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Experiences from the Missouri Antimicrobial Stewardship Collaborative: A Mixed Methods Study.

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Abstract

We performed a mixed methods study to evaluate antimicrobial stewardship program (ASP) uptake and assess variability of program implementation in Missouri hospitals. We found that despite increasing uptake of ASPs in Missouri, there is wide variability in both the scope and sophistication of these programs.

Background

The Centers for Disease Control and Prevention (CDC) Core Elements of Antibiotic Hospital Antibiotic Stewardship ("Core Elements") allows healthcare systems to select specific elements out of a list of variety of tracking metrics and interventions.[1] This recommendation leaves room for flexibility in program implementation, but it also allows hospitals to satisfy all Core Elements while still having an ineffective antimicrobial stewardship program (ASP). This concern is greatest for resource-limited rural community hospitals.[2]

This study evaluated the implementation of ASPs in Missouri via a survey and assessed facilitators and barriers to ASP implementation via semi-structured qualitative interviews.

Methods

Survey

A 93-question online survey based on the CDC Core Elements was developed by our research team of infectious diseases physicians, ASP pharmacists, and dissemination and

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implementation scientists to assess the characteristics of ASPs in Missouri (Qualtrics, Provo, Utah; see supplementary file).

The survey was disseminated to ASP leadership in all 125 hospitals in Missouri. Only one survey was accepted per hospital. Incomplete surveys were excluded from the analysis. Stewardship pharmacists covering more than one hospital were instructed to complete the survey for each hospital supervised. Survey responses were collected from 04/09/2019 to 07/31/2019. No incentives for participation were offered.

Statistical analysis was performed using SAS 9.4 (SAS Institute, Cary, North Carolina). Statistical testing was performed with Fisher's exact test and Mann-Whitney U. A p-value of < 0.05 was considered significant.

Semi-structured Interviews

An interview guide based on the Core Elements was also developed by our research team to assess facilitators and barriers of implementing ASPs. We recruited ASP pharmacists from smaller, rural, and critical access hospitals to take part in 30–60 minute semi-structured interviews. We conducted interviews from 4/4/2019 to 7/11/2019 until we reached thematic saturation.

Interviews were recorded, transcribed, and then coded by two independent coders using NVivo 12 (QSR International, Melbourne, Australia). The codebook and themes were piloted, revised, and approved by the research team.

Results

Survey

Forty-five completed surveys were received out of the 125 eligible Missouri hospitals (36% response rate). For survey respondents, hospital size ranged from 12 to 1378 beds with a median of 113 (IQR 55, 242). Non-responding hospitals were smaller with a median bed number of 58 (IQR 32, 155; $p = 0.04$). Of responding hospitals 16% were critical access hospitals (CAHs) compared to 34% of non-responding hospitals ($p = 0.04$). Of responding hospitals, 67% reported fulfilling all seven CDC Core Elements (supplementary data, Table 1). Only 3 of 7 (43%) CAHs had implemented all seven cores compared to 27 of 38 (71%) non-CAHs ($p = 0.19$).

Leadership Commitment—All but one hospital surveyed reported a hospital leadership commitment to antimicrobial stewardship. Only 57% reported that leadership ensured relevant staff were given sufficient time for stewardship activities.

Accountability and Drug Expertise—Fifty-nine percent of hospitals reported appointing a single pharmacy leader dedicated for the ASP. Of these programs, 91% reported having no protected time for stewardship activities. Only 29% of the CAHs reported having a dedicated pharmacist leader.

Policies and Interventions to Improve Antibiotic Use—All respondents reported performing some type of stewardship intervention (Table 1), however, the number of interventions varied widely from 2 to 12 (supplementary data, table 2).

Tracking and Reporting Antibiotic Use and Outcomes—Sixty-one percent of hospitals reported submitting data to the National Healthcare Safety Network (NHSN) Antibiotic Utilization and Resistance (AUR) module while 29% of hospitals utilized the NHSN standardized antimicrobial administration ratios for antimicrobial tracking.

Education—Hospitals provided stewardship education in a variety of ways, with the most popular being facility-specific feedback on antibiotic prescribing trends (supplementary data, Table 3). Targets of education were commonly physicians, pharmacists, and nurses. Sixteen hospitals involved patients in their educational efforts.

Tracking outcomes—Tracking of antimicrobial-associated outcomes was performed by 93% of hospitals, with one to four measures being tracked (supplementary data, Table 4).

Stewardship Resources—The most commonly used resources for ASPs were state-based collaboratives and ASP toolkits (Table 2). Of the respondents using state-based collaboratives, 45% found them very or extremely useful, while only 23% of those using regional and national collaboratives rated them similarly. The CDC ASP toolkit was used most frequently, with 85% finding it very or extremely useful.

Semi-structured Interviews

Eight pharmacists from eight hospitals were interviewed. Hospital size ranged from 55 to 496 beds with six having less than 150 beds. Fourteen codes were used to thematically analyze the interviews (supplementary data, table 5). Five key themes (supplementary data, table 6) are discussed below.

Theme 1: Stewardship is highly collaborative, but pharmacy driven—Everyone interviewed noted that their ASPs were led by pharmacists with other disciplines collaborating, often with semi-regular team meetings. Pharmacists felt underprepared for ASP responsibilities and often these responsibilities were uncompensated.

Theme 2: There is need for internal resources and support—Pharmacists typically agreed that insufficient internal resources, including staffing, time, and salary support, were provided to the ASP. This hindered the pharmacist’s contribution to the ASP. Pharmacists noting low leadership support also lacked resources to support the ASP.

Theme 3: Resistant physicians hinder program success—Interviewees noted that stewardship activities often strained relationships between ASP pharmacists and practicing physicians, which harmed educational efforts.

Theme 4: Importance of proper tracking tools—The sophistication of tools, their user-friendliness, and staff comfort with them were commonly linked to tracking and

reporting. Pharmacists with difficult tools compiled reports on paper or used Microsoft Excel as workarounds.

Theme 5: Common desire for networked relationships and platforms—The majority of pharmacists wanted a way to share resources by connecting to other hospitals and pharmacists. Common requests included sharing of educational materials and tools, learning from hospitals of similar sizes, and sharing other stewardship information.

Discussion

The survey and interview results show that despite broad ASP uptake, there is significant variability in implementation. Programs vary in the scope and complexity of their interventional and tracking efforts, as well as in the degree of support and resources afforded to them. Programs that are more involved tend to be more effective. Stenehjem et. al. showed that stewardship programs that promoted daily engagement with the stewardship team resulted in a significant reduction in antibiotic usage.[3]

Leadership support and dedicated resources remain substantial barriers to effective stewardship in many hospitals. While the majority of ASPs had documented support statements there was minimal dedicated time provided to ASP pharmacists. CAHs may be of particular concern, as pharmacy ASP leadership was largely not available among CAHs and none compensated pharmacist time for stewardship activities. The new recommended ASP staffing guidance from CMS may help improve resource allocations in the future.[4]

A major limitation of this study was its low response rate despite aggressive reminders. The large proportion of smaller hospitals and CAHs among non-participants highlights the difficulty of disseminating stewardship resources to more rural facilities. Though respondents represented a large geographic and size distribution of hospitals in the state, there was inadequate capture of CAHs to fully evaluate unique issues in the state's most resource limited hospitals. Other limitations included self-reporting bias and possible duplication due to multiple hospitals using the same system ASP resources.

Conclusion

Continued barriers to implementing ASPs in community settings are related to inadequate leadership commitment, resource allocation, and the need for improved physician communication.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Comparison of antimicrobial stewardship interventions implemented at Missouri hospitals stratified by critical access hospital status.

Type of Intervention	Critical Access Hospitals n = 7 (%)	All Other Hospitals n = 38 (%)
Requiring a defined duration for antibiotic prescriptions	2 (29)	12 (32)
Requiring indication for antibiotic prescriptions	3 (43)	27 (71)
Developing and implementing facility specific treatment guidelines/ recommendations based on national guidelines	5 (71)	27 (71)
Antibiotic “time outs”	5 (71)	17 (45)
Prior authorization-pharmacy or physician approval for select antibiotics	3 (43)	11 (29)
Formulary restrictions	6 (85)	30 (79)
Prospective audit and feedback	2 (28)	24 (63)
Automatic or actively suggested conversion from intravenous to oral antibiotic therapy for certain antibiotics *	3 (42)	32 (84)
Pharmacist dose adjustments for organ dysfunction	7 (100)	35 (92)
Pharmacist dose optimization	6 (86)	34 (89)
Automatic alerts for duplicative therapy	2 (29)	24 (63)
Time-sensitive automatic stop orders for certain antibiotics orders	2 (29)	21 (55)
Electronic or manual detection and prevention of antibiotic-related drug-drug interactions	6 (86)	29 (76)

Note.

* This result was statistically significant with a p-value of 0.03

Table 2.

Resources Used By Responding Hospitals

Description of Resource	Number of Hospitals Using Resource n (%)
State-based antimicrobial stewardship collaboratives	20 (44)
Antimicrobial stewardship toolkits	20 (44)
Regional or national antimicrobial stewardship collaboratives	13 (29)
Commercial telehealth support for antimicrobial stewardship	3 (7)
None of the above	14 (31)