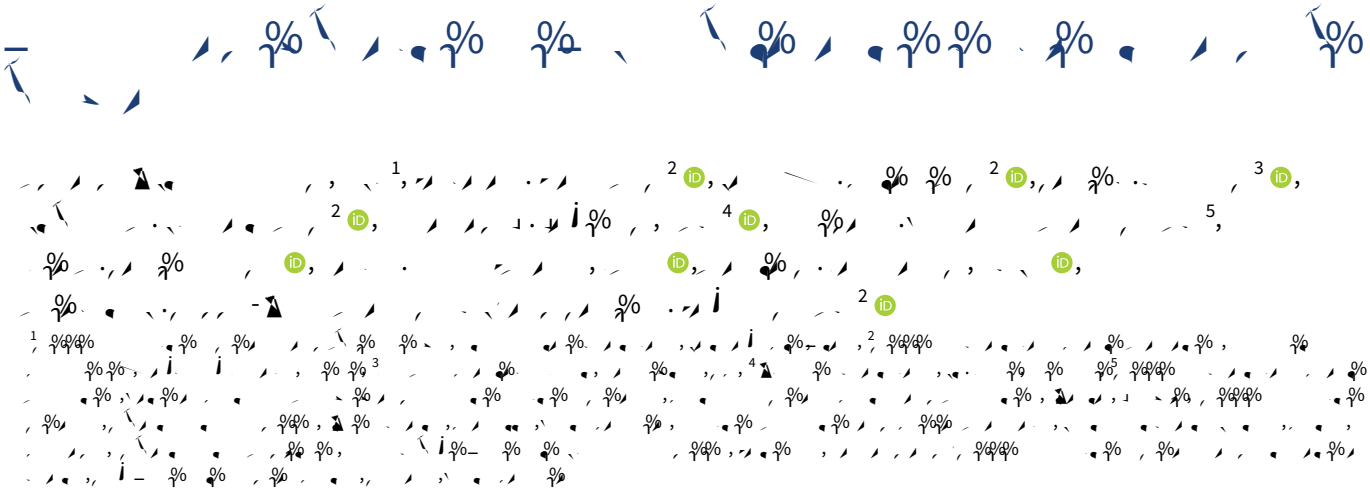
Original Article



Abstract

Objective: To determine the proportion of hospitals that implemented 6 leading practices in their antimicrobial stewardship programs (ASPs).
Design: Cross-sectional observational survey.

Setting: Acute-care hospitals.

Participants: ASP leaders.

Methods: Advance letters and electronic questionnaires were initiated February 2020. Primary outcomes were percentage of hospitals that (1) implemented facility-specific treatment guidelines (FSTG); (2) performed interactive prospective audit and feedback (PAF) either face-to-face or by telephone; (3) optimized diagnostic testing; (4) measured antibiotic utilization; (5) measured C. difficile infection (CDI); and (6) measured adherence to FSTGs.

Results: Of 948 hospitals invited, 288 (30.4%) completed the questionnaire. Among them, 82 (28.5%) had <99 beds, 162 (56.3%) had 100–399 beds, and 44 (15.2%) had ≥400+ beds. Also, 230 (79.9%) were healthcare system members. Moreover, 161 hospitals (54.8%) reported implementing FSTGs; 214 (72.4%) performed interactive PAF; 105 (34.9%) implemented procedures to optimize diagnostic testing; 235 (79.8%) measured antibiotic utilization; 258 (88.2%) measured CDI; and 110 (37.1%) measured FSTG adherence. Small hospitals performed less interactive PAF (61.0%; P = .0018). Small and nonsystem hospitals were less likely to optimize diagnostic testing: 25.2% (P = .030) and 21.0% (P =

implement the Core Elements in all hospitals that receive federal funding.[3] The CDC updated its Core Elements in 2019 to emphasize the importance of hospital leadership, commitment, accountability, pharmacy expertise, actions such as prospective audit and feedback (PAF), local guidelines for common conditions, and antibiotic use tracking using the National Healthcare Safety Network (NHSN) Antimicrobial Use option.[4]

To support the National Action Plan for CARB, The Joint Commission established ASP standards for its accredited hospitals effective January 2017.[5] In 2017, the Agency for Healthcare Research and Quality (AHRQ) Safety Program for Improving Antibiotic Use began a pragmatic quality-improvement program that produced free, setting-specific, tool kits for ASPs.[6,7] The Centers for Medicare and Medicaid Services (CMS) added federal regulations for hospital antibiotic stewardship programs to the conditions of participation in 2019.[8]

These combined efforts appear to have been successful in establishing ASPs in hospitals; self-reported data from NHSN annual hospital surveys revealed that 91% of acute-care hospitals had all 7 Core Elements in place in 2020, compared to only 41% in 2014.[9] Although most hospitals have a basic infrastructure, it is important to ensure that ASPs are implementing effective approaches that strengthen and advance their existing programs.

To identify promising, evidence-based leading ASP practices, The Joint Commission and The Pew Charitable Trusts convened an in-person meeting of experts and key stakeholder organizations in May 2018.[10] Leading practices can be described as best and emerging interventions that complement, strengthen, or go beyond traditional interventions conducted by ASPs. The group identified 6 leading practices (3 established or emerging practices and 3 measurement-related practices) that top-performing ASPs should be performing to improve care for patients: (1) development and implementation of facility-specific treatment guidelines (FSTGs), (2) interactive prospective audit and feedback (also known as handshake stewardship), (3) optimizing diagnostic testing (also known as diagnostic stewardship), (4) measurement of antimicrobial use using days of therapy per 1,000 days present or patient days, (5) measurement of hospital-onset CDI, and (6) measurement of adherence to FSTGs.

In this study, we assessed the proportion of Joint Commission–accredited hospitals that have implemented these 6 leading practices of antimicrobial stewardship, and we identified hospital characteristics associated with these practices.

Methods

This cross-sectional observational study was guided by 9 expert

minimum sample size, calculated based on 5% precision and confidence intervals (CIs) of 95% after applying a finite population correction factor, was determined to be 274 hospitals.

Data analysis

We used R version 3.5 software (R Foundation for Statistical

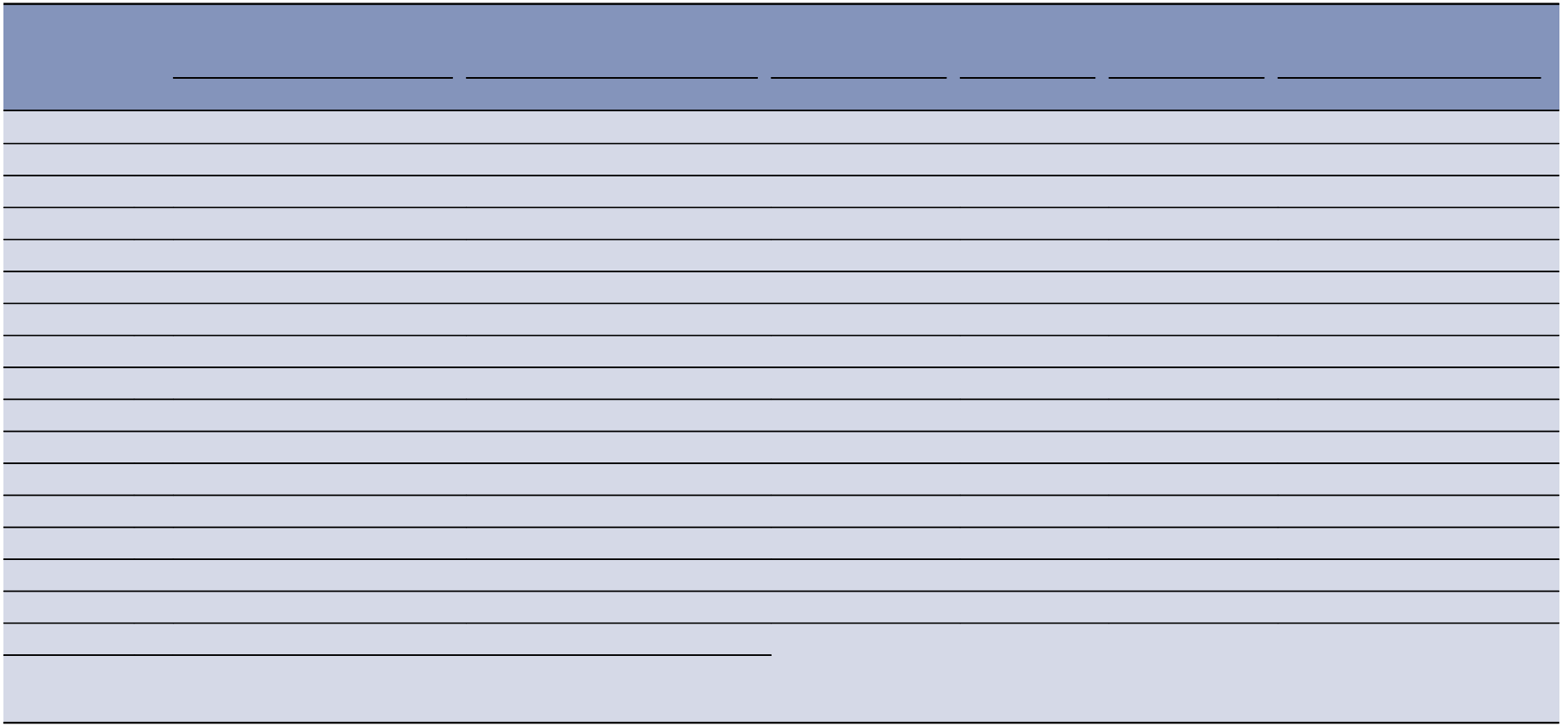


Table 4.

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1–3 i	55 (1 .1)
4–5 i	123 (42.)
– i	5 (20.5)
	2 (0.)

68.8%) using some combination of telephone (n = 224, 77.8%), face-to-face (n = 198, 68.8%), text message (n = 155, 53.8%), or EHR alert (n = 104, 36.1%). Most hospitals (n = 198, 68.8%) reviewed orders for all units; 142 (49.3%) reviewed orders for all antimicrobials, and 123 (42.7%) reviewed orders 4–5 days per week (Table 4).

Regarding the leading practice criteria, 214 hospitals (72.4%) performed interactive PAF whereby an ASP team member provided feedback either by telephone (speaking with the clinician or leaving voice message), face to face, or both. Small hospitals (61.0%; 95% CI, 56.0%–66.0%; $P = .0018$), rural hospitals (52.6%; 95% CI, 46.5%–58.6%; $P < .001$), and nonteaching hospitals (68.2%; 95% CI, 63.9%–72.4%; $P = .0076$) were less likely to have implemented interactive PAF (Table 3).

Diagnostic testing optimization

Overall, 207 hospitals (71.9%) had procedures in place to optimize the appropriate use of diagnostic tests. Regarding the leading practice criteria, only 105 hospitals (34.9%) had implemented procedures to optimize testing for both *C. difficile* and UTIs (Table 3). Small hospitals (25.2%; 95% CI, 20.7%–29.6%; $P = .030$) and nonsystem hospitals (21.0%; 95% CI, 15.5%–26.6%; $P = .0077$) were less likely to meet this leading practice.

The main strategies used to optimize diagnostic testing for *C. difficile* were laboratory-initiated interventions (n = 165 hospitals, 57.3%) or clinician education sessions (n = 162, 56.3%). Allowing reflex urine cultures only when specific parameters were met (n = 91, 31.6%) and clinician education (n = 87 hospitals, 30.2%) were strategies commonly used to optimize urine-specimen testing. Hospitals frequently (n = 120, 41.7%) used a clinical decision support system to optimize diagnostic testing for CDI though fewer (n = 34, 11.8%) did so for urine-specimen testing (Supplementary Table 2 online).

Measurement-related practices

Regarding antimicrobial use, 235 (79.8%) hospitals routinely measured days of therapy (DOT) per 1,000 days present or 1,000 patient days. Small hospitals (67.8%; 95% CI, 63.0%–72.5%; $P = .0010$), rural hospitals (69.1%; 95% CI 63.5%–74.8%; $P = .033$), and nonteaching hospitals (74.2%; 95% CI, 70.2%–78.2%; $P = .033$) were less likely to measure antibiotic DOTs (Table 3).

The overall proportion of hospitals measuring hospital-onset CDI (HO-CDI) was high (n = 258, 88.2%). Small hospitals were least likely (80.3%; 95% CI, 76.2%–84.3%; $P = .0038$) to measure HO-CDI. The proportion of hospitals monitoring provider adherence to at least 1 FSTG (ie, CAP, UTI, SSTI or sepsis) was low. Only 110 hospitals (37.1%) met this leading practice, with no differences by hospital characteristics (Table 3). Approximately one-fourth assessed adherence to either UTI (n = 73 hospitals, 25.3%), sepsis (n = 71 hospitals, 24.7%), or CAP (n = 70 hospitals, 24.3%); how-

technical staff needed to incorporate FSTGs into EHRs.[25–27] Similarly, belonging to a system was associated with optimizing diagnostic testing for *C. difficile* and UTIs. Diagnostic testing guidelines can often be integrated into EHR order sets at the system level.

As described, our findings indicated that most hospitals have implemented some, but not all, of the leading practices. Oversight organizations and national public health agencies have played a pivotal role in working to establish prioritized requirements for ASPs, driving demonstrable improvement over time, maintaining antibiotic stewardship in the national spotlight, and modifying prioritized requirements with new data. Now may be the right time for oversight organizations to direct increased attention to ASPs and to help reprioritize resources. Several studies have reported that ASP activities decreased when resources shifted to the COVID-19 pandemic response.[28–32]

Our findings underscore the importance of substantive time and financial commitment from clinical and administration leadership for ASPs at both the health-system and local-hospital levels. Such support can create an infrastructure that will facilitate the dissemination and implementation of best practices and build the personnel and technical capacity for ASPs to achieve local goals, assess guideline adherence, and provide interactive prospective audit and feedback, much of which is carried out by pharmacists. When possible, health-system leaders should centralize these capacities and expertise to provide specialized support for smaller hospitals, for example, through antibiotic stewardship telehealth programs.[21,33]

ASP leaders must tailor the implementation of practices or interventions to the local facility environment and their challenges. ASP leaders should determine that the internal environment would be receptive to the change.[34–36] ASP leaders can also take advantage of free resources such as the AHRQ tool kits and the CDC antimicrobial stewardship program assessment tool.[7,37]

This study had several limitations. The sample included only hospitals accredited by The Joint Commission. Despite efforts to clarify that this project was unrelated to accreditation, the possibility of a positive response bias exists. A follow-up qualitative study of challenges and facilitators related to implementing these practices in a subsample of respondents will elucidate areas in which the questionnaire was unclear. The overall response rate was likely affected by the COVID-19 pandemic. To adjust for lower response rate in small hospitals, we weighted the analysis of leading practice prevalence. Nonresponding hospitals may have been less advanced in their ASP practices. Another limitation is the potential positive

7. Antibiotic stewardship toolkits. Agency for Healthcare Research and Quality website. https://www.ahrq.gov/antibiotic-use/index.html. Published June 2021. Accessed October 28, 2021.