ASM Microbe 2017 Highlights

The ASM Microbe 2017 meeting, organized by the American Society for Microbiology (ASM), convened in New Orleans from Jun 1 to 5, 2017. This large, ambitious conference was organized into seven different tracks with more than 500 sessions and 575 speakers and was attended by more than 10,000 multidisciplinary international scientists. The tracks covered the breadth and depth of microbiology:

- Antimicrobial agents and infectious diseases
- Applied and environmental science
- Clinical and public health microbiology
- Ecological and evolutionary science
- Host-microbe biology
- Molecular biology and physiology
- Profession of microbiology

The opening session speakers were Julie Theriot, PhD, from Stanford University, with a presentation titled “Entropy, Stress and Collapse: Application of Simple Physics Models to Understanding Bacterial Cell,” and Dr. Lalita Ramakrishnan, PhD, from the University of Cambridge. Her presentation was titled, “Lessons for Tuberculosis Treatment from the Zebrafish.” The President’s Forum included two presentations related to host-microbe interactions. Heidi Nelson, MD, from the Mayo Clinic presented “Microbes, Metabolism, and New Insights into Gut Health,” and Christopher W. Woods, MD, MPH, from the Duke University Medical Center presented “Harnessing the Host Response for Infectious Disease Diagnosis.”

A very interesting keynote speaker was Kate Rubins, PhD, NASA astronaut and molecular biologist. She discussed conducting science in space in a presentation titled, “Science in Extreme Environments: Building Extraterrestrial and Earth-Based Research Capabilities.” She highlighted the importance of monitoring the microbial environment if humans are going to spend lengthy periods in earth’s orbit or in deep-space travel.

**Antimicrobial stewardship** was a subtrack of the “antimicrobial agents and infectious diseases” track and included numerous workshops, symposium and posters (see summaries below). The first day included five different antimicrobial stewardship workshops. Topics included implementing programs and rapid diagnostics, using the electronic medical record and clinical decision support software to facilitate interventions, designing interventions for scientific dissemination, and assessing medical-legal
issues in antibiotic stewardship. Meet-the-expert topics included antibiotic shortages, improving prescribing in neonates and children, antibiotic allergies as a target for stewardship programs, measuring antibiotic consumption, and antifungal stewardship. Additional antimicrobial stewardship presentations included adapting guidelines for antibiotic prescribing to local needs and a symposium focused on how microbes evolve below the minimum inhibitory concentration (MIC) to promote a rise in antibiotic resistance.

A global antimicrobial stewardship perspective was featured in a symposium that was organized in cooperation with the International Society of Chemotherapy. Ramanan Laxminarayan, PhD, MPH, director of the Center for Disease Dynamics, Economics and Policy, began the discussion with an overview of the progress in global antimicrobial stewardship and the remaining challenges. His presentation was followed by several others, including “A Plan for Antimicrobial Stewardship in Low-to-Middle Income Countries,” by Heiman Wertheim, MD, PhD, Radboud University Medical Center, the Netherlands, and “Medical and Nursing Education Regarding Microbiology Test Use: An Under Recognized Strategy to Improve Antimicrobial Stewardship,” by Susan Benson, MBBS, Fiona Stanley Hospital, Perth, Australia.

-Marnie L. Peterson, PharmD, PhD
Antimicrobial stewardship effective at a Greek hospital

Investigators at a Greek tertiary care hospital report that an antimicrobial stewardship program (ASP) reduced consumption of most antibiotics in its first 6 months of implementation.

The ASP was implemented at the 460-bed hospital at the beginning of 2016. To evaluate its impact on antibiotic use, the investigators collected data on antibiotic consumption and numbers of patient-days for the first 6 months of the year (January-June) and compared them with data from the first 6 months of 2015. Antibiotic use was calculated in defined daily doses (DDDs)/100 patient-days.

The results showed that a 16.7% reduction in total antibiotic use (from 104.3 to 86.9 DDDs/100 patient-days) was observed between 2015 and 2016, with nearly all antibiotics seeing a reduction in use. In addition, the ASP resulted in a 21.2% reduction in antibiotic cost (from 1,088 to 857 euros/100 patient-days).

The authors say the potential effects in reducing resistance rates remain to be shown.

MDR *Pseudomonas* infections nearly twice as deadly for hospital patients

A review of hospital-onset *Pseudomonas aeruginosa* infections in the United States has found that the mortality from multidrug-resistant *P. aeruginosa* (MDR-PSA) is nearly twice that of non-MDR PSA infections.

For the study, researchers used an electronic research dataset that includes microbiology/general lab results, pharmacy orders, and financial data to identify PSA isolates from blood, wound, urine, respiratory tract, gastrointestinal tract, and other sources collected at US hospitals from January 2013 to September 2015. Isolates were labeled as hospital-onset if they were collected more than 3 days after admission or through 1 day after discharge. The researchers then compared the mortality and hospital length of stay associated with MDR-PSA versus non-MDR-PSA infections.

Of 4,522 cases, 3,643 (80.6%) were non-MDR and 879 (19.4%) were MDR-PSA. Isolates recovered from respiratory sources accounted for 42.4% of all MDR cases, followed by urine (33.1%), and wound (18.3%). While the overall mortality for all PSA infections was 12.8%, the researchers found that mortality was 19.8% for patients with MDR-PSA infections compared to 11.1% for patients with non-MDR PSA infections. In addition, patients with MDR-PSA were in the hospital for 14.3 days longer than patients with non-MDR-PSA.
Study co-author Sanjay Merchant, PhD, executive director of the Center for Observational and Real World Evidence at Merck & Co., told Infectious Disease News that the findings highlight the need for effective therapy against MDR PSA infections.

"Additionally, hospitals should consider utilizing various infection management strategies, including hand hygiene, environment cleaning and increasing heterogeneity of antibiotic prescribing, to minimize the emergence and spread of MDR-PSA resistance in hospitals," he said.

Jun 3 ASM Microbe 2017 abstract
Jun 4 Infectious Disease News article

Researchers note new MCR-1 findings in China
Two abstracts from researchers in China document some new findings on the colistin-resistance gene MCR-1.

In the first abstract, researchers from Sun-Yat Sen University report that a strain of *Escherichia coli* isolated from fecal samples of colonized patients at a hospital in Guangzhou was found to harbor both the MCR-1 gene and the carbapenem-resistance gene NDM-5 on mobile plasmids. Of the 349 fecal samples collected, 88 (25.2%) were MCR-1 positive and resistant to colistin, and one strain (GB788) was also resistant to imipenem and meropenem, due to the presence of NDM-5.

Jun 6 ASM Microbe 2017 abstract

In the other study, an analysis of 8,022 fecal samples collected in Guangzhou over 5 years revealed that 497 (6.2%) were MCR-1-positive and 182 (2.3%) were MCR-1-positive and cefotaxime resistant. As well, investigators noted marked increases in MCR-1-positive and MCR-1-positive/cefotaxime resistant Enterobacteriaceae human gastrointestinal colonization. Sub-cultured MCR-1-positive/cefotaxime-resistant isolates were commonly MDR. In addition, whole-genome sequencing of 50 MCR-1/third-generation cephalosporin–resistant isolates demonstrated wide diversity among *E. coli* strains.

The authors note that the numerous genetic mechanisms associated with MCR-1 have likely contributed to its dissemination and will facilitate its persistence, and that the emergence of pan-drug resistant strains could pose challenges for prevention and control of infections.

Jun 6 ASM Microbe 2017 abstract

ESBL-producing *E. coli* higher in young children
A study by researchers with Seattle Children’s Hospital suggests that the frequency of extended-spectrum beta-lactamase (ESBL)-producing *Escherichia coli* is higher in young children than in adults.

In the study, researchers obtained 385 *E coli* isolates from young children treated at the hospital in 2010-2011 and 2016 and tested them against a panel of antibiotics and for clonal identity. The isolates were compared with *E coli* isolates from adult patients (both ambulatory and hospitalized) collected from other Seattle hospitals around the same time.
Testing revealed that resistance to third-generation cephalosporins and production of ESBLs were more than twice as high in *E coli* from young children than ambulatory adults (7.1% vs. 3.3%, *P* = .022), but didn’t differ significantly from hospitalized adults (7.1% vs. 5.9%, *P* = .1). The researchers found, however, that the increase in ESBL-producing *E coli* in young children occurred within the past 5 years, while the adult isolates didn’t show such an increase.

In addition, ESBL production in young children was largely driven by the prevalence of two clonal groups, ST131 and ST1193, whereas the ESBL-producing *E coli* in adults contained numerous different clones. There was no difference between the children and the adults in resistance to other beta-lactam antibiotics and trimethoprim-sulfamethoxazole.

Third-generation cephalosporins were prescribed in the young children in 38% of the cases, which was significantly more frequent than in either group of adults.

**Jun 2 ASM Microbe 2017 abstract**

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**Data show benefits of computerized decision support in hospitals**

Implementation of comprehensive antimicrobial stewardship (AMS) supported by a computerized decision support system (CDSS) reduced broad-spectrum antibiotic use and was associated with declining resistance in gram-negative bacteria at three Australian hospitals, researchers in Australia reported.

Using an interrupted time series analysis of segmented regression of antibiotic usage at three hospitals in a metropolitan health network in Sydney, the researchers showed that, from 2004 to 2016, AMS significantly reduced fluoroquinolone and gentamicin use in hospital 1, while AMS + CDSS significantly reduced fluoroquinolone, gentamicin, and antipseudomonal penicillins use in hospital 2, with a sustained fluoroquinolone and gentamicin decline thereafter. In addition, an analysis of gram-negative bacterial isolates from blood (*E coli*, *Klebsiella*, and *Proteus*) revealed that resistance to fluoroquinolones and gentamicin was significantly reduced in hospitals 2 and 3 and to antipseudomonal penicillins at all three hospitals after AMS + CDSS implementation.

Carbapenem use and resistance remained stable.

**Jun 2 ASM Microbe 2017 abstract**

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**CRE infections higher in China than elsewhere**

Chinese investigators studying the epidemiology of carbapenem-resistant Enterobacteriaceae (CRE) infection in China report that overall incidence is higher than reported in the United States and Europe.

In a study of CRE infections diagnosed at 28 hospitals in 15 provinces in 2015, the investigators found 774 CRE cases involving 769 patients and an overall incidence rate of 4.23 infections per 10,000 discharges. The incidence rate differed significantly by region, with the highest rate in Jiangsu (16.67) and the lowest in Hubei (0.32). The median age of patients was 61 years, and 67.5% were male. Lower
respiratory tract infections were most common (65.4%), and 79.6% of patients had an underlying condition. In-hospital mortality was 11.6%.

Among the 774 CRE cases, most cases were caused by *Klebsiella pneumoniae* infection (73.8%), followed by *E coli* (17.2%), *Enterobacter cloacae* (6.8%), and *Citrobacter freundii* (2.2%). Of the 185 isolates sent for further testing, 162 (87.6%) produced carbapenemase enzymes. Most carbapenemase-producers (55.1%) were KPC-2.

The authors say the findings suggest an urgent need to enhance infection control measures and clinical awareness of CRE in China.

*Jun 2 ASM Microbe 2017 abstract*

**South Carolina study reveals seasonal variation in antimicrobial resistance**

A study by researchers in South Carolina has found seasonal variation in antimicrobial resistance of community-acquired *E coli* bloodstream isolates.

In the study, researchers used multivariate logistic regression to examine the difference in antimicrobial resistance of *E coli* isolates during the warmest four months of the year (June-September) compared with the rest of the year. The isolates were collected from 2010 through 2015.

Among 339 unique patients with community-acquired *E coli* bloodstream infections (median age 65 years), antimicrobial resistance rates were lower during the summer months for amoxicillin-clavulanic acid, cefazolin, ceftriaxone, and trimethoprim-sulfamethoxazole. After adjustments for calendar year, demographics, and baseline clinical characteristics, the summer months were independently associated with lower antimicrobial resistance for amoxicillin-clavulanic acid (odds ratio [OR] 0.53), cefazolin (OR 0.26), ceftriaxone (OR 0.25), and trimethoprim-sulfamethoxazole (OR 0.27).

Noting that antibiotic consumption in the community has been demonstrated to vary by season on multiple continents, with lowest use coming during summer months, the authors of the study say the findings suggest antimicrobial resistance may be partially reversible through antimicrobial stewardship efforts.

*Jun 4 ASM Microbe 2017 abstract*

**Delayed antimicrobial therapy highlighted in bacteremia patients**

A study by researchers with the University of Florida highlights the challenge of timely initiation of antibiotics in bacteremia patients.

In the retrospective study, researchers evaluated all patients at a UF Health hospital who had positive blood cultures for gram-negative bacteria from January to June 2016. The patients were divided into those who were on effective antibiotic therapy at the time their blood cultures turned positive, and those who were on ineffective therapy. Of the 187 patients identified, 42 patients (22%) were receiving
ineffective antibiotic therapy when their blood culture turned positive. The mean delay to effective therapy was 24 ± 33 hours from positive blood culture, with 50% of patients (21 of 42) initiated on appropriate therapy at least 8 hours later.

An interim analysis of 92 patients (42 on effective and 50 on ineffective therapy) showed that the mean hospital length of stay (LOS) in the effective versus ineffective groups was 24.9 ± 33.9 days versus 35.1 ± 65.3 days ($P = 0.33$), while the mean LOS in the intensive care unit (ICU) was 10.8 ± 25.2 days versus 16.6±47.3 days ($P = 0.47$). Although the mean hospital and ICU LOS were not statistically significant between the two groups, the authors note that the results were numerically greater in the ineffective antibiotic arm.

While more analysis of clinical and microbiological outcomes is needed, the authors argue that the results indicate the need rapid diagnostic testing methods to be integrated into bacteremia management.

Jun 2 ASM Microbe 2017 abstract

**Lactobacillus isolate from yogurt shows promise against resistant bacteria**

A *Lactobacillus* isolate from yogurt, called *Lactobacillus parafarraginis*, inhibited the growth of several multidrug-resistant (MDR)/extended spectrum beta-lactamase (ESBL) bacteria from patients at a hospital in Washington, D.C., according to preliminary data presented at the ASM (American Society of Microbiology) Microbe meeting that wrapped up yesterday.

Researchers from Howard University screened 68 lactic acid bacteria isolated from commercial yogurt and cheese for antimicrobial activity against *Staphylococcus aureus*, *Listeria monocytogenes*, and *Escherichia coli* O157:H7. Although 93% showed antimicrobial activity against the pathogens, they identified an *L paragarraginis* isolate as showing high potential against resistant bacteria.

When tested in the lab, the bacterium inhibited 14 MDR and ESBL bacteria from clinical sources: *E coli* (5 isolates), *Pseudomonas aeruginosa* (2), *Acinetobacter baumannii/haemolyticus* (3), *Enterobacter aerogenes* (1), *Proteus mirabilis* (2), and *Klebsiella pneumoniae* (1).

"Considering the current upsurge of antibiotic resistance in hospitals, especially among the gram-negative bacteria, and the exigent need to find viable alternatives, findings from the study may hold promise for possible therapeutic application," said lead author Rachelle Allen-McFarlane, Howard University doctoral candidate in biology, in an ASM press release.

Jun 2 ASM Microbe abstract
Jun 2 ASM news release
Antibiotics plus MDRO colonization raise UTI risk in nursing homes

Interactions between antibiotic use and prior colonization with multidrug-resistant organisms (MDROs) may significantly increase the risk of urinary tract infection (UTI) in nursing home residents with indwelling urinary catheters.

Researchers from the University of Michigan, Ann Arbor, analyzed data from 233 patients with indwelling urinary catheters and 182 catheter-associated UTIs gathered as part of a previous study across 12 Michigan nursing homes.

Asymptomatic MDRO colonization of the groin or peri-rectal area significantly increased the risk that Proteus mirabilis would later be identified in urine (Hazard ratio [HR], 3.31). Colonization with Escherichia coli and vancomycin-resistant Enterococcus (VRE) each posed about double the likelihood of the pathogens entering the urinary tract (HR, 2.14 and 1.95, respectively).

Co-colonization of P. mirabilis and E. coli increased the likelihood that E. coli would be present in the urinary tract (HR, 3.87), and E. coli and VRE co-colonization was associated with a sixfold higher likelihood of identifying Enterococcus species in urine (HR, 6.11).

Antibiotic exposure combined with MDRO colonization presented the highest risk for infection. Bug-drug combinations significantly associated with UTI development were P. mirabilis colonization and quinolones (HR, 9.98), E. coli and penicillins (HR, 9.23), and P. mirabilis and glycopeptides (HR, 6.88).

Given that recent studies estimate that up to 50% of US nursing home residents may be colonized with MDROs, the authors write, "Identifying potentially modifiable risk factors such as antibiotic use, MDRO colonization, and catheterization may help reduce infection incidence."

Jun 2 abstract