

Pediatric Antimicrobial Stewardship Programs

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The frequent use of antimicrobials in pediatric patients has led to a significant increase in multidrug-resistant bacterial infections among children. Antimicrobial stewardship programs have been created in many hospitals in an effort to curtail and optimize the use of antibiotics. Pediatric-focused programs are necessary because of the differences in antimicrobial need and use among this patient population, unique considerations and dosing, vulnerability for resistance due to a lifetime of antibiotic exposure, and the increased risk of adverse events. This paper serves as a position statement of the Pediatric Pharmacy Advocacy Group (PPAG) who supports the implementation of antimicrobial stewardship programs for all pediatric patients. PPAG also believes that a pediatric pharmacy specialist should be included as part of that program and that services be covered by managed care organizations and government insurance entities. PPAG also recommends that states create legislation similar to that in existence in California and Missouri and that a federal Task Force for Combating Antibiotic-Resistant Bacteria be permanently established. PPAG also supports post-doctoral pharmacy training programs in antibiotic stewardship.

ABBREVIATIONS ASP, antimicrobial stewardship program; ID, infectious diseases; PPAG, Pediatric Pharmacy Advocacy Group

KEYWORDS antimicrobial resistance; antimicrobial stewardship; infection management; infection prevention stewardship; pharmacy education; residents

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Background

Antibiotic-resistant bacteria cause more than 2 million illnesses and 23,000 deaths every year in the United States.¹ Antibiotics are widely prescribed for children; approximately 20% of all outpatient and 60% of all inpatient visits result in at least 1 antibiotic prescription.^{2,3} Additionally, data demonstrate that many of these prescriptions are unnecessary, and large variability in prescribing between institutions further supports the potential for improvement.²⁻⁸ The frequency of antimicrobial use in pediatric patients has led to a significant increase in the prevalence of multidrug-resistant bacterial infections among children during the past 2 decades.⁹ Unfortunately, the development and availability of new antimicrobials have been limited at best, and to compound this problem, there have been several shortages of available antimicrobials in recent years.¹⁰

Antimicrobial stewardship programs (ASPs) have been created in many hospitals in an effort to curtail and optimize antibiotic use. In 2016 the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America updated their guidelines for implementation of ASPs.¹¹ They define antimicrobial stewardship as “coordinated interventions designed to improve and measure the appropriate use of [antibiotic] agents by promoting the selection of the optimal [antibiotic] drug regimen including dosing, du-

ration of therapy, and route of administration.” Broad goals of an ASP continue to include the optimization of clinical outcomes and minimization of unintended consequences of antimicrobial use. Previously, most literature focused on adult patient populations; however, in recent years there have been efforts by both the American Academy of Pediatrics and the Pediatric Infectious Diseases Society to advance and implement pediatric ASPs within various health care settings.¹⁰ Pediatric-focused ASPs are necessary because of the differences in antimicrobial need and use among this patient population, unique considerations and dosing, vulnerability for resistance due to a lifetime of antibiotic exposure, and the increased risk of adverse events.¹²

In June 2016, the Joint Commission released pre-publication requirements for the new Antimicrobial Stewardship Standard, which are effective as of January 2017. This standard, which will be part of the medication management standards, provides specifics with regard to elements, including accountability, leadership, education, and core elements, that will be required. This will lead to an advancement in ASPs, because as of a 2011 survey of freestanding children’s hospitals, only 40% (16 of 38) had a formal ASP, with dedicated FTEs for the program.¹³ The opportunity for expansion is clear, because ASPs are crucial to the improvement of clinical outcomes and patient safety by combating antibiotic resistance, improving the appropriate use of

Table. Recommendations of the Pediatric Pharmacy Advocacy Group Regarding Antimicrobial Stewardship Programs

States create legislation similar to what exists in California and Missouri, and that the recently created Task Force for Combating Antibiotic-Resistant Bacteria remain a permanent Federal Task Force.

Every pediatric patient admitted to an acute care hospital should benefit from an antimicrobial stewardship program that is staffed by a pediatric pharmacy specialist or one available for consultation when necessary.

Expansion of postdoctoral training programs for pharmacists in pediatric infectious diseases.

Inclusion of antimicrobial stewardship as an element of training in pediatric pharmacy residencies, and inclusion of pediatrics as an element of training in infectious diseases pharmacy residencies.

Outpatient antimicrobial stewardship services provided by pharmacists trained in pediatrics be included in coverage by managed care organizations and government insurance entities.

antimicrobials, and reducing adverse events

The purpose of this position statement is to discuss the current state of legislation, establish the position of the Pediatric Pharmacy Advocacy Group (PPAG) in support of implementation of ASPs for all pediatric patients, and provide recommendations for implementation.

Recommendations

Recommendations of the Pediatric Pharmacy Advocacy Group regarding antimicrobial stewardship programs can be found in the Table.

Advocacy

The PPAG recommends that states create legislation similar to that implemented in California¹⁴ and Missouri.¹⁵ In addition, legislation should include reference to antimicrobial stewardship in the pediatric population and the importance of having a pediatric infectious diseases (ID) physician and a pediatric pharmacist, both trained in antimicrobial stewardship. Legislative efforts should also continue to increase antimicrobial stewardship in the outpatient setting, including a source of funding support. PPAG also recommends that the recently created Task Force for Combating Antibiotic-Resistant Bacteria remain a permanent Federal Task Force.^{16,17}

Availability and Access

The PPAG believes that every pediatric patient admitted to an acute care hospital should benefit from an ASP that is staffed by a pediatric pharmacy specialist or one available for consultation when necessary. All freestanding children's hospitals should have ASPs, structured with consideration given to guidelines, best evidence, and local culture and resources. The ASP programs should include all 7 core elements recommended by the Centers for Disease Control and Prevention: leadership commitment; accountability with a single leader; drug expertise with a single pharmacist leader; action by implementing at least one recommendation; tracking; reporting; and education.¹⁸ In addition, children who are admitted to a primarily adult institution should receive services from the institution ASP, with assistance from local/regional pediatric ID experts, as

needed. These programs should be supported by the hospital administration both in establishing hospital-wide expectation of acceptance, and monetarily, through funding for qualified FTE support (pediatric ID physician(s) and pediatric ID pharmacists) and data resources. Programs should engage local pediatric subspecialists in the optimal management of special situations and also routinely evaluate institution antibiotic use and resistance patterns. The outcome measures used in this evaluation should be appropriate and optimal for the pediatric population being evaluated.

Pharmacist Training

PPAG recommends expansion of training programs for pharmacists in pediatric ID. Training of the ideal pharmacist to lead these programs is at this time difficult, because there are only 2 pediatric ID-focused pharmacy residency programs currently available.¹⁹⁻²¹ Further, ASP certification programs offered by the large organizations provide limited coverage of pediatric-specific ASPs. Of note, for its spring 2016 conference, the Society for Healthcare Epidemiology of America held its first antibiotic stewardship certificate course for both adult and pediatric practitioners. The specific importance and need for well-trained pediatric ID pharmacists is addressed more fully in a recent review article justifying the need for pediatric ASPs.¹²

PPAG also recommends inclusion of antimicrobial stewardship as an element of training in pediatric pharmacy residencies, and inclusion of pediatrics as an element of training in ID pharmacy residencies. Until more training programs are available to develop future pediatric ID/ASP pharmacists, we recommend that postgraduate year-2 programs in pediatrics require training in ASPs and those training programs in ID require significant pediatric ID/ASP exposure. Further, those who have completed postgraduate residency training in either pediatrics or ID should seek additional experience and competency in the area in which they are not trained. Some opportunities that currently exist include attendance at the Annual Pediatric Infectious Diseases Society Antimicrobial Stewardship Conference, or obtaining on-the-job training from working closely with their opposite-trained counterparts. We

also recommend the creation of pediatric ASP certification programs.

Pharmacists trained in adult ID and/or ASP with limited pediatric experience should seek additional training in pediatric antimicrobial stewardship. In addition, consultation with pediatric pharmacy specialists should occur in order to ensure that special factors, such as altered pharmacokinetics, optimal weight-based dosing, age-based bacterial colonization and infection epidemiology, and pediatric-specific medical conditions, receive appropriate consideration. All pediatric pharmacists, whether practicing in a standalone children's hospital or in an institution that serves both adults and pediatric patients, should understand and advocate basic principles of antimicrobial stewardship.

Reimbursement

The PPAG recommends that outpatient ASP services provided by pharmacists trained in pediatrics be included in coverage by managed care organizations and government insurance entities. Antimicrobial stewardship can extend to the outpatient settings as well in order to promote appropriate prescribing of antibiotics²² and reduce antibiotic resistance in the community. Because children so commonly receive antimicrobials in an outpatient setting and because of recently elucidated sequelae of antibiotic use in childhood, we believe that all children would benefit from antimicrobial stewardship in the ambulatory setting despite the limited data or experience. Pediatric and ID specialists should collaborate to study optimal methods of improving antibiotic use in ambulatory pediatrics, and should advocate for programs at the local, state, and national levels.

Conclusions

All hospitals should have ASPs that serve all patient types. This includes the adult academic and community hospitals that primarily care for children. In addition, successful antimicrobial stewardship needs to be further identified and implemented in the ambulatory setting, which includes emergency departments, urgent care centers, and retail-based clinics. The recent "National Action Plan for Combating Antibiotic-Resistant Bacteria"¹ should help encourage the creation of ASPs, and PPAG strongly encourages these programs to include pediatric patients.

The PPAG supports the creation of pediatric-specific ASPs, in the interest of decreasing the incidence of antibiotic-resistant bacteria and improving health care for children. We recommend that hospital administrations provide support to these programs, and agree with legislative and reimbursement initiatives for ensuring their presence. The PPAG encourages individual pharmacists involved in pediatric antimicrobial stewardship

to pursue training specific to such. Further, additional pediatric ID pharmacy residencies should be created, and both pediatric and ID pharmacy residencies should include pediatric antimicrobial stewardship training in their curriculums.

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REFERENCES

1. National action plan to combat antibiotic-resistant bacteria. March 2015. https://www.whitehouse.gov/sites/default/files/docs/national_action_plan_for_combating_antibiotic-resistant_bacteria.pdf. Accessed December 19, 2016.
2. Gerber JS, Newland JG, Coffin SE, et al. Variability in antibiotic use at children's hospitals. *Pediatrics*. 2010;126(6):2067-2073.
3. Hersh AL, Shapiro DJ, Pavia AT, et al. Antibiotic prescribing in ambulatory pediatrics in the United States. *Pediatrics*. 2011;128(6):1053-1061.
4. Levy ER, Swami S, Dubois G, et al. Rates and appropriateness of antimicrobial prescribing at a children's hospital, 2007-2010. *Infect Control Hosp Epidemiol*. 2012;33(4):346-353.
5. Janowski AB, Michaels MG, Martin JM, Green MD. Piperacillin-tazobactam usage at a tertiary pediatric hospital: an antimicrobial stewardship review. *J Pediatric Infect Dis Soc*. 2016;5(3):342-345.
6. Schulman J, Dimand RJ, Lee HC, et al. Neonatal intensive care antibiotic use. *Pediatrics*. 2015;135(5):826-833.
7. Newland JG, Stach LM, De Lurgio SA, et al. Impact of a prospective-audit-with-feedback antimicrobial stewardship program at a children's hospital. *J Pediatric Infect Dis Soc*. 2012;1(3):179-186.
8. Paul IM, Maselli JH, Hersh AL, et al. Antibiotic prescribing during pediatric ambulatory care visits for asthma. *Pediatrics*. 2011;127(6):1014-1021.

9. Milstone AM, Bryant K, Huskins C, et al. The past, present, and future of healthcare infections prevention in pediatrics: multidrug-resistant organisms. *Infect Control Hosp Epidemiol*. 2010;31(suppl):S18-S21.
10. Hyun DY, Hersh AL, Namtu K, et al. Antimicrobial stewardship in pediatrics: how every pediatrician can be a steward. *JAMA Pediatr*. 2013;167(9):859-866.
11. Barlam TF, Cosgrove SE, Abbo LM, et al. Implementing an antibiotic stewardship program: guidelines by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America. *Clin Infect Dis*. 2016;62(10):1197-1202.
12. Magsarili HK, Giroto JE, Bennett NJ, et al. Making a case for pediatric antimicrobial stewardship programs. *Pharmacotherapy*. 2015;35(11):1026-1036.
13. Newland JG, Gerber JS, Weissman SJ, et al. Prevalence and characteristics of antimicrobial stewardship programs at freestanding children's hospitals in the United States. *Infect Control Hosp Epidemiol*. 2014;35(3):265-271.
14. The California Antimicrobial Stewardship Program Initiative. <http://www.cdph.ca.gov/programs/hai/Pages/AntimicrobialStewardshipProgramInitiative.aspx>. Accessed December 19, 2016.
15. Modifies provisions relating to infection reporting of health care facilities and telehealth services Centers for Disease Control and Prevention. Core elements of hospital antibiotic stewardship programs. <https://trackbill.com/bill/mo-sb579-modifies-provisions-relating-to-infection-reporting-of-health-care-facilities-and-telehealth-services/1209364/>. Accessed December 19, 2016.
16. The White House, Office of the Press Secretary. Executive order – combating antibiotic-resistant bacteria. Exec. Order No. 13676, 3CFR. Available at: <https://www.whitehouse.gov/the-press-office/2014/09/18/executive-order-combating-antibiotic-resistant-bacteria>. Effective September 18, 2014. Accessed December 19, 2016.
17. The White House: National Action Plan for Combating Antibiotic-resistant Bacteria. Washington, DC. Available at: https://www.whitehouse.gov/sites/default/files/docs/national_action_plan_for_combating_antibiotic-resistant_bacteria.pdf Published March 2014. Accessed December 19, 2016.
18. Centers for Disease Control and Prevention. Core elements of hospital antibiotic stewardship programs. <http://www.cdc.gov/getsmart/healthcare/implementation/core-elements.html>. Accessed December 19, 2016.
19. American Society of Health-Systems Pharmacists Residency Directory. <https://accred.ashp.org/aps/pages/directory/residencyProgramSearch.aspx>. Accessed December 19, 2016.
20. American College of Clinical Pharmacy, Residency Directory. <https://www.accp.com/resandfel/> December 19, 2016.
21. Society of Infectious Disease Pharmacists, Residency Directory. <http://www.sidp.org/Residencies>. December 19, 2016.
22. Gerber JS, Prasad PA, Fiks AG. Effect of an outpatient antimicrobial stewardship intervention on broad-spectrum antibiotic prescribing by primary care pediatricians. *JAMA*. 2013;309(22):2345-2352.