ScienceForecast
A digital science library

Research Article
Published: 05 Feb, 2019

Journal of Pediatric and Womens Healthcare

Knowledge and Utilization of an Antimicrobial Stewardship Program in a Non-freestanding Children's Hospital

Santos RP[1], Smith A[2], Dudek C[2], Mitchell-Van Steele A[3] and Lomaestro B[3]*

[1]47 New Scotland Avenue MC 88, Albany Medical Center, Albany, New York (12208), USA

[2]43 New Scotland Avenue MC 129, Albany Medical College, Albany, New York (12208), USA

[3]47 New Scotland Avenue MC 85, Albany Medical College, Albany, New York (12208), USA

Abstract

Background: We provide evidence supporting the hypothesis that ASP implementation in a non-freestanding children's hospital has unique challenges among pediatric providers.

Methods: An online survey was performed within a 734-bed academic medical center with 125 beds dedicated to pediatric patients. The survey consisted of a 10-item multiple choice and 5-point Likert scale validated questionnaire sent via SurveyMonkey. Nonparametric tests ($\chi 2$ and Fisher's exact test) were used to assess differences between groups.

Result: 273 responded to the survey and 243 (89%) completed all questions. There were 60 (22%) adult providers, 66 (24%) pediatric providers, and 147 (54%) adult-pediatric providers. Most of the respondents were attending/faculty (176, 64%) who had been working for ≤5 years (139, 51%). More pediatric providers were unaware of ASP in the medical center compared to adult providers (76% *vs* 48%, $p<0.01$). More pediatric providers had not attended educational meetings on ASP outside the medical center than adult providers (83% *vs* 63%, $p=0.01$). Majority has no educational training on ASP within the medical center (191, 70%). Most agreed with the primary goals of ASP (248, 91%) and its role in reducing drug resistance (212, 78%) without significant difference among providers. Most providers were confident in prescribing antimicrobials (210, 77%) without utilizing the ASP team (205, 75%) regardless of practice area.

Conclusion: Some pediatric providers were unaware of the ASP and its utilization in non-freestanding children's hospital and majority has not received educational training. These unique challenges are avenues for interventions to improve ASP in non-freestanding children's hospital.

Keywords: Antimicrobial stewardship program (ASP); Knowledge; Utilization; Non-freestanding children's hospital; Children

Keypoints

The medical literature regarding pediatric ASP addresses issues predominantly from freestanding children's hospital. This study supported the hypothesis that there are challenges among pediatric providers in their knowledge and utilization of ASP in a non-freestanding children's hospital and we identified avenues for improvement.

Introduction

Hospital-based antimicrobial stewardship programs (ASP) can improve judicious use of antimicrobial therapies, optimize clinical outcomes, and decrease antimicrobial resistance. A growing body of medical evidence describes effective implementation of an ASP leading to fewer inappropriate uses of broad spectrum antibiotics, decreased incidence of Gram-negative bacteremia, fewer prescription errors and adverse events related to antimicrobial use [1-3].

The medical literature regarding ASP in children predominantly addresses programs in freestanding children's hospitals. Only 55 of the approximately 250 children's hospitals in the United States are freestanding [4]. These free-standing hospitals are located mainly in large urban areas and many are affiliated with academic training programs. These do not represent the majority of hospitals taking care of pediatric patients since there are approximately 200 non-freestanding children's hospitals in the US. Thus, non-freestanding pediatric hospitals are responsible for a significant proportion of the pediatric population in the US. It is important to assess outcome

OPEN ACCESS

*Correspondence:
Roberto P. Santos, Department of Pediatrics, Division of Infectious Diseases, Albany Medical Center, 47 New Scotland Avenue, MC 88, Albany, NY 12208, USA.
Tel: (518) 262-5332
Fax: (518) 262-5301
E-mail: SantosR@mail.amc.edu

Received Date: 10 Dec 2018
Accepted Date: 01 Feb 2019
Published Date: 05 Feb 2019

Citation: Santos RP, Smith A, Dudek C, Mitchell-Van Steele A, Lomaestro B. Knowledge and Utilization of an Antimicrobial Stewardship Program in a Non-freestanding Children's Hospital. J Pediatr Womens Healthcare. 2019; 2(1): 1013.

ISSN 2643-797X

measures as well as barriers in the utilization of pediatric ASP in non-freestanding children's hospitals [5]. This is consistent with the current recommendations in addressing deficiencies in education and lack of accurate data [2] in the implementation of ASP in the unique setting of caring for children within an adult medical center [5].

ASP implementation in a non-freestanding children's hospital may pose unique challenges for pediatric providers. We hypothesize that ASP implementation in a non-freestanding children's hospital have distinct barriers and challenges among pediatric providers. This study aims to assess awareness, knowledge, and utilization of ASP by pediatric providers compared with adult providers in a non-freestanding children's hospital.

Materials and Methods

An online survey was performed at Children's Hospital – Albany Medical Center (AMC), a non-freestanding children's hospital within a 734-bed academic medical center with 125 beds dedicated to pediatric floor, between August and September 2013.

In 2006, AMC formally developed the antimicrobial stewardship team consisting of a full time (FTE) adult infectious disease trained clinical pharmacist (BL) and 0.5 FTE adult infectious disease physician. The adult ASP incorporated pediatric champions (RPS, AMV) in 2012. The team collaborates with the hospital epidemiology, clinical microbiology, Pharmacy and Therapeutics Committee, Antibiotic Committee, and hospital administration. The ASP team utilizes core strategies (i.e. prospective audit of antimicrobial use with intervention and feedback, formulary restriction, except preauthorization) and supplemental strategies (i.e. education, guidelines and clinical pathway development, antimicrobial order form, de-escalation, dose optimization, and intravenous to oral therapy conversion) [1].

The survey consisted of a 10-item forced choices and 5-point Likert scale questionnaire on awareness, continuing medical education experience, general knowledge, and utilization of ASP by attending physicians, fellows, residents, and nurses. Content validation of the questionnaire was provided by several pharmacists and infectious disease consultants who are experts on ASP. Additional validation was performed using positive (pharmacy students who had completed their ASP rotation) and negative controls (1st and 2nd year medical students who had not started clinical rotations).

Anonymous online surveys (an initial and a reminder email 4 weeks later) were sent via SurveyMonkey to all credentialed providers. Respondents were divided into three groups based on self-reported patient exposure: pediatric providers who see patients <18 years, adult providers (≥ 18 years), and those pediatric-adult providers (all age group).

Descriptive analyses (proportions), parametric (95% confidence intervals), and nonparametric ($\chi 2$ and Fisher's exact test) tests were used to assess differences between groups with α <0.05 considered significant. All statistical analyses were performed using GraphPad Prism 6.00 (La Jolla, CA). Expedited review with waiver of informed consent approval for this study was provided by the IRB at Albany Medical Center, NY. (3448).

Results

Two hundred seventy three (19%) of the 1421 credentialed providers responded to the survey invitation and 243 (89%) completed all questions. There were 60 (22%) adult providers, 66 (24%) pediatric providers, and 147 (54%) pediatric-adult providers. Sixty-six (47%) of the 140 pediatric providers responded. Most respondents were hospital attending or faculty (176, 64%) and majority had been working for ≤5 years (139, 51%).

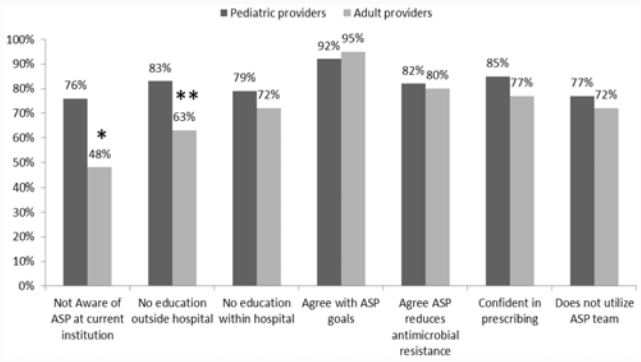

Figure 1: Antimicrobial stewardship program (ASP) awareness and education of pediatric providers compared to adult providers in a non-freestanding children's hospital. Pediatric providers were significantly unaware of ASP in the medical center compared to adult providers (76% *vs.* 48%). Significantly more pediatric providers had not attended educational meetings on ASP outside the medical center than adult providers (83% *vs.* 63%). *p<0.01; **p=0.01.

The majority were not aware of the ASP in the medical center (173, 63%). Pediatric providers were significantly unaware (50, 76%; 95% confidence interval [63%, 85%]) of ASP in the medical center compared to adult providers (29, 48% [35%, 61%]). (p<0.01) (Figure 1).

The majority had not attended educational meetings on ASP outside the medical center (209, 77%). Significantly more pediatric providers had not attended educational meetings on ASP outside the medical center (55, 83% [72%, 91%]) than adult providers (38, 63% [50%, 75%]). (p=0.01) (Figure 1) Most respondents had not received educational training on ASP such as conferences or grand rounds within the medical center (191, 70%), with no significant difference among pediatric (52, 79% [66%, 88%]) versus adult providers (43, 72% [59%, 83%]).

The majority agreed with the primary goals of ASP (248, 91%) with no significant difference between the pediatric (61, 92% [81%, 97%]) and adult providers (57, 95% [85%, 99%]). The majority agreed (212, 78%) in the role of ASP in reducing antimicrobial resistance without significant difference between pediatric (54, 82% [70%, 83%]) and adult providers (48, 80% [68%, 90%]).

Most were confident in prescribing antimicrobial agents (210, 77%) with no significant difference between pediatric (56, 85% [72%, 92%]) and adult providers (46, 77% [63%, 86%]). The majority were not utilizing the ASP team (205, 75%) without significant difference between pediatric (51, 77% [64%, 87%]) and adult providers (43, 72% [57%, 82%]).

Discussion

This study supported the hypothesis that there are distinct challenges among pediatric providers in their knowledge and utilization of ASP in a non-freestanding children's hospital. It identified potential education and communication barriers in the improvement and maintenance of a pediatric ASP within a medical center. Some pediatric providers lacked awareness and educational training but agreed on the general principles and usefulness of ASP

in a medical center. Like the adult providers, they were confident in prescribing antimicrobial agents but would less likely utilize the ASP team.

The implementation of ASP at freestanding children's hospital may not be generalizable to the diverse settings of larger general hospitals with pediatric wards. The core principles and strategies of ASP are similar, but differences exist in prescribing practices and targeted antimicrobial agents, unique to the clinical needs of pediatric providers [6]. Further, the available resources and perception of ASP vary in different medical centers with academic affiliations [7]. In a survey of pediatric infectious disease consultants in December 2008, the major barriers in ASP implementation include lack of resources such as funding, dedicated personnel, and time reported by more than half of the participants [8]. The lack of dedicated pediatric ASP personnel and time remains the crux of the problems in implementing ASP in our children's hospital.

One of the unique challenges in a non-freestanding children's hospital is decreased awareness of pediatric providers of the available ASP in the medical center. Approximately 2/3 of the respondents, of which the majority were pediatric providers, were not aware and had not received any education on ASP within or outside the medical center (Figure 1). Since mandatory implementation of ASP throughout healthcare is currently recommended[2] there should be provisions for education programs on ASP, preferably annually. These education programs should address the function of ASP and the strategies and methods employed to improve antimicrobial use. This is a simple problem to fix since periodic or ongoing education intervention on ASP may be easily implemented.

Healthcare providers may not establish a relationship with the ASP team if there is no awareness of their existence or no knowledge of their significance. In tertiary children's hospitals, there is frequent utilization of ASP for appropriate antimicrobial regimen when its use requires prior approval [9]. In the study by Metjian TA et al, [9] the majority of respondents agreed with the primary goals of ASP however, only a quarter utilizes the stewardship team. Wester CW et al [10] have described that most physicians view antibiotic resistance as an important problem nationally but not locally. Almost all agreed that injudicious antibiotic use is an important cause of resistance yet only 60% favored restricting its use. Disparities in physicians' knowledge and practice may compromise implementation of ASP. This has also been observed in a non-freestanding children's hospital where providers had different opinions regarding appropriate prescribing [11]. In our medical center majority of pediatric providers agrees with the ASP goals (92%) and that ASP reduces antimicrobial resistance (82%) yet less than 30% utilize the ASP team.

Overcoming bias relating to prescribers' misconceptions of ASP and their purpose is not a unique problem in any healthcare settings. However, ASP in a non-freestanding children's hospital may have fewer resources to draw from, particularly if the medical center only has a dedicated adult ASP personnel. The adult ASP team may not be comfortable in providing recommendations related to pediatric issues. This results in those pediatricians assuming antibiotic stewardship responsibilities even when their knowledge of those duties may be minimal [5,9]. In our experience we believe the pediatric providers' confidence in prescribing antimicrobial agents (85%) and easy access to pediatric infectious diseases specialists for quick non-formal consults may partly explain the non-utilization of the ASP team.

Local efforts at our medical center had significantly improved ASP. Since its implementation in 2006 spearheaded by a dedicated full time adult infectious disease clinical pharmacist (Personal communication, BL) there has been a significant impact on antimicrobial use among the overall patient population. Between 2008 and 2010 there was a significant decrease in vancomycin use while hospital admissions increased. There was a significant increase in conversion from intravenous (IV) to oral (PO) antibiotics regimen particularly with IV to PO levofloxacin and linezolid.

In response to the lack of awareness and utilization of ASP among pediatric providers as well as lack of training among providers in general we provided education programs. A lecture on ASP through the pediatric grand rounds was given in October 2014 a year after the online survey. The lecture consisted of the goals of ASP, history of when it was implemented at the medical center, and clinical vignettes were discussed on actual clinical scenarios to exemplify ASP intervention targets: bug-drug mismatch; drug dosing; unlikely infection; pharmacokinetic monitoring; and de-escalation of therapy. Among 40 pediatric providers who completed the post-intervention questionnaire showed there is a trend on increasing awareness of the ASP as well as increase in receiving education from the medical center [12]. There were several reasons provided regarding not utilizing the pediatric ASP: curbside questions addressed by pediatric infectious diseases attending and that most pathogens requiring antimicrobial therapy can be managed comfortably by general pediatric provider.

Medical evidence on the impact of ASP in nonfreestanding children's hospital remains limited. A review article by Hyun DY et al, [5] provided insights on how every pediatric provider can be an antimicrobial steward and illustrated the need to expand ASP activities in community hospitals or pediatric wards within a medical center. The study by Brigg Turner R et al, [13] evaluated the antibiotic use after an ASP intervention which included a pharmacist prospective auditing and feedback as well as physician group engagement. In general, they noted a significant decrease in antibiotic use particularly in the use of vancomycin during the postintervention period. The authors concluded that despite limited resource in a community hospital a simple ASP intervention can effectively decrease antibiotic use without compromising patient care in a non-freestanding children's hospital. A similar approach among community hospitals with pediatric wards may be utilized maximizing their limited resources. Further, there should be collaborative efforts among community hospitals as well as correspondence with a children's hospital within a tertiary medical center in a region such as ours in Upstate New York.

There are several limitations identified in this study. The response rate of providers was below the calculated sample size large enough to detect at least 5% difference in the proportion of those who are aware of the ASP program (alpha 0.05, beta 0.20) [14]. However, we found significant difference in the proportion of pediatric and adult providers who were not aware of the ASP program (by >25% difference) and those who have not attended any educational training on ASP outside the medical center (by 20% difference). Second, the results of this survey may not be extrapolated to other non-freestanding children's hospital with on-going education program on ASP. Lastly, recall bias may be a problem in any survey. The consistency in the response of all participants regardless if they are pediatric, adult, or pediatric-adult providers seems to mitigate this limitation: >80% agreed with the primary goals and the importance of ASP in decreasing antimicrobial resistance.

There should be continued efforts in identifying unique challenges in the implementation of ASP in non-freestanding children's hospitals. Provisions for on-going provider education[11] programs should be part of large medical centers with children's hospitals, particularly those providing graduate medical education with new trainees annually. This should include medical students to ensure adequate preparedness in the principle and practices of antimicrobial use [15]. Different teaching tools including grand rounds in different subspecialty programs, conferences, and clinical vignettes that participants can easily relate to are several education strategies that can be used. These are few of the on-going education programs and continuing medical education being offered at our medical center as a response to the unique challenges among pediatric providers [12]. Further, pediatric champions are essential for successful stewardship activities in non-freestanding children's hospitals in those institutions whose ASP is coordinated by adult medical providers.

Conclusions

The majority of surveyed providers had not received educational training but agreed with the primary goals and usefulness of ASP in a medical center. Most pediatric providers were unaware of the ASP and its utilization. These unique challenges are avenues for interventions such as on-going education programs to improve ASP in non-freestanding children's hospitals. These barriers to implementation of ASP in our medical center among pediatric providers significantly improved with the ongoing education programs on ASP which includes clinical vignettes on actual clinical scenarios to exemplify ASP intervention targets.

Acknowledgments

The authors are indebted to Douglas Fish, Sarah Elmendorf, Martha Lepow, and Thomas Lodise, for providing expert validation of the questionnaire.

The study was accepted for poster presentation at the Pediatric Academic Societies' & Asian Society of Pediatric Research Joint Meeting, Vancouver, Canada, May 5, 2014.

References

1. Dellit TH, Owens RC, McGowan JE, Jr., et al. Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. *Clinical infectious diseases: an official publication of the Infectious Diseases Society of America*. 2007; 44: 159-177.
2. Society for Healthcare Epidemiology of America, Infectious Diseases Society of America, Pediatric Infectious Diseases S. Policy statement on antimicrobial stewardship by the Society for Healthcare Epidemiology of America (SHEA), the Infectious Diseases Society of America (IDSA), and the Pediatric Infectious Diseases Society (PIDS). *Infection control and hospital epidemiology: the official journal of the Society of Hospital Epidemiologists of America*. 2012; 33: 322-327.
3. Ohl CA, Dodds Ashley ES. Antimicrobial stewardship programs in community hospitals: the evidence base and case studies. *Clinical infectious diseases: an official publication of the Infectious Diseases Society of America*. 2011; 53: S23-828; quiz S29-30.
4. Children's Hospital Association. Children's Hospital Association - Frequently Asked Questions on Children's Hospital. 2009. 2014.
5. Hyun DY, Hersh AL, Namtu K, et al. Antimicrobial stewardship in pediatrics: how every pediatrician can be a steward. *JAMA pediatrics*. 2013; 167: 859-866.
6. Newland JG, Hersh AL. Purpose and design of antimicrobial stewardship programs in pediatrics. The *Pediatric infectious disease journal*. 2010; 29: 862-863.
7. Patel SJ, Rosen E, Zaoutis T, Prasad P, Saiman L. Neonatologists' perceptions of antimicrobial resistance and stewardship in neonatal intensive care units. *Infection control and hospital epidemiology: the official journal of the Society of Hospital Epidemiologists of America*. 2010; 31: 1298-1300.
8. Hersh AL, Beekmann SE, Polgreen PM, Zaoutis TE, Newland JG. Antimicrobial stewardship programs in pediatrics. *Infection control and hospital epidemiology: the official journal of the Society of Hospital Epidemiologists of America*. 2009; 30: 1211-1217.
9. Metjian TA, Prasad PA, Kogon A, Coffin SE, Zaoutis TE. Evaluation of an antimicrobial stewardship program at a pediatric teaching hospital. *The Pediatric infectious disease journal*. 2008; 27: 106-111.
10. Wester CW, Durairaj L, Evans AT, Schwartz DN, Husain S, Martinez E. Antibiotic resistance: a survey of physician perceptions. *Archives of internal medicine*. 2002; 162: 2210-2216.
11. Levy ER, Swami S, Dubois SG, Wendt R, Banerjee R. Rates and appropriateness of antimicrobial prescribing at an academic children's hospital, 2007-2010. *Infection control and hospital epidemiology: the official journal of the Society of Hospital Epidemiologists of America*. 2012; 33: 346-353.
12. Botti MC SA, Lomaestro BM, Tristram DA, Santos RP. Do Education Programs Improve Knowledge and Utilization of an Antimicrobial Stewardship Program in a Non-freestanding Children's Hospital? *University Health-System Consortium Resident - Fellow Poster Session*; 2014, 2014; Anaheim, CA.
13. Turner RB, Valcarlos E, Loeffler AM, Gilbert M, Chan D. Impact of an Antimicrobial Stewardship Program on Antibiotic Use at a Nonfreestanding Children's Hospital. *Journal of the Pediatric Infectious Diseases Society*. 2017; 6: e36-e40.
14. Uitenbroek D. SISA - Simple Interactive Statistical Analysis. 1997. 2014.
15. Abbo LM, Cosgrove SE, Pottinger PS, et al. Medical students' perceptions and knowledge about antimicrobial stewardship: how are we educating our future prescribers? *Clinical infectious diseases: an official publication of the Infectious Diseases Society of America*. 2013; 57: 631-638.