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REVIEW

Pediatric Antimicrobial Stewardship Programs: Current Perspectives

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Abstract: With the rapid growth of the field of pediatric antimicrobial stewardship, there has been a marked increase in the establishment of programs dedicated to this specialty. Shared objectives of all pediatric antimicrobial stewardship programs (ASPs) include optimization of antibiotic use and improvement in clinical outcomes for children, while certain core operational strategies and metrics used to measure program effectiveness are typically utilized by pediatric ASPs. Antimicrobial stewardship is the responsibility of every individual who prescribes, dispenses, and administers antibiotics to children, and pediatric ASP principles are rooted in collaboration and cooperation. Pediatric ASPs are uniquely suited to meet the needs of the local populations they serve and the environments within which they practice while also fostering an awareness of the interconnected global nature of pediatric stewardship. As such, pediatric ASPs are well positioned to confront the evolving challenges of antimicrobial overuse and resistance.

Keywords: antimicrobial stewardship, pediatrics

Introduction

Antimicrobial stewardship (AS) is defined as any activity that promotes selection of the optimal dosing, route of administration, and duration of therapy for medications administered to treat infections.[1,2] Goals of antimicrobial stewardship programs (ASPs) include slowing the emergence of antibiotic resistance, eliminating unnecessary antimicrobial usage, improving patient outcomes, and reducing healthcare expenditures.[1,3,4]

Since publication of the Infectious Diseases Society of America (IDSA) guideline for ASP development in 2007, there has been a marked increase in the prevalence of formal ASPs in hospitals providing pediatric care.[1,5,6] This has occurred in part because of enhanced recognition of factors unique to AS in children. As noted by pediatric AS experts, children are not simply little adults.[3,7] ASP members must therefore be knowledgeable about infectious disease processes and manifestations specific to children. Pediatric antimicrobial susceptibility trends often differ from those of adults, while pharmacokinetic and pharmacodynamic properties of medications can vary according to patient age, weight and illness script. Certain antimicrobial adverse effects are frequently observed in children but may be uncommon in adults (and vice versa).[4] Pediatric ASPs must have familiarity with these characteristics and recognize the necessity of antibiotic conservation for children, who could require repeated exposures to antimicrobials throughout their lifetimes.[8]

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ASPs have traditionally been comprised of core members including an infectious diseases (ID) physician and a clinical pharmacist (preferably with infectious diseases training), with recognition of the critical need for involvement of clinical microbiology laboratory personnel, infection prevention and control professionals, and information systems specialists.[1,9] The importance of physician accountability, pharmacy expertise, and hospital leadership commitment to AS was affirmed by publication of the 2014 and 2019 United States Centers for Disease Control and Prevention (CDC) Core Elements of Hospital Antibiotic Stewardship Programs.[10,11] These publications also note the significance of incorporating front-line clinicians, nursing, infection prevention, quality improvement, clinical laboratory and information technology staff into ASPs.

The broad objectives of pediatric ASPs remain consistent regardless of the settings within which they operate. However, successful achievement of stewardship aims requires ASPs to identify important targets, process metrics and outcome measures based upon a variety of local factors and to creatively tailor their strategies accordingly. Important local variables to consider include resource availability, observed behavioral determinants of antimicrobial prescribing and system infrastructure – truly a "one size does not fit all" approach.[5,12] This review: 1) provides an overview of broadly applicable strategies for pediatric ASP use, 2) outlines suggested process and outcome measurements for gauging pediatric ASP success, and 3) describes how collaboration on a local level and on a global scale are critical to ensuring that broad objectives of pediatric ASPs are met.

Methods/Strategies

The IDSA recommends that inpatient ASPs utilize one (or both) core strategies of prospective audit with feedback (PAF) and/or preauthorization.[2,3,9] Preauthorization requires clinicians to obtain approval from ASPs to use certain antibiotics before they are prescribed or dispensed. PAF involves ASP review ("audit") of selected antibiotics at a defined interval following initiation, with subsequent engagement of prescribers through various types of interventions (ie, provision of "feedback").

Supplemental strategies include development and implementation of institution-specific clinical practice guidelines and management algorithms for frequently encountered infections such as community-acquired pneumonia and osteoarticular infections.[2,7,13,14] Incorporation of computerized decision support measures for antibiotic prescribing and use of computerized surveillance methods can also be beneficial for institutions with such capabilities, and AS principles should be incorporated into the continuing educational curricula of all healthcare professionals.

Frequently cited barriers to comprehensive ASP development and implementation include shortages of technological resources, funding, and dedicated time for AS.[15] Potential barriers to ASP development in low- and middle-income nations might include a dearth of core ASP team members with prior ASP experience and scant availability of educational programs pertaining to pediatric AS.[16] Navigation of these barriers requires an optimistic but realistic approach by ASP members, and such limitations must be recognized during program development and goal-setting. However, successful outcomes from smaller scale stewardship activities tailored to fit institutional needs (and utilizing currently existing resources) can often be used as leverage for future ASP support.

Targets, Process and Outcome Measures

Specific targets for ASP efforts will vary amongst individual hospitals, communities, regions, and countries.[7] At the hospital level, targets can be identified via concurrent auditing of antimicrobial use and infectious conditions likely to trigger such use.[17,18] Eliminating unnecessary antibiotic use is just one of the many goals of ASPs, and so other potential targets might include: 1) facilitating antimicrobial dosing adjustment and monitoring, 2) enhancing timely transitioning from intravenous (IV) to oral antibiotics and 3) optimizing total durations of therapy.

Process Measures

The preferred measure of antibiotic use is days of therapy (DOTs).[2,19] One DOT is when a single antibiotic is given to a single patient on a calendar day, regardless of the number of doses administered during that day. For example, if an infant received ampicillin plus gentamicin for 2 days, then the infant's DOTs would equal 4. Aggregated DOT rates are standardized by using a denominator of person time at risk, which when measuring inpatient antibiotic utilization is typically achieved by use of either patient days or days present. Whereas patient days are based on hospital census data captured each day at the same time of day, days present is an electronic count of all calendar days on which a patient is present in a given location for any portion of that calendar day. The antibiotic use metrics of DOTs per 1000 patient days and DOTs per 1000 days present are typically analyzed at recurring intervals such as once monthly or once every three months.

Use of additional process metrics to evaluate ASP intervention efficacy depends in part upon the particular strategies and chosen targets of an ASP.[20] As per the IDSA,[2] "Measures that consider the goals and size of the specific intervention should be used." For programs using a PAF core strategy, acceptance rates of ASP recommendations and provider adherence to agreed-upon recommendations can be tracked. For ASPs utilizing supplemental strategies like clinical practice guidelines and management algorithms, measurements of clinician compliance should be performed.

Outcome Measures

As with process metrics, selected outcome measures should be closely intertwined with individual ASP strategies, targets and intervention goals. For instance, ASPs seeking to optimize antimicrobial dosing adjustment and monitoring might evaluate the frequency of adverse drug events over time.[20] For ASPs that implement strategies to facilitate timelier conversion from IV to oral antibiotics and/or to optimize total durations of therapy prescribed, monitoring unplanned hospital readmissions and proportions of patients with clinical failure would be important.[2] As with process metrics, measurement of outcome metrics must be performed on a continuous basis in order to ensure ongoing intervention success and to identify potential areas for improvement.

Collaboration, Not Competition

AS is a team effort, and is the responsibility of every individual who prescribes, dispenses, administers and receives antimicrobial therapy. Pediatric ASPs are therefore collaborative ventures at the hospital/local level and on a national/international scale.

Hospital/Local Stewardship

Pediatric Nurses as Antimicrobial Stewards

Bedside nurses work to ensure proper communication between all members of the medical team, patients and families, and they frequently serve as the strongest advocates for optimal patient care.[21,22] These traits make staff nurses uniquely positioned to take on active leadership roles in AS activities. Indeed, nurses already play key roles in AS through many of their daily clinical responsibilities regardless of whether or not they are aware of it.[23,24] Duties such as obtaining and recording accurate allergy histories, ensuring antibiotic administration at proper dosages and times, and facilitating timely IV to oral therapy conversion are just some of the many ways through which bedside nurses actively impact AS.[25,26] Accordingly, most nurses agree that formal incorporation into ASPs is not only welcome but necessary.[21,22,25]

Implementation, maintenance, and growth of successful ASPs require a willingness to understand and have a flexible mindset about certain cultural norms, including those specific to individual hospitals, medical specialties, and to the hierarchical culture of medicine.[27,28] ASPs must concurrently work to promote behavioral modifications leading to improved antimicrobial utilization – and such efforts often require advocating for cultural change. Staff nurses report that some of the greatest barriers to their involvement in AS stem from unit-specific and hierarchical cultural expectations, including inconsistent nursing inclusion during the rounding process and deference to physicians and pharmacists regarding antibiotic management plans.[21,25,26] ASPs must work with nurses to address and overcome these challenges in order to integrate nurses into formal stewardship structures. Potential solutions might include inviting nurses to participate in hospital ASP committees,[23,26] facilitating inclusion of active input from nurses during daily rounds, and stressing upon unit/hospital leadership the importance of nursing involvement in ASP activities. As noted by Monsees et al,[25] "It is critical to create an environment where nurses are empowered to lead and [their] input is solicited."

Hospitalists

Hospitalist physicians provide a rapidly expanding proportion of care for hospitalized children and are therefore likely to regularly interact with ASPs.[29] Pediatric hospitalists wield significant influence over antimicrobial prescribing, as evidenced by one survey of resident physicians identifying hospitalists as the most influential source impacting resident selection of antibiotic therapy – more so than ID specialists![30] Nevertheless, pediatric hospitalists recognize the value of their ID specialist colleagues, and hospitalist expertise in the area of quality improvement uniquely positions hospitalists to be champions of antimicrobial stewardship activities.[31–33] Successful hospitalist-led AS initiatives have included incorporation of 72-hour antimicrobial time-outs (during which antimicrobial use is assessed 72 hours following initiation for necessity, suitability for tailoring based on culture data, and for initial determination of an anticipated duration of therapy). Other examples have included facilitation of timely conversion from IV to oral antibiotics to reduce outpatient parenteral antimicrobial therapy (OPAT) use, as well as multidisciplinary guideline development for frequently encountered infections.[13,32,34]

Neonatologists

Antibiotics are the most frequently utilized medications in neonatal intensive care units (NICUs).[35,38] Clinicians in NICUs encounter challenges unique to the neonatal population that can complicate antimicrobial treatment decisions. Neonates can exhibit non-specific clinical symptoms like apnea, respiratory distress and hypotension that can be seen with neonatal sepsis but which can also be non-infectious sequelae of premature birth. Maternal receipt of antimicrobials prior to/during delivery and suspected/confirmed chorioamnionitis often impact provider decisions regarding administration of antibiotic therapy.[35,39]

As widespread antibiotic use in NICUs over the past 40 years has significantly reduced infant morbidity and mortality, one longstanding physician perception has been that potential benefits of empiric antibiotics in neonates consistently outweigh potential risks associated with their use.[40] Cantey et al found that 94% of all antibiotic usage in a Level III NICU over 14 months was initiated as empiric therapy for suspected infection – with infections confirmed by positive cultures in only 5% of cases.[41] In contrast to the aforementioned perception, antibiotic courses as brief as 4 days administered to very low and extremely low birth weight infants during the first week of life have been associated with a greater likelihood of adverse outcomes including chronic lung disease, necrotizing enterocolitis, invasive candidiasis and late-onset sepsis (possibly due to antibiotic-induced alterations in the neonatal intestinal microbiome).[36,37,42,43]

Per Cantey and Patel,[35] "Neonatologists may be more receptive to implementing changes in their practice if advocated by a well-respected peer rather than ID doctors or pharmacists." Fortunately, increasing numbers of neonatologists are answering the call to advocate for neonatal AS. The Vermont Oxford Network, a voluntary collaborative of more than 1200 hospitals located throughout 31 countries, seeks to improve the quality and safety of neonatal care through data-driven quality improvement and research (https://public.vtoxford.org). In 2016 the collaborative partnered with the CDC to launch the internet-based quality improvement collaborative titled Choosing Antibiotics Wisely, with the aim of decreasing antibiotic overuse in neonates at participating institutions.[44] Additionally, the American Academy of Pediatrics (AAP) Committee on Fetus and Newborn made AS a point of emphasis in their clinical reports on recommended management of neonates with suspected or proven early-onset bacterial sepsis.[45,46] These guidelines were developed with input from the AAP Committee on Infectious Diseases. While NICU AS initiatives seem to be most efficacious when driven primarily by neonatologists, active and ongoing ID and clinical pharmacy support, encouragement and promotion of such efforts are critical to ensuring their sustained success.[47,48]

Intensivists

Prior studies have found that 57–79% of children admitted to pediatric intensive care units (PICUs) receive antibiotics.[49] Critical care physicians acknowledge that the problem of antimicrobial resistance is relevant to their daily practice and that optimization of antibiotic prescribing behaviors should be a significant priority.[49,50] Intensivists must concurrently balance these concerns with the recognized need for prompt antibiotic initiation for pediatric sepsis and while bearing in mind that approximately one-half of all ICU patients are diagnosed with bacterial infections.[51–53]

Major ASP challenges in PICU settings include widespread variability regarding use of available diagnostic testing methods and the relative ambiguity with interpretation of results. For example, bacterial pneumonia accounts for a significant percentage of PICU antibiotic use and nosocomial pneumonia is the most common indication for empiric antibiotics in PICUs.[49,54] However, pediatric chest radiography (which has long been considered the gold standard for diagnosis of pneumonia) does not reliably distinguish bacterial from viral lower respiratory tract infections.[55] Differentiation between pulmonary consolidation and atelectasis on x-rays of intubated children can be notoriously difficult, and X-ray interpretations may be littered with ambiguous terminology such as "… shifting atelectasis, cannot rule out developing infiltrate" and "… patchy infiltrates versus atelectasis." Endotracheal aspirate cultures are often obtained in PICU settings to evaluate for ventilator-associated pneumonia despite their lack of diagnostic specificity for infection.[54,56] Not surprisingly, successful AS approaches in these circumstances are highly dependent upon multidisciplinary collaboration.

One study from a freestanding US children's hospital ASP found marked variation in empiric antibiotic prescribing practices amongst individual critical care specialists.[57] The findings were reviewed with those intensivists, and the ASP worked with them to develop empiric antibiotic use guidelines for their most frequently encountered infections. Repeated cycles of education, review, feedback and reeducation were undertaken to reinforce the guidelines following their introduction, with PAF initiated for the most commonly used broad-spectrum antibiotics 6 months after guideline implementation. Significant declines in broad-spectrum antibiotic use and purchasing costs were observed post-implementation without increases in patient lengths of stay or mortality. The study authors concluded that the chronology of empiric antibiotic use guideline development and implementation followed by ongoing ASP PAF was a key factor in their success.[57]

Intensivists note that multidisciplinary creation of locally adapted clinical practice guidelines and management protocols are perhaps the most valuable of AS interventions,[50] and intensivists should be empowered to take a leading role in their creation, implementation and maintenance. ASP members contribute valuable expertise to this process, including knowledge of local antimicrobial susceptibility patterns that can influence empiric treatment decisions.[54] Such collaboration between intensivists and ASPs has the potential to decrease unnecessarily broad-spectrum antibiotic use and stem the tide of increasing antimicrobial resistance frequently observed in PICU settings.

Oncologists and Bone Marrow Transplantation (BMT) Specialists

Children receiving chemotherapy for malignancies and/or undergoing bone marrow transplantation are at particularly increased risk for morbidity and mortality due to infection.[58,59] Given this, and given the lack of widely accepted clinical practice standards for management of certain infectious conditions in pediatric oncology/BMT patients, oncologists and transplant specialists may frequently find themselves at odds with ASP team members.

As noted by Wolf and Margolis,[58]

> The main basis for this discrepancy seems to be different approaches to weighing the possibility of uncontrolled infection versus the relative risks of broad-spectrum antibiotics.

Effective stewardship in this population therefore requires establishment and maintenance of: 1) trust amongst provider groups, 2) emphasis on mutual interests and shared goals, and 3) regular and frequent communication.[59,60] As these traits form the basis for all efficacious ASP interventions and as fear of adverse outcomes is a significant driver of unnecessary antibiotic usage, it is therefore not surprising that effective stewardship approaches to oncology/BMT patient care incorporate strategies successfully adopted elsewhere. Such strategies include multidisciplinary development of locally adapted practice guidelines combined with ongoing PAF, promotion of antifungal and antiviral stewardship, and judicious incorporation of molecular diagnostic testing.[60–62]

Laboratory

Coordinated partnership between clinical microbiology laboratories and ASPs is integral to ensuring mutual success. Diagnostic technologies such as matrix-assisted laser desorption ionization-time of flight (MALDI-TOF) and multiplex polymerase chain reaction (PCR) allow for rapid and accurate identification of infectious pathogens and certain antimicrobial resistance genes before return of organism identification and susceptibility testing results by traditional culture-based methods.[63,64] Prior to considering implementation of emerging rapid diagnostic technologies, laboratories should partner with ASPs to develop comprehensive cost-benefit analyses that take into account anticipated savings on unnecessary antibiotic usage, decreases in hospital lengths of stay, and reductions in unnecessary hospital admissions. These analyses can then be used to help justify the often expensive upfront costs of equipment purchasing and implementation.[65,66]

Rapid pathogen identification theoretically allows for a shortened time interval between antibiotic initiation and optimization. However, such benefits can be negated in the absence of existing decision support structures to assist with testing interpretation and provide real-time clinical guidance.[65,67] Clinical microbiology laboratories and ASPs should establish protocols to ensure prompt reporting of rapid diagnostic test results, followed by real-time ASP interpretation and timely dissemination of antimicrobial recommendations to front-line providers.[67] The verbiage for reporting certain bacterial genetic resistance determinants (eg, presence of the *mecA* gene encoding for methicillin resistance in a *Staphylococcus aureus* isolate) detected by various rapid molecular diagnostics should be carefully crafted and reviewed by a multidisciplinary team of laboratory personnel, ID specialists, ASP team members and infection preventionists prior to dissemination.[66]

National/International Stewardship

As antimicrobial resistance is a global problem, curbing its spread through AS requires collaboration at national and international levels. In North America, the Children's Hospitals Solutions for Patient Safety Network (https://www.solutionsforpatientsafety.org/) is a system of over 135 children's hospitals dedicated to reduction of harms to pediatric patients. Promotion of AS efforts is one of the many aims of the network. Established in 2013, the Sharing Antimicrobial Reports for Pediatric Stewardship (SHARPS) collaborative (http://pediatrics.wustl.edu/sharps) was developed to share best stewardship practices, establish comparative antimicrobial use reports for benchmarking, and to foster a cooperative approach to stewardship by development of novel interventions and conduction of clinical AS studies.[68] SHARPS is currently comprised of more than 70 children's hospitals located throughout the US, Canada and the United Kingdom. In conjunction with the Pediatric Infectious Diseases Society (PIDS), the collaborative hosts an annual International Pediatric Antimicrobial Stewardship Conference open to all medical professionals with an interest in pediatric AS. SHARPS members, in cooperation with the PIDS Pediatric Committee on Antimicrobial Stewardship, the AAP Section on Infectious Diseases and the Health Care Without Harm Clinician Champions in Comprehensive Antibiotic Stewardship Group, developed an online pediatric ASP toolkit to provide resources for improving antibiotic use in all healthcare settings (which is available to the public at: http://www.pids.org/asp-toolkit.html).

In Australasia, the Australian and New Zealand Paediatric Infectious Diseases Group – Australasian Stewardship of Antimicrobials in Paediatrics (ANZPID-ASAP) group was established in 2011 (https://www.asid.net.au/groups/antimicrobial-stewardship). Comprised of ID physicians and pharmacists representing children's hospitals located in every state and territory of Australia and New Zealand, expressed goals of the ANZPID-ASAP group include promotion of pediatric AS in Australia and New Zealand via open exchange of ideas, working toward establishment of a national AS program for children, and advocating for inclusion of children in any future plans regarding national AS standards.[69]

The Antibiotic Resistance and Prescribing in European Children (ARPEC) project was initially founded in 2011 as a method for standardizing surveillance of antimicrobial use and consumption in neonates and children admitted to hospitals primarily located throughout Europe.[12,70] This project, which brought together interested physicians and healthcare professionals from networks such as the European Society of Paediatric Infectious Diseases and the European Surveillance of Antimicrobial Consumption project, has subsequently expanded across the globe. Health professionals from hundreds of hospitals in 41 countries located throughout Europe, Africa, Asia, Australasia, Latin America and North America currently participate in what is now known as the Global Antimicrobial Resistance, Prescribing and Efficacy Among Children (GARPEC) project.[12,71]

Outpatient ASPs

Approximately 1 in 5 pediatric ambulatory visits per year result in prescription of antibiotics.[7,72,73] Of the millions of outpatient antibiotic prescriptions written for children and adolescents each year, nearly 30% are estimated to be inappropriate.[74] Identified key drivers of inappropriate outpatient prescribing include patient/parental pressure and time constraints inherent to outpatient practice. During times of diagnostic uncertainty, antibiotic prescription may erroneously be perceived as always being the "safest" option.[75] Given these factors, there is a clear need for multifaceted outpatient pediatric AS initiatives aimed at prescribers and their patients/families, as well as for formalized ASPs in the outpatient setting.[76]

There is a rapidly expanding body of literature identifying potential high-yield targets for outpatient pediatric AS according to diagnoses, antimicrobial classes and formulations, prescriber specialties, and/or various combinations of these variables. Diagnoses frequently encountered in the outpatient setting categorized as "low-hanging fruit" ripe for outpatient AS interventions include acute otitis media (AOM), pharyngitis, acute bacterial sinusitis, skin and soft-tissue infections, community-acquired pneumonia, and urinary tract infections.[77–81] Macrolides and third-generation oral cephalosporins like cefdinir are often prescribed inappropriately as first-line agents for treatment of pharyngitis and community-acquired pneumonia.[78,80,82] In one study conducted within a single large US healthcare system, pediatricians were more likely than advanced practice providers and non-pediatricians to have: 1) prescribed antibiotics for pediatric sinusitis that were concordant with national guidelines and 2) appropriately withheld antibiotics when upper respiratory infections were diagnosed.[83] The authors conclude that engaging advanced practice providers and non-pediatricians who care for children should be an integral component of outpatient AS.

As per Bozzella et al,[73] providing education for prescribers, patients and families is one of the cornerstones of AS and is the foundation upon which future interventions can be built. Prescriber education should include discussion of best practices for specific conditions based on current medical literature and consensus guidelines. This education can serve as a bridge to future collaborative efforts like prescriber-led development of locally adapted practice guidelines and decision support pathways. Active engagement of prescribers increases the likelihood of sustained success, and is rooted in a behavioral principle known as the "IKEA effect." This principle (which borrows its name from the Swedish-based furniture company whose products often require at least some self-assembly) asserts that people will value a product to a greater degree and feel more ownership over it if they produced it themselves.[84] Ideally, provider education should include individualized PAF with peer comparisons.[73] Similar to inpatient PAF, outpatient PAF must be continuous in order to sustain the desired benefits over time.[85]

With regard to patients and families, education should begin before a patient is seen and continue throughout the entirety of the visit. Informational pamphlets, booklets, brochures, and even videos about appropriate antibiotic use placed in waiting rooms have been shown to successfully educate patients and their families.[73] Clinicians should be well versed in effective communication techniques for situations when parents expect antibiotics and they are not indicated.[86] Delayed antibiotic prescribing (ie, when a prescription is provided along with instructions to fill it only under certain circumstances) for infections like AOM represents shared decision-making and can be an implicit sign of trust between clinicians, patients and families. Notably, incorporation of this technique into outpatient practice does not increase inappropriate antibiotic utilization.[73]

There is a recognized need for AS measures focusing on children discharged to home on OPAT.[3,5,7,87–89] Children with conditions such as osteomyelitis, complicated appendicitis and pneumonia with pleural empyema have traditionally been treated with prolonged OPAT. However, there is evidence to support timelier transitioning of these patients from IV to oral antibiotics.[32,89] As per the 2018 IDSA guideline for OPAT management,[90]

> Ensuring that OPAT is only prescribed for patients where an equivalent oral therapy is not available is a high priority for pediatric ID specialists and pediatric antimicrobial stewardship programs.

One study from a freestanding US children's hospital investigated the impact of formalized OPAT stewardship program creation on their institution's OPAT use.[91] The program (which was created by expanding the duties of the hospital's existing inpatient ASP) used multiple strategies including ASP patient review, coordination with the peripherally inserted central catheter team prior to catheter placement and engagement of patient care coordinators to achieve a 24% overall reduction in OPAT use during the study's intervention period. Importantly, no significant changes in hospital readmission rates were observed between patients discharged to home on oral antibiotics in the pre- and post-intervention periods. Similar studies underscoring the beneficial effects of OPAT stewardship are necessary.

Future Directions

Stewardship Within Non-Freestanding Children's Hospitals

As per Kronman et al,[5]

> Much of the pediatric [ASP] research performed to date has assessed stewardship programs in the acute care setting, primarily within freestanding children's hospitals. The need to expand antimicrobial stewardship across the healthcare spectrum … has become evident.

A majority of hospitalized children are cared for in facilities which are not freestanding children's hospitals.[92] Given the many differences between freestanding and non-freestanding children's hospitals including patient case mix, illness severity, clinical outcomes, and resource availability for ASP activities, more ASP studies from non-freestanding children's hospitals and those located within larger (primarily adult) facilities are needed.[18,93–95] Children's hospitals within larger medical centers may have overlapping infrastructure with the larger (adult) center such as shared clinical microbiology laboratories, electronic health records and electronic data mining software programs. Pediatric ASPs operating in these "hospital-within-a-hospital" settings alongside adult ASPs possess unique advantages and face unique challenges relative to programs at freestanding children's hospitals, and this aspect of pediatric AS should be explored in greater detail.

Post-Acute and Long-Term Care Facilities

Children with complex medical conditions who reside in long-term care facilities (LTCFs) and who require ongoing use of invasive devices such as urinary catheters and mechanical ventilation are at increased risk for development of healthcare-associated infections. Correspondingly, almost one-half of pediatric LTCF residents have received one or more courses of antibiotics for known or suspected healthcare-associated infections.[96] Healthcare workers at LTCFs agree that limiting antibiotic overuse through stewardship is important; however, the core AS strategies of preauthorization and/or PAF have yet to be implemented within a large majority of pediatric LTCFs.[97,98] Barriers to AS in pediatric LTCFs include a paucity of consensus treatment guidelines for infections in this patient population, and evidence-based studies outlining effective AS implementation strategies in this population are clearly necessary.[97,98]

Direct-to-Consumer Telemedicine

Patient use of direct-to-consumer telehealth services (during which patients pay a fee to have direct access to a physician via a videoconference) continues to increase, and for many families telemedicine can offer benefits such as reduced out-of-pocket costs relative to in-person physician visits.[99] One study by Foster et al of nearly 13,000 telemedicine visits for pediatric respiratory tract infections found that antibiotics were prescribed in 55% of all encounters.[100] The study also found that antibiotic receipt was the strongest single predictor of parental satisfaction with their children's telemedicine physicians, and that visits during which antibiotics were prescribed were frequently shorter in duration. The authors conclude that the high rates of antibiotic prescribing for children with acute respiratory tract infections suggest the need for telemedicine AS, as most children with such infections do not require antibiotics. A retrospective analysis by Ray et al of 4600 pediatric telemedicine visits for acute respiratory tract infections found that children at telemedicine visits were more likely to receive antibiotics and less likely to receive antibiotic management concordant with pediatric-specific national guidelines compared to children seen by their primary care providers and by urgent care providers.[101] The authors of that study also emphasize the need for AS initiatives targeting direct-to-consumer telemedicine services.

Conclusions

The "one size does not fit all" nature of pediatric AS demands that ASPs be comprised of creative individuals who are eager to collaborate and who possess a keen understanding of the environments within which ASPs operate. Amongst pediatric ID trainees and young faculty, there is currently an immense interest in the burgeoning field of AS.[102] This enthusiasm should be harnessed to advance the cause of pediatric AS around the globe and to achieve the shared aims of all ASPs, which include limiting the spread of antimicrobial resistance, eliminating unnecessary antimicrobial use and improving outcomes for all pediatric patients.[1,4]

Disclosure

The author reports no conflict of interest in this work.

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