how to interpret PCT in the setting of CKD/ESRD and how it can be used to guide antibiotic treatment decisions.

Study Rationale
Within TriHealth, Cincinnati’s largest health system, serum procalcitonin is used as a general guide in the decision making process of antibiotic treatment duration in respiratory tract infections. This does not specifically include or exclude patients with renal insufficiency and how to determine appropriateness of antibiotic therapy duration. TriHealth’s antimicrobial stewardship teams routinely review PCT trends in combination with other clinical assessments in order to make recommendations to the medical team on appropriate antibiotic use. Our stewardship teams have anecdotally observed reluctance among providers to discontinue antibiotic therapy in patients with renal insufficiency whose PCT remains elevated, despite resolution of other signs of infection.

Hypothesis
Procalcitonin clearance is reduced in the setting of renal insufficiency, which leads to prolonged CAP treatment duration compared to patients without renal insufficiency.

Methods
This is a retrospective chart review conducted over a 2-year period investigating antibiotic treatment duration of adult inpatients diagnosed with CAP. Two cohorts will be identified for comparison.

- Cohort 1: Those with preexisting renal insufficiency (CKD Stages III-V)
- Cohort 2: Those without renal insufficiency
- Severity of illness will be controlled for by matching patients between groups by CURB-65 scores
# Inclusion Criteria
- Adult patients ≥ 18 years of age
- CKD or ESRD requiring renal replacement therapy
- Diagnosis of community acquired pneumonia on antibiotic therapy
- At least one positive PCT, identified as below:
  - Normal renal function: ≥ 0.25 ng/mL
  - CKD Stage III-IV: PCT ≥ 0.25 ng/mL
  - CKD Stage V: PCT ≥ 0.5 ng/mL
  - HD: PCT ≥ 0.5 ng/mL

# Exclusion Criteria
- Age < 18 years of age
- Pregnancy
- Recent trauma, major surgery or major burn < 1 week prior to admission
- Active cancer diagnosis
- AKI without underlying CKD
- CKD Stage I or II
- Acute Pancreatitis
- Transplant patients or patients on immunosuppressive therapy

## Statistics
A minimum sample size of 278 is needed for this study. 139 patients will be included in each cohort. Percentages will be calculated for all categorical variables and will be compared using Chi square or Fisher’s Exact tests as appropriate. Differences of antibiotic duration between groups will be calculated using the student t-test. If independent variables are different between the groups, linear regression will be used.

## Data Collection
- **Independent variables**
  - Age
  - Gender
  - Infection Type
  - PCT
  - Baseline Serum Creatinine (SCr)
  - CURB-65 Score
- **Dependent variables**
  - Hospital length of stay (LOS)
  - Antibiotic treatment duration

## Outcome Measures:
- **Primary**
  - Antibiotic treatment duration
- **Secondary**
  - Rates of readmission at 30 days
  - PCT trend

## About TriHealth
TriHealth is the Cincinnati area’s largest health system, comprised of five hospitals and more than 130 outpatient sites of care. As the oldest and largest private teaching and specialty health care facility in Greater Cincinnati, TriHealth’s Good Samaritan Hospital is among the best hospitals in the region, providing a range of quality services to patients in Ohio, Indiana, and Kentucky. With many highly respected programs and services, we are consistently recognized by regional and national organizations for providing superior care. Most importantly, the community trusts and relies upon us every day to care for their loved ones. More information about TriHealth can be found at www.trihealth.com. Information about TriHealth Pharmacy Residency programs can be found at www.trihealth.com/pharmacyresidency.

## References