**Background.** Ceftolozane/tazobactam (TOL-TAZ) is a novel cephalosporin antibiotic combined with a known  $\beta$ -lactamase inhibitor. It has activity against some extended-spectrum  $\beta$ -lactamase (ESBL)-producing Enterobacteriaceae and multidrug-resistant *Pseudomonas aeruginosa* (MDRPA). To date, little experience has been published on outcomes with TOL-TAZ for MDRPA infections in immunocompromised patients.

*Methods.* This was a retrospective study of adult patients (≥18 years) with an immunocompromising condition (solid-organ transplant; hematologic malignancy; solid tumors; metastatic cancer) at 20 academic medical centers who had microbiologically confirmed MDRPA isolated in culture and received TOL-TAZ for at least 24 hours. 30-day survival, in-hospital mortality, and the rates of microbiologic and clinical cure were assessed.

Results.

Intra-abdominal

Characteristic			Result (	N = 65)		
Immunocompromisir	ng condition:		n(S	%)		
Solid-organ transplan			35 (5	3.8)		
Solid tumor			20 (3	30.7)		
Leukemia			4 (6	6.1)		
Lymphoma/multiple	myeloma		3 (4	1.6)		
Metastatic cancer			3 (4	1.6)		
Male, n(%)			38 (5	58.4)		
Age (median, IQR)			64 (20-87)			
Charlson Comorbidity	y Index (media	an, IQR)	6 (1-	6 (1-12)		
APACHE II score (me	edian, IQR)		20 (4	20 (4-41)		
ICU, n(%)			37(5	6.9)		
Hospital day index in			17 (0–265)			
Hospital day TOL-TAZ	19 (0–284)					
3grs q8hrs, <i>n</i> (%)			23 (35.3)			
1.5grs q8hrs, <i>n</i> (%)	23 (35.3)					
Concomitant IV antib	15 (23.0)					
Aminoglycoside, n/N			7/15 (			
Fluoroquinolone, n/N	4/15 (26.7)					
Polymyxin, <i>n/N</i> (%)	3/15 (20)					
B-lactam, n/N(%)	1/15 (6.6)					
TOL-TAZ susceptible	35/37 (94.6)					
Outcomes by primar	y infection					
Primary infection	n (%)	30-day survival	Microbiologic	Clinical cure		
,		n/N(%)	cure	n/N(%)		
			n/N(%)			
Pneumonia	33 (50.7)	30/33 (90.9)	24/33 (72.7)	28/33 (84.8)		
Wound/Bone/Joint	12 (18.4)	8/12 (66.6)	7/12 (58.3)	7/12 (58.3)		
UTI	9 (13.8)	7/9 (77.7)	7/9 (77.7)	8/9 (88.8)		

Bloodstream	4 (6.1)	4/4 (100)	4/4 (100)	4/4 (100)
Overall outcomes,	n(%)			
30-day survival			56 (8	36.1)
In-hospital mortalit	y		17 (2	26.1)
Microbiologic cure			49 (	75.3)
Clinical cure			51(7	78.4)
-				

7/7 (100)

7/7 (100)

4/7 (57.1)

7 (10.7)

*Conclusion.* In this study of 65 critically-ill immunocompromised patients, the 30-day survival was 86.1%; clinical cure was78.4% and microbiologic cure 75.3%. TOL-TAZ is a viable option for immunocompromised patients with MDRPA infections.

Disclosures. J. Gallagher, Achaogen: Consultant, Consulting fee. Merck: Consultant, Grant Investigator and Speaker's Bureau, Consulting fee and Research grant. Allergan: Consultant and Speaker's Bureau, Consulting fee. Astellas: Consultant and Speaker's Bureau, Consulting fee. Cempra: Consultant, Consulting fee. Cidara: Consultant, Consulting fee. CutisPharma: Consultant, Consulting fee. Paratek: Consultant, Consulting fee. Shionogi: Consultant, Consulting fee. Tetraphase: Consultant, Consulting fee. Theravance: Consultant, Consulting fee. The Medicines Company: Consultant, Consulting fee. Melinta: Speaker's Bureau, Consulting fee.

#### 2383. In Vitro Activity of Ceftolozane–Tazobactam in Comparison With Ceftazidime–Avibactam vs. Antimicrobial Non-Susceptible *Pseudomonas aeruginosa* Clinical Isolates, Including Multidrug-Resistant and Extensively Drug-Resistant Subsets: CANWARD, 2007–2017

Resistant Subsets: CANWARD, 2007–2017 Andrew Walkty, MD<sup>1,2</sup>; Heather J. Adam, PhD<sup>1,2</sup>; Melanie Baxter, MSc<sup>2</sup>; Philippe Lagace-Wiens, MD<sup>1,2</sup>; James Karlowsky, PhD<sup>1,2</sup>; Daryl Hoban, PhD<sup>1,2</sup> and George Zhanel, PhD<sup>2</sup>; <sup>1</sup>Shared Health, Winnipeg, MB, Canada, <sup>2</sup>Medical Microbiology and Infectious Diseases, University of Manitoba, Winnipeg, MB, Canada

Session: 250. Treatment of AMR Infections Saturday, October 6, 2018: 12:30 PM

**Background.** Pseudomonas aeruginosa (PA) is an important nosocomial pathogen. Treatment options for infections caused by multidrug-resistant (MDR) and extensively drug-resistant (XDR) isolates remain limited. Ceftolozane-tazobactam (C/T) and ceftazidime-avibactam (CZA) are two newer antimicrobials with antipseudomonal activity. The purpose of this study was to directly compare the *in vitro* activity of C/T and CZA vs. antimicrobial non-susceptible (NS) PA clinical isolates obtained as part of the CANWARD study.

**Methods.** Annually from 2007 to 2017, sentinel hospitals across Canada submitted blood, respiratory, urine, and wound isolates (consecutive, one per patient/infection site) from patients attending ERs, medical and surgical wards, hospital clinics, and ICUS (CANWARD). Susceptibility testing was performed using broth microdilution (and breakpoints) as described by CLSI. MDR PA were defined as isolates that tested NS to at least one antimicrobial from  $\geq 3$  classes. XDR PA were defined as isolates that tested NS to at least one antimicrobial from  $\geq 5$  classes.

**Results.** 4224 PA isolates were obtained as a part of CANWARD. 628 (14.9%) were MDR, and 129 (3.1%) were XDR. The *in vitro* activity of C/T and CZA (plus relevant comparators) is presented below.

	C/T		CZA		Meropenem		Piperacillin– tazobactam	
	MIC <sub>50</sub> /MIC <sub>90</sub>	%S						
All Isolates	0.5/2	98.2	2/8	94.1	0.5/8	81.2	4/64	83.3
(n = 4,224)								
Amikacin NS	1/8	86.4	4/16	84.8	1/32	61.5	8/256	63.9
(n = 330)								
Ceftazidime NS (n = 755)	1/4	90.5	8/16	68.9	4/32	48.2	64/512	21.6
CZA NS (n = 248)	2/16	77.8	16/>16	0.0	8/>32	29.4	64/512	17.3
C/T NS (n = 78)	16/>64	0.0	16/>16	29.5	8/>32	38.5	256/>512	23.1
Ciprofloxacin NS (n = 1,010)	1/4	94.8	4/16	85.3	2/32	56.9	16/256	64.8
Gentamicin NS (n = 823)	1/4	94.3	4/16	88.7	1/16	62.1	8/128	70.5
Meropenem NS (n = 793)	1/4	93.9	4/16	77.9	8/16	0.0	16/256	52.6
Piperacillin-tazo- bactam NS (n = 686)	1/4	91.3	8/16	70.1	4/32	45.2	64/512	0.0
Tobramycin NS (n = 283)	1/8	88.0	4/16	83.7	4/32	38.9	16/256	58.0
MDR (n = 628)	1/8	89.8	8/>16	69.4	8/32	22.6	64/512	22.0
XDR (n = 129)	2/16	78.3	8/>16	55.0	16/>32	0.0	128/512	0.0

**Conclusion.** The *in vitro* activity of C/T was superior to CZA vs. antimicrobial NS PA clinical isolates (including MDR and XDR isolates) recovered from patients across Canada.

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### 2384. Multidrug-Resistant Gram-Negative Infections Treated With Ceftolozane-Tazobactam: Impact of Delayed Initiation

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# Session: 250. Treatment of AMR Infections

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**Background.** Delayed appropriate antibiotic therapy for multidrug-resistant (MDR) Gram-negative bacterial (GNB) infections has been associated with increased mortality. Ceftolozane-tazobactam (C/T) is a novel antipseudomonal cephalosporin and  $\beta$ -lactamase inhibitor combination with excellent *in vitro* activity against MDR

GNB, however its ability to improve patient outcomes may be attenuated if initiation is delayed or it is reserved for salvage therapy. We sought to determine the impact of delayed C/T initiation on 30-day mortality in patients with MDR GNB infections.

**Methods.** This was a multicenter, retrospective cohort study including adult patients treated with C/T ( $\geq$ 72 hours) for suspected or confirmed MDR GNB (resist-ant to  $\geq$ 1 drug from  $\geq$ 3 classes) infections between January 2015 and February 2018. Classification and regression tree (CART) analysis was used to determine the time point of C/T initiation from index culture or diagnosis most predictive of 30-day mortality. Clinical characteristics and outcomes were compared between patients receiving early or delayed C/T, defined by the CART time point. Multivariable logistic regression was conducted to determine the independent association between early C/T initiation and 30-day mortality.

**Results.** A total of 144 patients were included. The median (IQR) age was 61 (49, 71) years with a male (65%) and African American (53%) predominance. The most common source of infection was respiratory (64%) and MDR *Pseudomonas aeruginosa* was isolated from 92% of cultures. A breakpoint in time was identified of 119 hours where 30-day mortality was significantly increased (11.8% vs. 26.2%; P = 0.032). Absence of prior infection or colonization with MDR GNB was the only variable independently associated with delayed C/T (aOR 3.28, 95% CI 1.53, 7.01). After adjustment for confounding variables, delayed C/T was associated with a > 3-fold increase in 30-day mortality (aOR 3.22, 95% CI 1.11, 9.40).

**Conclusion.** These data suggest that delaying C/T initiation by approximately 5 days substantially increases the risk of mortality in patients with MDR GNB infections, underscoring the importance of early appropriate therapy and the need for incorporation of C/T into automated susceptibility testing panels to support earlier initiation.

Disclosures. S. L. Davis, Achaogen: Scientific Advisor, Consulting fee. Allergan: Scientific Advisor, Consulting fee. Melinta: Scientific Advisor, Consulting fee. Nabriva: Scientific Advisor, Consulting fee. Zavante: Scientific Advisor, Consulting fee. M. J. Rybak, Allergan: Consultant, Grant Investigator and Speaker's Bureau, Research grant and Research support. Achaogen: Consultant, Grant Investigator and Speaker's Bureau, Consulting fee, Research grant and Research support. Bayer: Consultant, Grant Investigator and Speaker's Bureau, Consulting fee, Research grant and Research support. Melinta: Consultant, Grant Investigator and Speaker's Bureau, Consulting fee, Research grant and Research support. Merck: Consultant, Grant Investigator and Speaker's Bureau, Consulting fee, Research grant and Research support. Theravance: Consultant, Grant Investigator and Speaker's Bureau, Consulting fee, Research grant and Research support. Sunovian: Consultant, Grant Investigator and Speaker's Bureau, Consulting fee, Research grant and Research support. Zavante: Consultant, Grant Investigator and Speaker's Bureau, Consulting fee, Research grant and Research support. NIAID: Consultant, Grant Investigator and Speaker's Bureau, Consulting fee, Research grant and Research support.

2385. Ceftazidime–Avibactam in Combination With Fosfomycin: A Novel Therapeutic Strategy Against Multidrug-Resistant *Pseudomonas aeruginosa* Krisztina M. Papp-Wallace, PhD<sup>1,2</sup>; Elise T. Zeiser, BS, MPH<sup>2</sup>; Scott A. Becka, BS<sup>2</sup>; Steven T. Park, MS<sup>3</sup>; Marisa L. Winkler, MD/PhD<sup>4</sup>; Kevin Nguyen, BS<sup>3</sup>; Indresh Singh, MS<sup>5</sup>; Granger Sutton, PhD<sup>5</sup>; Derrick E. Fouts, PhD<sup>5</sup>; Evelyn J. Ellis-Grosse, PhD<sup>6</sup>; George L. Drusano, MD<sup>7</sup>; David S. Perlin, PhD<sup>3</sup> and <u>Robert</u> A. Bonomo, MD<sup>2,8</sup>, <sup>1</sup>Medicine, Case Western Reserve University, Cleveland, Ohio, <sup>3</sup>Public Health Research Institute, New Jersey Medical School, Rutgers Biomedical and Health Sciences, Newark, New Jersey, <sup>4</sup>Brigham and Women's Hospital, Boston, Massachusetts, <sup>5</sup>J Craig Venter Institute, Rockville, Maryland, <sup>6</sup>Zavante Therapeutics, Inc., San Diego, California, <sup>7</sup>Institute for Therapeutic Innovation, Lake Nona, Florida, <sup>8</sup>Case Western Reserve University, Cleveland, Ohio

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**Background.** By targeting penicillin binding protein-3, the AmpC  $\beta$ -lactamase, and MurA, another enzyme involved in cell wall synthesis, with the ceftazidime-avibactam-fosfomycin combination, we previously overcame multidrug resistance (MDR) *in vitro* in an archived collection of *Pseudomonas aeruginosa* clinical isolates. Here, we further validate the ceftazidime-avibactam-fosfomycin combination using the MDR *P. aeruginosa* clinical isolate, CL232.

**Methods.** Whole genome and transcriptome sequencing, checkerboard analysis, and determination of mutation frequency as well as mutation prevention concentration were conducted. In addition, the ceftazidime-avibactam-fosfomycin combination was tested in a neutropenic thigh murine infection model with a high bacterial burden  $(2 \times 10^7 \text{ colony forming units} (CFUs))$  of MDR *P. aeruginosa* clinical isolate CL232.

**Results.** Checkerboard analysis revealed slight synergy with fractional inhibitory concentration index of 0.53 for 25–6.25 µg/mL of ceftazidime–avibactam combined with 12.5 µg/mL of fosfomycin. Accordingly, the resistance elements in *P. aeruginosa* CL232 were analyzed via whole-genome sequencing (WGS) and transcriptome sequencing (RNAseq). WGS of CL232 revealed mutations in genes (e.g., *oprD, ampR*) that contribute to  $\beta$ -lactam resistance. Moreover, expression of the AmpC  $\beta$ -lactamase and the MexAB-OprM efflux pump were upregulated (~2–6-fold). The potential for the development of ceftazidime–avibactam-fosfomycin resistance was sessed in *vitro*. Fosfomycin alone was found to have a high mutation frequency  $1.9 \times 10^{-5}$ ; however, the addition of ceftazidime–avibactam reduced this frequency by 3-logs. In addition, the ceftazidime–avibactam-fosfomycin combination poseses the lowest mutation prevention concentration at 64 mg/L–64 mg/L. In a neutropenic thigh murine infection model, the ceftazidime–avibactam–fosfomycin combination

was found to reduce CFUs by 5-6 logs compared with vehicle-treated mice, while ceftazidime-avibactam and fosfomycin dosed separately decreased CFUs by ~1 log and 2–3 logs, respectively.

**Conclusion.** The combination of ceftazidime-avibactam-fosfomycin is highly likely to offer patients who suffer from infections with a high bacteria burdens (i.e., pneumonia) a therapeutic hope against MDR *P. aeruginosa*.

Disclosures. K. M. Papp-Wallace, F. Hoffmann-La Roche Ltd: Grant Investigator, Research grant. E. J. Ellis-Grosse, Zavante Therapeutics, Inc.,: Employee and Shareholder, Salary.

### 2386. Efficacy of Lefamulin (LEF) vs. Moxifloxacin (MOX) Against Common Pathogens in Adults With Community-Acquired Bacterial Pneumonia (CABP): Results From the Phase 3 Lefamulin Evaluation Against Pneumonia (LEAP 1) Study

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## Session: 250. Treatment of AMR Infections

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**Background.** New CABP treatments with targeted activity and improved tolerability are needed. LEF, a novel pleuromutilin antibiotic that binds to a conserved region of the bacterial ribosome, is in development for IV or oral CABP treatment. This Phase 3 clinical study evaluated the efficacy of LEF vs. MOX in adults with CABP.

**Methods.** In this multicenter, randomized, double-blind study, 551 adult patients with CABP (Patient Outcomes Research Team Risk Class 2III) were randomized to LEF 150 mg IV Q12 hours (n = 276) or MOX 400 mg IV Q24 hours (n = 275). After 6 IV doses, qualifying patients could be switched to oral therapy. Adjunctive linezolid was given with MOX for suspected methicillin-resistant *S. aureus*.

Primary outcomes were early clinical response (ECR) in the intent-to-treat (ITT) population (FDA endpoint), and investigator assessment of clinical response (IACR) at test of cure in the modified ITT (mITT) and clinically evaluable (CE-TOC) populations (co-primary EMA endpoints). The microITT population included all patients with a baseline CABP pathogen detected by respiratory tract or blood culture, urinary antigen test, serology, and real-time PCR from sputum, oropharyngeal and nasopharyngeal swabs. The microITT2 population included patients with a CABP pathogen detected by methods excluding PCR. Confirmatory identification and susceptibility testing of isolates, serology, and PCR were performed by a central laboratory.

**Results.** LEF was noninferior to MOX for ECR and IACR (LEF 87.3% [ITT], 81.7% [mITT], 86.9% [CE-TOC]; MOX 90.2% [ITT], 84.2% [mITT], 89.4% [CE-TOC]). The most common pathogen identified was *S. pneumoniae*. In the microITT population (*n* = 159 per arm), LEF and MOX demonstrated similar ECR and IACR rates (figure). LEF was efficacious against *S. pneumoniae* (including resistant phenotypes), *H. influenzae, M. catarrhalis, S. aureus*, and atypical pathogens. In the microITT2 population, likely due to smaller sample sizes.

**Conclusion.** In this first Phase 3 clinical trial, LEF showed similar efficacy to MOX against the most commonly identified CABP pathogens. LEF demonstrates promise as a targeted monotherapy for the treatment of CABP in adults.

#### Efficiency of Lefamulin and Moxifloxacin Against Community-Acquired Bacterial Pneumonia Pat

Baseline pathogen, rate" (n/N)	ECR				IACR			
	Lefamulin		Moxifloxacin		Lefamulin		Moxifloxacin	
	microITT	microlTT2	microITT	microITT2	microITT	microlTT2	microITT	microITT
Streptococcus pneumoniae (SP)	88.2% (82/93)	85.7% (36/42)	93.8% (91/97)	88.6% (39/44)	84.9% (79/93)	81.0% (34/42)	87.6% (85/97)	86.4% (38/44)
Multidrug-Resistant SP (MDRSP)	(6/6)	(6/6)	(5/6)	(5/6)	(6/6)	(6/6)	(4/6)	(4/6)
Staphylococcus aureus (SA)	(10/10)	(7/7)	- (4/4)	(3/3)	(8/10)	(6/7)	(4/4)	(3/3)
Methicillin-Susceptible SA (MSSA)	(7/7)	(7/7)	(3/3)	(3/3)	(6/7)	(6/7)	(3/3)	(3/3)
Haemophilus influenzae	92.2% (47/51)	(6/6)	<b>94.7%</b> (54/57)	(5/6)	84.3% (43/51)	(5/6)	84.2% (48/57)	(6/6)
Moraxella catarrhalis	92.0% (23/25)	(0/1)	100% (11/11)	(1/1)	80.0% (20/25)	(0/1)	100% (11/11)	(1/1)
Mycoplasma pneumoniae	84.2% (16/19)	92.3% (12/13)	90.0% (18/20)	91.7% (11/12)	84.2% (16/19)	84.6% (11/13)	95.0% (19/20)	91.7% (11/12)
Chlamydophila pneumoniae	90.9% (10/11)	(8/9)	94.7% (18/19)	93.3% (14/15)	72.7% (8/11)	(7/9)	68.4% (13/19)	73.3% (11/15)
Legionella pneumophila	88.9% (16/18)	88.2% (15/17)	85.7% (12/14)	85.7% (12/14)	77.8% (14/18)	82.4%	78.6%	78.6%

preamment group = ½ for internation and as for moxitoxicen : intercent, nvi = patients with a response of success/ patients with a specific baseline pathogen ECR=early clinical response; IACR=investigator assessment of clinical response; <u>microTIT</u>:=patients inTT population with ≥1 baseline CABP pathogen; microTIT2=patients inTT population with ≥1 baseline CABP pathogen confirmed by methods excluding PCR.

Disclosures. T. File, BioMerieux: Scientific Advisor, Consulting fee. Curetis: Scientific Advisor, Consulting fee. Melinta: Scientific Advisor, Consulting fee. Merck: Scientific Advisor, Consulting fee. MotifBio: Scientific Advisor, Consulting fee. Nabriva: Investigator and Scientific Advisor, Consulting fee. Pfizer: Scientific Advisor, Consulting fee. Paratek: Scientific Advisor, Consulting fee. L. Goldberg, Nabriva: Employee, Employee Stock Options and Salary. S. Paukner, Nabriva: Employee and Shareholder, Salary. A. Das, Achaogen: Consultant, Consulting fee. Cempra: Consultant, Consulting fee. Tetraphase: Consultant, Consulting fee. Paratek: Consultant, Consulting fee. Tetraphase: Consultant, Consulting fee. Wockhardt: Consultant, Consulting fee. UTILITY: Consultant, Consulting fee. Savante: Consultant, Consulting fee. UTILITY: Consultant, Consulting fee. Shareholder, Equity, Shareholder, J. Saviski, Nabrica Therapeutics, Plc: Employee, Salary. C. Sweeney, Nabriva: Employee, employee stock options and Salary. E.