# Cost-saving Opportunities Among Hospitalized Community-Acquired Pneumonia Patients Treated with Omadacycline, an Aminomethylcycline Antibiotic with IV and Oral Formulations, Compared to Ceftriaxone and Macrolide Therapy

Poster #4-048

**Kenneth LaPensee, PhD, MPH[1]; Thomas Lodise, PharmD, PhD[2]**

[1]Paratek Pharmaceuticals, Inc., King of Prussia, PA, USA; [2]Albany College of Pharmacy and Health Sciences, Albany, NY, USA

## BACKGROUND

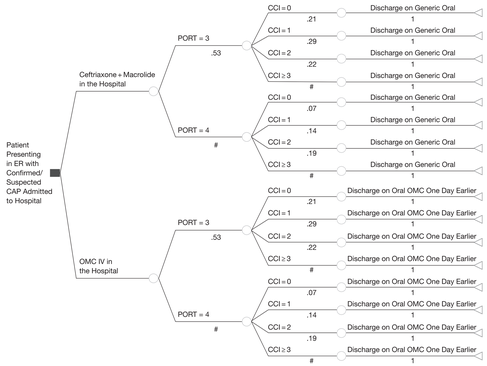
- Community-acquired pneumonia (CAP) is a significant cause of morbidity and mortality across the United States (US)
  - In the US alone, direct annual medical costs for CAP exceed $15 billion, and over 80% of this total is due to hospitalization costs[1]
- The most frequently prescribed regimens for treating hospitalized adults with CAP (not admitted to the intensive care unit) are ceftriaxone in combination with a macrolide (e.g. azithromycin), or fluoroquinolone (e.g. levofloxacin) monotherapy[2]
  - While this is congruent with current CAP management guidelines,[3] nearly 40% of hospitalized adults with CAP who received ceftriaxone plus azithromycin failed to respond by Day 4 of therapy[4]
- Omadacycline (OMC; Paratek Pharmaceuticals, Inc., King of Prussia, PA) is an aminomethylcycline, a tetracycline-class antibiotic, recently approved in the US for the treatment of adult patients with community-acquired bacterial pneumonia[5]
- OMC is available in intravenous (IV) and oral formulations, and has activity against the most common bacterial CAP pathogens, including multi-drug resistant *Streptococcus pneumoniae*[6]
- A decision-analytic model was created to highlight cost-saving opportunities among patients hospitalized for CAP for whom a respiratory fluoroquinolone would not be a suitable option, who are instead treated with OMC compared to ceftriaxone plus macrolide therapy
  - The analysis examined the cost impact of shifting patients with CAP from the current standard of inpatient treatment (ceftriaxone plus macrolide) to inpatient IV OMC treatment with early hospital discharge on oral OMC
  - Numerous studies across various infection types demonstrated that antibiotics with IV and oral formulations can shorten hospital length of stay relative to treatment with antibiotics with IV-only formulations, such as ceftriaxone plus macrolide[7-9]

## METHODS

### Model Structures and Populations

- We used a deterministic framework from the US payer and health system's perspective to develop a decision-analytic model (early hospital discharge model)
  - This model replaced use of empiric IV ceftriaxone plus azithromycin (where fluoroquinolone treatment was not advisable) with OMC for treating patients with CAP (**Fig. 1**)
  - We selected ceftriaxone + azithromycin as the comparator because it is one of the most frequently used empiric antibiotic regimens for hospitalized patients with suspected or documented CABP[2]
  - As fluoroquinolones are also available in IV and oral formulations, it was prudent to specify that these models only pertained to patients for whom fluoroquinolones were unsuitable
  - The model was developed using TreeAge Pro 2018 (Williamstown, MA) (64-bit) build-ID: 18.2.0-v20180628; the population for this model was adult patients with CAP who presented to the emergency department (ED)

**Figure 1. Cost-minimization Model from US Payer and Health Systems' Perspectives with 1 or 2 Days Shorter Hospital Length of Stay# with Omadacycline Relative to Inpatient Treatment with Ceftriaxone Plus Azithromycin.**




CAP = community-acquired pneumonia, CCI = Charlson comorbidity index, IV = intravenous, OMC = omadacycline, PORT = patient outcomes research team
#Balance probability needed to reach 100%.

- The early hospital discharge model compared costs associated with ceftriaxone plus macrolide versus OMC treatment (IV in hospital and discharge home on oral) among patients hospitalized for CAP, classified as Pneumonia Severity Index (PSI) Class III or IV, stratified by Charlson Comorbidity Index (CCI) score[10] (**Fig. 1**)

## METHODS

- Two different OMC treatment scenarios were considered: (1) 1-day or (2) 2-day reduction in hospital length of stay (LOS) with OMC relative to ceftriaxone plus azithromycin
- All patients in this model were assumed to have received outpatient treatment after initial hospitalization to complete a 7-day course of therapy

### Model Inputs

- Data from a retrospective, observational study that used hospital discharge data from the Vizient (formerly MedAssets Health System) Database was used as the input for the hospital LOS associated with CAP inpatient treatment with ceftriaxone plus azithromycin[11]
  - Patients were included in this study if they (1) were aged ≥18 years; (2) had a primary diagnosis for CAP; (3) received ceftriaxone plus azithromycin on hospitalization day 1 or 2; and (4) had ≥1 year's enrollment in the database before the index date
- For patients with multiple hospitalizations for CAP during the study period, only the first episode was considered
- In the Vizient Database, the median LOS for CAP patients in PSI Class III and IV who received ceftriaxone plus macrolide therapy were 5 and 6 days, respectively
- The cost of a hospital day was estimated to be $2,273[12]
  - Inpatient treatment costs associated with each decision arm, when applicable, were calculated by multiplying cost per day by mean LOS
- Wholesale costs for ceftriaxone, azithromycin, and oral step-down agents post-discharge were obtained from the RED BOOK pricing database ($2-$3 per day)
- In the OMC arm, daily costs of OMC were varied in a one-way sensitivity analysis (between $0 and $1,000 per day), and daily OMC costs were assumed to be the same for both the IV and oral formulations
  - Cost of OMC loading doses was not considered in the model and was assumed to be part of the average daily cost
- No differences in the efficacy, adverse events, and hospital readmissions between ceftriaxone plus azithromycin and OMC were assumed, given the lack of comparator studies between both regimens

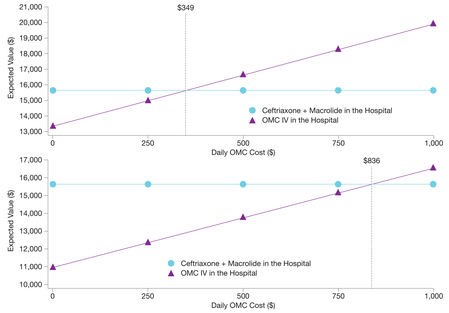
### Model Analyses and Outputs

- For the early hospital discharge model, the goal was to define the upper end of the average daily OMC acquisition cost that still conferred cost savings with 1- or 2-day hospital LOS reductions relative to inpatient treatment with ceftriaxone plus azithromycin

## RESULTS

- From the payer or health system perspective, OMC was cost saving with a 1-day hospital LOS reduction if its average daily cost was ≤$349
- OMC was cost saving with a 2-day hospital LOS reduction if the average daily cost of OMC was ≤$836 (**Fig. 2**)

**Figure 2 - Omadacycline Breakeven Acquisition Cost when Patients Are Discharged (a) 1 Day or (b) 2 Days Earlier than with Standard of Care from the Hospital Perspective.**




IV = intravenous, OMC = omadacycline

## LIMITATIONS

- This was a modeling exercise. Similar to all studies of this nature, several assumptions were made, and the results should be interpreted with caution
- We did not include treatment response rates, adverse events, or re-hospitalization as comparative CAP trials between OMC and ceftriaxone plus azithromycin have not been performed
- We purposely limited data inputs relative to major healthcare resource components, and the costs associated with the model inputs were derived from published literature sources
  - The major driver of cost in this model was hospital LOS
- Hospital LOS by PSI class and CCI score was derived from an analysis of hospitalized adult patients who received ceftriaxone plus macrolide for suspected or documented CAP using the Vizient Research Database
- Laboratory or other electronic medical record information was not available in the Vizient Database. Therefore, ICD-9-CM diagnosis codes were used, in part, to derive the PSI and CCI scores
- We did not factor in indirect costs, such as subsequent outpatient follow-up, patient satisfaction, quality of life, and productivity measurements

## CONCLUSIONS

- Hospital LOS is an important clinical and economic consideration in the management of patients with CAP
- Given the costs associated with the inpatient management of patients with suspected or documented CAP, more structured approaches are needed to facilitate a more rapid response to hospital discharge in stable hospitalized patients
- Hospitals aspiring to minimize costs without compromising outcomes by avoiding or reducing LOS should determine if replacement of ceftriaxone plus a macrolide (e.g. azithromycin), with an agent such as omadacycline, might confer cost savings, where a fluoroquinolone is unsuitable
- Like all studies of this nature, the findings in this analysis and modeling require validation in the real-world settings

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