

Research Report Template
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PROJECT TITLE & AUTHORS

Project Title:	Antimicrobial Stewardship Program Needs Assessment for Arizona Critical Access Hospitals	
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PROPOSAL CHECKLIST

Completed (Y)	Checklist item
Y	Project title is clear and concise.
Y	Names and emails for project advisor(s) and up to five students per group are provided.
Y	Abstract is no more than 250 words and retains headings
Y	Introduction provides a definition of the topic under study, importance of the topic, and the issue addressed by the study and is no more than one single-spaced page.
Y	There is NO literature review section
Y	Purpose of project is clearly and concisely stated
Y	Methods section uses headings and represents a summary of the methods used. (Actual methods used should be described if they were modified from the proposal.)

Y	Data analysis described is appropriate and responds to the purpose.
Y	Appropriate tables are included in the results section.
Y	Text of results section interprets the findings reported in the tables, not repeating them.
Y	The discussion section includes a description of the most important findings, and relates findings to the literature.
Y	The final section of the discussion is the limitations section.
Y	The conclusions respond to the purpose statement.
Y	Reference list is complete and contains appropriate references, and reference style is applied correctly and consistently.
Y	Data collection/recording form(s) and/or questionnaire(s) are included in the appendix.
Y	Information is placed in the appropriate section—introduction, methods, results, etc.
Y	Template structure is maintained and all required sections are included. Red text instructions/examples are removed. Proposal is written in Times New Roman 12-point font and does not exceed 10 single-spaced pages (excluding appendices). Proposal has been spell-checked and grammar-checked.

ABSTRACT

Specific Aims:

This study was undertaken to investigate the specific antimicrobial stewardship (AMS) needs amongst the 15 critical access hospitals (CAHs) and two CAH-status applicants in Arizona and evaluate which factors influenced full versus partial implementation of the 7 CDC Core Elements.

Methods

This was an IRB-approved, cross-sectional, qualitative and quantitative study examining data gathered from a questionnaire, which was adapted from a similar survey conducted by Doron et al. The survey was student-administered via telephone to an antimicrobial stewardship program (ASP) member from Arizona's CAHs and CAH-status applicants. ASP representatives were recruited by contacting each facility's inpatient pharmacy. The survey included four sections consisting of Likert-scale, multiple choice, and open-response questions that evaluated demographics and ASP practices and protocols if it is present.

Results

All representatives surveyed were pharmacists who either led, co-led, or were members of their hospital's ASP. The majority (70%) were pharmacy directors at their respective facilities. Hospitals that dedicated 20 or more hours per week to antimicrobial stewardship were more likely

to report full implementation of the Core Elements ($p=0.035$). The most frequently reported ASP-related challenge faced by respondents was a lack of ID expertise (31.6%).

Conclusions

Due to the budgetary and staffing constraints in rural hospitals, it is often difficult to allocate more hours towards AMS efforts. Increasing dedicated AMS time at Arizona's CAHs could be an important area to target for additional funding and resources in order to allot more time for stewardship activities and increase Core Elements implementation.

INTRODUCTION

Antibiotic resistance is one of the most problematic public health issues our nation is currently facing, which prompted the Centers for Disease Control and Prevention (CDC) to launch a campaign to promote effective antimicrobial stewardship in the United States.¹ In 2014, the CDC released the CDC Core Elements, which were developed to define key components for an effective ASP.¹ These have since been updated in 2019.¹ Antibiotic resistance refers to the ability of bacteria to mutate and gain characteristics that can lead to the reduction or elimination of the effectiveness of available antibiotics. An ASP is a program that improves patient outcomes by promoting appropriate use of antibiotics, reducing antimicrobial resistance, and diminishing the spread of infections due to multidrug-resistant organisms.¹ ASPs have proven to be effective in mitigating antibiotic resistance, adverse effects from antibiotics, and improving infection cure rates.¹ The Centers for Medicare/Medicaid Services (CMS) requires all acute care and critical access hospitals to implement an AMS program based on the CDC Core Elements of Antimicrobial Stewardship.² These Core Elements were developed by the CDC to define key components of effective ASPs, which is defined as having successfully implemented hospital leadership commitment, accountability, pharmacy expertise, action, tracking, reporting, and education.¹ However, according to the CDC, there are disparities in Core Element implementation among hospitals. In 2015, more than 50% of hospitals with more than 50 beds reported meeting all seven ASP core elements compared to 26% of hospitals with fewer than 50 beds.²

In a developed country like the United States, it is hard to imagine a patient dying from a bacterial infection given the widespread availability of antibiotics. However, the threat of multidrug-resistant organisms has been increasingly gaining traction in the nation, and rural communities have not been exempt from this issue.^{1,2} In the 2019 Antibiotic Resistance Threats Report, the CDC warns the readers to avoid the mentality of believing that this current problem is only happening in neighboring states and not in one's own community.³ The time for action is now because the post-antibiotic era that we like to refer to in the future tense is already here. The 2019 CDC data show that every year there are about 2.8 million antibiotic-resistant infections, and 35,000 individuals die annually because of this public health threat.³ Moreover, *Clostridioides difficile* infections, which may develop after antibiotic use, resulted in 12,800 deaths^{2,3}. Small, rural hospital systems like CAHs are not immune to the hazards of antibiotic resistance. Historically, CAHs have had more difficulties in implementing the CDC Core Elements due to staffing limitations, infrastructure, and resources².

Most of the current literature assessing the implementation of the CDC Core Elements focuses on urban hospitals and academic medical centers; there is a paucity of data regarding the state of ASPs in rural hospitals, and specifically rural CAHs². With CAHs often being limited in

their financial resources and ability to retain an infectious diseases specialist on staff, this gap in knowledge further hinders these institutions from maintaining ASPs in line with the CDC Core Elements.² There are currently 15 CAHs in rural Arizona, with two more in the process of applying for this status, and each serves a medically underserved population suffering from many chronic disease states.⁴ As of yet, there has been no research done to assess the implementation of ASP Core Elements in these Arizona CAHs or to evaluate their specific ASP needs. Therefore, this study aims to investigate these measures across all Arizona CAHs to see what factors influenced full adherence to the 7 CDC Core Elements..

METHODS

This was an IRB-approved cross-sectional qualitative and quantitative study examining data gathered from a questionnaire adapted from a similar survey conducted by Doron et al. and the University of Washington Tele-Antimicrobial Stewardship Program (UW-TASP). The survey was student-administered via telephone call to an ASP member from each of Arizona's CAHs and CAH status applicants. Given that antimicrobial stewardship duties are typically pharmacy-driven, ASP representatives were recruited by contacting each facility's inpatient pharmacy. The survey included four sections (demographics, ASP practices and protocols, questions about gaps of practices or protocols, and questions regarding interest in joining ASP support programs) consisting of Likert-scale multiple choice, and open-response questions.

Design

This project was a cross-sectional, descriptive study using data gathered from a survey administered to an antimicrobial stewardship member from critical access hospitals and CAH applicant institutions in AZ. This study was approved by the University of Arizona Institutional Review Board Human Subjects Protection Program.

Subjects

All CAHs in Arizona including those that were in the process of applying for CAH status were eligible to participate in a survey assessing their antimicrobial stewardship needs. To qualify as a CAH, they were required to meet the following criteria per the Centers for Medicare and Medicaid Services: no more than 25 inpatient beds, must not exceed a 96-hour length of hospital stay, must have agreements, contracts, or affiliations for transfer and services, and must be located more than a 35-mile drive from any other hospital or CAH.³ Hospitals that did not meet the criteria of CAH designation were excluded from this study.

Measures

Data were collected using a printed questionnaire generated in REDCap based on previous surveys addressing the same research topic. Using the surveys designed by Doron et al. and the University of Washington Tele-Antimicrobial Stewardship Program (UW-TASP) as frameworks and starting points. The questions were adapted to suit our unique project aims and ensured that CDC Core Elements adherence and ASP gaps were being appropriately assessed.^{5,6} The survey consisted of four sections with 61 items total. The first section focused on the facility

demographics, the second and third sections focused on institutions with or without antimicrobial stewardship programs respectively, and the last section prompted the participants to provide their contact information and gave them the opportunity to subscribe to a listserv. The primary dependent variable was the antimicrobial stewardship needs of critical access hospitals in Arizona as measured by adherence to the CDC Antibiotic Stewardship Core Elements at Small and Critical Access Hospitals guidelines.

Data Collection

Data collection took place from August 2021 to February 2022. Contact information for each participant was obtained from the State Office of Rural Health and from the Rural Health Professions Program at the R. Ken Coit – College of Pharmacy. Each participant was notified by email in July 2021 of the upcoming survey and included information for scheduling a telephone or Zoom interview. The survey questionnaire was derived from similar surveys conducted by Doron et al.⁵ and UW-TASP in their research and was estimated to take 30 minutes to complete. Data was stored on REDCap servers with password protected access; only the authors and senior co-authors had access to the data files and completed surveys.

Data Analysis

Based on the number of critical access hospitals in AZ, we anticipated at least an 82% (14 out of 17 CAHs) response rate since we planned to reach out to the participants live over the phone or conference call and input their responses immediately into REDCap. Frequencies and percentages were calculated for categorical variables and were compared using a Chi-square test. The *a priori* p-value was set at 0.05. Post-hoc testing was performed, and a Bonferroni correction was applied to the data to account for multiple statistical tests being performed simultaneously. Data was analyzed using the statistical calculation platform SPSS® Version 28.0 by IBM.⁷

RESULTS

Ten out of 17 Arizona critical access hospitals completed our survey, a 59% response rate. All representatives surveyed thus far were pharmacists who either led, co-led, or were members of their hospital's ASP. The demographic characteristics of the survey participants are shown in Table 1. The majority (70%) of survey participants were pharmacy directors at their respective facilities. In terms of the presence of an Antimicrobial Stewardship Program, the proportion of hospitals with an established ASP was greater (70%) than hospitals without an ASP (30%). A majority (60%) of institutions spend 19 hours or less on ASP activities per week, and 70% of surveyed CAHs have access to Infectious Diseases (ID) consult services. There were more facilities with ASPs that were pharmacist-led (70%) and more that reported full implementation of all the CDC Core Elements (60%).

Factors associated with ASPs having full Core Elements implementation versus partial implementation are shown in Table 2. When the various factors were examined, facilities that dedicated 20 or more hours per week to antimicrobial stewardship were more likely to report full implementation of the Core Elements ($p=0.035$). Figure I shows that the most frequently reported ASP-related challenges faced by CAHs in Arizona include a lack of ID expertise (31.6%), lack of dedicated or paid time for stewardship activities (26.3%), lack of computer/IT support (21.1%),

lack of leadership support (10.5%), lack of participation by prescribers (5.3%), and lack of pharmacy expertise (5.3%). As depicted on the bar graph in Figure 2, out of the 7 CDC Core Elements, all participants reported that they have leadership commitment and pharmacy expertise implemented as part of their ASP. In contrast, tracking (80%) is the Core Element with the least uptake across the CAHs surveyed.

DISCUSSION

In this survey with 10 out of 17 respondents from CAHs in Arizona, the primary finding is that hospitals that devoted 20 hours or more per week to their stewardship efforts were more likely to have full implementation of the 7 CDC Core Elements. However, the second most frequently reported ASP challenge faced by CAHs in AZ is the lack of dedicated/paid time for stewardship activities. The average time participants spent on AMS was 18.2 hours per week with a range of 6 to 25 hours. Due to the budgetary and staffing constraints in these rural hospitals, it is often difficult to allocate more hours towards AMS efforts. For example, one of the participants reported that they only have 1 pharmacist and 1 pharmacy technician currently employed in their pharmacy department; therefore, it has been challenging for their institution to fully implement the Core Elements. The study conducted by Doron et al. also identified staffing constraints (69.4%) and funding issues (50.6%) as one of the major barriers to implementation.⁵ Increasing dedicated AMS time at Arizona's CAHs could be an important area to target for additional funding and resources in order to allot more time for stewardship activities and increase Core Elements implementation.

Additionally, tracking was the Core Element with the least uptake across the CAHs surveyed. Almost all of the CAHs surveyed utilized self-developed software (60%) or no software at all (30%) for AMS activities. Given that a lack of ID expertise was the most commonly reported ASP challenge among the included CAHs, implementing robust, vetted tracking software developed and supported by large tele-mentoring services may be a potential intervention to improve tracking within ASPs. Although 70% of surveyed CAHs utilized ID consult services, only 50% consulted UW-TASP or Project ECHO, two of the nation's largest ID tele-mentoring services. One participant interviewed was not aware of UW-TASP or Project ECHO. Thus, increasing awareness and utilization of large tele-mentoring services like these could be another beneficial intervention in providing ID expertise, as well as improving tracking and Core Elements implementation.

The relationship between rurality and Core Elements implementation was also examined by comparing each CAH's index of relative rurality (IRR) value identified through its postal code and its implementation of the Core Elements. There was no significant relationship identified according to degree of rurality, however this could be due to not meeting adequate power to detect a difference. A potential area of future research could be further analyzing the degree of rurality and its effect on antimicrobial stewardship practices and Core Elements implementation both in Arizona and nationally. Further studies could also examine objective data provided by CAHs rather than subjective interviews regarding the areas examined by this project.

The primary limitation of our study is the limited sample size of only 17 CAHs in Arizona, and thus, the outcomes of the study may not be generalizable to other CAHs outside of Arizona or any larger hospitals. Participation was also a significant challenge in addition to the limited sample size that potentially resulted in power not being met to detect further significant relationships between the ASP factors examined and Core Elements implementation. The ongoing COVID-19 pandemic's increased demand on inpatient pharmacy services likely contributed to the incomplete

participation by all 17 CAHs. Two CAHs also declined to participate due to their requirement of internal approval for research participation. Another limitation of our survey was that it involved subjectively reported data rather than objectively derived information from the hospitals' electronic medical record. This subjective approach was chosen in the interest of maximizing participation and garnering personal insights into the ASP challenges faced by these institutions. We also only interviewed pharmacists from the CAHs, which could potentially be a source of bias, but this was done intentionally with the reasoning that pharmacists are usually heavily involved in stewardship activities and may be more willing to participate given that the majority of our investigators are pharmacy students. Despite these limitations, our significant finding that more time dedicated to AMS activities resulted in greater Core Elements implementation is not surprising and can be a generalized approach taken to direct resources towards improving implementation at other CAHs, given that staffing and budgetary constraints are major obstacles for CAHs nationwide.⁵

CONCLUSION

This study contributes a novel finding to the literature that CAHs in Arizona that dedicate 20 or more hours per week to AMS activities are more likely to report full implementation of the CDC Core Elements. Although there were no other factors found to impact Core Elements implementation significantly, future research will illuminate other potential interventions that can be made to improve AMS practices in CAHs further. There is still a large paucity of data examining AMS practices of CAHs in Arizona, and indeed nationwide, and it is imperative that further investigation is done to elucidate potential solutions that can mitigate disparities in optimal AMS implementation at these institutions.

REFERENCES

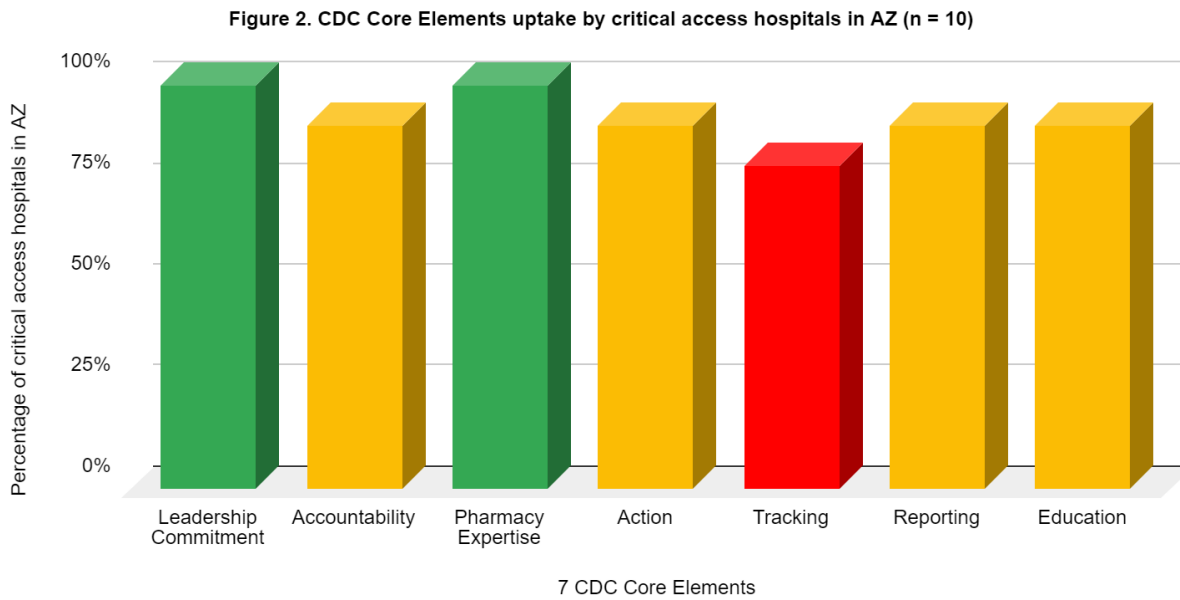
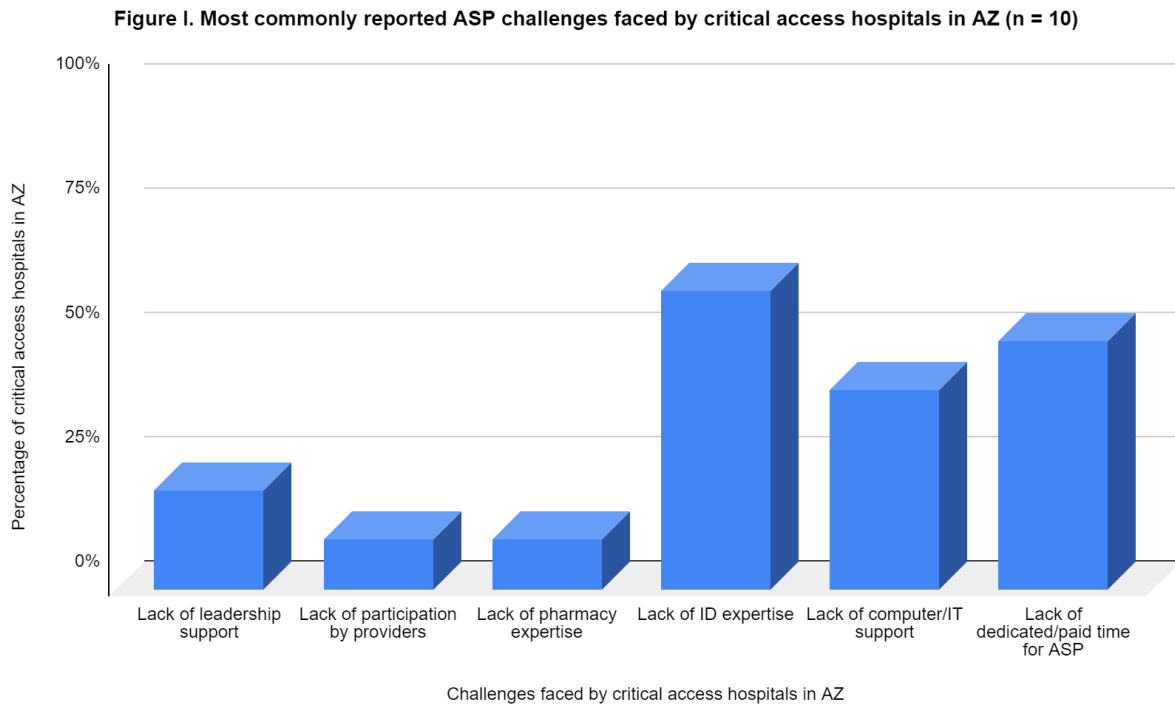
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TABLES AND FIGURES

Table 1. Characteristics of survey participants (n=10)	
Characteristic	No. (%)
Position at the facility Pharmacy Director Staff Pharmacist	7/10 (70%) 3/10 (30%)
Licensed beds 19 or less 20 to 25	5/10 (50%) 5/10 (50%)
Annual admissions Less than 100 100 to 500 501 to 1000 1001 to 5000 More than 5000 Unsure	1/10 (10%) 2/10 (20%) 3/10 (30%) 0/10 (0%) 1/10 (10%) 3/10 (30%)
Presence of ASP Yes In progress	7/10 (70%) 3/10 (30%)
Establishment of ASP 3 years or less Greater than 3 years	5/10 (50%) 5/10 (50%)
Hours per Week dedicated to ASP 19 hours or less 20 hours or more	6/10 (60%) 4/10 (40%)

Table 1. Characteristics of survey participants (n=10); cont.	
Characteristic	No. (%)
Hospital has ID consultation service	
Yes	7/10 (70%)
No	3/10 (30%)
Hospital has a published antibiogram	
Yes	9/10 (90%)
No	1/10 (10%)
Frequency of antibiogram update	
Semi-annual or quarterly	3/10 (30%)
Every year or less frequent	5/10 (50%)
Unsure	2/10 (20%)
Pharmacist leadership with ASP	
Pharmacist led	7/10 (70%)
Non-pharmacist led	3/10 (30%)
Participation in ASP tele-mentoring services	
Yes	6/10 (60%)
UW-TASP	3/10 (30%)
Project ECHO (UNM)	2/10 (20%)
Multi-hospital collaboration	3/10 (30%)
Other: private physician	1/10 (10%)
No participation	4/10 (40%)
Utilization of software	
Yes	
Self-developed (e.g. Excel)	6/10 (60%)
Other: UW-TASP developed	1/10 (10%)
No	3/10 (30%)
Implementation of CDC Core Elements	
Partial implementation	4/10 (40%)
Full implementation	6/10 (60%)
Abbreviations: <i>Infectious Diseases (ID), antimicrobial stewardship program (ASP), University of Washington Tele-Antimicrobial Stewardship Program (UW-TASP), Extension for Community Healthcare Outcomes (ECHO), University of New Mexico (UNM), Center for Disease Control and Prevention (CDC)</i>	

Table 2. Factors associated with having an ASP: Full implementation versus Partial implementation of CDC Core Elements			
Factor(s)	Full Implementation	Partial Implementation	Chi-square value (p-value^a)
Has ID consultation service	4/7 (57.1%)	3/7 (42.9%)	0.079 (0.78)
≥20 hours dedicated to AMS	4/4 (100%)	0/4 (0%)	4.4 (0.035)
<20 number of beds	3/5 (60%)	2/5 (40%)	0 (1.0)
Presence of ASP	4/7 (57.1%)	3/7(42.9%)	0.079 (0.78)
Presence of consult service	4/7 (57.1%)	3/7 (42.9%)	0.079 (0.78)
Presence of antibiogram	5/9 (55.6%)	4/9 (44.4%)	0.74 (0.39)
Pharmacist-led	5/7 (71.4%)	2/7 (28.6%)	1.27 (0.26)
Pharmacy influence (very influential)	4/6 (66.7%)	2/6 (33.3%)	0.278 (0.60)
Time of ASP establishment (greater than 3 years)	3/5 (60%)	2/5 (40%)	0 (1.0)
Pharmacist approving restricted antimicrobials	3/6 (50%)	3/6 (50%)	0.972 (0.62)
Presence of hospital-specific restriction criteria created by ASP	4/5 (80%)	1/5 (20%)	2.5 (0.29)
Utilization of software for ASP monitoring	4/7 (57.1%)	3/7 (42.9%)	0.079 (0.78)
Utilization of telementoring services	4/6 (66.7%)	2/6 (33.3%)	0.90 (0.34)
Rurality (Rural)	2/3 (66.7%)	1/3 (33.3%)	0.079 (0.78)
<i>a. All p-values are for a 2x2 Chi-square test</i>			



APPENDICES**Appendix C1: Data Collection Form****Survey of Antimicrobial Stewardship Programs Among Arizona Critical Access Hospitals****Section 1: Demographics****Survey Questionnaire:****Did the participant provide oral consent? Yes or No**

- 1. What is your position at this facility?**
 - a. Staff pharmacist
 - b. Pharmacy Director
 - c. Physician
 - d. Hospital administrator (i.e. Chief Nursing Officer, Chief Medical Officer, Chief Executive Officer)
 - e. Floor Nurse
 - f. Quality Improvement Specialist
 - g. Infection Preventionist
 - h. Other (please specify): _____
- 2. Are you an active member of your institution's antimicrobial stewardship committee?**
 - a. Yes
 - b. No
 - c. Not applicable (no antimicrobial stewardship committee)
- 3. Are you a designated critical access hospital?**
 - a. Yes
 - b. No
- 4. If you answered no for the question above, have you applied for CAH designation?**
 - a. Yes
 - b. No
- 5. How many licensed beds are in your facility? _____**
- 6. What is the average annual number of admissions for your healthcare facility?**
 - a. Less than 100
 - b. Between 100-500
 - c. Between 501-1,000
 - d. Between 1,001-5,000
 - e. More than 5,000
 - f. Unsure
- 7. Does your facility have an antibiogram?**
 - a. Yes
 - b. No
 - c. Unsure
- 8. If the answer to question #6 is yes, how often is it updated?**

- a. Every year
 - b. Every other year
 - c. Unsure
 - d. Other (please specify): _____
- 9. If the answer to question #7 is yes, what is the publication date of your current cumulative susceptibility guide (antibiogram)? _____**
- 10. What is the estimated total annual antimicrobial expenditure (antibacterials and antifungals only) at your facility? _____**
- 11. What percentage of your total inpatient pharmacy medication budget is represented by antimicrobials (antibacterials and antifungals) only?**
- a. <10%
 - b. Between 10% to 15%
 - c. Between 16% to 25%
 - d. Greater than 26%
 - e. Unsure
- 12. Does your facility have an Infectious Disease consult service?**
- a. Yes, full-time
 - b. Yes, part-time.
 - c. Yes, through telemedicine.
 - d. No, we do not.
- 13. If your institution has an Infectious Disease consult service, are your consultants any of the following?**
- a. Private consulting service
 - b. Hospital-based
 - c. Combination of private and hospital based
 - d. Other (please specify): _____
- 14. Does your institution have an antimicrobial stewardship program?**
- a. Yes
 - b. No
 - c. In progress/under development
- 15. How many hours per week are dedicated to antimicrobial stewardship?**
- _____
- 16. Is your institution a member of any of the following antimicrobial stewardship tele-mentoring services?**
- a. University of Washington Tele-Antimicrobial Stewardship Program (UW TASP)
 - b. Project ECHO through the University of New Mexico
 - c. Multi-hospital antimicrobial collaboration
 - d. Other: _____
 - e. No
- 17. If a member of any of these organizations, how many times per month do you utilize your tele-mentoring service?**
- a. 4 or more times per month
 - b. 2 to 3 times per month
 - c. 0 to 1 time per month
- 18. How does your participation influence care in your hospital?**

- a. Very influential
- b. Somewhat influential
- c. Neutral
- d. Somewhat uninfluential
- e. Not influential

19. Out of the 7 CDC Core Elements, which of these do you have in place?

- a. Leadership Commitment: dedicating necessary human, financial and information technology resources. (Y/N/In progress)
- b. Accountability: appointing a single leader responsible for program outcomes. Experience with successful programs show that a physician leader is effective. (Y/N/In progress)
- c. Pharmacy Expertise: appointing a single pharmacist leader responsible for working to improve antibiotic use. (Y/N/In progress)
- d. Action: implementing at least one recommended action, such as systemic evaluation of ongoing treatment needs after a set period of initial treatment. (Y/N/In progress)
- e. Tracking: Facility monitoring of antibiotic prescribing and resistance patterns. (Y/N/In progress)
- f. Reporting: regular reporting information on antibiotic use and resistance to doctors, nurses and relevant staff. (Y/N/In progress)
- g. Education: educating physicians, pharmacists and nurses about antibiotic resistance and optimal antibiotic prescribing. (Y/N/In progress)

Section 2: Institutions with an Antimicrobial Stewardship Program

1. **If you have an antimicrobial stewardship team at your facility, who is part of this team? Check all that apply.**
 - a. Infectious Disease Physician(s)
 - b. Infectious Disease Pharmacist(s)
 - c. Clinical Microbiologist
 - d. Information System Specialist
 - e. Infection Control Specialist
 - f. Quality Improvement Specialist
 - g. Hospital Epidemiologist
 - h. We have no formal "team"
 - i. Other (please specify): _____
2. **From the members listed above, who is the leader of your institutions' antimicrobial stewardship program? (Please specify if there are co-leaders)**
 - a. Infectious Disease Physician(s)
 - b. Infectious Disease Pharmacist(s)
 - c. Clinical Microbiologist
 - d. Information System Specialist
 - e. Infection Control Specialist
 - f. Quality Improvement Specialist
 - g. Hospital Epidemiologist

- h. We have no formal “team”
 - i. Other (please specify): _____
- 3. When was your stewardship program established?**
- a. Less than 6 months, we are just starting.
 - b. 6 months to a year ago
 - c. 1-3 years ago
 - d. Greater than 3 years ago
- 4. Is your program utilized for adults, pediatrics, or both?**
- a. Adults only
 - b. Pediatrics only
 - c. Both adults and pediatrics
- 5. Which of these educational techniques are utilized to educate prescribers about appropriate prescription of antimicrobials? Check all that apply.**
- a. Hospital or department newsletter
 - b. Email
 - c. Grand Rounds presentations
 - d. Departmental Conferences/meetings
 - e. None
 - f. Other (please specify): _____
- 6. What other certifications or additional training in Infectious Diseases or antimicrobial stewardship does the pharmacist have?**
- a. PGY1
 - b. PGY2
 - c. Additional certifications (please specify): _____
- 7. What is the level of involvement of the ASP pharmacist in the antimicrobial stewardship program?**
- a. The ASP pharmacist approves restricted antimicrobials.
 - b. The ASP pharmacist approves restricted antimicrobials at certain times only (ex. nights or weekends)
 - c. The ASP pharmacist does not approve restricted antimicrobials.
 - d. Other (please specify): _____
- 8. Which of the following antimicrobial stewardship interventions are utilized by your facility? Check all that apply.**
- a. Hospital-specific guidelines and clinical pathways for treatment of infections
 - b. Antimicrobial Cycling
 - c. Antimicrobial Order Forms/clinical indication required at time of prescribing (pre-authorization, “front end”)
 - d. Streamlining or de-escalation of therapy (prospective audit and feedback, “back end”)
 - e. Automatic stop orders (stop dates automatically applied to an order when the duration of therapy is not specified)
 - f. Antibiotic Dose optimization (i.e. renal dosing, hepatic dosing, obesity dosing)
 - g. Parenteral (IV) to oral conversion
 - h. Restriction criteria for certain antibiotics/antifungals
 - i. Utilization of rapid diagnostic tests for microbiologic culture results
 - j. ID consult required

- k. Verbal approval required (telephone or face-to-face)
 - l. None
 - m. Other (please specify): _____
- 9. If a “front end” approach is used, who is responsible for providing the approval for restricted antibiotics? Check all that apply.**
- a. ID physician on the Antimicrobial Stewardship team
 - b. ID pharmacist
 - c. Other (please specify): _____
- 10. Are any of the antimicrobial stewardship interventions pharmacy-driven protocols?**
- a. Yes - please specify which ones: _____
 - i. Hospital-specific guidelines and clinical pathways for treatment of infections
 - ii. Antimicrobial Cycling
 - iii. Antimicrobial Order Forms/clinical indication required at time of prescribing (pre-authorization, “front end”)
 - iv. Streamlining or de-escalation of therapy (prospective audit and feedback, “back end”)
 - v. Automatic stop orders (stop dates automatically applied to an order when the duration of therapy is not specified)
 - vi. Antibiotic Dose optimization (i.e. renal dosing, hepatic dosing, obesity dosing)
 - vii. Parenteral (IV) to oral conversion
 - viii. Restriction criteria for certain antibiotics/antifungals
 - b. No
- 11. Do any of the antimicrobials on your hospital formulary have restriction criteria that were developed by your ASP?**
- a. Yes
 - b. No
- 12. If answered yes to question above, which antibiotics/antifungals are restricted?**
- a. Carbapenems
 - b. Fluoroquinolones
 - c. Daptomycin
 - d. Linezolid
 - e. Azole antifungals (please specify which one(s)) _____
 - f. Echinocandins
 - g. Amphotericin
 - h. Other: _____
- 13. Are you satisfied with the degree to which clinicians at your facility streamline or de-escalate therapy based on culture data?**
- a. Very satisfied
 - b. Somewhat satisfied
 - c. Neutral
 - d. Somewhat unsatisfied
 - e. Very unsatisfied

- 14. Are bedside nurses involved with optimizing antimicrobial therapies at your institution (i.e. facilitating IV to PO interventions, providing patient education about antibiotics, facilitating antibiotic de-escalations)?**
- Yes
 - No
- 15. How does your facility measure the effectiveness of the antimicrobial stewardship program? Check all that apply.**
- Total antimicrobial expenditures
 - Antimicrobial resistance trends via an institutional antibiogram
 - Antibiotic days of therapy (DOT)
 - Frequency of physicians' acceptance of the antimicrobial stewardship team's interventions
 - We do not measure the effect of the antimicrobial stewardship program
 - Other: _____
- 16. Does your facility use proprietary or self developed software to facilitate your antimicrobial stewardship program?**
- No
 - Self developed (i.e. excel spreadsheet, etc)
 - ASP built into electronic medical record
 - I don't know
 - Third party program (please specify name of program): _____
- 17. Please assess your AMS team's overall KNOWLEDGE OF ANTIMICROBIAL STEWARDSHIP?**
- Novice
 - Advanced Beginner
 - Competent
 - Proficient
 - Expert
- 18. Please assess your AMS team's overall KNOWLEDGE OF INFECTIOUS DISEASES?**
- Novice
 - Advanced Beginner
 - Competent
 - Proficient
 - Expert
- 19. Please assess your AMS team's overall KNOWLEDGE OF MICROBIOLOGY?**
- Novice
 - Advanced Beginner
 - Competent
 - Proficient
 - Expert
- 20. Please assess the likelihood of PROVIDER ACCEPTANCE of AMS recommendations?**
- Very likely
 - Somewhat likely
 - Neutral

- d. Somewhat unlikely
 - e. Very unlikely
- 21. Please rate your satisfaction with LEADERSHIP SUPPORT of your AMS program?**
- a. Very likely
 - b. Somewhat likely
 - c. Neutral
 - d. Somewhat unlikely
 - e. Very unlikely
- 22. What other concerns or challenges do you have with advancing your current antimicrobial stewardship program?**
- a. Lack of leadership support
 - b. Lack of participation by prescribers
 - c. Lack of pharmacy expertise
 - d. Lack of infectious disease expertise
 - e. Lack of computer/IT support
 - f. Lack of dedicated/paid time for AMS program
 - g. Other (please specify) _____

Section 3: Institutions without an Antimicrobial Stewardship Program

- 1. Has your institution considered having an antimicrobial stewardship program? If you answered “yes” proceed to question 2. If you answered “no” proceed to question 3. If you answered “I don’t know” proceed to question 4.**
- a. Yes
 - b. No
 - c. I don’t know
- 2. If an antimicrobial stewardship program was considered, what were the barriers for implementation? Check all that apply. If this question applies to you proceed to question 4.**
- a. Funding
 - b. Staffing constraints
 - c. Insufficient medical staff buy-in
 - d. Not a priority
 - e. Organized program has not been proposed
 - f. Other (please specify): _____
- 3. If an antimicrobial stewardship program was NEVER considered, why not? Check all that apply. If this question applies to you proceed to question 4.**
- a. Funding
 - b. Staffing constraints
 - c. Insufficient medical staff buy-in
 - d. Not a priority
 - e. Organized program has not been proposed
 - f. Other (please specify): _____
- 4. If your institution implemented an antimicrobial stewardship program, would it be utilized for pediatrics, adults, or both?**
- a. Adults only
 - b. Pediatrics only

- c. Both adults and pediatrics
 - d. Please explain, if necessary: _____
- 5. Does a formal education program to educate prescribers exist for the appropriate prescription of antimicrobials? (i.e. staff trainings, AMS grand rounds, one-on-one provider education)**
- a. Yes (please specify _____)
 - b. No
 - c. I don't know
- 6. If the answer to question 5 is yes, what educational technique is utilized? Check all that apply.**
- a. Newsletter
 - b. Email
 - c. Conferences
 - d. Grand rounds
 - e. Other (please specify): _____
- 7. Which of the following antimicrobial stewardship interventions are utilized by your facility? Check all that apply.**
- a. Hospital-specific guidelines and clinical pathways for treatment of infections
 - b. Antimicrobial Cycling
 - c. Antimicrobial Order Forms/clinical indication required at time of prescribing (pre-authorization, "front end")
 - d. Streamlining or de-escalation of therapy (prospective audit and feedback, "back end")
 - e. Automatic stop orders (stop dates automatically applied to an order when the duration of therapy is not specified)
 - f. Antibiotic Dose optimization (i.e. renal dosing, hepatic dosing, obesity dosing)
 - g. Parenteral (IV) to oral conversion
 - h. Restriction criteria for certain antibiotics/antifungals
 - i. Utilization of rapid diagnostic tests for microbiologic culture results
 - j. ID consult required
 - k. Verbal approval required (telephone or face-to-face)
 - l. None
 - m. Other (please specify): _____
- 8. If a *front end* approach is utilized, who is responsible for providing approval for restricted antibiotics? Check all that apply.**
- a. ID physician
 - b. ID pharmacist
 - c. ID fellow
 - d. Other (please specify): _____
- 9. Does your institution have a specific committee that approves formulary restrictions?**
- a. No
 - b. I don't know
 - c. Yes (please specify): _____
- 10. How satisfied are you with the degree to which providers at your institution streamline or de-escalate therapy based on culture data?**

- a. Very satisfied
 - b. Somewhat satisfied
 - c. Neutral
 - d. Somewhat unsatisfied
 - e. Very unsatisfied
- 11. From your perspective, to what extent do physicians at your institution agree with the idea of restricting antimicrobials?**
- a. Vast majority agree
 - b. Small majority agree
 - c. Physicians are neutral
 - d. Small majority disagree
 - e. Vast majority disagree
 - f. I don't know
- 12. Please assess your team's overall KNOWLEDGE OF ANTIMICROBIAL STEWARDSHIP?**
- a. Novice
 - b. Advanced Beginner
 - c. Competent
 - d. Proficient
 - e. Expert
- 13. Please assess your team's overall KNOWLEDGE OF INFECTIOUS DISEASES?**
- a. Novice
 - b. Advanced Beginner
 - c. Competent
 - d. Proficient
 - e. Expert
- 14. Please assess your team's overall KNOWLEDGE OF MICROBIOLOGY?**
- a. Novice
 - b. Advanced Beginner
 - c. Competent
 - d. Proficient
 - e. Expert
- 15. Please assess the likelihood of PROVIDER ACCEPTANCE of recommendations?**
- a. Very likely
 - b. Somewhat likely
 - c. Neutral
 - d. Somewhat unlikely
 - e. Very unlikely
- 16. Please rate your satisfaction with LEADERSHIP SUPPORT of your recommendations?**
- a. Very satisfied
 - b. Somewhat satisfied
 - c. Neutral
 - d. Somewhat unsatisfied
 - e. Very unsatisfied

17. What other concerns or challenges do you have with introducing an antimicrobial stewardship program at your institution?

- a. Lack of leadership support
- b. Lack of participation by prescribers
- c. Lack of pharmacy expertise
- d. Lack of infectious disease expertise
- e. Lack of computer/IT support
- f. Lack of dedicated/paid time for AMS program
- g. Other (please specify) _____

Section 4: Almost finished!!!

Thank you for participating in this project and completing the survey!

Please provide your contact information below. This information is optional but encouraged, this will be used to clarify responses, return results, and obtain additional information.

Results will be shared with participants who provide their contact information to help them with their practice. If you would like to receive the results from this survey and/or are willing to be contacted for any further clarifications to your responses, this section is **REQUIRED to be completed.**

Name: _____

Email: _____

Contact number: _____

position/title: _____

Associated institution/facility: _____

- 1. Would your institution be interested in participating in a weekly teleconference/mentoring service via a tele-antimicrobial stewardship program?**
 - a. Yes
 - b. No
 - c. Maybe

- 2. Are you willing to fill out a similar follow-up questionnaire?**
 - a. Yes
 - b. No
 - c. Maybe

- 3. Please include below any feedback, comments, concerns, or challenges you wish to share in regards to antimicrobial stewardship initiatives. This can include suggestions for questions to be included or eliminated on future surveys.**