David T. Bearden, Pharm. D.
Clinical Assoc. Professor and Chair, Dept. of Pharmacy Practice, Clinical Asst. Dir., Dept. of Pharmacy Services Oregon State University/Oregon Health & Science University

National attention on important issues and urgent causes is generally viewed as a plus. As a prime example, even in its overall raising of an alarm, the Disneyland measles outbreak has sparked a new national debate about the necessary role of vaccines in an era where many have not experienced the diseases being prevented. Similar light shed on evolving infectious diseases problems have been seen in outbreak stories of resistant pathogens like the recent CRE infections linked to duodenoscopes. For the infectious diseases practitioner this is yet another brief national reminder to the rest of the world that we are in a constant battle with many of these issues daily – but most don’t make the headlines. (I must confess I can only now hear the word “Ebola” without wanting to yell at the television reports.)

I’ll admit that having the government involved in things, particularly with the dysfunction that seems the norm at the capitol, may not always be a very comforting idea. However, in this case the National Action Plan for Combating Antibiotic-Resistant Bacteria is creating a national spotlight and path to improve national antimicrobial use. The strategy, created with expert input and multiple national bodies, looks at 5 pillars of effect: slowing the emergence and spread of resistance; improving human and animal pathogen surveillance; advancing rapid diagnostics; accelerating drug and vaccine discovery; and improving international collaborations. While all these areas have a direct impact on the roles of the infectious diseases pharmacists, the national plan for limiting resistance emergence and spread is deeply rooted in the codified activity of a large portion of our work – antimicrobial stewardship.

The Action Plan calls for the eventual implementation of universal antimicrobial stewardship in hospitals and other acute settings. The methodology suggested is tying stewardship requirements to institutional CMS payment. While this method is certainly not without possible issues, it also presents a new ‘nationwide’ commitment to the necessity of antimicrobial stewardship. It will certainly be a challenge to continue to develop and support enough practitioners to roll out such an ambitious plan. However, this is a challenge we must all meet together to best impact the resistance problems at hand.

The Society has been completely vested in the need for appropriate use of antimicrobials for the past 25 years, all ahead of the national wave now gaining ground. We will continue to work with our amazing members and growing list of professional partners to capitalize on the current movement. Our patients and our healthcare system require it. The spotlight is on - it’s time to keep it center-stage.
Opportunities for Employment

Pharmacist Clinical Staff/UKHC – Infectious Diseases/Antimicrobial Stewardship
Contact: Scott Kincaid, sekiz232@uky.edu
Details: Pharmacist Clinical Staff

Assistant/Associate Professor
Location: California Northstate University, College of Pharmacy
Contact: Vasudha Gupta, v Gupta@cnhus.edu
Details: Assistant/Associate Professor

Infectious Diseases Clinical Pharmacy Specialist
Contact: Dr. Matt Goetz, Matt.Goetz@va.gov
Details: https://www.usajobs.gov/GetJob/ViewDetails/401827200

Antimicrobial Stewardship Pharmacist
Location: St. Mary's Medical Center, Grand Junction, CO
Contact: Kate Christmas, 919-977-6186
Details: ASP Pharmacist

Assistant Professor of Pharmacy
Location: St. Louis College of Pharmacy
Contact: Ryan Moenster, Pharm.D., BCPS (AQ-ID); Ryan.Moenster@stlcop.edu
Details: Assistant Professor

Project Director, Antibiotic Resistance Project
Location: Washington, DC
Contact: The Pew Charitable Trusts
Details: Project Director

Medical Science Liaison - Infectious Disease/Anti-Infective (CO, NM, UT Region)
Location: CO, NM, UT
Contact: Wendy Copley, wcopley@tmacmail.com
Details: Infectious Diseases/Anti-Infective

Clinical Pharmacy Specialist
Location: Maricopa Integrated Health System, Phoenix, Arizona
Contact: http://jobs.mhs.org/clinical-pharmacy-specialist-pharmacy-hospital/job/5146021
Details: Clinical Pharmacy Specialist

Senior Associate, Antibiotic Resistance Project
Details: Senior Associate

Infectious Diseases - Antimicrobial Stewardship Clinical Specialist
Location: Medical University of South Carolina
Contact: Joseph E. Mazur, PharmD, BCPS, mazurij@musc.edu
Details: ID-Antimicrobial Stewardship Clinical Specialist
Clinical Scientific Director - 7 positions available  
Location: Cubist - Multiple Territories  
Details: Clinical Scientific Director

Clinical Pharmacy Specialist - Infectious Disease  
Location: Florida  
Contact: Bob Costa, C.P.C., bob.costa@sierrastaffing.com  
Details: Clinical Pharmacy Specialist

Assistant/Associate Professor - Internal Medicine/Pharmacotherapy  
Location: University of Maryland - Rockville, MD  
Contact: Heather Congdon, Pharm.D., BCPS, CDE, lcongdon@rx.umaryland.edu  
Details: Assistant/Associate Professor - Internal Medicine

Medical Science Liaison - Infectious Disease/Antimicrobial  
Location: Multiple Territories  
Contact: Theravance Biopharma - Karmon Johnson, Pharm.D., 501-626-8200  
Details: Medical Science Liaison - ID

Medical Liaison - Infectious Disease  
Location: Multiple Locations  
Details: http://ejob.bz/ATS/jb.do?reqGK=839262

Antibiotics and Innovation Project (AIP) Project Director  
Location: The Pew Charitable Trusts, Washington, DC  
Details: Director

Assistant or Associate Professor of Clinical Pharmacy  
Location: UCSF School of Pharmacy  
Details: Clinical Pharmacy Faculty

Clinical Pharmacy Specialist, Infectious Diseases  
Location: Prestigious Hospital System, Philadelphia  
Contact: Bob Costa bob.costa@sierrastaffing.com  
Details: Clinical Pharmacy Specialist

Pharmacist  
Location: San Francisco General Hospital - HIV/AIDS Division  
Contact: Elena Jensen jensene@php.ucsf.edu  
Details: Pharmacist

Infectious Disease/Antimicrobial Stewardship Clinical Team Leader  
Location: Carolinas Healthcare System, Charlotte, NC  
Contact: Kelly Goodson, PharmD, Kelly.goodson@carolinashc.org  
Details: Clinical Team Leader

Clinical Pharmacist Specialist – Infectious Diseases  
Location: Maine Medical Center  
Contact: Ned Asherman; Easherman@mmc.org  
Details: Clinical Pharmacy Specialist - ID

Antibiotic Stewardship Pharmacist (ASP)  
Location: Alexian Brothers Health Systems  
Contact: Mary Williamson; mary.williamson@alexian.net  
Details: ASP

Medical Science Liaison  
Location: Nationwide Opportunities  
Contact: Lynette Lapola; LLAPOLA@judge.com  
Details: MSL

Infectious Disease Clinical Specialist  
Location: Eastern Maine Medical Center  
Contact: Jamie L. Cronin, PharmD, BCPS; jcronin@emhs.org  
Details: Infectious Disease Clinical Specialist

Senior Manager/Field Trainer for Infectious Disease Medical Science Liaison Team  
Location: Candidate can live anywhere in the US  
Contact: Theravance Biopharma - Karmon Johnson, Pharm.D., 501-626-8200  
Details: Senior Manager/Field Trainer

Medical Science Liaison - Infectious Disease/Antimicrobial  
Location: Southeast Region: GA, AL, FL, NC, TN, SC  
Contact: The Medical Affairs Company  
Details: Medical Science Liaison

Medical Science Liaison - Infectious Disease/Antimicrobial  
Location: West Region: CA, WA, AZ, NV, OR, CO  
Contact: The Medical Affairs Company  
Details: Medical Science Liaison

Clinical Pharmacist  
Location: Duke Antimicrobial Stewardship Outreach Network - Georgia/South Carolina  
Contact: Paul Thacker II, Paul.thacker@duke.edu, 919-684-4560  
Details: Clinical Pharmacist

Clinical Pharmacy Specialist – Infectious Disease  
Location: National Institutes of Health Clinical Center, Pharmacy Department, Bethesda, MD  
Contact: Barry Goldspiel, PharmD, BCPS, BCOP, bgoldspiel@nih.gov, 301-496-5869  
Details: Clinical Pharmacy Specialist

Nationwide Opportunities for Medical Science Liaison - Infectious Disease/Anti-Infective  
Location: Nationwide  
Contact: www.TheMedicalAffairsCompany.com; Wendy Copley; wcopley@tmacmail.com  
Details: Medical Science Liaison

Director, Global Medical Affairs Strategy  
Location: Cubist Pharmaceuticals, Inc. - Lexington, Massachusetts  
Details: Director

Clinical Pharmacy Specialist - Infectious Disease  
Location: Phoenix, Arizona  
Contact: Bob Costa, C.P.C., bob.costa@sierrastaffing.com  
Details: Clinical Pharmacy Specialist

Medical Science Liaison  
Contact: Theravance  
Details: Medical Science Liaison
<table>
<thead>
<tr>
<th>Position</th>
<th>Location</th>
<th>Contact</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director, Infectious Diseases, Global Health Science</td>
<td>The Medicines Company, Several positions throughout the USA (Field-Based) for Qualified Applicants; Immediate Hiring</td>
<td>Jill Massey, PharmD, MBA, <a href="mailto:Jill.Massey@themedco.com">Jill.Massey@themedco.com</a></td>
<td>Director, Infectious Diseases</td>
</tr>
<tr>
<td>Outpatient Infectious Diseases Clinical Pharmacy Specialist</td>
<td>Parkland Health and Hospital System, Dallas, TX</td>
<td>Steven Carlisle, PharmD, BCPS <a href="mailto:steven.carlisle@phhs.org">steven.carlisle@phhs.org</a></td>
<td>Outpatient ID Clinical Pharmacy Specialist</td>
</tr>
<tr>
<td>Assistant Professor of Translational Sciences</td>
<td>The University of Texas at Austin College of Pharmacy, San Antonio, Texas</td>
<td>Christopher Frei, Pharm.D., FCCP, <a href="mailto:freic@uthscsa.edu">freic@uthscsa.edu</a>, 210-567-8371</td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>Staff Pharmacist, Infectious Disease Specialist</td>
<td>Baptist Hospital East, Louisville, KY</td>
<td>Lindsey Higginbotham <a href="mailto:Lindsey.higginbotham@bhsi.com">Lindsey.higginbotham@bhsi.com</a></td>
<td>Staff Pharmacist</td>
</tr>
<tr>
<td>Infectious Diseases Medical Science Liaison - South Central</td>
<td>The Medical Affairs Company</td>
<td>TMAC Career Center <a href="http://tmac.hodesiq.com/">http://tmac.hodesiq.com/</a></td>
<td>ID Medical Science Liaison</td>
</tr>
<tr>
<td>Medical Science Liaison - Virology (AL, GA, MS, TN, SC)</td>
<td>Atlanta, Georgia, United States, 30301</td>
<td><a href="mailto:kotly001@umn.edu">kotly001@umn.edu</a></td>
<td>Medical Science Liaison</td>
</tr>
<tr>
<td>Tenure Track Assistant Professor</td>
<td>University of Minnesota</td>
<td><a href="mailto:kotly001@umn.edu">kotly001@umn.edu</a></td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>Senior Clinical Research Scientist</td>
<td>Cubist Pharmaceuticals, Lexington, Massachusetts</td>
<td>Senior Clinical Research Scientist</td>
<td></td>
</tr>
<tr>
<td>Tenured Associate/Full Professor</td>
<td>University of Minnesota</td>
<td><a href="mailto:jacob117@umn.edu">jacob117@umn.edu</a></td>
<td>Full/Associate Professor</td>
</tr>
</tbody>
</table>

*All listed job opportunities have more extensive information listed on SIDP's website.*

To add or revise listings please email Stephanie Bulak at sbulak@eami.com.

SIDP WELCOMES OUR NEWEST MEMBERS!

<table>
<thead>
<tr>
<th>Active</th>
<th>Associate</th>
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<tbody>
<tr>
<td>Andrew Carr</td>
<td>Brett Anderson</td>
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<tr>
<td>Angel Hyerly</td>
<td>Chris Childress</td>
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<tr>
<td>Armisha Desai</td>
<td>Fiona Bournazos</td>
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<tr>
<td>Cyle White</td>
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<td>Daniel Chastain</td>
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<td>Greg Perry</td>
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<td>Jan Pack</td>
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<td>Jody KP Chu</td>
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<tr>
<td>Jonathan Edwards</td>
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<tr>
<td>Jordan Schneider</td>
<td>Navaneeth Narayanan</td>
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<tr>
<td>Katie Barber</td>
<td>Pamela Ny</td>
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<tr>
<td>Kelly Percival</td>
<td>Polina Lerner</td>
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<tr>
<td>Kerri Johnson</td>
<td>Robert Ortuno</td>
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<tr>
<td>Lauren Cochran</td>
<td>Samuel Aitken</td>
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<tr>
<td>Lauren Lopez</td>
<td>Sara Al-Dahir</td>
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<tr>
<td>Mandelin Cooper</td>
<td>T. Lance Smith</td>
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<tr>
<td>Marianna Fedorenko</td>
<td>Tyler Liebenstein</td>
</tr>
<tr>
<td>Mary Beth Brinkman</td>
<td>Whitney Buckel</td>
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</table>

SIDP SIDP SIDP SIDP SIDP WELCOMES OUR NEWEST MEMBERS!
SIDP Members -

The results of the **SIDP Primary Elections** are now available. There was a talented ballot of candidates this year with 11 extremely qualified members who wanted to give back to the society by running for the President Elect and Board Member-At-Large. We would like to thank all the candidates for their time and commitment to SIDP.

The top two candidates for each position are listed as follows (in no particular order):  

---

**PRESIDENT-ELECT**  
- Melinda Neuhauser  
- Brandon Bookstaver  

**BOARD MEMBER-AT-LARGE**  
- Vincent Tam  
- Renee Claude Mercier  

---

The final elections open June 8th. We had great participation for the primary elections and we encourage all active members to help keep this momentum going by voting in the final elections. This year voters will be entered into a raffle for an i-Pad and the winner will be notified following the election results. *Your vote is important!*

---

The Antimicrobial Stewardship webinar subcommittee is working with the content authors and ProCE to update the live webinar presentations in preparation for CE re-accreditation (November 2015).

---

| 137 - New participants enrolled in the certificate program (Jan - April 2015) |
| 789 - Total number of active participants |
| 63 - Participants successfully completing the program between January and April 2015 |
A Professional Farewell
from One of SIDP's Founders

“It’s been 40+ years since receiving my pharmacy degree, and with half spent in clinical/academic settings and half in Pharma, the experiences have run the gamut.....unfortunate to exceptional! But, it’s time to cut back, spend more time with family, get some much-needed exercise, play some golf, take up fishing again, travel......”

“Effective April 1st, I will be officially “retired”, but still doing a limited amount of consulting for Theravance Biopharma. There may be other opportunities to share my experiences, so we’ll see what happens. I treasure all of the friends and colleagues in SIDP, and wish you all the best. Please stay in touch (same email address should continue to work), and for those of you that laugh at my foibles in golf, I can’t wait for the next FLOG......”

Steve Barriere
<table>
<thead>
<tr>
<th>Date / Location</th>
<th>Conference Name</th>
<th>Conference URL</th>
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<tr>
<td>September 17 San Diego, CA</td>
<td>SIDP 2014 Annual Meeting</td>
<td><a href="http://sidp.org/page-1415597">http://sidp.org/page-1415597</a></td>
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<td>September 22 San Diego, CA</td>
<td>2nd International Conference on Polymixins</td>
<td><a href="http://monash.edu/pharm/about/events/polymyxins/registration.html">http://monash.edu/pharm/about/events/polymyxins/registration.html</a></td>
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<tr>
<td>October 7 - 11 San Diego, CA</td>
<td>IDWeek 2015</td>
<td><a href="http://www.idweek.org">http://www.idweek.org</a></td>
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<tr>
<td>October 24 – 29 Chicago, IL</td>
<td>7th ASM Conference on Biofilms</td>
<td><a href="http://conferences.asm.org/index.php/upcoming-conferences/7th-asm-conference-on-biofilms">http://conferences.asm.org/index.php/upcoming-conferences/7th-asm-conference-on-biofilms</a></td>
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Congratulations to the following SIDP members for recent publications:

<table>
<thead>
<tr>
<th>Ballow, Charles</th>
<th>Hall, Ronald</th>
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<tr>
<td>Barber, Katie</td>
<td>Hayney, Mary</td>
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<td>Barton, Karen</td>
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<td>Burgess, David</td>
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<td>Cleeys, Kimberly</td>
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<td>Clay, Patrick</td>
<td>Kenney, Rachel</td>
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<td>Collins, Curtis</td>
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<td>Crandon, Jared</td>
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<td>Darin, Kristin</td>
<td>Kut, Joseph</td>
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<td>Deming, Paulina</td>
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<td>Williamson, John</td>
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<td>Worley, Marylee</td>
<td>Wrenn, Rebekah</td>
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</table>


**PK/PD**


**CLINICAL RESEARCH**


HIV


OTHER


Kassamali Z, Danziger L. To B or Not to B, that is the question: is it time to replace colistin with polymyxin B? Pharmacotherapy. 2014 Oct 24.


INTRODUCTION

Antibiotics account for nearly 80% of all prescription medications during pregnancy.\(^1\) Reports suggest that approximately 20-25% of women will receive an antibiotic during pregnancy.\(^1\) The most common infections encountered in pregnancy include urinary tract infections (UTI), sexually transmitted diseases (STDs) and upper respiratory tract infections (URTI).\(^1\) Although use of any medication is a risk versus benefit decision, untreated infections such as UTI or STDs are associated with significant fetal risk including spontaneous abortion, prematurity and low birth weight.\(^4\) Randomized controlled studies are often not feasible in pregnant women and are potentially unethical in many instances.\(^6\) Thus, pregnancy is often a standard criteria for exclusion in clinical trials. It is estimated that only 10% of medications marketed since 1980 have sufficient data regarding infantile risk in pregnancy.\(^7\)

As a method to establish teratogenic potential of these medications, the United States Food and Drug Administration (FDA) established a pregnancy risk categorization system in 1979.\(^9\) This mandate required newly marketed agents to include pregnancy risk categories of A, B, C, D and X supplemented by statements for risk interpretation (Table 1). In December of 2014, the FDA approved and unveiled a new plan for product labeling, effective June of 2015, which abolishes the original FDA Pregnancy Category system.\(^10\) Three narrative sections will be required in the product labeling including “Pregnancy”, “Lactation” and “Female and Male Reproductive Potential”, replacing previous sections, which will apply to all products approved since June of 2001.\(^10\)

Physiologic changes in pregnancy lead to potential pharmacokinetic changes that may impact drug therapy.\(^11\) Increases in total body water, blood volume (40-50%), and plasma volume (40-50%) contribute to increases in volume of distribution of various antibiotics.\(^11\) Renal blood flow increases by 50%, possibly due to vasodilation of afferent and efferent arterioles as a result of increased progesterone.\(^11\) Serum creatinine decreases, while glomerular filtration rate (GFR) increases enhancing elimination of renally excreted antibiotics. GFR will approach post-partum values at approximately 3 weeks prior to delivery.\(^12\) Alterations in gastrointestinal motility may lead to changes in absorption, oral bioavailability, and delayed onset of action of certain antibiotics.\(^12\) There are known changes in hepatic enzymes during pregnancy that clinicians may use to adjust doses, but current data are controversial as to whether these changes lead to clinically significant changes in drug metabolism and subsequent serum concentrations.\(^12\) Finally, decreases in albumin and alterations in maternal plasma pH are expected to lead to decreased protein binding and increased concentrations.
Antibiotic exposure in pregnancy may have untoward short-term and long-term effects on infant weight. A recent study showed that after adjusting for a number of factors, prenatal exposure of the infant to antimicrobials (via self-reporting by the mother) resulted in a lower birth weight of approximately 138 grams. Antimicrobial exposure during pregnancy has recently been linked to childhood obesity, although specific antimicrobial class exposure was not documented in the study. Prenatal antibiotic use and the risk of neurologic disease, including cerebral palsy and epilepsy, and atopic disease, including atopic dermatitis and asthma, have been studied independently. Several studies demonstrate an association while others do not. A recently published small study demonstrated that prenatal antibiotic use may be associated with the development of asthma by age three in children at risk for asthma (OR 3.1, 95% CI 1.4-6.8). Medication use by trimester is even more scarcely studied. Prenatal antibiotic risk associated with asthma and wheezing was significant when antibiotics were used by the mother in the second to third trimesters but not during the first. Conversely, a 2015 Cochrane review of prophylactic antibiotic use in the second and third trimesters which included seven randomized controlled trials did not demonstrate an increased risk of congenital abnormality. However, the authors concluded there was insufficient evidence to full evaluate possible fetal harm.

This paper, the conclusion of a 3-part review, provides updated information as of April 2015 on antibiotics in pregnancy to include drug-specific risk evaluation (Table 2) and clinical utility based on published evidence.

AMINOGLYCOSIDES
Amikacin, gentamicin, kanamycin, neomycin, streptomycin and tobramycin encompass the drug class of aminoglycosides. Aminoglycosides cross the placenta and may result in toxicities, especially if administered in the first trimester of pregnancy. Case reports of irreversible bilateral congenital deafness with maternal use of streptomycin in the first trimester have been described leading to a US boxed warning of the drug class and a FDA Pregnancy Category of D. Other aminoglycosides have not commonly demonstrated similar hearing loss but if hearing abnormalities occurred symptoms were mild without clinical significance. Animal studies with gentamicin in rats and rabbits did not result in fetal toxicity. During pregnancy, the serum half-life of aminoglycosides is shorter and clearance is increased. Due to this and a larger volume of distribution in pregnant women, aminoglycosides may have a lower serum peak concentration compared to non-pregnant women. Traditional or extended interval dosing of aminoglycosides in pregnancy are both supported in the literature. Despite toxicity reports, short courses of aminoglycosides, may be used in pregnant women with careful monitoring if likely benefit outweighs potential risk. Possible risks should be explained, especially in the first trimester. Due to the risks associated with streptomycin use specifically, this agent should be avoided.

BETA-LACTAMS
Penicillins
Penicillins and their newer derivatives are the most widely prescribed antimicrobial class during pregnancy. Intravenous penicillin remains the first-line therapy for group B streptococcal prophylaxis at the time of delivery if the patient is colonized with ampicillin recommended as a suitable alternative. Penicillins generally cross the placenta in high concentrations. Those penicillins with increased protein binding such as the antistaphylococcal penicillins (except methicillin) produce lower fetal tissue concentrations compared with those penicillins with low protein binding such as penicillin G or ampicillin. Due to increased plasma volume and creatinine clearance in pregnant patients, serum penicillin serum concentrations may be decreased as much as 50% which may require increased doses and/or frequency. Penicillins have a long track record of safety over many years with the parent compound penicillin as well as the aminopenicillins (ampicillin and amoxicillin) having the most robust safety data. All penicillins and their derivatives as well as penicillin combinations with beta-lactamase inhibitors such as clavulanate or sulbactam have been assigned a Pregnancy Category B rating from the FDA indicating no proven human risk. Pregnant patients should be prescribed penicillins if possible unless an allergy is documented that would prohibit penicillin-based therapy.

Cephalosporins
Cephalosporins have a long history of documented use in the pregnant population and are often used for similar indications as penicillins. Cephalosporins remain a first-line option for many infections in pregnancy with general use reserved for patients allergic or intolerant to penicillin therapy.

Cephalosporins have decreased plasma concentrations in pregnant patients due to increased renal elimination with potential dosage/frequency increases required. Unlike penicillins, fetal concentrations are low with most cephalosporins, especially first generation cephalosporins which achieve approximately 10% of maternal concentrations in the fetus.

The FDA has classified all cephalosporins as having Pregnancy Category B. Findings from a Michigan Medicaid database suggested a potential association between ceftriaxone and cardiac malformation. However, ceftriaxone is the drug of choice for the treatment of gonorrhea during pregnancy. Ceftriaxone should be used cautiously at term due to the potential risk of kernicterus. Newly approved agents such as ceftolozane/tazobactam and ceftazidime/avibactam are also Pregnancy Category B agents; however, they should be used with caution as there is a lack of published data during pregnancy.

Carbapenems
There is a paucity of data regarding the use of carbapenems during pregnancy. Ertapenem, meropenem, and doripenem are Pregnancy Category B while imipenem-cilastatin is a classified...
as Pregnancy Category C. Pharmacokinetic changes associated with pregnancy have been clearly shown to decrease imipenem concentrations. A study of 20 patients showed a nearly 70% reduction in peak serum imipenem concentrations in both early and late term pregnant patients (n=14) compared to the non-pregnant patient (n=6). Carbapenem therapy should be reserved for pregnant patients with infections resistant to penicillin and cephalosporin therapy with limited alternatives.

**Monobactams**

While its lack of cross reactivity with penicillins and cephalosporins makes aztreonam appealing, there are inconclusive data regarding the safety of aztreonam in pregnancy. Most safety data is in the perinatal period which supports its FDA Pregnancy Category B rating. Data are limited in the first trimester thus aztreonam should be used with caution during this period. Aztreonam crosses the placenta although fetal serum concentrations are low. Due to a lack of data at this time, aztreonam use should be restricted to patients with severe penicillin allergy who cannot receive beta-lactam therapy.

**FLUOROQUINOLONES**

Although fluoroquinolones are a group of synthetic antibacterial agents classed as Pregnancy Category C, however, they are generally contraindicated in pregnancy. Fluoroquinolones may be safe during the first trimester but are not recommended because previous animal studies found fetal harm. There is a suggested association with fluoroquinolones and renal toxicity, cardiac defects, and CNS toxicity in the fetus. Animal data has demonstrated bone and cartilage damage in the fetus. Data are inconsistent and more studies are needed to confirm these associations. Authors of a recent literature review concluded that the risks to humans may not be the same as animals however, because human studies had weak study designs, small sample sizes, and confounding variables, the data are not adequate to support their routine use in pregnancy. Because of the current evidence, fluoroquinolone use in pregnancy is only recommended if there is no alternative and the pregnancy remains viable.

**GLYCOPEPTIDES AND LIPOGLYCOPEPTIDES**

Vancomycin is a glycopeptide that is classified as Pregnancy Category B, and is thought to be safe to use in pregnancy in the case of serious gram positive infections, particularly during the second and third trimesters. Vancomycin crosses the placenta and has been found in umbilical cord blood after IV administration. Despite the absence of robust clinical data evaluating use of vancomycin in pregnancy, there are reports to suggest that it is safe to use during pregnancy. In one report, vancomycin IV was given to 10 pregnant women for infections caused by methicillin-resistant *Staphylococcus aureus* (MRSA) infections. No abnormalities, including hearing loss or nephrotoxicity, were noted in the fetus after at least 1 week of vancomycin therapy during the second or third trimesters. Other cases, where vancomycin was administered for 13 and 28 days, found similar results, with no ototoxicity or nephrotoxicity in the mother or neonate. In animal trials, no congenital malformations were noted following IV administration of vancomycin in rats or rabbits given 1 to 5 times the maximum recommended human doses. When used orally, vancomycin has little systemic absorption, and is not believed to cause adverse effects during pregnancy. Higher doses of oral vancomycin (>500 mg), renal dysfunction and severe colitis have been associated with detectable serum concentrations with oral administration and should be considered in exposure.

Telavancin, oritavancin, and dalbavancin are lipoglycopeptides with gram-positive activity similar to that of vancomycin. There are no human data available for telavancin, however, animal data suggest that telavancin may cause harm (Pregnancy Category C). In rat, rabbit, and minipig studies, telavancin caused limb and skeletal malformations and fetal weight loss. The manufacturer recommends that women of childbearing potential have a serum pregnancy test prior to beginning therapy with telavancin and placed on effective contraception continued during therapy. There are no human data available for the use of oritavancin or dalbavancin in pregnancy, and animal studies found no fetal toxicity at doses comparable to human doses (Pregnancy Category C). With oritavancin, doses of approximately 25% of the human dose had no evidence of harm to the fetus in rat and rabbit studies, while higher doses have not been tested. After dalbavancin exposures of 3.5 times the human dose, rats were found to have increased embryo lethality and offspring death. Telavancin, oritavancin, and dalbavancin should be avoided in pregnancy unless the benefit outweighs the risk to the fetus.

**MACROLIDES AND KETOLIDES**

Data on the safety of macrolides in pregnancy are widely variable. The first associations of erythromycin (Pregnancy Category B) exposure with cardiovascular defects and pyloric stenosis in offspring occurred in 2003, however later studies did not corroborate these results. In a retrospective cohort, investigators recorded the presence of congenital malformations, pyloric stenosis, or intussusceptions in order to determine the effect of macrolides on fetal development. In 1,033 women exposed to macrolides (erythromycin, azithromycin, clarithromycin, or roxithromycin), there was no association with development of major malformation in the fetus and macrolide use. In addition, exposure in the third trimester was not associated with pyloric stenosis or intussusception. In a review of maternal erythromycin exposure over 15 years, erythromycin was persistently associated with cardiovascular defects (risk estimate 1.70 (95% confidence interval 1.26-2.39)). Most defects were considered mild. In infants with congenital heart disease and pyloric stenosis, there was no association with macrolide exposure compared to non-exposed controls.

Azithromycin has generally been considered safe for use in pregnancy and is labeled as Pregnancy Category B. In rats and mice, azithromycin at doses 2-4 times human doses was not associated with any evidence of fetal harm. Clinically, a patient with Q fever was successfully treated with azithromycin...
500 mg for 6 days.\textsuperscript{54} No evidence of fetal abnormality or residual infection was found. In a comparison of women exposed to azithromycin versus other antibiotics or non-teratogens, no differences were found in the rates of major malformations between groups.\textsuperscript{55} Similar to erythromycin, data with clarithromycin (Pregnancy Category C) have been conflicting. In animal studies, some rats exposed to clarithromycin in the first trimester did not result in teratogenicity, while other strains showed low incidences of cardiac abnormalities after clarithromycin exposure.\textsuperscript{53} Other data report cleft palate in murine studies and retarded fetal growth in monkeys.\textsuperscript{53} In clinical reports, including a prospective controlled study, clarithromycin exposure has not been associated with increased incidence of major malformations.\textsuperscript{30,56,57}

Telithromycin is a ketolide antibacterial with similar structure and activity as the macrolides. There are no human data for the use of telithromycin in pregnancy, and it is labeled as Pregnancy Category C.\textsuperscript{58} In rats and rabbits, telithromycin was not teratogenic at doses ranging from 0.5 to 1.8 times the human doses.\textsuperscript{58} At higher doses, delayed fetal maturation was observed, possibly related to maternal toxicity. Given its relative limited utility and potential risk, telithromycin should be avoided in pregnancy.

**OXAZOLIDINONES**

Currently, there is a lack of controlled studies of linezolid and tedizolid in pregnant women. Positive maternal outcomes without fetal teratogenesis were detailed in a case report of linezolid use (4 weeks) starting at 14 weeks of pregnancy.\textsuperscript{59} Both agents are FDA Pregnancy Category C and animal studies in mice, rats and rabbits have not shown teratogenic effects.\textsuperscript{23,60} However, in rats, linezolid and tedizolid resulted in mild fetal toxicities including decreased fetal body weight and reduced ossification of the sternebrae at maternally toxic doses.\textsuperscript{60,61} A reduction in fetal weight and increase in costal cartilage abnormalities were seen with tedizolid use in mice with the absence of maternal toxicities (4-fold the estimated human exposure based on area under the concentration curve (AUC)).\textsuperscript{59} Fetal weight loss and maternal toxicity were identified with tedizolid use in rabbits. However, in a pre- and post-natal toxicity study of rats, no offspring defects were documented with tedizolid used at the highest tested dose equivalent to the plasma AUC exposure of the 200mg/day clinical dose.\textsuperscript{60} Oxazolidinones could be considered for use during pregnancy when potential benefits outweigh the risks.

**TETRACYCLINES**

Labeled as Pregnancy Category D, tetracyclines have proven teratogenicity in humans.\textsuperscript{23,82} They are associated with congenital defects while large doses have been linked to maternal liver toxicity.\textsuperscript{63} Tetracyclines cross the placenta and when used beyond the second trimester, they can bind to calcium in the developing fetus causing permanent discoloration of bones and teeth. They are contraindicated past the fifth week of pregnancy.\textsuperscript{23} The American Academy of Dermatology guidelines recommend avoiding tetracyclines in pregnancy.\textsuperscript{64} Topical tetracyclines are considered safe for the treatment of maternal acne.\textsuperscript{65} Tetracyclines should be used with extreme caution, if at all, in pregnancy, and only when a clear benefit has been established. In rare cases, doxycycline may be considered in pregnant women who have life-threatening tick-borne illnesses.

**Miscellaneous Antibiotics**

**Clindamycin**

Clindamycin is a lincosamide antibiotic and is classified as Pregnancy Category B.\textsuperscript{23} Some experts, but not all, support the use of oral clindamycin as an alternative to metronidazole as clindamycin has been shown to reduce preterm birth and late miscarriage.\textsuperscript{4,66} In contrast, vaginal clindamycin is not recommended due to systemic absorption, increased risk of adverse neonatal outcomes (neonatal infection and low birth weight), and lack of efficacy.\textsuperscript{23,34} Systemic clindamycin crosses the placenta reaching cord serum concentrations about half of the mother's.\textsuperscript{67} Late clindamycin use (up to 32 weeks gestation) is associated with adverse outcomes and CDC treatment guidelines recommend avoiding vaginal clindamycin in the latter half of pregnancy.\textsuperscript{34,68}

**Daptomycin**

Daptomycin is Pregnancy Category B and should be used in pregnancy only if the benefit outweighs the risk.\textsuperscript{5,23} There are no controlled trials with daptomycin (a cyclic glycopeptide) during pregnancy, however, isolated reports suggest that daptomycin may be safe to use.\textsuperscript{69,70} In the first report, a woman in the third trimester was successfully treated with daptomycin 4 mg/kg for 14 days for vancomycin- and ampicillin-resistant Enterococcus faecium pylonephritis.\textsuperscript{59} In another report, a 14-week pregnant patient with a history of drug abuse was successfully treated with daptomycin 6 mg/kg for 6 weeks for tricuspid valve endocarditis.\textsuperscript{70} No adverse effects were noted in the patient or in the neonate at birth in either report. In animal studies, daptomycin was administered to rats and rabbits at doses 2-4 times human doses with no evidence of harm to the fetus.\textsuperscript{15}

**Fidaxomicin**

Although fidaxomicin, a non-absorbable macrocyclic antibiotic, is Pregnancy Category B, there are no published documented cases of use in pregnant women. Reproductive studies in rats and rabbits at doses 66 to 200 times the exposure expected in humans at standard dosing (200mg orally twice daily) revealed no harm to the fetus.\textsuperscript{71} Systemic exposure to fidaxomicin is minimal with plasma concentrations falling below the level of detectability in most patients.\textsuperscript{72} No studies of fidaxomicin concentrations in breast milk are available; however, due to the pharmacokinetic profile, limited infant exposure would be expected.

**Fosfomycin**

Fosfomycin (Pregnancy Category B) is generally well tolerated and although it crosses the placental barrier, no adverse events in the fetus or infant have been reported.\textsuperscript{73} In Europe, it is used with caution in pregnancy as an injectable agent, which is not available in the United States.\textsuperscript{73} This agent is recommended
because of its high sensitivity, ease of use, and safety in pregnancy.74 75

**Nitrofurantoin**

Nitrofurantoin is classified as Pregnancy Category B, however, it is contraindicated in the first trimester of pregnancy.23,76 Several trials have linked nitrofurantoin use in asymptomatic *Trichomonas vaginalis* infection or increased fetal fibronectin concentrations with increased pre-term birth (PTB) rates.77,78 Multivariate analysis showed no relationship between nitrofurantoin exposure at any time during pregnancy with PTB, low birth weight or congenital abnormalities.79 Vaginal nitrofurantoin should be used with caution when used during pregnancy, as a potential link with congenital hydrocephalus has been suggested.80 Nitrofurantoin also remains a guideline-recommended therapy for BV and Trichomonal infections in pregnancy but risk of repeat exposure during pregnancy is unknown and a reduced risk of PTB has not been clearly established.

**Sulfamethoxazole/Trimethoprim**

Sulfamethoxazole and trimethoprim are both rated FDA Pregnancy Category C.23 Animal studies have demonstrated teratogenic effects. Sulfamethoxazole and trimethoprim both cross the placenta and should be avoided in the first trimester due to trimethoprim’s mechanism as a folate antagonist. Exposure during this period can result in major congenital malformations (OR 2.43; 95% CI 1.92-3.08), primarily neural tube (OR 6.3; 95% CI 4.34-9.15) and cardiac defects (OR 1.76; 95% CI 1.05-2.95).85 Trimethoprim has also been associated with an increase in cleft palates with first trimester use (prevalence OR 14.29; 95% CI 3.46–59.05).90 Increases in cardiac (OR 2.49; 1.18–5.26) and limb (OR 2.13–4.23) malformations were seen with trimethoprim use 12 weeks prior to conception.91 However, maternal folic acid supplementation reduces the risk of major fetal malformations from trimethoprim. Sulfonamides should not be used in the third trimester as they theoretically result in an increase of unbound bilirubin due to competitive protein binding. However, the literature lacks clinical reports of this outcome with sulfamethoxazole and trimethoprim.92 Sulfamethoxazole and trimethoprim use during the first trimester has been also associated with urinary tract defects (OR 3.05; 95% CI 1.13-8.23) and its use during the last two trimesters has been associated with small for gestational age newborns (OR 1.61, 95% CI 1.16–2.23).93 Pharmacokinet parameters in pregnancy are similar to those in non-pregnant women.94 Overall, sulfamethoxazole and trimethoprim should be avoided in the first trimester and after 32 weeks gestation, if other treatment options are available.92 In the second and third trimesters, use in pregnant women may occur if the benefits outweigh the potential risks.

**Polymyxin**

Polymyxin B and colistin are considered Pregnancy Category C.23,85 In the few published cases and single database examined, there does not appear to be an increased risk of PTB, low birth weight or congenital abnormalities, although the data are quite limited.86 In an animal model examining risk during pregnancy, polymyxin B demonstrated toxic effects to the embryo in a dose-dependent manner. This was hypothesized due to its effects on reduction in metabolism, heart loss or neuromuscular blockade.87 Topical use of polymyxin B as part of a Polgyrax® suppository is used outside of the United States for BV.96 Due to the limited use in pregnant women and high potential for adverse events, strong caution should be advised prior to use.
may prompt discontinuation of anti-tuberculosis therapy. INH is also recommended for latent TB infection (LTBI) in pregnancy as a first-line treatment. Low risk patients may be advised to defer treatment of LTBI until after pregnancy for concerns over medication exposure. High-risk patients (e.g. HIV) should be initiated on INH therapy. Pyridoxine (B6) daily oral supplementation (25-50mg/day) is advised in all pregnant women receiving INH to mitigate neurologic complications in mother and newborn.97,98

Rifampin use in animals at up to 10 times the normal human dose did not produce any fetal abnormalities, however increasing the dose to 15 times human exposure at the time of conception was associated with significant fetal malformations.98,100 Use of rifampin in over 2,000 pregnant women has not produced an increase in fetal abnormalities.98,101 Rifampin has a Pregnancy Category C rating.23 INH coupled with rifampin is known to increase liver enzymes additively, thus careful monitoring is advised. An association between rifampin and newborn bleeding has been described, thus prophylactic Vitamin K may be necessary.98 Data on alternative rifamycins, rifabutin and rifapentine, are limited in pregnancy and thus should be used with caution.96 Several cases of rifapentine use have reported both normal delivery and fetal abnormalities, which were also observed at standard exposures in some animal studies.102 They are considered Pregnancy Category C and not recommended in the current guidelines.23,96 This may expose the fetus to anti-TB medications during the most critical time point.

Ethambutol is Pregnancy Category B and is generally considered safe in pregnancy.23,96 It is associated with retrobulbar neuritis in the general population; however there has not been an associated increase in either pregnant mothers or infants born to mothers exposed to ethambutol during pregnancy.98,103 There are no controlled studies to date investigating pyrazinamide (PZA) use in animals or humans; however literature is available documenting use without fetal or maternal harm.97,104 Pyrazinamide may be associated with increased risk of hepatotoxicity, especially in combination with INH and/or rifampin. The current Infectious Diseases Society of America (IDSA) guidelines recommend caution with pyrazinamide use in pregnancy, however, the World Health Organization and International Union against Tuberculosis and Lung Diseases (IUTLD) recommend the use of PZA in pregnancy.96,105 In general, PZA is thought to be safe in pregnancy (Pregnancy Category C), however careful risk assessment is needed and enhanced monitoring, specifically of uric acid and liver enzymes is suggested.

Fluoroquinolones and aminoglycosides, which may be used in multidrug resistant MTB, should be avoided in pregnancy as discussed in prior sections.96,97 The newest antituberculous agent, bedaquiline, is considered Pregnancy Category B.23,106 Reproductive studies in rats revealed no fetal injury, however caution should be exercised in pregnant women.106 Due to relative lack of use in the United States, additional agents will not be discussed, however the IUTLD recommends against all injectable anti-tuberculosis agents in pregnancy.105

CONCLUSIONS
The use of antibiotics in pregnancy requires careful assessment and a discussion of risk versus benefit to mother and fetus, both short and long-term. In general, many antibiotics are considered safe in pregnancy, especially beta-lactams, macrolides, clindamycin, and fosfomycin; however, additional data are needed for the majority of antibiotic classes. Emerging antibiotic resistance will certainly play a role in future use of broad-spectrum and alternative agents in pregnancy. Pharmacists play a prominent role in risk assessment and evaluation of available evidence for optimal antibiotic selection, dosing and monitoring. Pharmacists should also be aware of the new guidelines for product labeling and pregnancy risk implemented in the summer of 2015.
<table>
<thead>
<tr>
<th>Pregnancy Category Rating</th>
<th>Level of Evidence</th>
<th>Accompanying Text Labeling Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>No risk in human studies; Adequate and well-controlled human studies have failed to demonstrate a risk to the fetus in the first trimester of pregnancy (and there is no evidence of risk in later trimesters).</td>
<td>None</td>
</tr>
<tr>
<td>B</td>
<td>No risk in other studies; Animal reproduction studies have failed to demonstrate a risk to the fetus and there are no adequate and well-controlled studies in pregnant women</td>
<td>Nevertheless, because the studies in humans cannot rule out the possibility of harm, [name of drug] should be used during pregnancy only if clearly needed</td>
</tr>
<tr>
<td>C</td>
<td>Risk not ruled out; Animal reproduction studies have shown an adverse effect on the fetus and there are no adequate and well-controlled studies in humans, but potential benefits may warrant use of the drug in pregnant women despite potential risks.</td>
<td>[Name of drug] should be given to a pregnant woman only if clearly needed</td>
</tr>
<tr>
<td>D</td>
<td>Positive evidence of risk; There is positive evidence of human fetal risk based on adverse reaction data from investigational or marketing experience or studies in humans, but potential benefits may warrant use of the drug in pregnant women despite potential risks.</td>
<td>If this drug is used during pregnancy, or if the patient becomes pregnant while taking this drug, the patient should be apprised of the potential hazard to the fetus</td>
</tr>
<tr>
<td>X</td>
<td>Contraindicated in pregnancy; Studies in animals or humans have demonstrated fetal abnormalities and/or there is positive evidence of human fetal risk based on adverse reaction data from investigational or marketing experience, and the risks involved in use of the drug in pregnant women clearly outweigh potential benefits.</td>
<td>[Name of drug] is contraindicated in women who are or may become pregnant. If this drug is used during pregnancy, or if the patient becomes pregnant while taking this drug, the patient should be apprised of the potential hazard to the fetus</td>
</tr>
</tbody>
</table>
Table 2. Antibiotics Pregnancy Rating

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>FDA Pregnancy Category Rating</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aminoglycosides</td>
<td>D</td>
<td>Should be avoided, unless specific benefit established. Streptomycin linked to hearing loss in newborns.</td>
</tr>
<tr>
<td><strong>Beta-Lactams</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penicillins</td>
<td>B</td>
<td>Generally safe to use</td>
</tr>
<tr>
<td>- including amino-penicillins; extended-spectrum penicillins; and beta-lactam/beta-lactamase inhibitor combinations</td>
<td></td>
<td>Generally safe to use; use ceftriaxone with caution at term due to risk of kernicterus</td>
</tr>
</tbody>
</table>
| Cephalosporins (all generations)
a | B                             | Generally safe to use                                                                   |
<p>| Carbapenems                              | B                             | Use with caution only when penicillins or cephalosporins not an option                   |
| - Doripenem, ertapenem, and meropenem    | C                             |                                                                                         |
| - Imipenem-cilastatin                    |                               |                                                                                         |
| Aztreonam                                | B                             | Use only if severe allergy to beta-lactams                                              |
| Fluoroquinolones                         | C                             | Avoid in pregnancy unless benefits outweigh risks.                                       |
| <strong>Glycopeptides and Lipoglycopeptides</strong>  |                               |                                                                                         |
| Vancomycin                               | B                             | Appears to be safe and effective.                                                       |
| Lipoglycopeptides                        | C                             | Avoid in pregnancy unless benefits outweigh risks.                                       |
| - Telavancin, dalbavancin, oritavancin   |                               |                                                                                         |
| <strong>Macrolides and Ketolides</strong>             |                               |                                                                                         |
| Macrolides                               | B                             | Generally safe to use azithromycin; use erythromycin and clarithromycin with caution and only if benefits outweigh risks. |
| - Azithromycin, erythromycin             | C                             |                                                                                         |
| - Clarithromycin                         |                               |                                                                                         |
| Telithromycin                            | C                             | May use if benefits outweigh risks.                                                      |
| Oxazolidinones                           | C                             | May use if benefits outweigh the risks.                                                  |
| - Linezolid, tedizolid                   |                               |                                                                                         |
| Tetracyclines                            | D                             | Should be avoided.                                                                      |
| - Tetracycline, minocycline, doxycycline |                               |                                                                                         |
| <strong>Miscellaneous Antibiotics</strong>            |                               |                                                                                         |
| Clindamycin                              | B                             | Appears to be safe and effective; review STI guidelines regarding oral vs vaginal routes. |</p>
<table>
<thead>
<tr>
<th>Drug</th>
<th>Category</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Daptomycin</strong></td>
<td>B</td>
<td>May use if benefits outweigh risks.</td>
</tr>
<tr>
<td><strong>Fidaxomicin</strong></td>
<td>B</td>
<td>Limited use, however limited systemic exposure decreases potential risk to fetus.</td>
</tr>
<tr>
<td><strong>Fosfomycin</strong></td>
<td>B</td>
<td>Appears to be safe and effective.</td>
</tr>
<tr>
<td><strong>Metronidazole</strong></td>
<td>B</td>
<td>Topical metronidazole should be avoided.</td>
</tr>
<tr>
<td><strong>Polymyxins</strong></td>
<td>C</td>
<td>Should be used with caution. Careful monitoring of ADE.</td>
</tr>
<tr>
<td>- Polymyxin B, colistin</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Folate antagonists</strong></td>
<td>C</td>
<td>Avoid trimethoprim in first trimester due to major congenital malformations. Sulfamethoxazole should be avoided in the third trimester.</td>
</tr>
<tr>
<td>- Sulfamethoxazole, trimethoprim</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tigecycline</strong></td>
<td>D</td>
<td>Avoid in pregnancy unless benefits outweigh risks.</td>
</tr>
<tr>
<td><strong>Antimycobacterial agents</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Isoniazid (INH)</td>
<td>C</td>
<td>Hepatic enzymes should be monitored closely during pregnancy while on tuberculosis therapy. Pyridoxine (B6) should be given with INH during pregnancy.</td>
</tr>
<tr>
<td>- Ethambutol</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>- Pyrazinamide</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>- Rifampin, rifabutin, rifapentine</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bedaquiline</strong></td>
<td>B</td>
<td></td>
</tr>
</tbody>
</table>

*Ceftolozane/tazobactam and ceftazidime/avibactam were recently approved at the time of this manuscript, but also carry a Pregnancy Category B rating*
REFERENCES


47. Dalvance (dalbavancin) Package Insert.: Durata Therapeutics.; May 2014.


60. <sivextro-prescribing-info.pdf>.


71. Dificid (fidaxomicin) Package Insert.: Cubist Pharmaceuticals; April 2014.


75. Unlu BS, Yildiz Y, Keles I, et al. Urinary tract infection in pregnant population, which empirical antimicrobial agent should be specified in each of the three trimesters? Ginekologia polska 2014;85:371-6.


92. Tygacil (tigecycline) Package Insert.: Wyeth Pharmaceuticals; July 2010.


After much hard work by this past year’s SIDP newsletter committee we are happy to announce some changes to the newsletter you have come to expect. While many of the components will remain the same, the newsletter committee with the Board’s approval has developed several new sections to supplement and further enhance the newsletter. These sections are highlighted below.

### CLINICAL CASES
- **Aim:** sharing patient cases with educational value. Novelty and rarity are not requirements.
- **Content:**
  - Case Title
  - Brief Summary (up to 100 words summarizing case presentation and outcome)
  - Background (relevance of topic)
  - Case Presentation
  - Relevant Diagnosis and Treatment Information
  - Outcome and Follow-up
  - Discussion and Learning Points
  - References (no more than 10 references)

### TRAINEE CORNER
- **Aim:**
  - Encourage trainee-associate and student members to engage in SIDP through newsletter publication
  - Develop content that is directly pertinent to trainee-associate and students SIDP members
  - Provide an additional format for mentor-mentee collaborative work to be showcased
  - Exemplify value of trainee membership for prospective trainee members
- **Content:**
  - Short vignettes not to exceed 750 words

### ID DRUG INFORMATION
- **Aim:** Dissemination of succinct updates or explanations of:
  - Clinical pearls
  - Regulatory updates
  - Safety information
  - New drugs with clinical implications for ID practice
  - Current and upcoming research in the area of ID
  - Interpretation of recent research or publications as they pertain to clinical ID
- **Content:**
  - Concise (max 500 words or ½ page)

### STEWARDSHIP PEARLS
- **Aim:**
  - Encourage Society members to share strategies that have successfully expanded Antimicrobial Stewardship Program services at their institution
- **Contents:**
  - Insight on successfully implemented ASP initiatives
  - Enough detail should be provided for other members to consider the ASP initiative for implementation at their respective institutions
  - Possible topics may include but are not limited to: IV-PO conversion, protocols, clinical decision pathways, use of rapid diagnostic testing methods, restricted anti-infective agents formulary, etc

Please note the high quality manuscripts we have all become used to seeing will remain as part of the newsletter. If you have interest in developing one of these documents for the Society or have questions about preparation of these documents please do not hesitate in contacting me at tgtowne@manchester.edu.

Be on the lookout in upcoming newsletters for some of these articles, consider writing one as well!
SOCIETY OF INFECTIOUS DISEASES PHARMACISTS
MEMBERSHIP APPLICATION

(PLEASE TYPE OR PRINT)

Last Name  First Name  Middle Initial  Sex: M/F

Company/Organization

Mailing Address  Department

City  State or Province  Zip/Postal Code  Country

Telephone  Fax

Business Email Address  Personal Email Address

DEGREE(S) EARNED:  B.S. (Pharmacy)  M.S.  Pharm.D.  Ph.D.  Other

TRAINING EXPERIENCE:

<table>
<thead>
<tr>
<th>Infectious Diseases Fellowship</th>
<th>Informal Training</th>
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</thead>
<tbody>
<tr>
<td>Advanced Practice Residency</td>
<td>Infectious Diseases Residency</td>
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</tbody>
</table>

My primary place of employment is (check one):

- Hospital Setting
- Governmental Organization
- Industry
- Academic Setting
- Private Medical Group Setting
- Governmental Organization
- Managed Care
- Other

I am applying for (check only one):

- Active Member - Any pharmacist who has substantial professional activities in the area of infectious diseases pharmacotherapy or research may participate as a voting, active member of The Society. Prospective members must have been practicing or performing research in infectious diseases pharmacotherapy for at least two years after receipt of the terminal academic degree. Active member applicants must submit 2 letters of reference from fellow health care professionals attesting to substantial professional activities in the area of infectious disease pharmacotherapy or research and a current curriculum vitae.

- Associate Member - Pharmacist or non-pharmacist not meeting the requirements for the Active membership, but with an interest in the area of infectious disease pharmacotherapy, may participate as a non-voting member of The Society. Associate member applicants must submit 1 letter of reference from a fellow health care professional attesting to his/her interest in the area of infectious disease pharmacotherapy or research along with a current curriculum vitae.

- Trainee-Associate Member - Pharmacist in either a residency or fellowship program with emphasis on infectious disease pharmacotherapy, and not more than two years past the receipt of the terminal degree, or student in an accredited school of pharmacy pursuing a degree in pharmacy, may participate as a non-voting member of The Society. Those individuals more than two years past the terminal degree should apply for active or associate status, whichever is appropriate. Trainee-Associate member applicants must provide a letter from their program director and student applicants must provide a letter from a professor. All applicants must also provide a current curriculum vitae.

Are you a current member applying for a membership upgrade?  Yes  No

Membership Dues Structure (U.S. Funds):  Active and Associate Members: $100 for one year or three year membership for $270  Trainee-Associate Members: $25 per year. (No multiple year rate is available.)

Payment Information:

Check enclosed  Charge my:  Visa  MC  Amex  Discover  Amount authorized $__________________

Account number  CVV (back of card)  Exp. date

Cardholder's name  Signature of cardholder

Cardholder's billing address

City  State  Zip

All dues are in U.S. Funds. Send a check, money order or you may charge your dues to Mastercard, Visa, American Express, Discover or Diner’s Club.
Include card number, name on card, CVV (back of card) and expiration date. If you use a credit card, SIDP’s management company, “EAMI”, will charge your credit card for your SIDP dues.

Application/dues fees are non-refundable. If you are denied membership in the active category, your dues will be applied to associate member status. Thank you.

Please mail this completed application, appropriate information and dues payment to:
The Society of Infectious Diseases Pharmacists
823 Congress Ave., Ste. 230
Austin, TX 78701