

THE STEWARD

A Newsletter of the Carolina Antimicrobial Stewardship Program



From the Medical Director



**Nikolaos
Mavrogiorgos, MD**

Antibiotic resistance is complex and has many causes, but there is no doubt that antibiotic use in the inpatient and outpatient settings is a significant contributing factor. It is incumbent on us all to preserve antibiotics through the thoughtful and judicious use of these precious medications. And I say "us all"

because the bedrock of antibiotic stewardship is teamwork. Each of us has a role to play; each of us can make meaningful changes that improve both patient care and population health.

There is no turning back; antibiotic resistance is here to stay, and it frequently (next page)

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From the Medical Director, cont.

necessitates the use of--often broad--empiric or culture-based antibiotics. Even so, there are many opportunities for improvement, as it is well established that a significant proportion of antibiotic courses are either unnecessary or too long. For example, we commonly see unnecessary use of antibiotics for asymptomatic bacteriuria and acute bronchitis and longer than needed antibiotic courses for cystitis, pyelonephritis, or pneumonias.



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The stewardship team at UNC Medical Center -- Carolina Antibiotic Stewardship Program (CASP)--is a multidisciplinary team within the Office of Quality Excellence's Infection Prevention department. Its members are infectious diseases physicians (adult and pediatric), infectious diseases pharmacists, representatives from the microbiology lab, nursing, other clinical departments, and residency training programs. The team performs a number of daily activities, such as prospective and retrospective monitoring of antibiotic use, particularly broad-spectrum ones, prospective review of restricted antibiotics, and monitoring of positive blood cultures to ensure the drug matches the bug. CASP has also developed UNC-specific guidelines for treatment of common infections, such as community- and hospital-acquired pneumonia.

Over the last couple of years, we had a number of achievements (p. 14), including a significant decrease in meropenem use, through our prospective monitoring of antimicrobials. Through our ongoing partnership with Infection Prevention, there has been a sustained decrease in *C. difficile* rates (p. 7).

Pediatric stewardship director Zach Willis developed and expanded a wonderful pilot of antibiotic time-outs (p. 8). We've seen further expansion of our robust Outpatient Parenteral Antibiotic Therapy (OPAT) program (p. 14). The last several months were of course also marked by the COVID-19 pandemic. The stewardship program and particularly the OPAT program had to adjust, for example, by shifting a lot of our stewardship interventions from in-person to virtual (p. 12), making use of tools such as Epic chat and tele-medicine appointments for OPAT patients. The stewardship team members also continue to play an active role in the development of COVID-19 treatment guidelines amid rapidly evolving evidence (p. 11).

This year we are excited about a number of CASP initiatives, including on the release of new guidelines on durations of antibiotic therapy . Many common infections, such as pneumonias or urinary tract infections, can be treated with a shorter duration of therapy with the same success rates as longer courses. When therapy can be shortened, it decreases potential for unintended consequences for the patient, such as development of *C. difficile* infection (an organism that often causes infection following a disruption in the balance of normal gut bacteria after antibiotic use) or the development of drug resistance. We will also continue expanding the antibiotic time-out program and develop programs for safe de-labeling of patients who are incorrectly thought to be allergic to penicillins. And of course we will continue our COVID-19 related work.

The bedrock of antibiotic stewardship is teamwork. Each of us can make meaningful changes that improve both patient care and population health.

We look forward to continuing working with all clinical teams at UNC Medical Center to develop programs so that the right antibiotic is used, for the right patient, and the right duration. Together, we can slow antimicrobial resistance and help ensure that antibiotics are preserved as much as possible.

Clinicians' Corner

by Lindsay Daniels, PharmD, MPH



More than half of all patients receive at least one antimicrobial agent during their hospital stay. Much of this prescribing at UNC Medical Center is appropriate; however, many patients are over-treated with antibiotic therapies that are unnecessary, too broad-spectrum or are continued for excessive durations.

Antibiotics are life-saving drugs. Without them, modern advances in medicine would not be possible. Reducing unnecessary antibiotic exposure is essential to preserving the efficacy of these drugs for the future. Our goal in stewardship is to optimize therapy for patients who require antibiotics and to avoid the use of antibiotics where they will not be of benefit and could cause harm. (next page)

Carolina Antimicrobial Stewardship Program Sets New Strategies

In mid-2020, the Carolina Antimicrobial Stewardship Program (CASP) finalized its fiscal year 2021 strategies with broad input from the team. Some, such as the pediatric interventions to improve care for community-acquired pneumonia and surgical site infections, are phased, multi-year strategies. Annual review of stewardship strategies allows CASP to focus its efforts on the most salient areas of antimicrobial stewardship for the UNC Medical Center. The CASP fiscal year 2021 strategies include:

1. PROSPECTIVE AUDIT AND FEEDBACK ON ANTIBIOTIC USE, INCLUDING FOR BROAD-SPECTRUM ANTIBIOTICS AFTER 72 HOURS OF USE	7. CONTINUE CASP WORK IN COVID-19
2. PROMOTE APPROPRIATE EVIDENCE-BASED DURATIONS OF THERAPY	8. PEDIATRIC SURGICAL SITE INFECTIONS: IMPROVE ADMINISTRATION OF PERIOPERATIVE ANTIBIOTIC PROPHYLAXIS IN UNC CHILDREN'S HOSPITAL OPERATING ROOM
3. EXPAND COLLABORATION WITH THE UNC MEDICAL CENTER HEALTHCARE-ASSOCIATED INFECTIONS PREVENTION WORKGROUP	9. CARRY OUT ANTIMICROBIAL STEWARDSHIP EDUCATION
4. DEVELOP AND IMPLEMENT EVIDENCE-BASED PRACTICE FOR PEDIATRIC COMMUNITY-ACQUIRED PNEUMONIA	10. ENHANCE THE MULTIDISCIPLINARITY OF THE CASP TEAM
5. IMPLEMENT ANTIBIOTIC TIME-OUTS HOSPITAL-WIDE	11. PARTICIPATE IN THE CENTERS FOR DISEASE CONTROL AND PREVENTIONS' NATIONAL HEALTHCARE SAFETY NETWORK'S ANTIBIOTIC USE AND RESISTANCE MODULES
6. DEVELOP PILOT OF QUESTIONNAIRE TO ASSESS PENICILLIN ALLERGY	12. UPDATE CASP MEASURES AND METRICS

Clinicians' Corner, cont.

Every weekday, an infectious diseases (ID) physician and ID pharmacist on the Carolina Antimicrobial Stewardship Program (CASP) team work together to review current antimicrobial use across the hospital. When we identify opportunities to improve antimicrobial use for specific cases, we reach out to the clinical teams to discuss the case and provide recommendations. Clinicians also frequently contact CASP for guidance, particularly with questions related to antibiotic choice, optimal route of administration, and durations of therapy. Providing clinical expertise related to antimicrobial therapy to optimize care for individual patients is an important function of CASP, and we seek to provide this service in a way that facilitates learning and collaboration.

Ultimately, antimicrobial stewardship affects all of us because of its potential to slow antimicrobial resistance, and as such, this work involves everyone. We all aim to provide the best care for patients, and appropriate antibiotic prescribing is our shared responsibility.

Everyone can be an antimicrobial steward. Here are a few ways healthcare professionals can put antimicrobial stewardship principles into practice:

1 Collect necessary microbiology specimens for culture prior to empiric antibiotic initiation. Prior antimicrobial therapy can inhibit bacterial growth and decrease the yield of cultures. Collecting cultures prior to antibiotics improves their diagnostic utility and allows for tailoring regimens to the narrowest spectrum.

2 For patients with suspected infection and hemodynamic instability, initiate antibiotics promptly. For clinically stable patients, it may sometimes be appropriate to use a “watch and wait” approach, holding off on empiric therapy while the workup proceeds. However, in critically ill patients and those with signs of hemodynamic instability, delays in effective antibiotic therapy increases the risk of death. In these cases, it is important to start antibiotics as quickly as possible.

3 Choose empiric antibiotic regimens based on the pathogens most likely to be encountered.

Empiric antibiotic selection should be guided by the source of infection and the most likely pathogens. Consider patient-specific factors such as immunocompromising conditions, exposures, and whether the infection is hospital or community-acquired. Familiarize yourself with local susceptibility patterns. The [UNC Hospitals Antibigram](#) is prepared annually by the UNC Clinical Microbiology Lab and can serve as a guide for empiric antibiotic choices. This link is also available through your Epic dashboard.

4 Incorporate a daily assessment of empiric antibiotics into your patient care routine. As new information becomes available in the first few days following antibiotic initiation, adjust your plans accordingly. Incorporating an antibiotic time-out into your daily practice is an essential component of stewardship. Are antibiotics still indicated? Can the regimen be tailored based on the diagnosis, microbiology results, or clinical status? Has dosing been optimized? Is it appropriate to convert to oral antibiotics? This is also a good time to solidify a plan for duration of therapy.

5 Treat for the appropriate duration, using evidence-based short courses whenever possible. Antibiotics should be continued only for as long as necessary to optimize cure. Several clinical trials conducted in recent years have found short courses to be equally effective compared to longer courses for many types of infections. Shorter courses reduce the risk of adverse effects, limit disruption of the microbiome, and decrease the risk of selecting for antibiotic resistant organisms. CASP has developed a guidance document for [Best Practices for Duration of Antimicrobial Therapy](#) to serve as a quick reference for evidence-based durations. We encourage you to check out this useful resource when deciding on durations of antibiotic therapy for your patients.

Pediatric Stewardship News

Pediatric Community-Acquired Pneumonia Pathway

In summer of 2019, pediatric antimicrobial stewardship representatives **Bill Wilson** and **Zach Willis** initiated a two-phase plan to improve antimicrobial selection and streamline management of pediatric community-acquired pneumonia (CAP). The first phase, now completed, included convening a multidisciplinary team (infectious diseases, critical care, pulmonology, hospital medicine, surgery, and interventional radiology) to assist in developing treatment and management pathways. Additionally, Wilson and Willis started working with Pharmacy Analytics to create an auditing tool that could automatically assess antimicrobial compliance.

The second phase is now underway: the treatment guideline has been shared, and the multidisciplinary team is finalizing the CAP clinical pathway. Future plans include refinement of the auditing tool to reflect recommendations from this clinical pathway. This collaborative effort has allowed for constructive discussions about the complex care provided for pediatric patients with an antimicrobial stewardship lens throughout.

Antibiotic Time-outs in UNC Children's

Over the past year, three UNC Children's Hospital inpatient teams, including both hospitalist teams and the Pediatric Intensive Care Unit, joined the Antibiotic Time-out Project. Antibiotic time-outs are performed for all patients who have been on antibiotics for at least 48 hours and give the team a structured opportunity to carefully review the patient's diagnosis and antibiotic regimen. While most teams have a pharmacist responsible for antibiotic time-outs, **Rebecca Wellborn** and **Danny Hill**, the Nursing Unit Coordinators for the pediatric hospitalists, stepped up to serve as the first nursing champions. **Shawna Beck**, PharmD, volunteered as the pediatric intensive care unit (PICU) champion in the midst of the pandemic. All three teams hit the ground running and have completed antibiotic time outs for well over 80% of their eligible patients.

Pediatric COVID-19 & MIS-C Management Guidelines

When the COVID-19 pandemic reached North Carolina in March, no one knew yet how significantly children would be affected. Few, if any, controlled studies included children. The Carolina Antimicrobial Stewardship Program's pediatric members worked with a large multidisciplinary group representing multiple specialties to develop management guidelines for COVID-19.

As part of this team, deemed the Children's COVID-19 Squad, CASP members presented updates to the Department of Pediatrics and to the Wake and Southeast Area Health Education Centers, or AHECs. **Bill Wilson** provided critical guidance on criteria for use and dosing of new drugs such as remdesivir, coordinating with UNC Medical Center's Pharmacy Department to ensure that children would have access. **Tom Belhorn** worked closely with the Infection Prevention and COVID-19 testing task force to create policies and procedures for the safe management of children and their families who were exposed to or infected with SARS-CoV-2. **Zach Willis** helped the Children's COVID-19 Squad determine which therapies were likely to benefit children with COVID-19, such as remdesivir and dexamethasone, and which would cause more harm than good. All three worked to navigate constantly shifting federal and state regulatory requirements to provide these therapies.

During the initial wave of COVID-19 in the spring, reports of an unexplained inflammatory syndrome that appeared to affect children who had recovered from acute COVID-19 began to mount. This syndrome, named Multisystem Inflammatory Syndrome in Children (MIS-C), affects multiple organ systems, in some cases causing a myocarditis-like illness. The Children's COVID-19 Squad implemented diagnostic criteria, recommended testing, and treatment protocols for children with MIS-C.

Pediatric Stewardship News

Pediatric Perioperative Antibiotic Optimization

Last year, a multidisciplinary group (surgery, anesthesiology, perioperative nursing, infectious diseases, and pharmacy) came together to optimize the management and delivery of perioperative antibiotics for pediatric patients. This workgroup identified gaps in the overall delivery process that they are addressing to bring about positive change for patients. One gap identified early was that many patients do not have orders for perioperative antibiotics placed until they arrive the day of surgery. Changes in pre-surgery antibiotic ordering were implemented in July 2020.

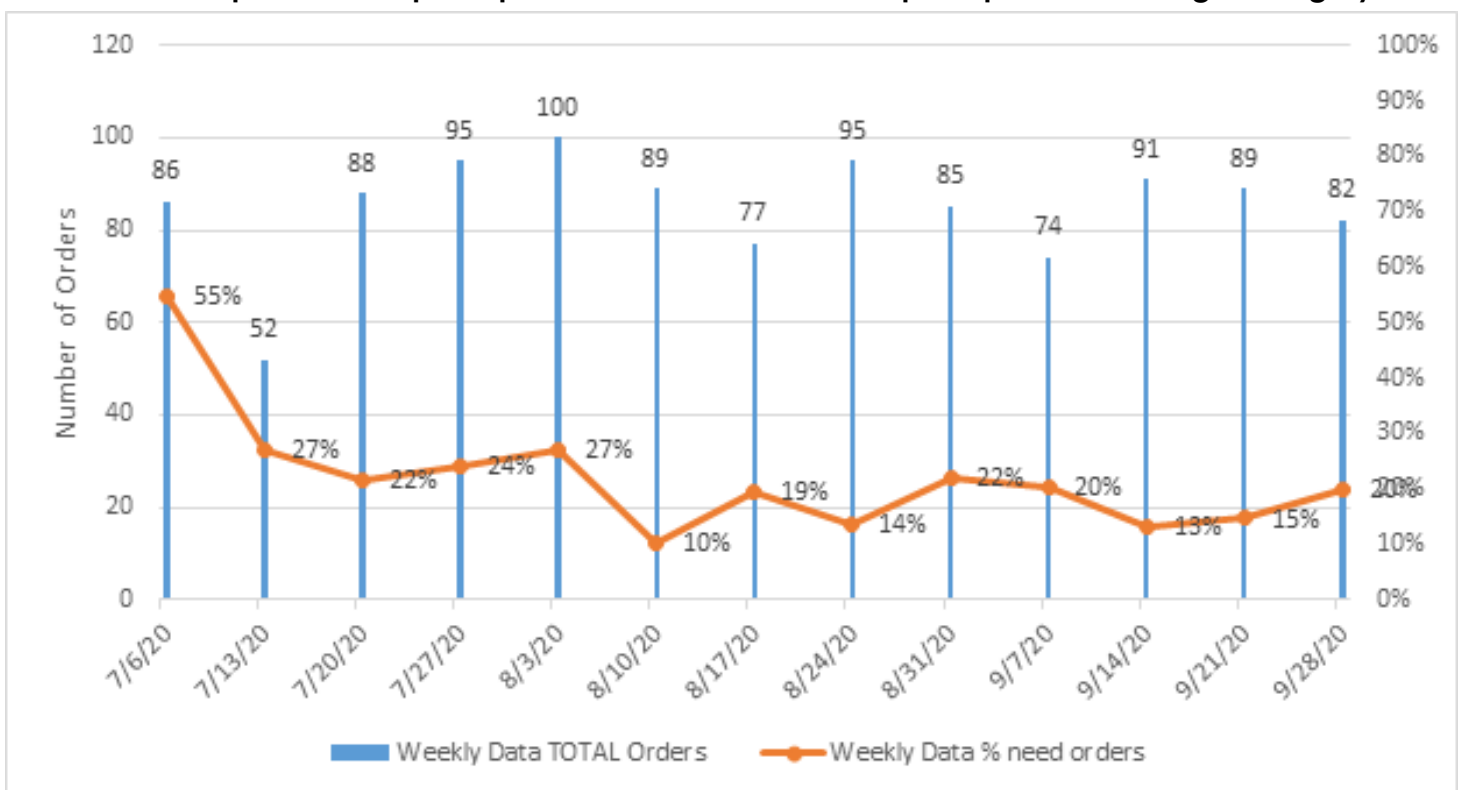
With the tremendous help of **Annemarie Funt** and her team of perioperative nurses reviewing surgery cases daily, there has been a dramatic increase in the number of patients who have orders placed prior to arrival (see graph below). This improvement was also made possible thanks to the continued provider education and morale boosts by **Sara Pittenger** and **Mike Phillips**,

physician champions from the anesthesiology and surgery groups, respectively.

In July, only 45% of patients had orders placed prior to arrival for surgery. Less than three months later, that number increased to 80%, reflecting a meaningful improvement in patient care.

This has allowed the pharmacy to better anticipate what antibiotics will be necessary, which ultimately allows the patient to receive the right drug at the right dose at the right time. Future plans with this workgroup include piloting a new checklist process with the pediatric and neonatal critical care units that will allow for improved communication among all members of the patient care team as well as improved delivery of perioperative antibiotics.

Pediatric patient with peri-operative antibiotic orders in place prior to arriving for surgery



Renewed Collaboration Expected to Help Keep *C. difficile* Infection Rates Low

Inpatient rates of *Clostridioides difficile* (or *C. difficile*), a common healthcare-associated infection, reached an all-time low at UNC Hospitals earlier this year as COVID-19 moved into North Carolina. In April, only two *C. difficile* infections (CDI) were reported, and the fiscal year ending June 30 showed a 16% reduction compared to the 2018 baseline.

The recent dramatic reductions are likely positive spillover effects from fastidious COVID-related infection prevention practices such as environmental cleaning and handwashing. Also, hospital beds were intentionally left empty in preparation for a surge in COVID-19 hospitalizations, keeping the hospitals' patient census lower than average. A third factor that likely contributed to the decrease was a temporary "no visitors" policy that was in place for several months.

(Visitors may unintentionally contribute to spreading germs.) Lower CDI rates are a silver lining to the upheaval caused by COVID, and hospital staff are eager to find ways to sustain the very low rates of this infection that sickens an estimated 462,000 people in the US, leading to some 15,000 deaths each year.

C. difficile can be especially dangerous for older persons or those who are hospitalized for other conditions. They may have weakened immune systems or be using antibiotics, which can pave the way for the pathogen to multiply rapidly in the intestines. Part of the problem with controlling *C. difficile* is that it forms spores, which are resistant to alcohol-based cleaners. Washing hands with soap and water is critical for prevention of *C. difficile*.

"*C. difficile* infection is a major problem, both because it can make people very sick, but also because it can be recurrent," said Nikolaos Mavrogiorgos, medical director of the Carolina Antimicrobial Stewardship Program (CASP) at UNC Medical Center. "There are patients who have *C. difficile* present in their gut but have no symptoms. These asymptomatic carriers

could potentially spread the infection in hospital settings and sometimes end up developing symptomatic infection down the road, too."

In addition to the human toll, hospitals are also at risk of losing millions of dollars in reimbursements from the Centers for Medicare and Medicaid Services if their healthcare-associated infection rates – to which CDIs contribute – pass a certain threshold. In 2016, UNC Medical Center set a goal of reducing CDI among its inpatients by 10%. Just over one year later, they achieved astonishing results: a 42% reduction in its CDI rate, far exceeding the initial goal.

C. difficile sickens an estimated 462,000 people in the US, leading to some 15,000 deaths each year.

The implementing team wrote about the evidence-based, multidisciplinary approach they took. The group used a bundle of proven interventions: hand hygiene; diagnostic stewardship to prevent inappropriate testing; education for clinicians on the hospital policy regarding *C. difficile* testing; enhanced isolation precautions for patients with known or suspected CDI; improved environmental cleaning and disinfection of the rooms of patients with CDI; and antimicrobial stewardship and pharmacy interventions, for example, to reduce the use of drugs associated with increased risk of CDI.

"Clindamycin, fluoroquinolones, and third- and fourth-generation cephalosporins are among the antibiotics linked with increased rates of CDI, but in reality, any broad-spectrum antibiotic can predispose to CDI, especially the longer patients are on them," explained Mavrogiorgos. "One main role of antimicrobial stewardship is to ensure that antibiotics are used prudently and that the shortest effective duration of therapy is chosen," he said.

A *C. difficile* workgroup started in 2016 (next page)

C. diff, continued

under the leadership of the department of Infection Prevention, and recently joined forces with related workgroups under the new Healthcare-Associated Infection Prevention Initiative. HAIPI and CASP forged a close collaboration to sustain low infection in partnership with the Nursing Department's Spread of Innovation initiative in 2020, which will continue into the next year.

“We’re all in this together.”

Three new interventions have been added to the existing bundle implemented in 2016. First, the Information Services Division enacted changes in the electronic medical record system to more efficiently document and display patients' bowel movements and laxative use so that the clinician ordering a CDI test has all the information in one place. Second, Environmental Services operationalized a detailed cleaning protocol to ensure all high-touch surfaces are cleaned each shift. Third, Nutrition and Food Services provides all patients with an opportunity to clean their hands before meals.

Implementing these changes during the pandemic is not without challenges. However, the multidisciplinary, collaborative approach that worked so well to reduce CDI in 2016 is expected to be the linchpin of the newly-added interventions.

"We count on our colleagues in antimicrobial stewardship and Pharmacy, Nursing and Providers, Environmental Services, Nutrition and Food Services,



Summerlin-Long

Information Services, the Microbiology lab, and the whole patient care team to help keep infection rates low," Shelley Summerlin-Long, a Senior Quality Improvement Leader in Infection Prevention said. "We're all in this together."

Antibiotic Time-outs Expand Stewardship's Reach

As a pediatric resident, Zachary Willis, MD, MPH developed an early interest in antimicrobial stewardship. In his role as director for pediatric antimicrobial stewardship with UNC Medical Center's Carolina Antimicrobial Stewardship Program (CASP), he was compelled to find ways to optimize antimicrobial use at UNC Children's Hospital and across the Medical Center. To that end, CASP tested an intervention called antibiotic time-outs in a 2017 pilot. It involved antimicrobial stewardship pharmacists identifying patients daily and asking a small group of pharmacists to review their antimicrobial therapy.



Antibiotic time-outs are formal reassessments of antimicrobials prescribed to inpatients. A time-out provides a structured opportunity to review a patient's antimicrobial therapy 36 to 72 hours into the regimen. The healthcare provider takes new information into account—such as results from blood or urine cultures and how the patient is responding to the drug — and decides if adjustments are needed to the drug, dose, duration, or route. For example, drugs can be selected to more precisely target the organism identified in a culture, discontinued if the patient is not found to have an illness that will respond to antimicrobials after all, or changed from the IV to oral route and vice versa. In approximately two-thirds of patients at UNC Hospitals, a time-out confirms that no change is needed. (next page)

Time-outs, cont.

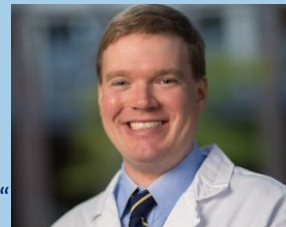
It turns out, CASP was ahead of the curve. “By early 2018, the Centers for Disease Control and Prevention and the Centers for Medicaid and Medicare Services were placing increased emphasis on antibiotic time-outs,” Willis said, referring to two federal divisions with a stake in ensuring hospital participation in antimicrobial stewardship. “However, colleagues at other institutions all seemed to agree that they were difficult to implement.” In its pilot, CASP found that adherence to time-outs was good, and the participating teams found time-outs beneficial to patient care. However, the team recognized that more support would be needed to continue and expand the antibiotic time-out process.

In August 2018, Willis received support from the UNC Institute for Healthcare Quality Improvement (IHQI) to implement routine, documented, meaningful antibiotic time-outs for medical patients at UNC Hospitals Hillsborough Campus. Hillsborough’s geriatrics and general medicine services participated in the pilot. The project also provided an opportunity to contribute to the small but growing evidence base on time-outs. In early 2019, Michael Swartwood joined as project manager, expanding its ability to manage data and provide timely feedback to teams on their progress. Willis, Swartwood, and their collaborators hope to demonstrate how time-outs can be a useful tool to optimize antimicrobial treatment and reduce unnecessary, redundant, or longer-than-needed antimicrobial use, as a part of a holistic antimicrobial stewardship program.

In the past year, all participating services have exceeded the 80% performance benchmark for eligible patients receiving an antibiotic time-out within the time window, according to Swartwood. “We’ve been impressed with the results we’ve seen at the Medical Center so far,” Willis shared. More results are expected to be published later this year.

The long-term goal of the IHQI award was to take

the approach refined at Hillsborough Hospital and expand across UNC Hospitals and then potentially to the entire UNC Health system. Two hospitalist services joined the two pilot services, all at Hillsborough. Later, the project added more services from the main UNC Hospitals campus: first family medicine services, followed by two pediatric general medicine services. The most recent addition to the project was the pediatric ICU, bringing the total number of participating teams to nine. Willis hopes that in time, the initiative will be hospital-wide. CASP recently created a [checklist](#) to help a patient care team determine whether conditions are favorable to begin implementation of time-outs.



Willis



Swartwood

“Committing to antibiotic time-outs is a culture change. As with any habit, it takes time for it to become second-nature. Across our participating services, we’ve seen nurse coordinators, physicians, and pharmacists take the lead to ensure that time-outs happen consistently,” Willis explained. “Service leaders can help by encouraging their teams to participate and adapting the process to their needs.”

So far, antibiotic time-outs have worked well consistently without prompts in the electronic medical record system. However, as more patient care teams initiate time-outs, integrating an automated best practice alert in a patient’s medical record will ensure that all eligible patients receive a time-out during the window when they can be most helpful. “We are working closely with Information Services to develop a prompt for the care team of any patient who has recently started an antimicrobial to complete a time-out. It’s just one more tool we have in our arsenal to make sure we’re doing the best we can by our patients to prevent harms caused by unnecessary antimicrobial use,” Willis said.

Ready for a Time-out?

- CASP recently created a readiness [checklist](#) to help a patient care team determine whether conditions are favorable to begin implementation of time-outs.
- Answering “yes” to most questions indicates that antibiotic time-outs may be the right next step for a service considering ways to optimize antimicrobial use.
- [Click the image for details.](#)



Defining Need

1. Do you feel that there is an opportunity to optimize antibiotic prescribing within your service?
2. Do you believe antibiotic time-outs would be an appropriate strategy to address this need?



Willingness to implement change

3. Are care team members receptive to implementing quality improvement initiatives?
4. Does your service have an established history of successful implementation of new practices, such as successful Quality Improvement projects?
5. Are there no other major changes being implemented at this time that may compete with the culture change introduced by the ATO initiative?
6. Are service supervisors supportive of the ATO initiative? Are they willing to make accommodations to help staff successfully carry out the initiative?



Infrastructure, resources, and current practice

7. Does your care team discuss patients' status and plan of care in-person as a group?
8. Do pharmacists accompany the care team/unit on rounds?
9. Does the care team use a daily (or otherwise regularly scheduled) checklist for each patient?
10. Does the rounding team have the authority to make antibiotic changes on most patients?



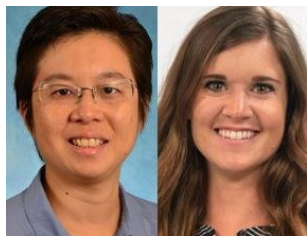
Sustainability

11. Is your team willing to review performance metrics regularly (e.g., quarterly), such as the proportion of eligible patients with an ATO and the outcome of each ATO?
12. Will your team be receptive to feedback about performance and willing to make adjustments to improve performance?

Boerneke, Kwan Train Physicians on Penicillin Allergy Awareness

UNC's Institute for Healthcare Improvement (IHQI) announced its 2020-2021 Improvement Scholars Program in March. Among those selected was Reducing the Healthcare Utilization of Broad-Spectrum Antibiotics: Implementation of Outpatient Penicillin Allergy Assessments. The project is co-led by Carolina Antimicrobial Stewardship Program member Renae Boerneke, PharmD, BCPS, CPP and Mildred Kwan, MD, PhD.

Boerneke is a clinical pharmacist practitioner within the Department of Pharmacy working in the UNC Infectious Diseases



Kwan (l) and Boerneke

Clinic, and Kwan is faculty in the Division of Rheumatology, Allergy & Immunology, Department of Medicine within the UNC School of Medicine and the Thurstone Arthritis Research Center. They are interested in the erroneous labeling of individuals with penicillin allergy, which has been recognized by several national agencies as an important antibiotic stewardship initiative.

"The evidence demonstrates that only one in ten

people who have been labeled as having a penicillin allergy are truly allergic," Boerneke explained. "However, several studies have demonstrated that having a penicillin allergy leads to higher use of broad-spectrum antibiotics, which contributes to the growing problem of antibiotic resistance. On top of that, broad-spectrum antibiotics are not only more expensive but also have a higher rate of adverse events, resulting in less favorable patient outcomes."

Boerneke and Kwan are working to improve implementation of the penicillin allergy screening protocol Boerneke developed in the outpatient care setting to aid the removal of erroneous allergies when indicated, identify inefficiencies and barriers, and work to expand this project into clinical areas of high need. To that end, they are training clinicians about the importance of obtaining an accurate allergy history through conducting penicillin allergy assessments and the utility of allergy and immunology referrals for penicillin skin testing. They created a [UNC Penicillin Allergy Handout](#) to educate patients and suggest healthcare providers take advantage of the educational materials available on the [AAAI's Penicillin Allergy Awareness Toolkit](#). The project continues through early 2021.

Stewardship Pharmacists Lead Remdesivir Roll-out Across UNC System

Antimicrobial Stewardship Program (CASP) is carrying out intensive stewardship in the realm of COVID-19. The work is a natural extension of its mission to improve the use of antimicrobials (which include antibiotics, antivirals, antifungals, and antiparasitics). In addition to CASP's daily stewardship to ensure patients receive antimicrobials only when needed, with the right drug, right dose, and right duration, team members are overseeing a painstaking process of making a new treatment available to hospitalized COVID-19 patients.

In May 2020, UNC Medical Center (UNCMC) was among the first hospitals to receive a batch of the first proven treatment for COVID-19 via the North Carolina Department of



Marx

Health and Human Services (NCDHHS). Remdesivir is a broad-spectrum antiviral created through a partnership between UNC epidemiologist Ralph Baric's Lab and Gilead Sciences. It shortens the average duration of COVID-19 symptoms by four days and shows a trend for decreased mortality.

Remdesivir had not yet been approved by the Food and Drug Administration (FDA) but was made available to critically ill patients since May under an Emergency Use Authorization (EUA). During an emergency such as the COVID-19 pandemic, an EUA makes treatments available prior to FDA approval based on limited but promising scientific evidence when there are no better alternatives available. The UNC Health Anti-Infective Subcommittee developed clinical guidance for physicians to help guide decisions about which patients are most likely to benefit from remdesivir, in accordance with strict EUA and NC DHHS rules. (Remdesivir was approved by the FDA in late October.)

Under an EUA, there are extra layers of assurances and reporting the Pharmacy Department undertakes to ensure that drugs are used appropriately, as UNCMC must provide a full accounting to NCDHHS for each dose administered. CASP's pharmacists Lindsay Daniels, PharmD, MPH and Ashley Marx, PharmD were responsibility for managing remdesivir across all UNC Health System hospitals.

"We all advocate for the patients, and each of us lends our expertise to ensure we're taking all factors available into account to make the best treatment decisions," Marx said.

As the global race forges ahead to identify safe and effective vaccines and therapeutics, all hope that additional, evidence-based treatments will continue to be added to the arsenal to help Marx and colleagues do just that.

Jonathan Parr, MD, MPH, a CASP team member who also directs the Division of Infectious Diseases inpatient COVID-19 service, praised the remdesivir roll-out, saying, "This is an extremely impactful activity and requires a tremendous amount of detailed, thoughtful work. Dr. Daniels and Dr. Marx have excelled in developing and implementing a system that supports patients, their loved ones, and their care teams across the state."



UNC Hospitals Incorporate Tele-antimicrobial Stewardship Approaches in the COVID-19 Era

The advent of COVID-19 catalyzed a still-evolving and radical shift in healthcare delivery, especially in hospitals that were already on the front lines of caring for the sickest patients. In March, as UNC Hospitals' non-critical employees were sent to work from home, Carolina Antimicrobial Stewardship Program (CASP) Medical Director Nikolaos Mavrogiorgos knew everyone would have to adapt to new realities. That's when he and CASP's Pharmacy Lead, Lindsay Daniels, put their heads together with the CASP team to see how they might adapt interventions to the times, with more physicians and pharmacists doing at least some of their work from home, and those in the hospital with infectious diseases expertise being tapped for the hospitals' COVID-19 response.

“There is a growing body of literature that demonstrates that tele-antimicrobial stewardship programs can effectively improve appropriate antimicrobial use, just as their traditional bricks-and-mortar counterparts do,” Mavrogiorgos explained.

“I was curious to explore how incorporating approaches such as video or teleconferencing might make our stewardship activities more nimble, given the changes brought with COVID,” he added.

National professional societies as well as regulatory and accreditation bodies now require or strongly recommend that all hospitals put in place an antimicrobial stewardship program. Tele-antimicrobial stewardship programs (tele-ASPs) are a practical option for expanding stewardship to smaller, rural facilities that often lack infectious diseases expertise available at larger, urban hospitals. Electronic medical record systems, the near-universal penetration of smartphones, secure chat and conferencing platforms, and strong, reliable



internet make tele-ASPs feasible in hospitals that do not yet have the resources for a fully in-house stewardship program.

A cornerstone intervention of antimicrobial stewardship is prospective audit and feedback, during which a member of the CASP team reviews inpatient medical records to ensure antimicrobial therapy is optimal based on available evidence. This intervention is mostly carried out using standard telemedicine communication tools embedded within the electronic medical record system such as secure messaging, and supplemented through use of pagers, phones, or a combination of these.

A critical component of any effective antimicrobial stewardship program is building trusted working relationships between members of the stewardship team and members of the various treatment teams who interface directly with patients. “Handshake stewardship”, a term coined by Parker, Hurst, Child, Palmer, and Pearce in 2015, refers to face-to-face feedback with clinicians about their patients who are being treated with antimicrobials using an informal, collegial, and collaborative approach to share recommendations. With face-to-face meetings and handshakes left by the wayside in the age of highly communicable COVID-19, it is likely that while the nomenclature and delivery of handshake stewardship may change, the characteristics that it embodies will be maintained through new pathways.

CASP uses a secure, HIPAA-compliant platform for video conferencing to review patients on antimicrobial therapy to identify opportunities to optimize therapy. Then, in place of in-person visits and handshakes with colleagues on the front lines of patient care, Mavrogiorgos, Daniels, and others on

Tele-antimicrobial Stewardship, cont.

the antimicrobial stewardship team, initiate a secure chat in the electronic medical record system.

“After we identify a patient whose therapy may be optimized,” Daniels explained, “we use a secure group chat to connect with the patient’s care team.” While it is not face-to-face communication as with handshake stewardship, because CASP team members typically have previously built trust and rapport with patient care teams, group chatting is a good substitute. It also has advantages over face-to-face interactions: it relieves some pressure when a

treatment decision is being questioned, and the patient care team members can respond when it is convenient. Additionally, using secure chats gives the attending antimicrobial stewardship physician or supervising antimicrobial stewardship pharmacist a chance to supervise fellows and pharmacy residents in training, even from a distance.

“In a few cases, speaking or meeting in real time is needed to work through unusually complex situations. But the majority of the time, tele-antimicrobial stewardship is the next best thing to being there,” said Daniels.

Meet the CASP Team

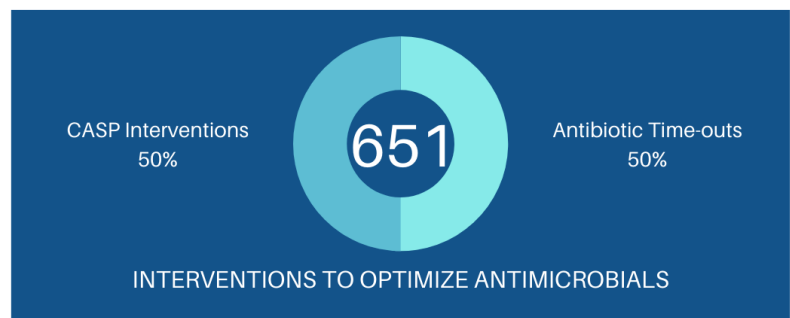
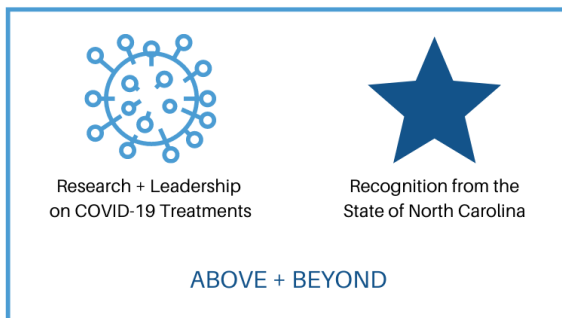
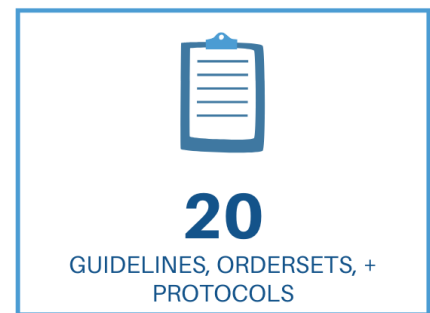
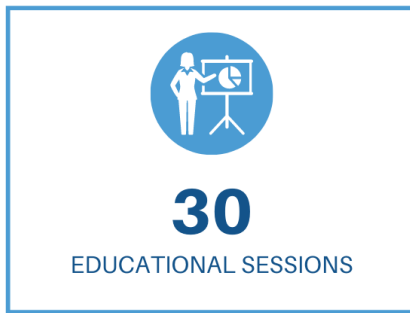
- Nikolaos Mavrogiorgos, MD | Medical Director, Carolina Antimicrobial Stewardship Program
- Lindsay Daniels, PharmD, MPH | Pharmacy Lead, Carolina Antimicrobial Stewardship Program
- Emily Sickbert-Bennett, PhD | Administrative Director, Carolina Antimicrobial Stewardship Program
- Zachary Willis, MD, MPH | Director of Pediatric Antimicrobial Stewardship

- Tom Belhorn, MD, PhD | Pediatric Infectious Diseases Physician
- Renae Boerneke, Pharm D, CPP, BCPS-OPAT Pharmacist
- Brian Bramson, MD | Associate Professor of Medicine and Pediatrics
- Emily Ciccone, MD, MHS | Advanced OPAT Fellow, Adult Infectious Diseases Physician
- Danielle Doughman, MSPH | Program Manager, Carolina Antimicrobial Stewardship Program
- Alan Kinlaw, PhD, MSPH | Epidemiologist, School of Pharmacy
- Anne Lachiewicz, MD, MPH | Associate Professor of Medicine, Division of Infectious Diseases
- Min Kim, MD, MSc | Clinical Fellow, Division of Infectious Diseases
- Will Kwan, Jr., MD | Assistant Professor, Division of Hospital Medicine
- Jessica Lin, MD, MSCR | Adult Infectious Diseases Physician
- Ashley Marx, PharmD | Infectious Diseases Pharmacist
- Melissa Miller, PhD | Director, McLendon Clinical Laboratories
- Ashlyn Norris, PharmD | Infectious Diseases Pharmacy Resident
- Jonathan Parr, MD, MPH | Adult Infectious Diseases Physician
- Carlos Rubiano, MD | Internal Medicine Residency Program, Inpatient Chief
- Michael Swartwood, BSN, RN, CAPM | Project Manager, Antibiotic Time-Outs
- Daphne Villanueva, MD | Immunocompromised Host Infectious Diseases Fellow
- Kayla Waldron, PharmD | Clinical Manager, Department of Pharmacy
- David Weber, MD, MPH | Medical Director, Office of Quality Excellence - Infection Prevention
- William Wilson, PharmD, BCPS | Pediatric Infectious Diseases Pharmacist
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At a Glance: CASP Achievements in FY2020



OPAT grows program despite pandemic challenges

UNC Medical Center's Outpatient Parenteral Antibiotic Therapy (OPAT) Program is a multidisciplinary team designed to provide a structured best practice-focused way for patients to receive IV antimicrobials outside of the acute care setting. OPAT allows patients to receive IV antimicrobials outside of the hospital, most commonly while at home. This increases patient independence and satisfaction while still delivering safe and appropriate antimicrobial therapy.

Over the past fiscal year (which ended on June 30), the program completed 354 separate OPAT courses. Patients completed 11,742 patient days on OPAT. One of the most rewarding elements of that number is that each patient day is a day that individuals were able to be out of the hospital and continue their recovery with greater independence. The three most common diagnoses during this period were: osteomyelitis (40% of OPAT courses), bacteremia (19% of OPAT courses), and diabetic foot infections (12% of OPAT courses).

Among the many changes brought by COVID-19 was a move from the team being co-located at UNCMC's

Infectious Diseases Clinic to a decentralized team working from various sites. Throughout this period of disruption, the OPAT program was able to continue providing its essential service enabling its patients to continue to receive their antimicrobials outside the hospital. In fact, the number of OPAT courses increased nearly 18% over the previous year, despite these challenges.

"Despite many challenges of COVID-19, our OPAT team adapted and worked together to continue to deliver excellent patient care," said OPAT team lead Renae Boerneke, PharmD.

Boerneke leads a team of physicians, a nurse practitioner, a nurse coordinator, an administrative specialist, a pharmacoepidemiologist, and a data manager. Together, the team manages the patient's antimicrobials, monitors labs, triages adverse events, interfaces with the patient's primary care providers, and provides oversight for the patient's inpatient to outpatient transition. The OPAT program started in 2015 and is now entering its fifth year. The past year was one unlike any in recent memory, yet UNCMC's OPAT program grew its ability to support patients and their recovery.

Posters & Publications

Carolina Antimicrobial Stewardship Program team members produce research posters and publications to contribute to evolving research on antimicrobial stewardship and related topics, advancing the field and building the evidence base. The most recent ones are listed below.



Posters

- Michael Swartwood, Claire Farel, Renae Boerneke, Nikolaos Mavrogiorgos, Ashley Marx, Asher Schranz, Emily Ciccone, Mary Catherine Bowman, Alan Kinlaw. (2020, Oct. 21). Identifying Intervention Opportunities to Prevent Readmissions during OPAT. [Poster Presentation]. ID Week 2020.
- Michael Swartwood, Renae Boerneke, Alan Kinlaw, Nikolaos Mavrogiorgos, Ashley Marx, Emily Ciccone, Asher Schranz, Mary Catherine Bowman, Claire Farel. (2020, Oct. 21). OPAT Delivery during COVID-19. [Poster Presentation]. ID Week 2020.
- Renae Boerneke, Michael Swartwood, Alan Kinlaw, Anita Holt, Nikolaos Mavrogiorgos, Ashley H Marx, Emily Ciccone, Asher Schranz, Mary Catherine Bowman, Claire Farel. (2020, Oct. 21). Post-discharge Coordination Telephone Outreach for Patients Enrolled in the UNC OPAT Program. [Poster Presentation]. ID Week 2020.
- Walker Mason, Alan C Kinlaw, Emily Ciccone, Kevin Alby, Melissa Miller, Lindsay Daniels. Implementation of rapid diagnostic testing and antimicrobial stewardship interventions to reduce time to optimal therapy for Staphylococcus aureus bacteremia. (Poster requires UNC Health log in.)



Publications

- Parr JB. Time to Reassess Tocilizumab's Role in COVID-19 Pneumonia. JAMA Intern Med. Published online October 20, 2020. doi:[10.1001/jamainternmed.2020.6557](https://doi.org/10.1001/jamainternmed.2020.6557)
- Daniels LM, Weber DJ. Interventions to improve antibiotic prescribing at hospital discharge: A systematic review Infection Control and Hospital Epidemiology 2020 Sept 1: 1-4 doi: [10.1017/ice.2020.367](https://doi.org/10.1017/ice.2020.367)
- Willis ZI, Wilson WS. Revised Daptomycin Interpretation Criteria for Enterococcus faecium: What Are the Implications for Children? J Pediatric Infect Dis Soc. 2020;9(2):265-267. doi: [10.1093/jpids/piz066](https://doi.org/10.1093/jpids/piz066)
- Rhea S, Jones K, Endres-Dighe S, Munoz B, Weber DJ, Hilscher R, MacFarquhar J, Sickbert-Bennett E, DiBiase L, Marx A, Rineer J, Lewis J, Bobashev G. Modeling inpatient and outpatient antibiotic stewardship interventions to reduce the burden of Clostridioides difficile infection in a regional healthcare network. PLoS One. 2020;15(6):e0234031. Published 2020 Jun 11. doi: [10.1371/journal.pone.0234031](https://doi.org/10.1371/journal.pone.0234031)
- Rimland CA, Morgan CE, Bell GJ, Kim MK, Hedrick T, Marx A, Bramson B, Swygard H, Napravnik S, Schmitz JL, Carson SS, Fischer WA, Eron JJ, Gay CL, Parr JB. Clinical characteristics and early outcomes in patients with COVID-19 treated with tocilizumab at a United States academic center. MedRxiv 2020.05.13.20100404; doi: [10.1101/2020.05.13.20100404](https://doi.org/10.1101/2020.05.13.20100404)
- Garcia Reeves AB, Lewis JW, Trogdon JG, Stearns SC, Weber DJ, Weinberger M. Association between statewide adoption of the CDC's Core Elements of Hospital Antimicrobial Stewardship Programs and rates of methicillin-resistant Staphylococcus aureus bacteremia and Clostridioides difficile infection in the United States. Infect Control Hosp Epidemiol. 2020 Apr;41(4):430-437. doi: [10.1017/ice.2019.352](https://doi.org/10.1017/ice.2019.352).

For more stewardship guidelines, resources, and news, visit www.med.unc.edu/casp.