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Association of inpatient antimicrobial utilization measures with antimicrobial stewardship activities and facility characteristics of Veterans Affairs medical centers

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Abstract:

Background: Antimicrobial stewardship programs (ASPs) have been advocated to improve antimicrobial utilization, but program implementation is variable.

Objective: To determine associations between ASPs and facility characteristics and inpatient antimicrobial utilization measures in the Veterans Affairs (VA) system in 2012.

Design: In 2012, VA administered a survey on antimicrobial stewardship practices to designated ASP contacts at VA acute care hospitals. From the survey, we identified 34 variables across three domains (evidence, organizational context, and facilitation) that were assessed using Multivariable Least Absolute Shrinkage and Selection Operator (LASSO) regression against four antimicrobial utilization measures from 2012: aggregate acute care antimicrobial use, antimicrobial use in patients with non-infectious primary discharge diagnoses, missed opportunities to convert from parenteral to oral antimicrobial therapy, and double anaerobic coverage.

Setting: All 130 VA facilities with acute care services.

Results: Variables associated with at least 3 favorable changes in antimicrobial utilization included presence of postgraduate physician/pharmacy training programs, number of antimicrobial-specific order sets, frequency of systematic de-escalation review, presence of pharmacists and/or Infectious Diseases (ID) attendings on acute care ward teams, and formal ID training of the lead ASP pharmacist. Variables associated with 2 unfavorable measures included bed size, the level of engagement with VA Antimicrobial Stewardship Task Force online resources, and utilization of antimicrobial stop orders.

Conclusions: Formalization of ASP processes and presence of pharmacy and ID expertise are associated with favorable utilization. Systematic de-escalation review and order set establishment may be high-yield interventions.

Key words: antimicrobial stewardship, inpatient, antibiotics, infectious diseases

Introduction:

The deleterious impact of inappropriate and/or excessive antimicrobial usage is well recognized. In the United States, the Centers for Disease Control and Prevention (CDC) estimates that at least 2 million people become infected with antimicrobial-resistant bacteria with 23,000 subsequent deaths and at least $1 billion in excess medical costs per year.[1]

In response, many healthcare organizations have developed antimicrobial stewardship programs (ASPs). Guidelines co-sponsored by the Infectious Diseases Society of America (IDSA) and the Society for Healthcare Epidemiology of America, as well as recent statements from the CDC and the Transatlantic Taskforce on Antimicrobial Resistance (TATFAR), all recommend core ASP elements.[2-5] The guidelines provide general recommendations on ASP structure, strategies, and activities. The recommended ASP *structure* is a team of physicians and pharmacists that collaborate with facility governing committees and other stakeholders to optimize antimicrobial use. While personnel with expertise in infectious diseases (ID) often lead ASPs, hospitalists are also recognized as key contributors, especially in quality improvement.[6, 7] Recommended *strategies* include prospective audit of antimicrobial use with intervention and feedback and formulary restriction with preauthorization. Recommended *activities* include education, creation of guidelines, clinical pathways, and order forms, and programs to promote de-escalation and conversion from parenteral (IV) to oral (PO) antimicrobial therapy. However, limited evidence exists regarding the effectiveness of these ASP core elements.[8, 9] While Cochrane reviews found clear evidence that particular stewardship strategies (e.g., audit and feedback, formulary restriction, guidelines implemented with or without feedback, protocols, computerized decision support) can be effective in reducing antimicrobial usage and improving clinical outcomes over the long term, little evidence exists favoring one strategy over another.[8]

Furthermore, most individual studies of ASPs are single-center, making their conclusions less generalizable.

In 2012, the VA National Antimicrobial Stewardship Task Force (ASTF), in conjunction with the VA Healthcare Analysis and Information Group (HAIG administered a survey on the characteristics of ASPs at all 130 acute care VA facilities (Appendix A). We used these survey results to first build an implementation model and then assess associations between facility-level variables and four antimicrobial utilization measures.

Materials and methods:

Survey and Data

In 2011, the ASTF was chartered to develop, deploy, and monitor a strategic plan for optimizing antimicrobial therapy management. Monthly educational webinars and sample policies were offered to all facilities, including a sample business plan for stewardship and policies to encourage de-escalation from broad-spectrum antimicrobials, promote conversion from parenteral to oral antimicrobial therapy, avoid unnecessary double anaerobic coverage, and mitigate unnecessary antimicrobial usage in the context of *Clostridium difficile* infection.[10]

At the time that ASTF was chartered, the understanding of how ASP structures across VA facilities were structured was limited. Hence, to capture baseline institutional characteristics and stewardship activities, the ASTF in conjunction with HAIG developed an inventory assessment of ASPs that was distributed online in November 2012. All 130 VA facilities providing inpatient acute care services responded.

We derived 57 facility characteristics relevant to antimicrobial utilization and conducted a series of factor analyses to simplify the complex dataset and identify underlying latent

constructs. We categorized resulting factors into domains of evidence, context, or facilitation as guided by the Promoting Action on Research Implementation in Health Services (PARiHS) framework.[11] Briefly, the evidence domain describes how the facility uses codified and non-codified sources of knowledge (e.g. research evidence, clinical experience). Organizational context is a facility's characteristics that ensure a more conducive environment to get evidence into practice (e.g. supportive leadership, organizational structure, evaluative systems). Facilitation emphasizes a facility personnel's "state of preparedness" and receptivity to implementation.

Using factor analysis to identify facility factors as correlates of the outcomes, we first examined polychoric correlations among facility characteristics to assess multicollinearity. We then performed independent component analysis to create latent constructs of variables that were defined by factor loadings (which indicated the proportion of variance accounted for by the construct) and uniqueness factors (which determined how well the variables were interpreted by the construct). Factors retained included variables that had uniqueness values of less than 0.7 and factor loadings greater than 0.3. Those associated with uniqueness values greater than 0.7 were left as single items, as were characteristics deemed *a priori* to be particularly important to antimicrobial stewardship. Factor scales that had only two items were converted into indices, while factor scores were generated for those factors that contained three or more items.[12-15]

Data for facility-level antimicrobial utilization measures were obtained from the VA Corporate Data Warehouse from calendar year 2012. The analysis was conducted within the VA Informatics and Computing Infrastructure (VINCI). All study procedures were approved by the VA Central Institutional Review Board.

Measures

Four utilization measures were defined as dependent measures: (1) Overall antimicrobial use; (2) Antimicrobial use in patients with non-infectious discharge diagnoses; (3) Missed opportunities to convert from parenteral to oral antimicrobial therapy; and (4) Missed opportunities to avoid double anaerobic coverage with metronidazole.

Overall antimicrobial use was defined as total acute care (i.e., medical/surgical/intensive care) antibacterial use for each facility aggregated as per CDC National Healthcare Safety Network Antimicrobial Use Option guidelines (antimicrobial days per 1000 patient days present). A sub-analysis of overall antimicrobial use was restricted to **antimicrobial use among patients without an infection-related discharge diagnosis**, as we surmised that this measure may capture a greater proportion of potentially unnecessary antimicrobial use. International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)[16] codes for infectious processes were identified by a combination of (1) those identified previously in the literature,[17] and (2) those identified by finding the descendants of all infections identified in the Systematized Nomenclature of Medicine--Clinical Terms (SNOMED CT).[18] Next, all remaining codes for principal discharge diagnoses for which antimicrobials were administered were reviewed for potential indications for systemic antibacterial use. Discharges were considered non-infectious if no codes were identified when systemic antimicrobials were or could be indicated. For this measure, antimicrobial days were not counted if administered on or one day after the calendar day of surgery warranting antimicrobial prophylaxis.

Missed opportunities for conversion from parenteral to oral (IV to PO) formulations of highly bioavailable oral antimicrobials (ciprofloxacin, levofloxacin, moxifloxacin, azithromycin, clindamycin, linezolid, metronidazole, and fluconazole) were

defined as the percentage of days of unnecessary IV therapy that were given when PO therapy could have been used among patients who were not in intensive care units at the time of antimicrobial administration who were receiving other oral medications, using previously described methodology.[19] **Missed opportunities for avoiding redundant anaerobic coverage with metronidazole** were defined as the percentage of days in which patients receiving metronidazole also received antibiotics with activity against anaerobic bacteria, specifically beta-lactam/beta-lactamase inhibitors, carbapenems, cefotetan/cefoxitin, clindamycin, moxifloxacin, or tigecycline), using previously described methodology.[20] Patients for whom *C. difficile* testing was either ordered or positive within the prior 28 days (indicating potential clinical concern for *C. difficile* infection) were excluded from this endpoint.

Analysis

The variables derived above were entered into a multivariable model for each of the 4 antimicrobial utilization measures. Least Absolute Shrinkage and Selection Operator (LASSO) regression was used to determine significant associations between variables and individual utilization measures.[21] LASSO was chosen because it offers advantages over traditional subset selection approaches in large multivariable analyses by assessing covariates simultaneously rather than sequentially, supporting prediction rather than estimation of effect.[22] P-values were not reported as they are not useful in determining statistical significance in this methodology. A tuning parameter of 0.025 was determined for the model based on a cross-validation approach. Significant variables remaining in the model are reported with the percent change in each utilization measure per unit change in the variable of interest. For binary factors, percent change is reported according to whether the variable is present or not. For ordinal variables, percent change is reported according to incremental increase in ordinal score. For continuous variables

or variables represented by factor or index scores, percent change is reported per each 25% increase in the range of the score.

Results:

Inpatient facility antimicrobial stewardship characteristics and antimicrobial utilization:

Frequencies of key facility characteristics that contributed to variable development are included in Table 1. Full survey results across all facilities are included in Appendix C. Factor analysis reduced the total number of variables to 32; we also included hospital size and VA complexity score. Thus, 34 variables were evaluated for association with antimicrobial utilization measures: 4 in the evidence domain, 23 in the context domain, and 7 in the facilitation domain (Table 2).

Median facility antimicrobial use was 619 antimicrobial days per 1000 days present (interquartile range (IQR) 554-700; overall range 346-974). Median facility non-infectious antimicrobial use was 236 per 1000 days present (IQR 200-286). Missed opportunities for conversion from IV to PO antimicrobial therapy were common, with a median facility value of 40.4% (391/969) of potentially eligible days of therapy (IQR 32.2-47.8%). Missed opportunities to avoid double anaerobic coverage were less common (median 15.3% (186/1214) of potentially eligible days of therapy, IQR 11.8%-20.2%) (Figure 1).

Overall antimicrobial use:

Four variables were associated with decreased overall antimicrobial use, though with small magnitude of change: presence of postgraduate physician/pharmacy training programs (0.03% decrease per quarter increase in factor score; on the order of 0.2 antimicrobial days per 1000 patient days present), presence of pharmacists and/or ID attendings on general medicine

ward teams (0.02% decrease per quarter increase in index score), frequency of systematic de-escalation review (0.01% decrease per ordinal increase in score), and degree of involvement of ID physicians and/or fellows in antimicrobial approvals (0.007% decrease per quarter increase in index score). There were no variables associated with increased overall antimicrobial use.

Antimicrobial use among discharges without infectious diagnoses:

Six variables were associated with decreased antimicrobial use in patients without infectious discharge diagnoses, while four variables were associated with increased use. Variables associated with the greatest magnitude of decreased use included facility educational programs for prudent antimicrobial use (1.8%; on the order of 4 antimicrobial days per 1000 patient days present), frequency of systematic de-escalation review (1.5% per incremental increase in score), and whether a facility's lead antimicrobial stewardship pharmacist had ID training (1.3%). Also significantly associated with decreased use was a factor summarizing the presence of four condition-specific stewardship processes (de-escalation policies, policies for addressing antimicrobial use in the context of *C. difficile* infection, blood culture review, and automatic ID consults for certain conditions) (0.6% per quarter increase in factor score range), the extent to which postgraduate physician/pharmacy training programs were present (0.6% per quarter increase in factor score range), and the number of electronic antimicrobial-specific order sets present (0.4% per order set). The variables associated with increased use of antimicrobials included the presence of antimicrobial stop orders (4.6%), the degree to which non-ID physicians were involved in antimicrobial approvals (0.7% per increase in ordinal score), the level engagement with ASTF online resources (0.6% per quarter increase in factor score range), and hospital size (0.6% per 50-bed increase).

Missed opportunities for parenteral to oral antimicrobial conversion:

Missed opportunities for IV to PO antimicrobial conversion had the largest number of significant associations with organizational variables: 14 variables were associated with fewer missed opportunities, while 5 were associated with greater missed opportunities. Variables associated with the largest reductions in missed opportunities for IV to PO conversion included having guidelines for antimicrobial duration (12.8%), participating in regional stewardship collaboratives (8.1%), number of antimicrobial-specific order sets (6.0% per order set), ID training of the ASP pharmacist (4.9%), and VA facility complexity designation (4.2% per quarter increase in score indicating greater complexity).[23] Variables associated with more missed opportunities included stop orders (11.7%), overall perceived receptiveness to antimicrobial stewardship among clinical services (9.4%), the degree of engagement with ASTF online resources (6.9% per quarter increase in factor score range), educational programs for prudent antimicrobial use (4.1%), and hospital size (1.0% per 50-bed increase).

Missed opportunities for avoidance of double anaerobic coverage:

Four variables were associated with more avoidance of double anaerobic coverage: ID training of the lead ASP pharmacist (8.8%), presence of pharmacists and/or ID attendings on acute care ward teams (6.2% per quarter increase in index score), degree of ID pharmacist involvement in antimicrobial approvals, ranging from not at all (score=0) to both weekdays and nights/weekends (score=2) (4.3% per ordinal increase), and the number of antimicrobial-specific order sets (1.5% per order set). There were no variables associated with less avoidance of double anaerobic coverage.

Variables associated with multiple favorable or unfavorable antimicrobial utilization measures:

To better assess the consistency of the relationship between organizational variables and measures of antimicrobial use, we tabulated variables that were associated with at least 3

potentially favorable (i.e., reduced overall or non-infectious antimicrobial use or reduced missed opportunities) measures. Altogether, five variables satisfied this criterion: the presence of postgraduate physician/pharmacy training programs, the number of antimicrobial-specific order sets, frequency of systematic de-escalation review, the presence of pharmacists and/or ID attendings on acute care ward teams, and formal Infectious Diseases (ID) training of the lead ASP pharmacist (Table 3). Three other variables were associated with at least 2 unfavorable measures: hospital size, the degree to which the facility engaged with ASTF online resources, and presence of antimicrobial stop orders.

Discussion:

Variability in ASP implementation across VA allowed us to assess the relationship between ASP and facility elements and baseline patterns of antimicrobial utilization. Hospitalists and hospital policy-makers are becoming more and more engaged in inpatient antimicrobial stewardship. While our results suggest that having pharmacists and/or physicians with formal ID training participate in everyday inpatient activities can favorably improve antimicrobial utilization, considerable input into stewardship can be made by hospitalists and policy-makers. In particular, based on this work, the highest yield from an organizational standpoint may be in working to develop order sets within the electronic medical record and systematic efforts to promote de-escalation of broad-spectrum therapy, as well as encouraging hospital administration to devote specific physician and pharmacy salary support to stewardship efforts.

While we noted that finding the ASTF online resources helpful was associated with potentially unfavorable antimicrobial utilization, we speculate that this may represent reverse

causality due to facilities recognizing that their antimicrobial usage is suboptimal and thus seeking out sample ASTF policies to implement. The association between the presence of automatic stop orders and potentially unfavorable antimicrobial utilization is less clear since the timeframe was not specified in the survey; it may be that setting stop orders too far in advance may promote an environment in which critical thinking about antimicrobial de-escalation is not encouraged or timely. The larger magnitude of association between ASP characteristics and antimicrobial usage among patients without infectious discharge diagnoses versus overall antimicrobial usage also suggests that clinical situations where infection was of low enough suspicion to not even have the providers eventually list an infectious diagnosis on their discharge summaries may be particularly malleable to ASP interventions, though further exploration is needed in determining how useful this utilization measure may be as a marker for inappropriate antimicrobial use.

Our results complement those of Pakyz, *et al*, who surveyed 44 academic medical facilities in March 2013 to develop an ASP intensity score and correlate this score and its specific components to overall and targeted antimicrobial use.[24] This study found that the overall ASP intensity score was not significantly associated with total or targeted antimicrobial use. However, ASP strategies were more associated with decreased total and targeted antimicrobial use than were specific ASP resources. In particular, the presence of a preauthorization strategy was associated with decreased targeted antimicrobial use. Our particular findings that indicate order set establishment and de-escalation efforts are associated with multiple antibiotic outcomes also line up with the findings of Schuts, *et al,* who performed a meta-analysis of the effects of meeting antimicrobial stewardship objectives and found that achieving guideline concordance (such as through establishment of order sets) and successfully

de-escalating antimicrobial therapy was associated with reduced mortality.[25, 26] This meta-analysis, however was limited by low rigor of studies included and potential for reverse causality. While our study has the advantages of capturing an entire national network of 130-acute care facilities with a 100% response rate, it too is limited by a number of issues, most notably the fact that the survey was not specifically designed for the analysis of antimicrobial utilization measures, patient-level risk stratification was not available, the VA population does not reflect the US population at-large, recall bias, and that antimicrobial prescribing and stewardship practices have evolved in VA since 2012. Furthermore, all of the antimicrobial utilization measures studied are imperfect at capturing inappropriate antibiotic use; in particular, our reliance on principal ICD-9 codes for non-infectious outcomes requires prospective validation. Many survey questions were subjective and subject to misinterpretation; other unmeasured confounders may also be present. Causality cannot be inferred from association. Nevertheless, our findings support many core indicators for hospital ASP recommended by the CDC and TATFAR,[3, 4] most notably, having personnel with infectious diseases training involved in stewardship and establishing a formal procedure for ASP review for the appropriateness of an antimicrobial at or after 48 hours from the initial order.

In summary, the VA has made efforts to advance the practice of antimicrobial stewardship system-wide, including a 2014 directive that all VA facilities have an ASP,[27] since the 2012 HAIG assessment that reported considerable variability in antimicrobial utilization and antimicrobial stewardship activities. Our study identifies areas of stewardship that may correlate with, positively or negatively, antimicrobial utilization measures that will require further investigation. A repeat and more detailed antimicrobial stewardship survey was recently

completed and will help VA gauge ongoing effects of ASTF activities. We hope to re-evaluate our model with newer data when available.

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Table Legends:

Table 1: Frequencies of key facility antimicrobial stewardship characteristics at VA facilities contributing to variable development (n=130)

Table 2: Antimicrobial stewardship facility variables examined according to Promoting Action on Research Implementation in Health Services (PARiHS) domain*

Table 3: Variables associated with multiple (≥3 potentially favorable or ≥2 potentially unfavorable) antimicrobial utilization measures*

Figure Legends:

Figure 1: Distribution of Inpatient Antimicrobial Utilization Measures across VA Acute Care Facilities, 2012

(Box shows median and 25-75 percentiles; whiskers show 5-95% range; circles represent individual outlier VA facilities)

Figure 1A: Overall antimicrobial use and antimicrobial use among patients discharged with no infectious diagnoses

Figure 1B: Missed opportunities for parenteral-to-oral antimicrobial conversion and to avoid potentially unnecessary double-anaerobic coverage

Appendix A:

2012 Survey of Antimicrobial Stewardship in VHA: Survey Instrument

Appendix B:

2012 Survey of Antimicrobial Stewardship in VHA: Survey Results

Table 1: Frequencies of key facility antimicrobial stewardship characteristics at VA facilities contributing to variable development (n=130)

Facility Characteristics	**# of facilities**	**(%)**
Contributors to Evidence Domain:		
Internal inpatient ID consultation available	103	79%
Any restriction of antimicrobial use	120	92%
Guidelines for antimicrobial duration (any)	47	36%
Written clinical pathways/guidelines for specific conditions (any)	96	74%
Contributors to Context Domain:		
At least one full-time attending ID physician at facility	78	60%
Dedicated clinical pharmacist in Emergency Department	20	18%
Presence of outpatient parenteral antimicrobial therapy program	85	65%
Facility rates helpfulness of VA Antimicrobial Stewardship Task Force (ASTF) SharePoint site as "Very Helpful" or "Helpful"	82	63%
Facility rates helpfulness of ASTF sample policy for intravenous to oral antibiotic conversion as "Very Helpful" or "Helpful"	68	52%
Facility rates helpfulness of ASTF sample policy for avoidance of double anaerobic coverage as "Very Helpful" or "Helpful"	51	39%
Facility rates helpfulness of ASTF sample policy for improving outcomes in patients with *Clostridium difficile* infection as "Very Helpful" or "Helpful"	51	39%
Facility rates helpfulness of ASTF sample business plan as "Very Helpful" or "Helpful"	49	38%
Facility identifies more information technology/data tools support as	95	73%

beneficial in achieving optimal antibiotic use		
Facility identifies more support from administration as beneficial in achieving optimal antibiotic use	79	61%
Facility identifies more support from pharmacy as beneficial in achieving optimal antibiotic use	75	58%
Facility identifies more support from ID physicians as beneficial in achieving optimal antibiotic use	73	56%
Facility identifies more prescriber buy-in as beneficial in achieving optimal antibiotic use	77	59%
Facility identifies more educational tools support as beneficial in achieving optimal antibiotic use	73	56%
Facility identifies more guidelines support as beneficial in achieving optimal antibiotic use	67	52%
Surgical residency program	84	65%
ID fellowship program	68	52%
Pharmacy residency program	102	78%
Participation in AS collaborative within geographic region (i.e. regional AS conference or committee)	13	10%
ID physician approves antibiotics during weekdays	57	44%
ID physician approves antibiotics during nights/weekends	39	30%
ID pharmacist approves antibiotics during: weekdays nights/weekends	44 8	34% 6%
Non-ID physician approves antibiotics during: weekdays	7	5%

nights/weekends	11	8%
Formal policy for ASP established	29	22%
Policy for de-escalation of antimicrobials	19	15%
Policy for intervention on antimicrobial usage in context of *C.difficile* infection	25	19%
Timely review of blood cultures to assure appropriate therapy	56	43%
Automatic ID consults for certain conditions	36	28%
Automatic stop orders for antimicrobial duration	98	75%
Electronic antimicrobial order form(s) for any specific antimicrobial	55	42%
General Medicine service deemed "very receptive" or "receptive" to ASP	110	85%
ICU Medicine service deemed "very receptive" or "receptive" to ASP	90	69%
Facility has AS team	49	38%
ID physician is a part of AS team	45	35%
Clinical Pharmacist/Clinical Pharmacy specialist is part of AS team	49	38%
Antibiograms disseminated via: facility intranet	96	74%
pocket card reference	56	43%
Medication Use Evaluation performed for any antibiotic in prior 2y	61	47%
Provision of group- or provider-specific feedback on patterns of antibiotic use	55	42%
Reporting of clinical outcomes related to antimicrobial use	71	55%
Systematic review for de-escalation performed (always or usually)	39	30%

Measurement of antibiotic use in: Defined Daily Doses	18	14%
Days of Therapy	19	15%
Measurement of antimicrobial expenditures	37	28%
Contributors to Facilitation Domain		
ID physicians attend on medical ward teams	89	68%
Clinical pharmacist assigned to acute care teams	118	91%
Business plan for ASP approved or in development	41	32%
ASP Clinical Pharmacist/Clinical Pharmacy Specialist with ID training	34	26%
Educational programs for prudent antimicrobial use	94	72%
Communication to providers on principles of antibiotic use:		
Email alerts	51	39%
Newsletters	37	28%
Pharmacy alerts	48	37%
Engagement with ASTF outreach efforts:		
Finding ASTF national webinars "very helpful" or "helpful"	70	54%
Finding ASTF face-to-face meetings "very helpful" or "helpful"	48	37%
Electronic resources used to facilitate ASP activities:		
Basic electronic medical record system	115	88%
Proprietary software	14	11%
Administrative electronic databases	23	18%

Table 2: Antimicrobial stewardship facility variables examined according to Promoting Action on Research Implementation in Health Services (PARiHS) domain*

No.	Factor Name	Variable Type (Range)	Contributing Survey Question(s)/Data Sources[a]
	Evidence Domain		
E1	Availability of inpatient ID consultation *(score 0 indicates non-ID physicians or pharmacists handling ID issues; score 5 indicates internal inpatient ID service)*	Ordinal (0-5)	Q12
E2	Presence of policies that restrict certain antimicrobials	Binary (0,1)	Q22
E3	Guidelines for antimicrobial duration	Binary (0,1)	Q33
E4	Number of written clinical pathways/guidelines for specific conditions	Ordinal (0-7)	Q25a
	Context Domain		
	Structural Characteristics:		
C1	Facility complexity (Level 1a, 1b, 1c, 2, or 3)	Continuous	Internal VA data
C2	Number of hospital beds	Ordinal (0-433)	Internal VA data
	Resources:		
C3	Number of full-time Infectious Diseases (ID) attendings on site	Ordinal (0-10)	Q1a

C4	Dedicated clinical pharmacist in Emergency Department	Binary (0,1)	Q13
C5	Presence of outpatient parenteral antimicrobial therapy program	Binary (0,1)	Q14
C6	Degree of engagement with VA Antimicrobial Stewardship Task Force (ASTF) *(summary of helpfulness ratings of ASTF SharePoint site and sample policies)*	Factor Score	Q42-46,
C7	Perceived benefit of types of support in achieving optimal antimicrobial use *(# of categories of additional support deemed potentially helpful to AS)*	Factor Score	Q54
	Affiliation/networks		
C8	Presence of postgraduate physician/pharmacy training programs (Infectious Diseases fellowship, surgical residency, pharmacy residency)	Factor Score	Q2, Q5, Q7
C9	Participation in stewardship regional collaboratives	Binary (0,1)	Q18
	Decision-making		
C10	Degree of involvement of ID physicians and/or fellows in antimicrobial approvals *(i.e. during weekdays vs. just nights/weekends)*	Index	Q23e,f
C11	Degree of ID pharmacist involvement in antimicrobial approvals	Ordinal (0-2)	Q23e,f
C12	Degree of non-ID physician involvement in	Ordinal	Q23e,f

	antimicrobial approvals	(0-4)	
	Formalization		
C13	Presence of formal stewardship policy	Binary	Q17, Q20a
C14	Presence of condition-specific stewardship interventions *(number present of: de-escalation policies, policies for addressing antimicrobial use in the context of C. difficile infection, blood culture review, automatic ID consults for certain conditions)*	Factor Score	Q29, Q31, Q32, Q38
C15	Antimicrobial stop orders in place	Binary (0,1)	Q34
C16	Number of antimicrobial-specific order sets in place	Ordinal (0-9)	Q24
	Receptiveness to Change		
C17	Overall receptiveness to stewardship among clinical services *(count of clinical services deemed "receptive" or "very receptive")*	Factor Score	Q55
	Leadership		
C18	Degree and duration of physician and pharmacy involvement in stewardship *(how long ASP has been in place and % time dedicated to ASP by physicians and pharmacists)*	Factor Score	Q19, Q19f,g
	Evaluation and Feedback		
C19	Degree of dissemination and evaluation of antimicrobial outcome data *(# of methods of*	Index	Q16b, Q52

	antibiogram dissemination plus whether MUE has been done on any antibiotic within 2y)		
C20	Degree to which antimicrobial usage and outcomes are reported to providers *(frequency of group or provider-specific feedback on patterns of antimicrobial use and whether reports on clinical outcomes related to antibiotic use are generated)*	Index	Q49, Q50a
C21	Frequency of systematic de-escalation review *(score 0=never; score 4=always)*	Ordinal (0-4)	Q30
C22	Measurement of antimicrobial usage in Defined Daily Doses or Days of Therapy	Binary (0,1)	Q51a,b
C23	Measurement of antimicrobial expenditures	Binary (0,1)	Q51c
	Facilitation Domain		
F1	Presence of pharmacists and/or ID attendings on acute care ward teams	Index	Q9a, Q11
F2	Business plan for antimicrobial stewardship (in place or in development)	Ordinal (0-2)	Q47
F3	Lead antimicrobial stewardship pharmacist has ID training	Binary (0,1)	Q19f5d
F4	Educational programs for prudent antimicrobial use	Binary (0,1)	Q35
F5	Number of resources utilized to update providers on antimicrobials *(email alerts, newsletters, pharmacy*	Ordinal (0-4)	Q36

	alerts, other)		
F6	Level of engagement with ASTF educational resources and/or face-to-face ASTF meetings *(combined helpfulness rating of ASTF webinars and meetings)*	Index	Q39, Q40
F7	Number of electronic resources used to facilitate AS activities *(basic electronic medical record system, proprietary software, administrative databases)*	Ordinal (0-2)	Q48

*: See Appendix A for full set of survey questions and Appendix B for the full survey results

Table 3: Variables associated with multiple (≥3 potentially favorable or ≥2 potentially unfavorable) antimicrobial utilization measures*

No.	Factor Name	All antimicrobial use	Antimicrobial use in patients with non-infectious primary diagnoses	Parenteral-to-oral missed opportunities	Avoiding double anaerobic coverage missed opportunities
Associated with Multiple Potentially Favorable Utilization:					
C8	Presence of postgraduate physician/pharmacy training programs (Infectious Diseases fellowship, surgical residency, pharmacy residency) *(Factor Score)*	-0.034%	-0.60%	-1.2%	
C16	Number of antimicrobial-specific order sets in place *(Ordinal, range 0-9)*		-0.40%	-6.0%	-1.5%
C21	Frequency of systematic de-escalation review *(Ordinal, range 0-4)*	-0.011%	-1.5%	-0.060%	
F1	Presence of pharmacists and/or ID attendings on acute care ward teams	-0.022%		-1.6%	-6.2%

	(Factor Score)				
F3	Lead antimicrobial stewardship pharmacist has ID training *(Binary)*		-1.3%	-5.0%	-8.8%
Associated with Multiple Potentially Unfavorable Utilization:					
C2	Hospital beds *(Ordinal, range 0-433; % change reported for 50-bed increase)*		0.62%	1.0%	
C6	Degree to which an individual facility found ASTF sample policies to be helpful *(Factor Score)*		0.59%	6.9%	
C15	Antimicrobial stop orders in place *(Binary)*		4.6%	11.7%	

*: All reported associations with antimicrobial utilization measures are statistically significant using a LASSO (Least Absolute Shrinkage and Selection Operator) tuning parameter of 0.025. The magnitude of association is reported as percentage change in the utilization measure according to presence of the factor or not (for binary variables), incremental change in ordinal score (for ordinal factors), and quarter increase in factor score range (for factors for which factor score was reported).

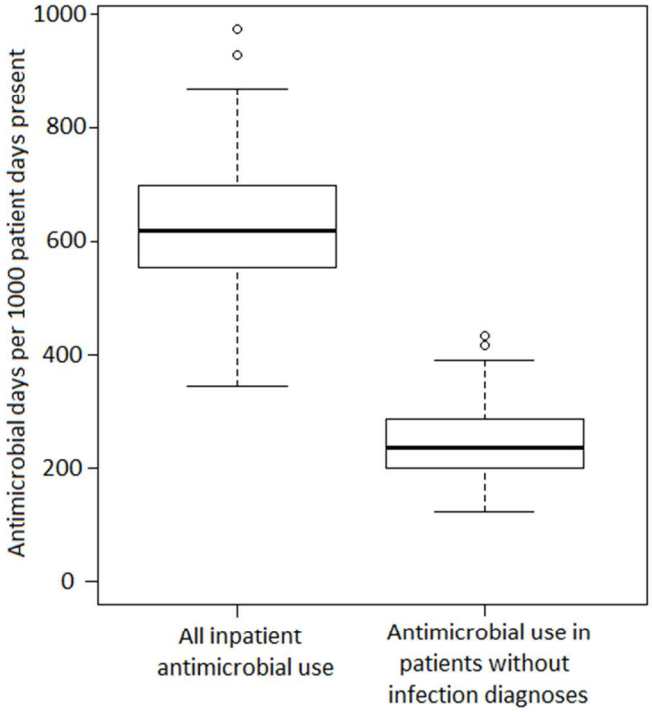


Figure 1: Distribution of Inpatient Antimicrobial Utilization Measures across VA Acute Care Facilities, 2012 (Box shows median and 25-75 percentiles; whiskers show 5-95% range; circles represent individual outlier VA facilities)

Figure 1A: Overall antimicrobial use and antimicrobial use among patients discharged with no infectious diagnoses

190x142mm (300 x 300 DPI)

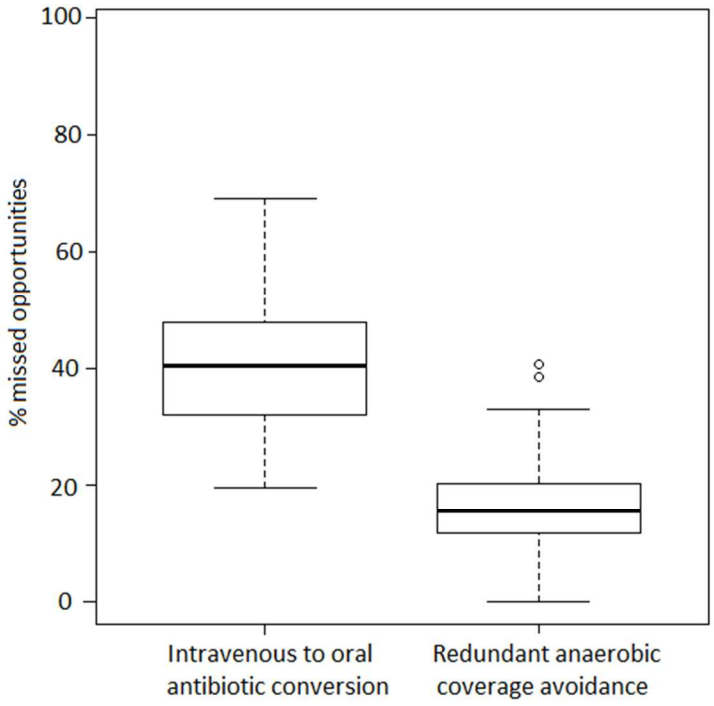


Figure 1: Distribution of Inpatient Antimicrobial Utilization Measures across VA Acute Care Facilities, 2012 (Box shows median and 25-75 percentiles; whiskers show 5-95% range; circles represent individual outlier VA facilities)

Figure 1B: Missed opportunities for parenteral-to-oral antimicrobial conversion and to avoid potentially unnecessary double-anaerobic coverage

190x142mm (300 x 300 DPI)

2012 Survey of Antimicrobial Stewardship in VHA

VHA is committed to providing the highest quality health care to Veterans. The goal of this survey is to gather information on the current state of VHA Antimicrobial Stewardship (AS) programs and resources across the VHA system. This new survey will provide both VA Central Office officials and the field with a useful and accessible picture of the characteristics and organization of AS activities, teams, and programs available in VHA.

Purpose: This survey will gather information on the current state of facility level AS activities, programs, personnel, and resources across the VHA system.

The Program Office will use the results for multiple objectives.

- Identify currently available AS experts at facilities
- Understand the current state and effectiveness of AS policies, programs, and education
- Guide operational policies, procedures, standards, and guidelines on best practices for AS activities to provide Veterans with personalized, proactive health care
- Provide data to guide VHA's system-wide AS strategic plan
- Aid in developing and implementing AS programs and expanding existing programs
- Develop a communication plan to promote effective facility level AS programs

Suggested Respondents: Chief of Staff, Chief of Infectious Disease, Chief of Medicine, Chief of Pharmacy, (i.e., individual knowledgeable about AS activities within your medical facility)

All approved VA Integrated Facilities are to submit a single combined response.

Estimated Completion Time: 30-90 minutes (Additional time may be needed to gather information from other departments)

Section I: Point of Contact and Facility/Health Care System (HCS) Information

Name of Point of Contact for survey response: _____
Title: _____
Phone Number (including area code): _____ Extension: _____
What is your VISN Number? (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, 17, 18, 19, 20, 21, 22, 23)
Select Facility and Station Number: (Select from list provided)

AS Point of Contact Information

If you would like to ensure that your facility is notified of activities, national policy, and field guidance please provide:

Name of AS lead physician: _____
Identify the physician's specialty:
( ) Infectious Diseases (ID)
( ) Internal Medicine
( ) Hospitalist
( ) Family Practice
( ) Other *If other,* please specify _____

Name of AS lead Clinical Pharmacist/Clinical Pharmacy Specialist: _____

Name of other AS lead provider: _____
Identify the provider's specialty: *(Check all that apply)*
[ ] Infection Control Professional (ICP)
[ ] Nurse
[ ] Advanced Practice Nurse
[ ] Physician Assistant
[ ] Microbiologist
[ ] Other *If other,* please specify _____

Section II: Facility Components

1. Please provide the number (i.e., head count) of the following medical professionals in your facility. (Please include, VA, Non-VA, WOC, and Fee/ Contract)

ID Attending Physicians (head count) *Mark one each line*	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10+**
a. Full-Time ID Attending Physicians	□	□	□	□	□	□	□	□	□	□	□
b. Part-Time ID Attending Physicians	□	□	□	□	□	□	□	□	□	□	□

Mark one each line		
Does your facility participate in:	**Yes**	**No**
2. ID **fellowship** program?	□	□
3. Internal medicine residency program?	□	□
4. Family practice residency program?	□	□
5. Surgical residency program?	□	□
6. Emergency medicine residency program?	□	□
7. Pharmacy residency program?	□	□
8. ID pharmacy residency program?	□	□

9. Are Clinical Pharmacists/Clinical Pharmacy Specialists assigned to any acute care teams or wards at your hospital/facility? ( ) Yes ( ) No
   a. *If yes,* which teams/wards? *(Please include, VA, Non-VA, WOC, and Fee/Contract)* *(Check all that apply)*
      [ ] 1) Medicine
      [ ] 2) Surgery
      [ ] 3) Combined Medicine/Surgery
      [ ] 4) Intensive Care Unit
      [ ] 5) Community Living Center
      [ ] 6) Step-Down Unit/Telemetry
      [ ] 7) Dialysis Unit
      [ ] 8) Other *If other,* 8a) Please specify _____

10. Please estimate the proportion of general medicine inpatients admitted to hospitalists.
    ( ) 0% ( ) 1-10% ( ) 11-20% ( ) 21-30% ( ) 31-40% ( ) 41-50%
    ( ) 51-60% ( ) 61-70% ( ) 71-80% ( ) 81-90% ( ) 91-100% ( ) No hospitalists
    ( ) No inpatient services

11. Please estimate the proportion of inpatient attending service on general medical ward teams covered by the ID staff.
    ( ) 0% ( ) 1-5% ( ) 6-10% ( ) 11-15% ( ) 16-20% ( ) 21-25%
    ( ) 26-50% ( ) > 50% ( ) No ID staff ( ) No inpatient services

12. Does your facility offer internal VA inpatient ID Consultation Service?
( ) Yes ( ) No ( ) No inpatient services

a. *If no,* who handles ID issues? *(Check all that apply)*
[ ] 1) Non-VA external ID physicians
[ ] 2) Another VA facility's ID physicians via E-Consult or telemedicine
[ ] 3) Non-ID trained (VA or non-VA) physician with interest in ID
[ ] 4) Clinical Pharmacist/Clinical Pharmacy Specialist
[ ] 5) No one in particular handles ID related issues
[ ] 6) Unsure who handles ID related issues
[ ] 7) Other *If other,* 7a) Please specify _____

13. Does your facility have an Emergency Department (ED)? ( ) Yes ( ) No

a. *If yes,* who staffs your main ED?

Check all that apply each line	**Full time VA**	**Part time VA**	**Non VA staff (WOC, Fee/Contract, Other)**	**None**
1) Emergency physician	□	□	□	□
2) Internal medicine physician	□	□	□	□
3) Family practice physician	□	□	□	□
4) Other physician	□	□	□	□
5) Resident physician	□	□	□	□
6) Mid-level provider	□	□	□	□
7) Other provider	□	□	□	□

If other provider, 7a) Please specify _____

b. Is there a Clinical Pharmacist/Clinical Pharmacy Specialist dedicated to staff the ED?
(Please include, VA, Non VA, WOC, and Fee/ Contract) ( ) Yes ( ) No

14. Does your facility offer intravenous (IV) home antimicrobial infusion? ( ) Yes ( ) No
If yes,
a. What is the specialty of the Manager/Director for the Intravenous (IV) home antimicrobial infusion program? *(Check all that apply)*
[ ] 1) General Internist
[ ] 2) Hospitalist
[ ] 3) ID Physician
[ ] 4) Other Physician
[ ] 5) Clinical Pharmacist/Clinical Pharmacy Specialist
[ ] 6) Home Coordinator
[ ] 7) Other *If other,* 7a) Please specify _____
b. Who are the members of the IV home antimicrobial infusion program? *(Check all that apply)*
[ ] 1) VA pharmacy/VA nursing
[ ] 2) VA pharmacy/Contract nursing
a. *If* VA pharmacy/Contract nursing, are services: *(Check all that apply)*
[ ] 1) Contracted year to year
[ ] 2) Contracted patient to patient
[ ] 3) Other *If other,* a) Please specify _____
[ ] 3) Contract pharmacy/VA nursing
a. *If* Contract pharmacy/VA nursing, are services: *(Check all that apply)*
[ ] 1) Contracted year to year
[ ] 2) Contracted patient to patient
[ ] 3) Other *If other,* a) Please specify _____

[ ] 4) Contract pharmacy/contract nursing
a. *If* Contract pharmacy/contract nursing, are services: *(Check all that apply)*
[ ] 1) Contracted year to year
[ ] 2) Contracted patient to patient
[ ] 3) Other *If other,* a) Please specify _____
[ ] 5) Other *If other,* 5a) Please specify _____

15. Does your facility have an on-site microbiology laboratory? ( ) Yes ( ) No

If yes, **answer the following questions:** *Mark one each line*	**Yes**	**No**
a. Does your facility's laboratory service have a director with a doctoral degree who is trained in microbiology?	□	□
b. **Does your facility's microbiology laboratory** selectively report susceptibility to antimicrobial agents? (i.e., suppress reporting for some tests)	□	□
c. **Does your facility's microbiology laboratory** report Minimum Inhibitory Concentration (MICs) for all organisms?	□	□
d. **Does your facility's microbiology laboratory** report MICs for selected organisms?	□	□

d1. *If yes,* which organisms? *(Check all that apply)*
[ ] a) Staphylococcus aureus
[ ] b) Streptococcus pneumoniae
[ ] c) Pseudomonas aeruginosa
[ ] d) Enterobacteriaceae
[ ] e) Other *If other,* e1) Please specify _____

16. Are yearly updated Antibiograms available to all providers? ( ) Yes ( ) No
If yes,
a. How are the data reported? *(Check all that apply)*
[ ] 1) Outpatient
[ ] 2) Inpatient - whole house
[ ] 3) Inpatient - unit specific
[ ] 4) Inpatient/Outpatient combined
[ ] 5) Other *If other,* 5a) Please specify _____
b. How are the data disseminated? *(Check all that apply)*
[ ] 1) Facility Intranet
[ ] 2) Pocket card reference
[ ] 3) Posted at charting locations
[ ] 4) Other *If other,* 4a) Please specify _____

Section III: Antimicrobial Stewardship Policy

17. Does your facility have a formal written policy that establishes an AS program?
( ) Yes ( ) No ( ) In development
If yes,
a. How many years has the policy been in place? ( ) <1 ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 or more years
b. Does the policy address inpatient antibiotic use? ( ) Yes ( ) No ( ) In development ( ) No inpatient services
c. Does the policy address outpatient antibiotic use? ( ) Yes ( ) No ( ) In development
d. Who approved this policy? *(Check all that apply)*
[ ] 1) Local Pharmacy and Therapeutics (P&T) Committee
[ ] 2) Clinical Executive Board
[ ] 3) Chief of Staff
[ ] 4) Other *If other,* 4a) Please specify _____

If no or in development,
e. Is there an informal policy for antimicrobial stewardship? ( ) Yes ( ) No
If yes,
e1) How many years has the policy been in place? ( ) <1 ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 or more years ( ) Unknown
e2) Does the policy address inpatient antibiotic use? ( ) Yes ( ) No ( ) No inpatient services
e3) Does the policy address outpatient antibiotic use? ( ) Yes ( ) No

Check one	Yes	No
18. Does your facility participate in a formal AS collaborative with non-VA facilities in your geographic region?	☐	☐

Section IV: Antimicrobial Stewardship (AS) Personnel

19. Does your facility have an AS team? ( ) Yes ( ) No ( ) In development
(Antimicrobial Stewardship (AS) Team: For the purposes of the survey, an AS team is defined as a multi-disciplinary group that is composed of at least a physician and Clinical Pharmacist/Clinical Pharmacy Specialist who routinely meet (daily or several times a week) to discuss patient-specific and/or facility-specific AS components.)
If yes,
a. How many years has the team been in existence?
( ) less than 1 year ( ) 1 year to 2 years ( ) 2 years to 3 years ( ) more than 3 years
b. Does the AS team work in or consult in the acute medical/surgical setting?
( ) Yes ( ) No ( ) No inpatients at this facility
c. Does the AS team work in or consult in the outpatient setting? ( ) Yes ( ) No
d. Does the AS team work in or consult in the Community Living Center setting?
( ) Yes ( ) No ( ) No Community Living Center
e. Does the AS team work in or consult in the Dialysis Center setting? ( ) Yes ( ) No ( ) No Dialysis Center

19f. Please tell us about the AS team members' activities and their time effort.
For each member of the team, please note whether they have daily or periodic involvement with AS activities, as well as the percentage of time they spend on AS tasks.
If "No Involvement," enter NA for b. workload credit, and c. % FTEE

19f. Please provide information for the AS team members' activities and time effort.	**a) Team member involvement** *(Choose one)* ( ) Daily Involvement ( ) Periodic Involvement ( ) No Involvement ( ) NA	**b) Is Workload credit captured?** *(Choose one)* ( ) Yes ( ) No ( ) NA	**c) % of FTEE time designated for stewardship** *(Choose one)* 0% 1-10% 11-20% 21-30% 31-40% 41-50% 51-60% 61-70% 71-80% 81-90% 91-100% NA
1) ID Physician			
2) ID Fellow			
3) Medical Resident			
4) Medical Student			
5) Clinical Pharmacist/Clinical Pharmacy Specialist			
6) Pharmacy Resident (PGY1)			
7) Pharmacy Resident (PGY2)			

19f. Please provide information for the AS team members' activities and time effort.	**a) Team member involvement** *(Choose one)* ( ) Daily Involvement ( ) Periodic Involvement ( ) No Involvement ( ) NA	**b) Is Workload credit captured?** *(Choose one)* ( ) Yes ( ) No ( ) NA	**c) % of FTEE time designated for stewardship** *(Choose one)* 0% 1-10% 11-20% 21-30% 31-40% 41-50% 51-60% 61-70% 71-80% 81-90% 91-100% NA
8) Pharmacy Student			
9) MDRO Coordinator			
10) Infection Control Practitioner			
11) Outpatient Provider			
12) Clinical Microbiology Lab Director or Lab Staff			
13) Information Technology Staff			
14) Hospital Administration			

19f5d) If the AS team includes a lead Clinical Pharmacist/Clinical Pharmacy Specialist (CP/CPS), does he/she have ID training? ( ) Yes ( ) No ( ) No lead Clinical Pharmacist/Specialist

19f5d1. If the CP/CPS has ID training, please check the training that applies.
- [ ] a) Current BPS certification in Pharmacotherapy **with** added Qualifications in Infectious Diseases BCPS-AQID
- [ ] b) Current BPS certification in Pharmacotherapy **without** BCPS-AQID
- [ ] c) Completed an ASHP accredited specialty residency (PGY2) in ID
- [ ] d) Completed an ASHP accredited general residency (PGYI)
- [ ] e) Completed an ACCP accredited fellowship in ID
- [ ] f) Completed other (i.e., Critical care, etc.) accredited post graduate program
- [ ] g) SIDP certification
- [ ] h) MAD-ID certification
- [ ] i) Over 10 years experience as a CP/CPS for ID issues
- [ ] j) None of the above

19g. Who typically oversees the day-to-day operations of the AS team? *(Check all that apply)*
- [ ] 1) Clinical Pharmacist/Clinical Pharmacy Specialist
- [ ] 2) Pharmacy resident
- [ ] 3) ID attending
- [ ] 4) ID fellow
- [ ] 5) Other physician
- [ ] 6) Other *If other,* 6a) Please specify _____

19h. Under whose authority does the AS team function? *(Check all that apply)*
- [ ] 1) P&T Committee
- [ ] 2) Chief of Pharmacy
- [ ] 3) Chief of Medicine
- [ ] 4) Chief of ID
- [ ] 5) Chief of Staff
- [ ] 6) Infection Control Committee
- [ ] 7) Quality Management

[ ] 8) Other *If other,* 8a) Please specify _____

Section V: Antimicrobial Stewardship Activities

20. Does your facility have a written policy to promote substitution of oral antibiotics for parenteral antibiotics? (i.e., an IV to PO Conversion policy) ( ) Yes ( ) No *(If no, skip to Q20c)*

If yes,

a. What year did the policy begin?

( ) Before 2000 ( ) 2000 ( ) 2001 ( ) 2002 ( ) 2003 ( ) 2004 ( ) 2005
( ) 2006 ( ) 2007 ( ) 2008 ( ) 2009 ( ) 2010 ( ) 2011 ( ) 2012

b. Is this policy approved by the local P&T committee? ( ) Yes ( ) No ( ) Unknown

If no,

c. Does your facility have an informal policy to promote substitution of oral antibiotics for parenteral antibiotics (i.e., an IV to PO conversion Policy)? ( ) Yes ( ) No

21. *If an IV to PO conversion policy exists,* is the AS team authorized to unilaterally (without primary physician approval) change the route of therapy? ( ) Yes ( ) No ( ) No policy

If yes,

a. Who makes the changes? *(Check all that apply)*

[ ] 1) Physician
[ ] 2) Nurse Practitioner/Physician Assistant (NP/PA)
[ ] 3) Clinical Pharmacist/Clinical Pharmacy Specialist
[ ] 4) Other *If other,* 4a) Please specify _____

b. Which parenteral drugs are covered by the IV to PO conversion policy?	Yes	No
1) Azithromycin	☐	☐
2) Ciprofloxacin	☐	☐
3) Levofloxacin	☐	☐
4) Moxifloxacin	☐	☐
5) Clindamycin	☐	☐
6) Linezolid	☐	☐
7) Metronidazole	☐	☐
8) Minocycline	☐	☐
9) Doxycycline	☐	☐
10) Fluconazole	☐	☐
11) Rifampin	☐	☐
12) Trimethoprim/Sulfamethoxazole	☐	☐
13) Other _____	☐	☐

If other, 13a) Please specify _____

22. Does your facility restrict the use of antibiotic agents? ( ) Yes ( ) No *(If no, skip to Q23)*

If yes,

a. Please tell us how your facility restricts the use of the following agents?

Check all that apply each line	No restrictions	ID use only	Prior approval	Prospective audit for continued use	Local criteria for use	*If other restriction-* Please specify
1) Daptomycin	☐	☐	☐	☐	☐	☐ _____
2) Linezolid	☐	☐	☐	☐	☐	☐ _____
3) Vancomycin	☐	☐	☐	☐	☐	☐ _____

Check all that apply each line	No restrictions	ID use only	Prior approval	Prospective audit for continued use	Local criteria for use	*If other restriction-* Please specify
4) Tigecycline	☐	☐	☐	☐	☐	☐ _____
5) Ceftaroline	☐	☐	☐	☐	☐	☐ _____
6) Imipenem	☐	☐	☐	☐	☐	☐ _____
7) Meropenem	☐	☐	☐	☐	☐	☐ _____
8) Doripenem	☐	☐	☐	☐	☐	☐ _____
9) Ertapenem	☐	☐	☐	☐	☐	☐ _____
10) Piperacillin/Tazobactam	☐	☐	☐	☐	☐	☐ _____
11) Ticarcillin/Clavulanate	☐	☐	☐	☐	☐	☐ _____
12) Cefepime	☐	☐	☐	☐	☐	☐ _____
13) Ceftazidime	☐	☐	☐	☐	☐	☐ _____
14) Aztreonam	☐	☐	☐	☐	☐	☐ _____
15) Caspofungin	☐	☐	☐	☐	☐	☐ _____
16) Micafungin	☐	☐	☐	☐	☐	☐ _____
17) Anidulafungin	☐	☐	☐	☐	☐	☐ _____
18) Voriconazole	☐	☐	☐	☐	☐	☐ _____
19) Parenteral Fluconazole	☐	☐	☐	☐	☐	☐ _____
20) Posaconazole	☐	☐	☐	☐	☐	☐ _____
21) Lipid-based ampho B	☐	☐	☐	☐	☐	☐ _____
22) Ciprofloxacin	☐	☐	☐	☐	☐	☐ _____
23) Levofloxacin	☐	☐	☐	☐	☐	☐ _____
24) Moxifloxacin	☐	☐	☐	☐	☐	☐ _____
25) Amikacin	☐	☐	☐	☐	☐	☐ _____
26) Gentamicin	☐	☐	☐	☐	☐	☐ _____
27) Tobramycin	☐	☐	☐	☐	☐	☐ _____
28) Colistin	☐	☐	☐	☐	☐	☐ _____
29) Other	☐	☐	☐	☐	☐	☐ _____

If other agent, 29a) Please specify _____

23. For antimicrobial agents that require prior approval, what mechanism is in place for urgent approvals?
(Check all that apply)
[ ] a. Written consultation in CPRS
[ ] b. Telephone consultation with Clinical Pharmacist/Clinical Pharmacy Specialist (CP/CPS) or ID provider
[ ] c. Face-to- face encounter with Clinical Pharmacist/Clinical Pharmacy Specialist (CP/CPS) or ID provider
[ ] d. No antimicrobial agents require approval *(Skip to Q24)*

Check all that apply each line	ID Clinical Pharmacist/ Clinical Pharmacy Specialist	Other Clinical Pharmacist/ Clinical Pharmacy Specialist	ID Physician	ID Fellow	Other Physician	Other	NA
23e. Who approves use during weekday normal working hours?	□	□	□	□	□	□	□
23f. Who approves use during nights and/or weekends?	□	□	□	□	□	□	□

24. Which of the following, if any, antimicrobial order forms/sets are available in CPRS for specific agents?
(Check all that apply)
[ ] a. Vancomycin
[ ] b. Aminoglycosides
[ ] c. Piperacillin/tazobactam
[ ] d. Cefepime
[ ] e. Meropenem
[ ] f. Imipenem
[ ] g. Ciprofloxacin
[ ] h. Moxifloxacin
[ ] i. Other *If other,* i1) Please specify _____
[ ] j. None of the above

25. Are written clinical pathways/antimicrobial therapy guidelines available for any specific conditions?
( ) Yes ( ) No
If yes,
a. Which inpatient conditions? *(Check all that apply)*
[ ] 1) Community acquired pneumonia
[ ] 2) Hospital acquired or health care associated pneumonia
[ ] 3) Skin and soft tissue infection
[ ] 4) Urinary tract infection
[ ] 5) *Clostridium difficile* colitis
[ ] 6) Surgical Prophylaxis
[ ] 7) No inpatient services
[ ] 8) Other *If other,* 8a) Please specify _____
[ ] 9) None
b. Which outpatient conditions? *(Check all that apply)*
[ ] 1) Community acquired pneumonia
[ ] 2) Upper respiratory tract infection
[ ] 3) Skin and soft tissue infection
[ ] 4) Urinary tract infection
[ ] 5) *Clostridium difficile* colitis
[ ] 6) Surgical Prophylaxis
[ ] 7) Other *If other,* 7a) Please specify _____
[ ] 8) None
c. Were these guidelines developed by the AS Team and/or ID Service? ( ) Yes ( ) No
d. How are these guidelines disseminated?
[ ] 1) Email
[ ] 2) Web site
[ ] 3) Pathways built into CPRS
[ ] 4) Other *If other,* 4a) Please specify _____

26. Does your facility provide dose optimization by pharmacokinetics and pharmacodynamics for any antimicrobial? ( ) Yes, upon request ( ) Yes, per protocol ( ) No
    a. *If yes*, for which agents? *(Check all that apply)*
       [ ] 1) Vancomycin
       [ ] 2) Aminoglycosides
       [ ] 3) Extended infusion of piperacillin/tazobactam or other β-lactam
       [ ] 4) Other *If other,* 4a) Please specify _____

27. Independent of vancomycin or aminoglycoside pharmacokinetic dosing protocols, does the AS team unilaterally (without primary physician approval) change the **dosing** of antimicrobial therapy?
    ( ) Yes/always ( ) Yes/usually ( ) Yes/seldom ( ) No ( ) NA
    If yes,
    a. Who makes the changes? *(Check all that apply)*
       [ ] 1) Physician
       [ ] 2) Nurse Practitioner/Physician Assistant (NP/PA)
       [ ] 3) Clinical Pharmacist/Clinical Pharmacy Specialist
       [ ] 4) Other *If other,* 4a) Please specify _____

    b. How are the AS Team's interventions conveyed? *(Check all that apply)*
       [ ] 1) Verbal communication
       [ ] 2) CPRS note
       [ ] 3) CPRS alert
       [ ] 4) Email
       [ ] 5) Other *If other*, 5a) Please specify _____

28. Independent of vancomycin or aminoglycoside pharmacokinetic dosing protocols, does the AS team unilaterally (without primary physician approval) change the **selection** of antimicrobial therapy?
    ( ) Yes/always ( ) Yes/usually ( ) Yes/seldom ( ) No ( ) NA
    If yes,
    a. Who makes the changes? *(Check all that apply)*
       [ ] 1) Physician
       [ ] 2) Nurse Practitioner/Physician Assistant (NP/PA)
       [ ] 3) Clinical Pharmacist/Clinical Pharmacy Specialist
       [ ] 4) Other *If other,* 4a) Please specify _____

    b. How are the AS Team's interventions conveyed? *(Check all that apply)*
       [ ] 1) Verbal communication
       [ ] 2) CPRS note
       [ ] 3) CPRS alert
       [ ] 4) Email
       [ ] 5) Other *If other*, 5a) Please specify _____

Check one	Yes	No
29. Does your facility have a policy/procedure for de-escalation of antimicrobials?	☐	☐

Check one	Always	Usually	Sometimes	Seldom	Never
30. How often does the AS team systematically review antimicrobial use for recommendations regarding de-escalation of antimicrobials?	☐	☐	☐	☐	☐

Check one	Yes	No
31. Is there a process for timely review of positive blood cultures by the AS team to assure appropriate therapy is being given? (e.g., within 48 hours)	☐	☐

32. Does your facility require automatic ID consults for certain conditions? ( ) Yes ( ) No
    a. *If yes*, for which conditions? *(Check all that apply)*
    [ ] 1) Any bacteremia
    [ ] 2) *S. aureus* bacteremia
    [ ] 3) Other *If other,* 3a) Please specify _____

33. Does your facility have guidelines for antimicrobial duration? ( ) Yes ( ) No
    a. *If yes*, how are the guidelines distributed to providers? *(Check all that apply)*
    [ ] 1) Facility Intranet
    [ ] 2) Pocket card/reference
    [ ] 3) At charting locations
    [ ] 4) Upon order entry in CPRS
    [ ] 5) Other *If other,* 5a) Please specify _____

34. Are there automatic stop orders in place for antimicrobial duration? ( ) Yes ( ) No
    a. *If yes,* which antimicrobials? *(Check all that apply)*
    [ ] 1) All
    [ ] 2) Azithromycin
    [ ] 3) Ciprofloxacin
    [ ] 4) Moxifloxacin
    [ ] 5) Levofloxacin
    [ ] 6) Vancomycin
    [ ] 7) Piperacillin/tazobactam
    [ ] 8) Ertapenem
    [ ] 9) Imipenem
    [ ] 10) Meropenem
    [ ] 11) Doripenem
    [ ] 12) Aminoglycosides
    [ ] 13) Other 13a) *If other,* Please specify _____

35. Are there educational programs for prudent antimicrobial use available to prescribers? ( ) Yes ( ) No
    If yes,
    a. Which programs?
    [ ] 1) In-person group presentations, (i.e., lecture) ( ) Yes ( ) No
        a) *If yes*, how often is this program available?
        ( ) Weekly ( ) Monthly ( ) Quarterly ( ) Annually ( ) As needed ( ) Other
        If other, 1) Please specify _____
    [ ] 2) Individual provider academic detailing ( ) Yes ( ) No
        a) *If yes*, how often is this program available?
        ( ) Weekly ( ) Monthly ( ) Quarterly ( ) Annually ( ) As needed ( ) Other
        If other, 1) Please specify _____
    [ ] 3) Webinars ( ) Yes ( ) No
        a) *If yes,* how often is this program available?
        ( ) Weekly ( ) Monthly ( ) Quarterly ( ) Annually ( ) As needed ( ) Other
        If other, 1) Please specify _____
    [ ] 4) VISN programs ( ) Yes ( ) No
        a) *If yes,* how often is this program available?
        ( ) Weekly ( ) Monthly ( ) Quarterly ( ) Annually ( ) As needed ( ) Other
        If other, 1) Please specify _____

[ ] 5) Other ( ) Yes ( ) No
If yes,
a) Please specify _____
b) How often is this program available?
( ) Weekly ( ) Monthly ( ) Quarterly ( ) Annually ( ) As needed ( ) Other
If other, 1) Please specify _____

36. Are other resources used to ensure that providers get up-to-date information on the principles of antibiotic use? *(Check all that apply)*
[ ] a. Email alerts
[ ] b. Newsletters
[ ] c. Pharmacy alerts
[ ] d. Other *If other,* d1) Please specify _____
[ ] e. No other resources are used

37. Does your facility have an antimicrobial cycling program? ( ) Yes ( ) No
a. *If yes,* please provide an example of what agents are cycled. _____

Check one	Yes	No
38. Does your facility have a policy/review for intervention to limit use of non-*C. difficile* directed antibiotic exposure in order to improve outcomes for patients with *Clostridium difficile* infection?	□	□

Section VI: Antimicrobial Stewardship Resources

Mark one each line	Very helpful	Helpful	Neutral	Not very helpful	Not at all helpful	Not aware of National Events
39. How helpful do you find AS Taskforce National Webinars?	□	□	□	□	□	□
40. How helpful do you find face-to-face AS Task force meetings?	□	□	□	□	□	□

Mark one each line	Very likely	Likely	Neutral	Not very likely	Not at all likely	NA
41. Because of an AS Taskforce training event, how likely is your facility to: a. Address a specific AS ethical dilemma	□	□	□	□	□	□
b. Prepare or update a facility AS business plan for approval	□	□	□	□	□	□
c. Prepare or update AS policy (e.g., IV to PO conversion)	□	□	□	□	□	□
d. Prepare or update a policy limiting Dual Anaerobic Coverage	□	□	□	□	□	□
e. Prepare or update a policy limiting non-*C. difficile* directed antibiotic exposure in order to improve outcomes for patients with *Clostridium difficile* infection	□	□	□	□	□	□

Select the helpfulness of the following **National** items: *Mark one each line*	**Very helpful**	**Helpful**	**Neutral**	**Not very helpful**	**Not at all helpful**	**Not aware of this National item**	**NA**
42. AS Taskforce's sample *IV to PO Conversion Policy* in developing or augmenting your local facility's IV to PO conversion policy	□	□	□	□	□	□	□
43. Antimicrobial Stewardship SharePoint site	□	□	□	□	□	□	□
44. AS Taskforce's sample *Avoidance of Double Anaerobic Coverage Policy* in developing or augmenting your local facility's Avoidance of Double Anaerobic Coverage policy	□	□	□	□	□	□	□
45. AS Taskforce's sample *Intervention to Improve Outcomes for Patients with* C. difficile *Infection Policy* in developing or augmenting your local facility's Intervention to Improve Outcomes for Patients with *C. difficile* Infection policy	□	□	□	□	□	□	□
46. AS Taskforce's sample *Business Plan for AS* in developing or augmenting your local facility's Business Plan for AS	□	□	□	□	□	□	□

47. What is the status of your facility's Business Plan for AS?
( ) Approved ( ) Denied ( ) In process ( ) Not developed

48. Which of the following tools, if any, does your facility use to facilitate stewardship activities?
(Check all that apply)
[ ] a. CPRS
[ ] b. VistA
[ ] c. Proprietary software (e.g., TheraDoc)
[ ] d. Administrative electronic database (e.g., Corporate Data Warehouse, VISN data warehouse)
[ ] e. Pathfinder/Essence
[ ] f. Other *If other,* f1) Please specify _____
[ ] g. None

Section VII: Outcomes

49. Does your facility provide any group or provider-specific feedback regarding patterns of antimicrobial use?
( ) Yes ( ) No
If yes,
a. How often is this provided?
( ) Daily
( ) Weekly
( ) Monthly
( ) Quarterly
( ) Annually
( ) As needed
( ) Other *If other,* a1) Please specify _____
b. How is it done? *(Check all that apply)*
[ ] 1) Email alerts
[ ] 2) Other written correspondence

[ ] 3) Verbal presentation
[ ] 4) SharePoint
[ ] 5) Dashboard on regional or national databases
[ ] 6) Other *If other,* 6a) Please specify _____

50. Does your facility generate any reports based on the clinical outcomes related to antimicrobial use?
( ) Yes ( ) No
If yes,
a. Which reports are generated? *(Check all that apply)*
[ ] 1) Adverse drug effect
[ ] 2) Average length of therapy
[ ] 3) *C. difficile* infection rates
[ ] 4) Antimicrobial resistance rates (independent of the antibiogram, e.g., Carbepenem-resistant gram negatives, extended-spectrum ß-lactamase producing organisms)
[ ] 5) Other *If other,* 5a) Please specify _____
b. How often is this done?
( ) Daily
( ) Weekly
( ) Monthly
( ) Quarterly
( ) Annually
( ) As needed
( ) Other *If other,* b1) Please specify _____
c. Are presentations of the results made to any of the following? *(Check all that apply)*
[ ] 1) Providers
[ ] 2) P&T committee
[ ] 3) Infection Control Committee
[ ] 4) Other parts of administration
[ ] 5) Other *If other,* 5a) Please specify _____
[ ] 6) No presentations are made

51. Which of the following measurements of antimicrobial utilization and outcomes does your facility use?
(Check all that apply)
[ ] a. Defined daily dose (DDD)
[ ] b. Days of therapy (DOT)
[ ] c. Antimicrobial expenditures
[ ] d. Analyses of antimicrobial susceptibilities independent of the facility Antibiograms (i.e., tracking specific bacterial resistance)
[ ] e. Diagnosis Related Group (DRG) length of stay
[ ] f. Other *If other,* f1) Please specify _____
[ ] g. None

52. Has the AS team or your facility done a Medication Usage Evaluation (MUE) for any antibiotic(s) in the last 2 years? ( ) Yes ( ) No
a. *If yes,* please list which antibiotic(s) _____

53. Which of the following measurements of home infusion outcomes, if any, does your facility use?
(Check all that apply)
[ ] a. Line infections
[ ] b. Antimicrobial toxicities
[ ] c. Follow-up arranged
[ ] d. Labs
[ ] e. None

d1) *If "Labs" is checked*, which of the following outcomes are measured? *(Check all that apply)*
[ ] a) Labs are ordered appropriately
[ ] b) Labs are obtained per orders
[ ] c) Labs are sent to the appropriate persons for review
[ ] d) Lab review completed in a timely manner (e.g., within 48 hours)
[ ] e) Appropriate action performed, if needed, based on the labs
[ ] f) None

Section VIII: Antimicrobial Stewardship Barriers

54. What types of support would be beneficial at your facility in achieving optimal antimicrobial use?
(Check all that apply)
[ ] a. ID physician support
[ ] b. Pharmacy support
[ ] c. Administration support
[ ] d. Provider/prescriber buy-in
[ ] e. IT/data tools support
[ ] f. Educational tools support
[ ] g. Guidelines support
[ ] h. Other support *If other,* h1) Please specify _____

55. Please rank the individual services at your facility in their general receptiveness of antimicrobial stewardship - related interventions:

Mark one each line	**Very receptive**	**Receptive**	**Neutral**	**Not very receptive**	**Not at all receptive**	**No experience with that service**	**Service unavailable at facility**
a. Medicine (General)	□	□	□	□	□	□	□
b. Medicine (ICU)	□	□	□	□	□	□	□
c. Medicine (Subacute or Transitional Care)	□	□	□	□	□	□	□
d. Community Living Center	□	□	□	□	□	□	□
e. Emergency Department	□	□	□	□	□	□	□
f. Surgery (General)	□	□	□	□	□	□	□
g. Surgery (ICU)	□	□	□	□	□	□	□
h. Orthopedic Surgery	□	□	□	□	□	□	□
i. Cardiothoracic Surgery	□	□	□	□	□	□	□
j. Neurosurgery	□	□	□	□	□	□	□
k. Vascular Surgery	□	□	□	□	□	□	□

Mark one each line	Very receptive	Receptive	Neutral	Not very receptive	Not at all receptive	No experience with that service	Service unavailable at facility
l. Urology	□	□	□	□	□	□	□
m. Otolaryngology	□	□	□	□	□	□	□
n. Neurology	□	□	□	□	□	□	□
o. Psychiatry	□	□	□	□	□	□	□
p. Dental	□	□	□	□	□	□	□
q. Ophthalmology/ Optometry	□	□	□	□	□	□	□
r. Gynecology	□	□	□	□	□	□	□

Section IX: Additional Comments

56. If desired, please add any additional comments and/or clarifications.

Thank you for your time and cooperation!

Department of Veterans Affairs
Veterans Health Administration
Office of the Assistant Deputy Under Secretary for Health
for Policy and Planning

VA HEALTH CARE | Defining EXCELLENCE in the 21st Century

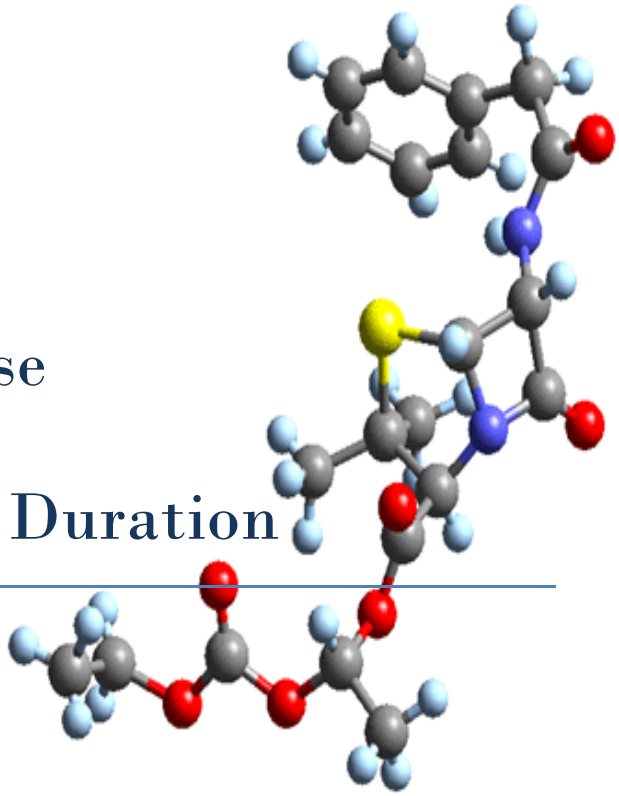
2012

Survey of Antimicrobial Stewardship in VHA

Right Drug

Right Dose

Right Duration



May 2013

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Prologue

In May of 2011, the Under Secretary for Health chartered the National VA Antimicrobial Stewardship Task Force to guide the national effort to improve antimicrobial use and enhance patient safety at all medical centers. The Task Force assists VA facilities in the development and expansion of Antimicrobial Stewardship (AS) activities. The goal is to ensure all VA facilities have the tools necessary to ensure safe, effective, and cost-effective use of antimicrobials. The Task Force serves as a resource for development and deployment of facility Antimicrobial Stewardship Programs to ensure high quality, safe, and reliable care for Veterans.

The National Infectious Diseases Service (NIDS) in conjunction with the Pharmacy Benefits Management Service (PBM) oversees Antimicrobial Stewardship in VA. These services align AS program operations and management with Veterans Health Administration's (VHA's) Office of Patient Care Services (PCS). These services promote quality practices and provide other support to frontline practitioners. A primary goal of these services is to develop and execute a VHA strategic plan for AS process modeling, training, education, and research by continually assessing the current state of AS, identifying gaps, and then proposing operational and budget strategies to address those gaps.

As we explore strategic AS opportunities to support the goal of improved patient care, local AS champions continue to be critical members of the VHA health care team. These champions are integral to the process of helping educate staff about innovative approaches for antimicrobial usage. This education will enhance diagnostic, procedural, and communication skills to support quality care and the best possible outcomes for Veterans.

The VHA AS Task Force is addressing national clinical priorities, to provide optimum operational policies, procedures, standards, and guidelines for AS activities. The objective of this survey was to evaluate and report on the current state of facility level AS activities, programs, personnel, and resources across the VHA Health Care System. The Survey of Antimicrobial Stewardship was developed as an internal environmental scan with the purpose of further supporting quality improvement efforts in AS activities. The data gathered will be used to determine the current state of AS, who provides stewardship, and where the gaps, if any, may be. The survey collected responses from facility champions to capture data on facility level AS activities.

/s/
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Co-Chair, National Antimicrobial Stewardship Taskforce

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/s/
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National Infectious Diseases Service
Member, National Antimicrobial Stewardship Taskforce

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Executive Summary

Background:

To provide baseline data on VHA-wide Antimicrobial Stewardship (AS) activities, the Office of Patient Care Services (PCS) assembled a team of champions to gather information from Chief of Staff/Chief of Infectious Diseases/Chief of Pharmacy and their designees across VA on their practices with regard to AS activities.

Data gathered will assist decision makers in providing a better understanding of the current state of AS activities, programs, personnel, policies, resources, and outcomes across the VHA system.

The survey was self-administered. As an administrative survey, this survey included self-reported data only and may be subject to individual interpretations.

The survey gathered information from 140 VA Medical Centers and Integrated Facilities. The data from all 140 facilities is available upon request from the program office.

Methods:

Healthcare Analysis and Information Group (HAIG) designed a Web-based online survey to gather data, delivered via the HAIG Web site. The survey was in the field from November 1 through December 4, 2012.

Following a presentation on a national Veterans Integrated Service Network (VISN) Chief Medical Officers (CMO) conference call, the Office of the Deputy Under Secretary for Health for Operations and Management sent an e-mail request to the CMO of each of the 21 VISNs to have their facilities complete the survey. Facilities that did not provide a response by the initial due date received e-mail prompts or phone calls. VISN 21, Manila, PI, a small outpatient clinic with the primary mission of doing Compensation and Pension examinations, opted out of the survey. Of the 140 responding facilities, 130 reported that they provided inpatient services.

Key Findings:

(Q1) Twenty-six facilities of the 130 with inpatient services reported they do not have an Infectious Disease (ID) attending physician.

(Q19) Forty-nine facilities of the 130 with inpatient services reported having an AS Team.

(Q20) Thirty-four of these 49 facilities have a written policy to promote intravenous antibiotics (IV) to oral antibiotics (PO) conversion. At 31 facilities, the policy is approved by the local Pharmacy and Therapeutics (P&T) committee. Fifty-one facilities without a formal policy do have an informal policy to promote substitution of oral antibiotics for parenteral antibiotics.

(Q22) In 2012, 120 inpatient facilities reported restrictions on the use of antibiotic agents, as compared to 106 facilities in 2011.

(Q28) Eight facilities reported that the AS team can change the selection of antimicrobial therapy.

(Q29) In 2012, 19 facilities reported having a policy for de-escalation of antimicrobials, as compared to 10 facilities in 2011.

(Q31) Fifty-six facilities have a process for timely review of positive blood cultures by the AS team.

(Q32) In 2012, 36 facilities reported that automatic ID consults for certain conditions are required. This is twice the number that reported this in 2011 (18). In both years, if ID consults are required, they are most often required for *S. aureus* bacteremia.

(Q34) Most facilities (98) have automatic stop orders in place for antimicrobial duration. Eighty-nine of those facilities have automatic stop orders for all the listed antimicrobials noted in the survey.

(Q47) Most inpatient facilities (87) have not developed a business plan for antimicrobial stewardship.

(Q52) The AS Teams at 61 inpatient facilities have done a Medication Usage Evaluation (MUE) for antibiotic(s) in the last 2 years.

(Q53) While 85 facilities with inpatient services offer some form of intravenous home infusion, most facilities (73) do not provide any measurements of home infusion outcomes.

Recommendations:

Some facilities should consider adding additional stewardship personnel to their staff based on reported results.

Inpatient facilities without an AS Team should consider creating an AS Team.

Facilities that do not have written policies should consider creating written policies to promote substitution of oral antibiotics for parenteral antibiotics to review for IV to PO conversion, avoidance of double anaerobic coverage, and intervention to avoid unnecessary antimicrobial use in patients with *C. difficile* infection. Templates are available on the AS SharePoint site.

Facilities that do not currently restrict the use of antibiotic agents should consider doing so.

Facilities that do not allow the AS Team to change the selection of antimicrobial therapy should consider developing a policy to allow them to do so.

Facilities that do not have a policy for de-escalation of antimicrobials including vancomycin should develop a policy. A template for vancomycin de-escalation is available on the AS SharePoint site.

Facilities without a process for timely review of positive blood cultures by the AS team should develop a process.

Facilities with inpatient ID consultation capabilities should consider developing a policy for automatic ID consults for certain conditions.

Facilities that do not have automatic orders in place for antimicrobial duration should develop policies to do so.

Facilities that do not utilize the template in the AS SharePoint site should consider doing so to develop a business plan for antimicrobial stewardship.

Facilities that do not consult with the AS Task Force for resources to assist with a Medication Usage Evaluation, should consider doing so.

Facilities should consult with the AS Task Force to provide any measurements of home infusion outcomes.

VHA Strategic Plan Relevance

In May of 2011, the Under Secretary for Health chartered the National VA Antimicrobial Stewardship (AS) Task Force to guide the national effort to improve antimicrobial use and enhance patient safety at all medical centers. The Task Force assists VA facilities in the development and expansion of Antimicrobial Stewardship activities. The goal is to ensure all VA facilities have the tools necessary to ensure safe, effective, and cost-effective use of antimicrobials. The Task Force serves as a resource for development and deployment of facility Antimicrobial Stewardship Programs thereby enhancing high quality, safe, and reliable care for Veterans.

These efforts are pursuant to providing Veterans with proactive, patient-driven health care, while achieving measurable health outcomes. Information compiled from the survey results that are aligned with the objectives of the VHA Strategic Plan may be discerned throughout this report. They also serve VHA's ability to utilize best practices and to align resources to deliver sustained value to veterans.

Conclusions:

The National AS Task Force strategic plan calls for it to serve as a valuable resource to VHA health care providers on the operational strategies of antimicrobial stewardship to address proper use of antimicrobial agents.

Consistent use of AS can optimize clinical outcomes, and minimize unintended consequences of antimicrobial use, including toxicity, the selection of pathogenic organisms, and the emergence of resistance. Appropriate use of antimicrobials is an essential part of patient safety.

When facilities have an established AS Team, the combination of effective AS with a comprehensive infection control program limits the emergence and transmission of antimicrobial-resistant bacteria. A secondary goal of AS is to reduce health care costs without adversely affecting quality of care.

With guidance from VA Central Office, facilities should consider adding AS personnel if a deficit exists, create suggested antimicrobial policies, and develop and champion AS Teams to encourage the coordination, oversight, and use of antimicrobial agents.

Report

Introduction

The National Infectious Diseases Service (NIDS) within the Office of Patient Care Services (PCS) provides information and assistance to VHA facilities in dealing with the prevention, diagnosis, and treatment of communicable diseases and infections. NIDS in combination with the Pharmacy Benefits and Management Service is responsible for the coordination and oversight of AS activities across VHA.

Program Background

VHA is committed to providing Veterans with exemplary services that are both patient-centered and evidence-based. Antimicrobial Stewardship activities can improve health care services and use of AS concepts can reduce patient risk and improve the quality of patient care. Strong AS activities, training, and education are crucial to prepare VHA's clinical staff and trainees to provide excellent patient care.

In recognition of this concept, VA created the National VA AS Task Force to optimize the care of Veterans by developing, deploying, and monitoring a national-level strategic plan for improvements in antimicrobial therapy management. The purpose of the plan is to assist VA facilities in the development and expansion of facility AS activities. The goal of the Task Force is to ensure all VA facilities have the tools necessary to ensure safe, effective, and cost-effective use of antimicrobials.

By elevating AS activities to the national-level, VHA is able to leverage the large resource investment expended across the system and develop national policies, guidelines, documentation strategies, and protocols. This ensures the optimization of resources and VHA's application of AS nationally.

VHA's AS strategy is consistent with progressive models currently used in medical institutions across the country. It is also complementary to similar approaches currently used by the Department of Defense (DoD) and other large, national integrated health care systems.

VHA is committed to providing the highest quality health care to Veterans. Use of this leading technology for AS activities is shown to reduce patient risk and improve the quality of patient care.

Purpose/Objectives

The primary goal of AS is to optimize clinical outcomes while minimizing unintended consequences of antimicrobial use, including toxicity, the selection of pathogenic organisms, and the emergence of resistance. Appropriate use of antimicrobials is an essential part of patient safety. The combination of effective AS with a comprehensive infection control program limits the emergence and transmission of antimicrobial-resistant bacteria. A secondary goal of AS is to reduce health care costs without adversely affecting quality of care.

To catalog resources and stewardship activities at local facilities, a Technical Advisory Group (TAG) was brought together to develop a national survey instrument to collect information from all VHA facilities on facility level AS Programs and activities.

The goal of this survey was to gather information on the current state of VHA AS Programs and resources across the VHA system. The survey results will provide both VACO officials and the field with a useful and accessible picture of AS Programs available in VHA, their characteristics, and their organization. The survey gathered information on best practices, information on the current state of VHA AS activities, personnel, policies, and resources across the VHA system. The survey results will help identify existing resources as well as any remaining barriers to improved delivery of quality care.

Antimicrobial Stewardship (AS) Program

The AS Guidelines (CID Jan 2007)[1] define an AS Program as a multidisciplinary activity that includes appropriate selection, dosing, route, and duration of antimicrobial therapy. The primary goal is to optimize clinical outcomes while minimizing unintended consequences of antimicrobial use, including toxicity, the selection of pathogenic organisms, and the emergence of resistance. Appropriate use of antimicrobials is an essential part of patient safety. The combination of effective AS with a comprehensive infection control program limits the emergence and transmission of antimicrobial-resistant bacteria. A secondary goal of AS is to reduce health care costs without adversely affecting quality of care.

The primary goal of the AS Program Review Survey was to gather information on the current state of VHA AS activities. The National AS Task Force will use the results for multiple objectives.

- Identify currently available AS experts at facilities
- Understand the current state and effectiveness of AS policies, programs, and education
- Guide operational policies, procedures, standards, and guidelines on best practices for AS activities to provide Veterans with personalized, proactive health care
- Provide data to guide VHA's system-wide AS strategic plan
- Aid in developing and implementing AS programs and expanding existing programs
- Develop a communication plan to promote effective facility level AS programs

Method

Survey Design/Tools

The AS Task Force supported the development of the survey in collaboration with a TAG of VHA Central Office AS leaders and special advisors of field-based professionals, including an ID Chief, a Staff Physician, an ID Research Practitioner, as well as administrative and clinical Pharmacy personnel.

Technical support was provided by the Healthcare Analysis and Information Group (HAIG). HAIG provided project management and support for this effort.

The survey was distributed to each VA Health Care System across VA by the HAIG. The survey collected responses from individuals knowledgeable about AS activities within the medical facility to capture data on facility level AS activities.

HAIG designed a Web-based online survey to gather data. The team used Inquisite® survey software by Allegiance Software, Inc. to create an automated online survey. The HAIG Web site was the delivery mechanism. The survey was in the field from November 1 through December 4, 2012. This was the second survey the AS Task Force conducted. The first survey was conducted in November 2011. A copy of the 2012 survey questionnaire is included in Appendix B.

Survey Preparation

Prior to sending out the survey, a pilot test using a representative sample of facilities (stratified by geographic region and facility complexity) was conducted to ensure face validity. Additionally, in advance of releasing the survey to the field, the TAG chair made a presentation on a national VISN CMO conference call.

The survey was reviewed and edited by leadership in the Office of the Assistant Deputy Under Secretary for Clinical Operations, the CMOs, the National Center for Organizational Development (NCOD), and the VHA Organizational Assessment Steering Committee (OASC).

Survey Procedures

All VA Medical Centers received a request to have the subject matter expert knowledgeable about AS activities within each VA Medical Center complete the survey. The survey gathered data on AS Program makeup, staff, support, resources, and restrictions at each facility.

The surveys collected data from 140 facilities. VISN 21, Manila, PI, a small outpatient clinic with the primary mission of doing Compensation and Pension examinations, opted out of the survey.

The survey was self-administered. As an administrative survey, this survey includes self-reported data only and may be subject to individual interpretations.

The Fiscal Year 2011 Facility Complexity Level Model is the ranking of VHA facilities based on the complexity of services they provide. The model is maintained by the Office of Productivity, Efficiency and Staffing (OPES, 10P2B). The Model defines Level 1 facilities as the most complex, and considers Level 3 facilities the least complex. The Model assigns Facility Complexity at the Parent Station Level. The Level 1 facilities are categorized into three groups: a, b, and c. North Chicago and Texas Valley Coastal Bend HCS are excluded from the Model because of data capture accuracy and sufficiency issues. Where appropriate, some responses to the survey have been compared at Facility Complexity Levels.

VA utilizes the US Census Bureau's definition for Urban, Rural and Highly Rural. An Urban Area is defined as any block or block group having a population density of at least 1,000 people per square mile. A Rural Area is any non-urban or non-highly rural area. Finally, a Highly Rural Area is any area having fewer than seven civilians per square mile. Where appropriate, some responses to the survey have been compared at Urban and Rural facility designations.

The data derived from this survey is intended as guidance to the national program office and VHA leadership about current state of AS activities. It will help form future clinical policy and strategic initiatives in VA Health Care Systems.

Main Measures

The survey collected data on the following main topics:

Facility Components

- Infectious Diseases (ID) Attending Physicians
- Residency / Fellowship Programs
- Clinical Pharmacists / Clinical Pharmacy Specialists

- Hospitalists
- Inpatient ID Consultation Services
- Emergency Department and staffing
- Intravenous (IV) home antimicrobial infusion
- Microbiology Laboratory
- Antibiograms

AS Policy

- Formal
- Informal
- Components

AS Personnel

- AS Team and members
- Oversight

AS Activities

- IV to PO Conversion Policy
- Agent Restrictions
- Computerized Patient Record System (CPRS) Forms
- Clinical Pathways / Guidelines
- Dosing and Selection of antimicrobial therapy
- De-escalation of antimicrobials
- Review of positive blood cultures by AS team
- ID Consults
- Guidelines / Automatic stop orders of antimicrobial duration
- Educational programs for prescribers

AS Resources

- AS Task Force Webinars, meetings
- Facility business plan
- AS Tools

AS Outcomes

- AS Provider-specific feedback for patterns of antimicrobial use
- Reports of clinical outcomes related to antimicrobial use
- Measurements of antimicrobial utilization and outcomes
- Medication Usage Evaluation for antibiotics
- Home infusion outcomes

AS Barriers / Acceptance

Discussion and Findings

The purpose of this survey was to provide baseline data on the current state of AS activities, personnel, policies, and resources across the VHA system. Of the 140 facilities surveyed, 130 reported they provided inpatient treatment and 10 indicated they were strictly outpatient facilities. Predominantly, statistics are reported on AS activities for the 130 inpatient treatment facilities.

A baseline survey was completed in 2011. The 2011 survey collected data from 130 facilities. Of those, 126 indicated they provided inpatient treatment and four reported they were strictly outpatient facilities. Some questions compare the 2011 and 2012 data.

Data gathered will assist in providing a better snapshot of how facilities provide AS services or determine the state of planning for providing AS activities for facilities. This survey is also intended to assist in improving processes and reduce variations. Survey results show there was variation in practices across facilities.

Section I: Facilities Components

(Q1) Most inpatient facilities have an ID attending physician, at least part time (104/130). Twenty-six inpatient facilities reported they do not have not have an ID attending physician. Two facilities reported having 10 or more full time and part time ID Attending physicians.

2012 ID Attending Physicians											
	Number of Part Time Physicians										
Number of Full Time Physicians	0	1	2	3	4	5	6	8	9	10+	Total
0	26	10	3	2	5	2		3		1	52
1	15	10	3	1	1	1	1			1	33
2	10	6	1	1	1			1		1	21
3	5			4							9
4	2	1	2	1							6
5	1										1
6		1			1			1			3
9									1		1
10+	1	1								2	4
Total	60	29	9	9	8	3	1	5	1	5	**130**

(Q2-8) Many inpatient facilities have residency programs, 78 percent have pharmacy residency programs, 73 percent have internal medicine residency programs, and 65 percent have surgical residency programs.

Does your facility participate in:	2012 'Yes' (N=130)	
	Count	Percent
Pharmacy residency program	102	78%
Internal medicine residency program	95	73%
Surgical residency program	84	65%
ID fellowship program	68	52%
Family practice residency program	30	23%
Emergency medicine residency program	17	13%
ID pharmacy residency program	12	9%

(Q9) Most inpatient facilities (91%) have clinical pharmacists assigned to acute care teams or wards. Of those facilities, 78 percent are assigned to Medicine, 76 percent to the Intensive Care Unit (ICU), and 70 percent to the Community Living Center (LTC).

Are Clinical Pharmacists/Clinical Pharmacy Specialists assigned to any acute care teams or wards at your hospital/facility?	2012 'Yes' (N=130)	
	Count	Percent
	118	91%

If yes, which teams/wards?	Inpatient 'Yes' 2012 (n=118)	
	Count	Percent
Medicine	92	78%
Intensive Care Unit	90	76%
Community Living Center	83	70%
Surgery	57	48%
Combined Medicine / Surgery	39	33%
Step-Down Unit / Telemetry	39	33%
Other	37	31%
Dialysis Unit	15	13%

(Q10) Many facilities (52) estimated that 91-100 percent of general medicine inpatients are admitted to hospitalists. Eight facilities reported no hospitalists.

(Q11) Many facilities (41) estimated that 0 percent of inpatient attending service on general medical ward teams is covered by ID staff. Eight facilities reported no ID staff.

Hospitalists	2012 'Yes' (N=130)	
	Count	Percent
0%	8	6%
1-10%	5	4%
11-20%	13	10%
21-30%	6	5%
31-40%	9	7%
41-50%	5	4%
51-60%	4	3%
61-70%	6	5%
71-80%	3	2%
91-100%	52	40%
No hospitalists	8	6%

ID Staff	2012 'Yes' (N=130)	
	Count	Percent
0%	41	32%
1-5%	20	15%
6-10%	21	16%
11-15%	14	11%
16-20%	8	6%
21-25%	6	5%
26-50%	6	5%
> 50%	6	5%
No ID staff	8	6%

(Q12) One-hundred three inpatient facilities offer internal VA inpatient ID Consultation Services. Of the 27 that do not, 20 reported that ID issues are handled by another VA facility's ID physician, and 10 reported that a Non-VA external ID physician handles ID issues.

Internal VA Inpatient ID Consultation Service	2012 (N=130)	
	Count	Percent
Yes	103	79%
No	27	21%

If no, who handles ID issues?	2012 (n=27)	
	Count	Percent
Another VA facility's ID physicians via E-Consult or telemedicine	20	74%
Non-VA external ID physicians	10	37%
Clinical Pharmacist/Clinical Pharmacy Specialist	9	33%

If no, **who handles ID issues?**	2012 (n=27)	
	Count	Percent
Unsure who handles ID related issues	2	7%
Other -- Please specify: CBOC; Other Facility in VISN	2	7%
Non-ID trained (VA or non-VA) physician with interest in ID	2	7%

Percentages do not total 100 percent because respondents could choose more than one.

(Q13) One-hundred thirteen inpatient facilities reported an Emergency Department (ED) and 17 reported no ED; of the facilities with an ED, reported full time staff includes, emergency physicians (88), internal medicine physicians (56), family practice physicians (22), other physicians (8), resident physicians (13), mid-level providers (54), and other providers (3). Most of these are full time, a few reported part time VA employees. Twenty facilities have a clinical pharmacist dedicated to staff the ED.

If your facility has an ED, **who staffs the main ED?**	Full time VA		Part time VA		Non VA staff		None	
	2012 (n=113)		2012 (n=113)		2012 (n=113)		2012 (n=113)	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Emergency physician	88	78%	23	20%	38	34%	12	11%
Internal medicine physician	56	50%	25	22%	29	26%	38	34%
Family practice physician	22	19%	8	7%	7	6%	84	74%
Other physician	8	7%	9	8%	9	8%	89	79%
Resident physician	13	12%	23	20%	18	16%	68	60%
Mid-level provider	54	48%	13	12%	5	4%	52	46%
Other provider	3	3%	1	1%	3	3%	106	94%

	(Includes any VA, Non VA, WOC, and Fee/Contract) 2012 (n=113)	
	Count	Percent
Dedicated Clinical Pharmacist	20	18%

Percentages do not total 100 percent because respondents could choose more than one.

(Q14) Eighty-five facilities with inpatient services offer IV home antimicrobial infusion. This program is most often provided by an ID physician (38). Other members of the IV home antimicrobial infusion program are contract pharmacy / contract nursing (68).

Does your facility offer intravenous (IV) home antimicrobial infusion?	2012 'Yes' (N=130)	
	Count	Percent
	85	65%

If yes, **what is the specialty of the Manager/Director for the intravenous (IV) home antimicrobial infusion program?**	2012 (n=85)	
	Count	Percent
General Internist	3	4%
Hospitalist	3	4%
ID Physician	37	44%
Other Physician	4	5%
Clinical Pharmacist / Clinical Pharmacy Specialist	18	21%
Home Coordinator	22	26%
Other	22	26%

Who are the members of the IV home antimicrobial infusion program? *(Check all that apply)*	2012 (N=85)	
	Count	Percent
VA pharmacy/VA nursing	17	20%
VA pharmacy/Contract nursing	20	24%
If **VA pharmacy/Contract nursing, are services:** *(Check all that apply)* **(N=20)**		
Contracted year to year	5	25%
Contracted patient to patient	16	80%
Other		
Contract pharmacy/VA nursing	11	13%
If **Contract pharmacy/VA nursing, are services:** *(Check all that apply)* **(N=11)**		
Contracted year to year	4	36%
Contracted patient to patient	6	55%
Other	2	18%
Contract pharmacy/contract nursing	64	75%
If **Contract pharmacy/contract nursing, are services:** *(Check all that apply)* **(N=64)**		
Contracted year to year	24	38%
Contracted patient to patient	38	59%
Other	7	11%
Other	7	8%

(Q15-15b) Most inpatient facilities (117) have an on-site microbiology laboratory. At several facilities (70) the laboratory service director has a doctoral degree and is trained in microbiology. The microbiology laboratory at 112 facilities selectively reports susceptibility to antimicrobial agents; in 2011, 95 facilities reported selective antimicrobial resistance reporting. At 43 facilities, the lab reports Minimum Inhibitory Concentration (MICs) for all organisms, or selected organisms (85). The most common organism for MIC reporting is Staphylococcus aureus (75).

On-site microbiology laboratory	2012 'Yes' (N=130)	
	Count	Percent
	117	90%

If your facility has an on-site microbiology laboratory answer the following questions:	2012 'Yes' (n=117)		2011 'Yes' (N=126)	
	Count	Percent	Count	Percent
Lab director with a doctoral degree trained in microbiology	70	60%		
Selectively report susceptibility to antimicrobial agents	112	96%	95	75%
Report MICs for all organisms	43	37%		
Report MICs for selected organisms	85	73%		

Percentages do not total 100 percent because respondents could choose more than one.

If MICs are reported for selected organisms, **which organisms?**	2012 (n=85)	
	Count	Percent
Staphylococcus aureus	75	88%
Streptococcus pneumoniae	60	71%

If MICs are reported for selected organisms, **which organisms?**	**2012 (n=85)**	
	Count	**Percent**
Other	34	40%

Percentages do not total 100 percent because respondents could choose more than one.

(Q16) Most inpatient facilities update Antibiograms yearly, 122 facilities in 2012 vs. 117 in 2011. At the facilities that do provide the reports, the data are reported for inpatient-whole house (30) and inpatient/outpatient combined (92). Facilities disseminate the report by facility intranet (96), pocket card reference (56), or at the charting location (12).

Are yearly updated Antibiograms available to all providers?	**2012 'Yes' (N=130)**		**2011 'Yes' (N=126)**	
	Count	**Percent**	**Count**	**Percent**
	122	94%	117	93%

2012					
If yes, **how are the data reported?**	**(n=122)**		*If yes,* **how are the data disseminated?**	**(n=122)**	
	Count	**Percent**		**Count**	**Percent**
Outpatient	9	7%	Facility Intranet	96	79%
Inpatient - whole house	30	25%	Pocket card reference	56	46%
Inpatient - unit specific	13	11%	Posted at charting locations	12	10%
Inpt/Outpt combined	92	75%	Other	25	20%
Other	8	7%			

Percentages do not total 100 percent because respondents could choose more than one.

Section II: AS Policy

(Q17) Thirty-five percent of facilities with inpatient services (46/130) do not have a formal written policy that establishes an AS program, although 55/130 (42%) facilities have the policy in development.

For the facilities that do have a formal written policy, 13 (45%) facilities reported the policy being in place between 1-4 years, while the policy has been in place less than 1 year at 11 facilities and 5 or more years at 5 facilities. The policy addresses inpatient antibiotic use at 28 facilities, and outpatient use at 14 facilities. At most facilities the formal written policy was approved by Local Pharmacy and Therapeutics (P&T) committee 23 (79%) and / or the Clinical Executive Board (CEB) 15 (52%). Of the facilities that have no formal written policy, 57/101 have an informal policy. In 2011, 21 (17%) of facilities reported a formal written AS policy.

Formal AS Program Written Policy	**2012 'Yes' (N=130)**		**2011 'Yes' (N=126)**	
	Count	**Percent**	**Count**	**Percent**
Yes	29	22%	21	17%
No	46	35%	105	83%
In development	55	42%		

17a. *If yes,* years in place	2012 'Yes' (n=29)	
	Count	Percent
< 1 year	11	38%
1 year	3	10%
2 years	3	10%
3 years	4	14%
4 years	3	10%
5 or more years	5	17%

17b & c. Does this policy address:	2012 'Yes' (n=29)	
	Count	Percent
Inpatient antibiotic use?		
Yes	28	97%
No		
In development	1	3%
Outpatient antibiotic use?		
Yes	14	48%
No	13	45%
In development	2	7%

Who approved this policy? *(Check all that apply)*	2012 'Yes' (n=29)	
	Count	Percent
Local Pharmacy and Therapeutics (P&T) Committee	23	79%
Clinical Executive Board	15	52%
Chief of Staff	11	38%
Other	4	14%

Percentages do not total 100 percent because respondents could choose more than one.

If no or in development, is there an informal policy for antimicrobial stewardship?	2012 'Yes' (n=101)	
	Count	Percent
Yes	57	56%
No	44	44%
In development		

17e1. *If yes,* years in place	2012 'Yes' (n=57)	
	Count	Percent
< 1 year	15	26%
1 year	2	4%
2 years	11	19%
3 years	4	7%
4 years	1	2%
5 or more years	24	42%

17e2 & 3. Does this policy address:	2012 'Yes' (n=57)	
	Count	Percent
Inpatient antibiotic use?		
Yes	54	95%
No	2	4%
In development	1	2%
Outpatient antibiotic use?		
Yes	27	47%
No	30	53%
In development		

(Q18) Thirteen facilities reported that they participate in a formal AS collaborative with non-VA facilities in their geographic region.

Participate in a formal AS collaborative with non-VA facilities in your geographic region	2012 'Yes' (N=130)	
	Count	Percent
	13	10%

Section III: AS Personnel

(Q19a-e - Q2-2011) In 2012, 49 facilities with inpatient services reported an AS Team. Of those, the team has been in place for less than 1 year at 13 facilities. At 46 facilities, the team works or consults in the acute medical / surgical setting, 25 in the outpatient setting, 33 in the Community Living Center, and 24 in the Dialysis Center setting. All 49 facilities with a team have a clinical pharmacist assigned, and 34 facilities reported that the pharmacist has ID training. Most facilities (45) reported an ID physician on the team, as well as an outpatient provider (37), and a clinical microbiology lab director (37).

Facilities with an AS team	2012 'Yes' (N=130)	
	Count	Percent
	49	38%

If yes, how many years?	2012 'Yes' (n=49)	
	Count	Percent
<1 year	13	27%
1 year to 2 years	8	16%
2 years to 3 years	9	18%
>3 years	19	39%

Does the AS Team work in or consult in the following setting:	2012 'Yes' (n=130)		2011 'Yes' (N=126)	
	Count	Percent	Count	Percent
Inpatient	46	35%	52	41%
Outpatient	25	19%	35	28%
Community Living Center	33	28%	38	32%
Dialysis Center	24	18%		

AS Team Member 2012 (N=49)	Daily Involvement	Periodic Involvement	No Involvement	N/A	Workload Captured
ID Physician	24	21	2	2	11
ID Fellow	9	14	8	18	2
Medical Resident	2	7	26	14	1

AS Team Member 2012 (N=49)	Daily Involvement	Periodic Involvement	No Involvement	N/A	Workload Captured
Medical Student		7	26	16	0
Clinical Pharmacist/ Clinical Pharmacy Specialist	39	10			23
Pharmacy Resident (PGY1)	4	28	9	8	13
Pharmacy Resident (PGY2)	4	10	10	25	7
Pharmacy Student	2	23	14	10	4
Multiple Drug Resistant Organisms (MDRO) Coordinator	4	20	15	10	1
Infection Control (IC) Practitioner	2	25	15	7	2
Outpatient Provider		1	36	12	0
Clinical Microbiology Lab Director	8	29	7	5	2
Information Technology Staff		15	24	10	1
Hospital Administration		14	27	8	0

Percent of FTEE time designated for Stewardship	0%	1-10%	11-20%	21-50%	51-100%	NA
ID Physician	15	14	9	4	1	6
ID Fellow	12	6	3	2		26
Medical Resident	5	3				41
Medical Student	4	1				44
Clinical Pharmacist/ Clinical Pharmacy Specialist	11	11	8	16	11	
Pharmacy Resident (PGY1)	11	11	2	4		23
Pharmacy Resident (PGY2)	5	2	3	4	1	37
Pharmacy Student	12	3	2	4		30
MDRO Coordinator	9	12		1		27
IC Practitioner	8	15		2		24
Outpatient Provider	4					45
Clinical Microbiology Lab Director	16	13	2	4		16
Information Technology Staff	11	4				34
Hospital Administration	6	5	1	1		37

(Q19f5d1) Thirty-four of the 49 facilities with an AS team (69%) reported their Clinical Pharmacist/Clinical Pharmacist Specialist (CP/CPS) involved with AS has ID training, 16 have completed an American Society of Health-System Pharmacists (ASHP) accredited general residency, and 14 have over 10 years of experience as a CPS for ID issues.

CP/CPS with ID Training: 2012 (n=34)	Count	Percent
Current BPS certification in Pharmacotherapy with BCPS-AQID	9	26%
Current BPS certification in Pharmacotherapy without BCPS-AQID	8	24%
Completed an ASHP accredited specialty residency (PGY2) in ID	10	29%
Completed an ASHP accredited general residency(PGY1)	16	47%
Completed an ACCP accredited fellowship in ID	4	12%
Completed other (i.e., Critical care, etc.) accredited post-graduate program	2	6%
SIDP certification	2	6%
MAD-ID certification	2	6%
Over 10 years of experience as a Clinical Pharmacist Specialist for ID issues	14	41%
None of the above	1	3%

Percentages do not total 100 percent because respondents could choose more than one.

(Q19g) At most facilities with an AS team (41/49), the clinical pharmacist/clinical pharmacy specialist oversees the day-to-day operations of the AS Team.

Who typically oversees the day-to-day operations of the AS Team 2012 (n=49)	Count	Percent
Clinical Pharmacist/Clinical Pharmacy Specialist	41	84%
Pharmacy resident	4	8%
ID attending	23	47%
ID fellow	1	2%
Other physician	1	2%
Other	6	12%

Percentages do not total 100 percent because respondents could choose more than one.

(Q19h) At most facilities with an AS team (30/49), the Chief of Infectious Diseases has authority over the AS team function.

Under whose authority does the AS team function? 2012 (n=49)	Count	Percent
P&T Committee	23	47%
Chief of Pharmacy	15	31%
Chief of Medicine	7	14%
Chief of ID	30	61%
Chief of Staff	12	24%
Infection Control Committee	16	33%
Quality Management	5	10%
Other	4	8%

Percentages do not total 100 percent because respondents could choose more than one.

Section IV: AS Activities

(Q20) Thirty-four facilities with inpatient services have a written policy to promote substitution of oral antibiotics for parenteral antibiotics (IV to PO) conversion. At many facilities (15/34), the policy was written in 2012. At 31 of 34 facilities, the policy is approved by the local P&T committee.

Yes Response	2012 (N=130)	
	Count	Percent
Does your facility have a written policy or an informal policy to promote substitution of oral antibiotics for parenteral antibiotics?	34	26%

What year did the policy begin? 2012 (n=34)	Count	Percent
Before 2000	4	12%
2001-2005	3	9%
2006-2010	7	21%
2011	5	15%
2012	15	44%
Is this policy approved by the local P&T committee? Yes (n=34)	31	91%

(Q21) The IV to PO conversion policy at 17 facilities with inpatient services authorizes the AS team to unilaterally change the route of therapy. At those 17 facilities, the Clinical Pharmacy Specialist may make the changes. At five of the facilities, a physician can make the changes. See the table below for the drugs that are covered by the policy.

If an IV to PO conversion policy exists, **is the AS team authorized to unilaterally change the route of therapy? 2012 (N=130)**	Count	Percent
Yes	17	13%
No	39	30%
No policy	74	57%

If yes, **who makes the changes?** *(Check all that apply)* **2012 (n=17)**	Count	Percent
Physician	5	29%
NP/PA	1	6%
Clinical Pharmacy Specialist	17	100%
Other		

Percentages do not total 100 percent because respondents could choose more than one.

Which parenteral drugs are covered by the IV to PO conversion policy? 2012 (n=17)	Count	Percent
Azithromycin	15	88%
Ciprofloxacin	16	94%
Levofloxacin	15	88%
Moxifloxacin	14	82%
Clindamycin	11	65%
Linezolid	15	88%
Metronidazole	15	88%
Minocycline	5	29%
Doxycycline	8	47%
Fluconazole	17	100%
Rifampin	8	47%
Trimethoprim/ Sulfamethoxazole	7	41%
Other	5	29%

Percentages do not total 100 percent because respondents could choose more than one.

(Q22) In 2012, 120 facilities reported restrictions in the use of antibiotic agents, and in 2011, 106 facilities reported restrictions. See the table below for the count of the different restrictions for agents.

Does your facility restrict the use of antibiotic agents?	2012 'Yes' (N=130 Inpt)		2011 'Yes' (N=126 Inpt)	
	Count	Percent	Count	Percent
	120	92%	106	84%

Agent restrictions 2012 (N=130)	None	ID use	Prior approval	Prospective audit for continued use	Local criteria for use	Other restriction
Daptomycin	9	44	65	15	17	4
Linezolid	2	42	67	15	23	4
Vancomycin	81	3	12	20	11	7
Tigecycline	8	42	66	13	14	5
Ceftaroline	9	40	58	12	11	15
Imipenem	41	20	37	18	19	9
Meropenem	12	22	71	18	18	10
Doripenem	9	27	58	13	10	22
Ertapenem	43	20	45	15	16	7
Piperacillin/Tazobactam	91	3	10	15	11	4
Ticarcillin/Clavulanate	60	14	23	13	8	18
Cefepime	68	12	23	18	14	3
Ceftazidime	63	11	25	17	14	7
Aztreonam	66	11	22	17	17	7
Caspofungin	10	32	57	12	12	18

Agent restrictions 2012 (N=130)	None	ID use	Prior approval	Prospective audit for continued use	Local criteria for use	Other restriction
Micafungin	37	26	49	16	10	8
Anidulafungin	6	22	59	9	8	28
Voriconazole	9	29	69	15	15	13
Parenteral Fluconazole	76	12	24	15	11	3
Posaconazole	5	33	72	12	11	14
Lipid-based amphotericin B	29	36	48	14	10	8
Ciprofloxacin	81	4	16	12	19	3
Levofloxacin	47	12	33	15	26	11
Moxifloxacin	74	8	18	12	19	4
Amikacin	61	15	24	14	14	9
Gentamicin	105	1	3	9	7	1
Tobramycin	86	5	14	10	11	5
Colistin	12	37	59	9	9	12
Other	66	9	19	6	6	22

Respondents could choose more than one response per agent

In 2011, 75 facilities reported a retrospective antimicrobial use audit. This question was not asked in 2012, and no facilities identified this in any other category question.

2011	Yes (N=126)	
	Count	Percent
Antimicrobial Preauthorization (Or approval within 24 hours)	70	56%
Policies for criteria for use of certain antimicrobials	89	71%
Prospective antimicrobial use audit	35	28%
Retrospective antimicrobial use audit	75	60%

(Q23) In 2012, most facilities had mechanisms in place for urgent approval of antimicrobial agents that require prior approval. The most frequently selected methods were written consultation in CPRS (80), and telephone consultation with Clinical Pharmacy Specialist or ID provider (88). Thirteen facilities indicated that no antimicrobial agents require approval.

For antimicrobial agents that require prior approval, what mechanism is in place for urgent approvals?	2012 'Yes' (N=130) Count	Percent
Written consultation in CPRS	80	62%
Telephone consultation with Clinical Pharmacist / ID provider	88	68%
Face-to-face encounter with Clinical Pharmacist / ID provider	41	32%
No antimicrobial agents require approval	13	10%

Percentages do not total 100 percent because respondents could choose more than one.

2012 – Yes Response *(Check all that apply)*	Who approves use during weekday normal working hours? (N=130)		Who approves use during nights and/or weekends? (N=130)	
	Count	Percent	Count	Percent
ID Clinical Pharmacist	44	34%	8	6%
Other Clinical Pharmacist	60	46%	50	38%
ID Physician	57	44%	39	30%
ID Fellow	34	26%	34	26%
Other Physician	7	5%	11	8%
Other	3	2%	14	11%
NA			15	12%

2011 – Yes Response	Pager Coverage for antimicrobial approval or questions (N=126)			
	Weekday normal working hours		Nights and / or weekends	
	86	68%	59	47%

(Q24) The majority of facilities do not provide order forms or sets in CPRS for the specific agents noted in the chart below. This was true both in 2012 and 2011.

Which of the following, if any, antimicrobial order forms/sets are available in CPRS for specific agents?	2012 'Yes' (N=130)		2011 'Yes' (N=126)	
	Count	Percent	Count	Percent
Vancomycin	41	32%	32	25%
Aminoglycosides	20	15%	25	20%
Piperacillin/tazobactam	26	20%		
Cefepime	15	12%		
Meropenem	8	6%		
Imipenem	13	10%		
Ciprofloxacin	16	12%		
Moxifloxacin	18	14%		
Other	22	17%	31	25%
None of the above	75	58%		

Percentages do not total 100 percent because respondents could choose more than one for the 2012 responses.

(Q25 a-d) Most inpatient facilities (96) have written clinical pathways guidelines available for specific conditions. In 2012 and 2011, the most common inpatient condition was community acquired pneumonia, 87 and 84 respectively. This was also the most common outpatient condition as well (56).

Are written clinical pathways/antimicrobial therapy guidelines available for any specific conditions?	2012 'Yes' (N=130)	
	Count	Percent
	96	74%

Which inpatient conditions? *(Check all that apply)*	2012 'Yes' (n=130)		2011 'Yes' (N=126)	
	Count	Percent	Count	Percent
Community acquired pneumonia	87	67%	84	67%
Hospital acquired or health care associated pneumonia	63	48%	57	45%
Skin and soft tissue infection	30	23%	29	23%
Urinary tract infection	33	25%	32	25%
Clostridium difficile colitis	43	33%	41	33%
Surgical Prophylaxis	53	41%	82	65%
Other	26	20%	45	36%
Which outpatient conditions? *(Check all that apply)*				
Community acquired pneumonia	56	43%		
Upper respiratory tract infection	23	18%		
Skin and soft tissue infection	26	20%		
Urinary tract infection	23	18%		
Clostridium difficile colitis	32	25%		
Surgical Prophylaxis	35	27%		
Other	10	8%		
None	26	20%		

Were these guidelines developed by the AS Team and/or ID Service?	2012 'Yes' (n=96)	
	Count	Percent
	59	61%

How are these guidelines disseminated?	2012 'Yes' (n=96)	
	Count	Percent
Email	28	29%
Web site	22	23%
Pathways built into CPRS	73	76%
Other	24	25%

(Q26) Most inpatient facilities, either upon request (68) or per protocol (51) provide dose optimization. This is an increase from the 91 facilities that provided dose optimization in 2011.

Dose optimization by pharmacokinetics and pharmacodynamics for any antimicrobial	2012 (N=130)		2011 (N=126)	
	Count	Percent	Count	Percent
Yes, upon request	68	52%	91	72%
Yes, per protocol	51	39%		
No	11	8%	35	28%
If yes, **for which agents?** *(Check all that apply)*	**(n=119)**			
Vancomycin	118	99%		
Aminoglycosides	110	92%		
Extended infusion of piperacillin/tazobactam or other β-lactam	30	25%		
Other	10	8%		

(Q27a-b) Only 24 inpatient facilities reported that the AS team unilaterally changes the dosing of antimicrobial therapy.

Independent of vancomycin or aminoglycoside pharmacokinetic dosing protocols, does the AS team unilaterally (without primary physician approval) change the dosing of antimicrobial therapy?	**2012 (N=130)**	
	Count	**Percent**
Yes, always	5	4%
Yes, usually	10	8%
Yes, seldom	9	7%
No	67	52%
NA	39	30%
If yes, **who makes the changes?** *(Check all that apply)* **(n=24)**		
Physician	7	29%
NP/PA	2	8%
Clinical Pharmacist	24	100%
Other	0	0%

Percentages do not total 100 percent because respondents could choose more than one

If yes, **how are the AS Team's interventions conveyed?** *(Check all that apply)* **(n=24)**	**Count**	**Percent**
Verbal communication	19	79%
CPRS note	20	83%
CPRS alert	3	13%
Email	1	4%
Other	1	4%

Percentages do not total 100 percent because respondents could choose more than one

(Q28) Eight inpatient facilities reported that the AS team can change the selection of antimicrobial therapy.

Yes Response	**2012 N=130**	
(Always 1, Seldom 7)	**Count**	**Percent**
28. Independent of vancomycin or aminoglycoside pharmacokinetic dosing protocols, does the AS team ever unilaterally change the **selection** of antimicrobial therapy?	8	6%
Who makes the changes? (n=8) *(Check all that apply)*		
Physician	5	63%
Nurse Practitioner/Physician Assistant	3	38%
Clinical Pharmacist/Clinical Pharmacy Specialist	7	88%
How are the AS Team's interventions conveyed? (n=8) *(Check all that apply)*		
Verbal Communication	7	88%
CPRS Note	7	88%

(Q29) Nineteen inpatient facilities have a policy for de-escalation of antimicrobials. This is up somewhat from 2011, when only 10 facilities reported having a policy.

Yes Response	2012 (N=130)		2011 (N=126)	
	Count	Percent	Count	Percent
29. Does your facility have a policy/procedure for de-escalation of antimicrobials?	19	15%	10	8%

(Q30) At 59 inpatient facilities, the AS team never systematically reviews antimicrobial use for recommendations regarding de-escalation of antimicrobials.

How often does the AS team systematically review antimicrobial use for recommendations regarding de-escalation of antimicrobials? 2012 (N=130)	Count	Percent
Always	25	19%
Usually	14	11%
Sometimes	17	13%
Seldom	15	12%
Never	59	45%

(Q31) Fifty-six inpatient facilities have a process for timely review of positive blood cultures by the AS team. This is down from 86 facilities reported in 2011.

Yes Response	2012 (N=130)		2011 (N=126)	
	Count	Percent	Count	Percent
Is there a process for timely review of positive blood cultures by the AS team to assure appropriate therapy is being given?	56	43%	86	68%

(Q32a) Thirty-six inpatient facilities reported that automatic ID consults for certain conditions are required. If they are required, it is most often for S. aureus bacteremia.

Yes Response	2012 (N=130)		2011 (N=126)	
Does your facility require automatic ID consults for certain conditions? (N=130)	Count	Percent	Count	Percent
	36	28%	18	14%
If yes, for which conditions? *(Check all that apply)* (n=36)	Count	Percent		
Any bacteremia	12	33%		
S. aureus bacteremia	14	39%		
Other	23	64%		

(33a) Forty-seven inpatient facilities have guidelines for antimicrobial duration. The most used distribution method for the guidelines are upon order entry in CPRS at 28 facilities.

Yes Response	2012 (N=130)		2011 (N=126)	
Does your facility have guidelines for antimicrobial duration?	Count	Percent	Count	Percent
	47	36%	46	37%

If yes, **how are the guidelines distributed to providers?** *(Check all that apply)* **2012 (n=47)**	Count	Percent
Facility Intranet	10	21%
Pocket card/reference	11	23%
At charting locations	2	4%
Upon order entry in CPRS	28	60%
Other	10	21%

(Q34a) Most facilities with inpatient services (98) have automatic stop orders in place for antimicrobial duration. And 89 of those facilities have automatic stop orders for all the listed antimicrobials noted in the survey.

Are there automatic stop orders in place for antimicrobial duration? 2012 (N=130)	Count	Percent
Yes	98	75%
No	32	25%

Which antimicrobials? *(Check all that apply)* **2012 (n=130)**	Count	Percent
1) All	89	68%
2) Azithromycin	1	<1%
3) Ciprofloxacin	1	<1%
4) Moxifloxacin	1	<1%
5) Levofloxacin	1	<1%
6) Vancomycin	4	3%
7) Piperacillin/tazobactam	1	<1%
8) Ertapenem	2	2%
9) Imipenem	3	2%
10) Meropenem	3	2%
11) Doripenem	2	2%
12) Aminoglycosides	3	2%
13) Other	6	5%

(Q35a) Most inpatient facilities (94) offer educational programs for prudent antimicrobial use for their prescribers. For the most part, the programs are available on an as needed basis.

Yes Response	2012 (N=130)		2011 (N=126)	
Are there educational programs for prudent antimicrobial use available to prescribers?	Count	Percent	Count	Percent
	94	72%	57	45%

How often is this program available?	Weekly	Monthly	Quarterly	Annually	As needed	Other
In-person group presentations **(n=81)**	2	11	7	13	40	8
Individual provider academic detailing **(n=43)**	6	2		2	31	2
Webinars **(n=41)**		15	3		18	5
VISN programs **(n=21)**		2	4	1	13	1
Other **(n=17)**	1	3	2	1	7	3

(Q36) Other resources facilities provide for up-to-date information on the principles of antibiotic use are email alerts (51), pharmacy alerts (48), and newsletters (37). Thirty-nine facilities provide no other resources.

Are other resources used to ensure that providers get up-to-date information on the principles of antibiotic use? *(Check all that apply)*	2012 (N=130)	
	Count	Percent
Email alerts	51	39%
Newsletters	37	28%
Pharmacy alerts	48	37%
Other	29	22%
No other resources are used	39	30%

(Q37a) One inpatient facility has an antimicrobial cycling program. The facility reported that Community Acquired Pneumonia protocols are the agents that are cycled.

Yes Response	2012 N=130		2011 N=126	
Does your facility have an antimicrobial cycling program?	Count	Percent	Count	Percent
	1	1%	2	2%

(Q38) Twenty-five facilities with inpatient services have a policy for intervention to limit use of non-*C. difficile* directed antibiotic exposure in order to improve outcomes for patients with *C. difficile* infection.

Does your facility have a policy/review for intervention to limit use of non-*C. difficile* directed antibiotic exposure in order to improve outcomes for patients with Clostridium difficile infection? 2012 'Yes' (N=130)	
Count	Percent
25	19%

Section V: AS Resources

(Q39-40) Most facilities with inpatient services found the AS Task Force National Webinars (70) and the face-to-face AS Task Force meetings (48) either very helpful or helpful. Fifty-six facilities were not aware of these national events, especially the face-to-face AS Task Force meetings (56).

How helpful do you find: 2012 (N=130)	Very helpful	Helpful	Neutral	Not very helpful	Not at all helpful	Not aware of National Events
AS Task Force National Webinars?	21	49	28	8	3	21
Face-to-face AS Task Force meetings?	24	24	21	3	2	56

(Q41a-e) The table below shows how likely facilities are to utilize the listed training event materials.

Because of an AS Taskforce training event, how likely is your facility to: 2012 (N=130)	Very likely	Likely	Neutral	Not very likely	Not at all likely	NA
Address a specific AS ethical dilemma	16	33	28	15	4	34
Prepare or update a facility AS business plan for approval	18	33	25	16	4	34
Prepare or update AS policy (e.g., IV to PO conversion)	28	41	18	8	5	30
Prepare or update a policy limiting Dual Anaerobic Coverage	21	32	21	16	6	34
Prepare or update a policy limiting non-*C. difficile* directed antibiotic exposure in order to improve outcomes for patients with *Clostridium difficile* infection	21	40	22	13	2	32

(Q42-46) The table below shows the how helpful facilities find these nationally offered items.

Select the helpfulness of the following National items: 2012 (N=130)	Very helpful	Helpful	Neutral	Not very helpful	Not at all helpful	Not aware of this National item	NA
AS Taskforce's sample *IV to PO Conversion Policy* in developing or augmenting your local facility's policy	27	41	16	4	1	19	22
Antimicrobial Stewardship SharePoint site	38	44	17	1	1	16	13
AS Taskforce's sample *Avoidance of Double Anaerobic Coverage Policy* in developing or augmenting your local facility's policy	14	37	28	5	2	28	16

Select the helpfulness of the following National items: 2012 (N=130)	Very helpful	Helpful	Neutral	Not very helpful	Not at all helpful	Not aware of this National item	NA
AS Taskforce's sample *Intervention to Improve Outcomes for Patients with C. difficile Infection Policy* in developing or augmenting your local facility's Intervention to Improve Outcomes for Patients with *C. difficile* Infection policy	15	36	29	3	0	28	19
AS Taskforce's sample *Business Plan for AS* in developing or augmenting your local facility's Business Plan for AS	15	34	19	8	1	33	20

(Q47) Most inpatient facilities (87) reported they had not developed a business plan for antimicrobial stewardship.

What is the status of your facility's Business Plan for AS?	2012 (N=130)	
	Count	Percent
Approved	12	9%
Denied	2	2%
In process	29	22%
Not developed	87	67%

(Q48) Most inpatient facilities reported they utilize CPRS to facilitate stewardship activities, 115 in 2012, and 105 in 2011.

Which of the following tools, if any, does your facility use to facilitate stewardship activities *(Check all that apply)*	2012 (N=130)		2011 (N=126)	
	Count	Percent	Count	Percent
CPRS	115	88%	105	83%
VistA	70	54%	81	64%
Proprietary software (e.g., TheraDoc)	14	11%	16	13%
Administrative electronic database (e.g., Corporate Data Warehouse, VISN data warehouse)	23	18%		
Pathfinder/Essence	7	5%		
Other	21	16%	18	14%
None	13	10%		

Section VI: Outcomes

(Q49a-b) Fifty-five inpatient facilities reported they provided group or provider-specific feedback regarding patterns of antimicrobial use. Twenty-nine of these facilities reported feedback is mostly provided on an as need basis. Some form of verbal presentation was the most reported method of delivery (30).

Does your facility provide any group or provider-specific feedback regarding patterns of antimicrobial use? 2012 'Yes' (N=130)	
Count	**Percent**
55	42%

How often is this provided?	2012 (n=55)	
	Count	**Percent**
Daily	1	2%
Monthly	5	9%
Quarterly	11	20%
Annually	7	13%
As needed	29	53%
Other	2	4%

How is it done? *(Check all that apply)*	2012 (n=55)	
	Count	**Percent**
Email alerts	13	24%
Other written correspondence	23	42%
Verbal presentation	30	55%
SharePoint	3	5%
Dashboard on regional or national databases	2	4%
Other	16	29%

Percentages do not total 100 percent because respondents could choose more than one.

(Q50a-c) Most inpatient facilities (71) generated reports based on the clinical outcomes related to antimicrobial use. The most common report generated is *C. difficile* infection rates (60). The reports were mostly generated monthly (33), or quarterly (23). Presentations were generally made to the Infection Control Committee (59) or the P&T Committee (45).

Does your facility generate any reports based on the clinical outcomes related to antimicrobial use? 2012 'Yes' (N=130)	
Count	**Percent**
71	55%

Which reports are generated? *(Check all that apply)*	2012 (n=130)	
	Count	Percent
Adverse drug effect	35	27%
Average length of therapy	12	9%
C. difficile infection rates	60	46%
Antimicrobial resistance rates (independent of the antibiogram, e.g., Carbepenem-resistant gram negatives, extended-spectrum ß-lactamase producing organisms)	41	32%
Other	9	7%

Percentages do not total 100 percent because respondents could choose more than one

How often is this done?	2012 (n=71)	
	Count	Percent
Daily	3	4%
Monthly	33	46%
Quarterly	23	32%
Annually	4	6%
As needed	7	10%
Other	1	1%

Are presentations of the results made to any of the following? *(Check all that apply)*	2012 (n=71)	
	Count	Percent
Providers	17	24%
P&T committee	45	63%
Infection Control Committee	59	83%
Other parts of administration	24	34%
Other	15	21%

Percentages do not total 100 percent because respondents could choose more than one

(Q51) Analyses of antimicrobial susceptibilities independent of the facility Antibiograms (44) is the most common measurement of antimicrobial utilization and outcomes. Many facilities (46) provide no measurements.

Which of the following measurements of antimicrobial utilization and outcomes does your facility use? *(Check all that apply)*	2012 (N=130)		2011 (N=126)	
	Count	Percent	Count	Percent
Defined daily dose (DDD)	18	14%	30	24%
Days of therapy (DOT)	19	15%	28	22%
Antimicrobial expenditures	37	28%	35	28%
Analyses of antimicrobial susceptibilities independent of the facility Antibiograms	44	34%	61	48%
(DRG) length of stay	13	10%	14	11%
Other	6	5%		
None	46	35%		

(Q52) The AS Team at 61 facilities with inpatient services have reported to have done a Medication Usage Evaluation (MUE) for any antibiotic(s) in the last 2 years.

Has the AS team or your facility done a Medication Usage Evaluation (MUE) for any antibiotic(s) in the last 2 years? 2012 'Yes' (N=130)	
Count	**Percent**
61	47%

(Q53d1) Most inpatient facilities (73) did not indicate they provided any measurements of home infusion outcomes. Of those that did, 37 facilities used Labs as a measurement. The most common measurements are: "Labs are sent to the appropriate persons for review" (28), and "Appropriate action performed, if needed, based on the labs" (28).

Which of the following measurements of home infusion outcomes, if any, does your facility use?	2012 'Yes' (N=130)	
	Count	**Percent**
Line infections	39	30%
Antimicrobial toxicities	29	22%
Follow-up arranged	33	25%
Labs	37	28%
None	73	56%

Percentages do not total 100 percent because respondents could choose more than one.

If "Labs" is checked, which of the following outcomes are measured? *(Check all that apply)*	2012 'Yes' (n=37)	
	Count	**Percent**
Labs are ordered appropriately	24	65%
Labs are obtained per orders	26	70%
Labs are sent to the appropriate persons for review	28	76%
Lab review completed in a timely manner (e.g., within 48 hours)	23	62%
Appropriate action performed, if needed, based on the labs	28	76%
None	2	5%

Section VII: AS Barriers/Acceptance

(Q54) Facilities sited several items of support that would be beneficial in achieving optimal antimicrobial use. Among these were IT/data tools support (95) administrative support (79), provider/prescriber buy-in (77), and pharmacy support (75).

What types of support would be beneficial at your facility in achieving optimal antimicrobial use? *(Check all that apply)*	2012 'Yes' (N=130)	
	Count	**Percent**
ID physician support	73	56%
Pharmacy support	75	58%
Administration support	79	61%
Provider/prescriber buy-in	77	59%
IT/data tools support	95	73%
Educational tools support	73	56%
Guidelines support	67	52%
Other support	18	14%

Percentages do not total 100 percent because respondents could choose more than one.

(Q55) Facilities found most services to be receptive or very receptive in all services, especially General Medicine (110) and ICU Medicine (90).

Please rank the individual services at your facility in their general receptiveness of antimicrobial stewardship - related interventions: 2012 (N=130)	Very receptive	Receptive	Neutral	Not very receptive	Not at all receptive	No experience with that service	Service unavailable at facility
Medicine (General)	51	59	9	3	0	6	2
Medicine (ICU)	37	53	11	6	0	6	17
Medicine (Subacute or Transitional Care)	39	44	11	3	0	8	25
Community Living Center	46	37	20	1	1	13	12
Emergency Department	23	47	16	9	1	17	17
Surgery (General)	19	47	27	17	1	6	13
Surgery (ICU)	20	37	24	14	3	9	23
Orthopedic Surgery	31	45	18	5	1	9	21
Cardiothoracic Surgery	10	29	8	9	0	5	69
Neurosurgery	9	26	6	2	0	8	79
Vascular Surgery	19	33	18	14	1	7	38
Urology	19	52	28	10	1	10	10
Otolaryngology	20	33	24	3	0	26	24
Neurology	23	41	19	1	0	28	18
Psychiatry	27	39	24	1	0	36	3
Dental	25	55	16	0	0	31	3
Ophthalmology / Optometry	29	46	20	0	0	31	4
Gynecology	11	23	12	0	0	43	41

Recommendations

Some facilities should consider adding additional stewardship personnel to their staff based on reported results.

Inpatient facilities without an AS Team should consider creating an AS Team.

Facilities that do not have written policies should consider creating written policies to promote substitution of oral antibiotics for parenteral antibiotics to review for IV to PO conversion, avoidance of double anaerobic coverage, and intervention to avoid unnecessary antimicrobial use in patients with *C. difficile* infection. Templates are available on the AS SharePoint site.

Facilities that do not currently restrict the use of antibiotic agents should consider doing so.

Facilities that do not allow the AS Team to change the selection of antimicrobial therapy should consider developing a policy to allow them to do so.

Facilities that do not have a policy for de-escalation of antimicrobials including vancomycin should develop a policy. A template for vancomycin de-escalation is available on the AS SharePoint site.

Facilities without a process for timely review of positive blood cultures by the AS team should develop a process.

Facilities with inpatient ID consultation capabilities should consider developing a policy for automatic ID consults for certain conditions.

Facilities that do not have automatic orders in place for antimicrobial duration should develop policies to do so.

Facilities that do not utilize the template in the AS SharePoint site should consider doing so to develop a business plan for antimicrobial stewardship.

Facilities that do not consult with the AS Task Force for resources to assist with a Medication Usage Evaluation, should consider doing so.

Facilities should consult with the AS Task Force to provide any measurements of home infusion outcomes.

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Appendix A -- Acknowledgements

Technical Advisory Group (TAG)

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We also wish to extend a special thanks to the staff who volunteered to pilot test the survey for their facility. They provided us with valuable knowledge regarding survey burden time, any problems or questions on the survey instrument or other tools used for collection of data from the field.

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Christopher Gentry, PharmD, BCPS - VISN 16, Oklahoma City, OK
Susan Duquaine, PharmD, BCPS, Clinical Pharmacist - VISN 17 - North Texas HCS
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Appendix B -- Survey Instrument
2012 Survey of Antimicrobial Stewardship in VHA

VHA is committed to providing the highest quality health care to Veterans. The goal of this survey is to gather information on the current state of VHA Antimicrobial Stewardship (AS) programs and resources across the VHA system. This new survey will provide both VA Central Office officials and the field with a useful and accessible picture of the characteristics and organization of AS activities, teams, and programs available in VHA.

Purpose: This survey will gather information on the current state of facility level AS activities, programs, personnel, and resources across the VHA system.

The Program Office will use the results for multiple objectives.

- Identify currently available AS experts at facilities
- Understand the current state and effectiveness of AS policies, programs, and education
- Guide operational policies, procedures, standards, and guidelines on best practices for AS activities to provide Veterans with personalized, proactive health care
- Provide data to guide VHA's system-wide AS strategic plan
- Aid in developing and implementing AS programs and expanding existing programs
- Develop a communication plan to promote effective facility level AS programs

Suggested Respondents: Chief of Staff, Chief of Infectious Disease, Chief of Medicine, Chief of Pharmacy, (i.e., individual knowledgeable about AS activities within your medical facility)

All approved VA Integrated Facilities are to submit a single combined response.

Estimated Completion Time: 30-90 minutes (Additional time may be needed to gather information from other departments)

Section I: Point of Contact and Facility/Health Care System (HCS) Information

Name of Point of Contact for survey response: _____
Title: _____
Phone Number (including area code): _____ Extension: _____
What is your VISN Number? (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, 17, 18, 19, 20, 21, 22, 23)
Select Facility and Station Number: (Select from list provided)

AS Point of Contact Information

If you would like to ensure that your facility is notified of activities, national policy, and field guidance please provide:

Name of AS lead physician: _____
Identify the physician's specialty:
( ) Infectious Diseases (ID)
( ) Internal Medicine
( ) Hospitalist
( ) Family Practice
( ) Other *If other,* please specify _____

Name of AS lead Clinical Pharmacist/Clinical Pharmacy Specialist: _____

Name of other AS lead provider: _____
Identify the provider's specialty: *(Check all that apply)*
[ ] Infection Control Professional (ICP)
[ ] Nurse
[ ] Advanced Practice Nurse
[ ] Physician Assistant
[ ] Microbiologist
[ ] Other *If other,* please specify _____

Section II: Facility Components

1. Please provide the number (i.e., head count) of the following medical professionals in your facility. (Please include, VA, Non-VA, WOC, and Fee/ Contract)

ID Attending Physicians (head count) *Mark one each line*	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10+**
a. Full-Time ID Attending Physicians	•	•	•	•	•	•	•	•	•	•	•
b. Part-Time ID Attending Physicians	•	•	•	•	•	•	•	•	•	•	•

Mark one each line		
Does your facility participate in:	**Yes**	**No**
2. ID **fellowship** program?	•	•
3. Internal medicine residency program?	•	•
4. Family practice residency program?	•	•
5. Surgical residency program?	•	•
6. Emergency medicine residency program?	•	•
7. Pharmacy residency program?	•	•
8. ID pharmacy residency program?	•	•

9. Are Clinical Pharmacists/Clinical Pharmacy Specialists assigned to any acute care teams or wards at your hospital/facility? ( ) Yes ( ) No
   a. *If yes,* which teams/wards? *(Please include, VA, Non-VA, WOC, and Fee/Contract)* *(Check all that apply)*
      [ ] 1) Medicine
      [ ] 2) Surgery
      [ ] 3) Combined Medicine/Surgery
      [ ] 4) Intensive Care Unit
      [ ] 5) Community Living Center
      [ ] 6) Step-Down Unit/Telemetry
      [ ] 7) Dialysis Unit
      [ ] 8) Other *If other,* 8a) Please specify _____

10. Please estimate the proportion of general medicine inpatients admitted to hospitalists.
    ( ) 0% ( ) 1-10% ( ) 11-20% ( ) 21-30% ( ) 31-40% ( ) 41-50%
    ( ) 51-60% ( ) 61-70% ( ) 71-80% ( ) 81-90% ( ) 91-100% ( ) No hospitalists
    ( ) No inpatient services

11. Please estimate the proportion of inpatient attending service on general medical ward teams covered by the ID staff.
    ( ) 0% ( ) 1-5% ( ) 6-10% ( ) 11-15% ( ) 16-20% ( ) 21-25%
    ( ) 26-50% ( ) > 50% ( ) No ID staff ( ) No inpatient services

12. Does your facility offer internal VA inpatient ID Consultation Service?
( ) Yes ( ) No ( ) No inpatient services

a. *If no,* who handles ID issues? *(Check all that apply)*
[ ] 1) Non-VA external ID physicians
[ ] 2) Another VA facility's ID physicians via E-Consult or telemedicine
[ ] 3) Non-ID trained (VA or non-VA) physician with interest in ID
[ ] 4) Clinical Pharmacist/Clinical Pharmacy Specialist
[ ] 5) No one in particular handles ID related issues
[ ] 6) Unsure who handles ID related issues
[ ] 7) Other *If other,* 7a) Please specify _____

13. Does your facility have an Emergency Department (ED)? ( ) Yes ( ) No

a. *If yes,* who staffs your main ED?

Check all that apply each line	**Full time VA**	**Part time VA**	**Non VA staff (WOC, Fee/Contract, Other)**	**None**
1) Emergency physician	•	•	•	•
2) Internal medicine physician	•	•	•	•
3) Family practice physician	•	•	•	•
4) Other physician	•	•	•	•
5) Resident physician	•	•	•	•
6) Mid-level provider	•	•	•	•
7) Other provider	•	•	•	•

If other provider, 7a) Please specify _____

b. Is there a Clinical Pharmacist/Clinical Pharmacy Specialist dedicated to staff the ED?
(Please include, VA, Non VA, WOC, and Fee/ Contract) ( ) Yes ( ) No

14. Does your facility offer intravenous (IV) home antimicrobial infusion? ( ) Yes ( ) No
If yes,
a. What is the specialty of the Manager/Director for the Intravenous (IV) home antimicrobial infusion program? *(Check all that apply)*
[ ] 1) General Internist
[ ] 2) Hospitalist
[ ] 3) ID Physician
[ ] 4) Other Physician
[ ] 5) Clinical Pharmacist/Clinical Pharmacy Specialist
[ ] 6) Home Coordinator
[ ] 7) Other *If other,* 7a) Please specify _____
b. Who are the members of the IV home antimicrobial infusion program? *(Check all that apply)*
[ ] 1) VA pharmacy/VA nursing
[ ] 2) VA pharmacy/Contract nursing
a. *If* VA pharmacy/Contract nursing, are services: *(Check all that apply)*
[ ] 1) Contracted year to year
[ ] 2) Contracted patient to patient
[ ] 3) Other *If other,* a) Please specify _____
[ ] 3) Contract pharmacy/VA nursing
a. *If* Contract pharmacy/VA nursing, are services: *(Check all that apply)*
[ ] 1) Contracted year to year
[ ] 2) Contracted patient to patient
[ ] 3) Other *If other,* a) Please specify _____

[ ] 4) Contract pharmacy/contract nursing
a. *If* Contract pharmacy/contract nursing, are services: *(Check all that apply)*
[ ] 1) Contracted year to year
[ ] 2) Contracted patient to patient
[ ] 3) Other *If other,* a) Please specify _____
[ ] 5) Other *If other,* 5a) Please specify _____

15. Does your facility have an on-site microbiology laboratory? ( ) Yes ( ) No

If yes, **answer the following questions:** *Mark one each line*	**Yes**	**No**
a. Does your facility's laboratory service have a director with a doctoral degree who is trained in microbiology?	•	•
b. **Does your facility's microbiology laboratory** selectively report susceptibility to antimicrobial agents? (i.e., suppress reporting for some tests)	•	•
c. **Does your facility's microbiology laboratory** report Minimum Inhibitory Concentration (MICs) for all organisms?	•	•
d. **Does your facility's microbiology laboratory** report MICs for selected organisms?	•	•

d1. *If yes,* which organisms? *(Check all that apply)*
[ ] a) Staphylococcus aureus
[ ] b) Streptococcus pneumoniae
[ ] c) Pseudomonas aeruginosa
[ ] d) Enterobacteriaceae
[ ] e) Other *If other,* e1) Please specify _____

16. Are yearly updated Antibiograms available to all providers? ( ) Yes ( ) No
If yes,
a. How are the data reported? *(Check all that apply)*
[ ] 1) Outpatient
[ ] 2) Inpatient - whole house
[ ] 3) Inpatient - unit specific
[ ] 4) Inpatient/Outpatient combined
[ ] 5) Other *If other,* 5a) Please specify _____
b. How are the data disseminated? *(Check all that apply)*
[ ] 1) Facility Intranet
[ ] 2) Pocket card reference
[ ] 3) Posted at charting locations
[ ] 4) Other *If other,* 4a) Please specify _____

Section III: Antimicrobial Stewardship Policy

17. Does your facility have a formal written policy that establishes an AS program?
( ) Yes ( ) No ( ) In development
If yes,
a. How many years has the policy been in place? ( ) <1 ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 or more years
b. Does the policy address inpatient antibiotic use? ( ) Yes ( ) No ( ) In development ( ) No inpatient services
c. Does the policy address outpatient antibiotic use? ( ) Yes ( ) No ( ) In development
d. Who approved this policy? *(Check all that apply)*
[ ] 1) Local Pharmacy and Therapeutics (P&T) Committee
[ ] 2) Clinical Executive Board
[ ] 3) Chief of Staff
[ ] 4) Other *If other,* 4a) Please specify _____

If no or in development,
e. Is there an informal policy for antimicrobial stewardship? ( ) Yes ( ) No
If yes,
e1) How many years has the policy been in place? ( ) <1 ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 or more years ( ) Unknown
e2) Does the policy address inpatient antibiotic use? ( ) Yes ( ) No ( ) No inpatient services
e3) Does the policy address outpatient antibiotic use? ( ) Yes ( ) No

Check one	Yes	No
18. Does your facility participate in a formal AS collaborative with non-VA facilities in your geographic region?	•	•

Section IV: Antimicrobial Stewardship (AS) Personnel

19. Does your facility have an AS team? ( ) Yes ( ) No ( ) In development
(Antimicrobial Stewardship (AS) Team: For the purposes of the survey, an AS team is defined as a multi-disciplinary group that is composed of at least a physician and Clinical Pharmacist/Clinical Pharmacy Specialist who routinely meet (daily or several times a week) to discuss patient-specific and/or facility-specific AS components.)
If yes,
a. How many years has the team been in existence?
( ) less than 1 year ( ) 1 year to 2 years ( ) 2 years to 3 years ( ) more than 3 years
b. Does the AS team work in or consult in the acute medical/surgical setting?
( ) Yes ( ) No ( ) No inpatients at this facility
c. Does the AS team work in or consult in the outpatient setting? ( ) Yes ( ) No
d. Does the AS team work in or consult in the Community Living Center setting?
( ) Yes ( ) No ( ) No Community Living Center
e. Does the AS team work in or consult in the Dialysis Center setting? ( ) Yes ( ) No ( ) No Dialysis Center

19f. Please tell us about the AS team members' activities and their time effort.
For each member of the team, please note whether they have daily or periodic involvement with AS activities, as well as the percentage of time they spend on AS tasks.
If "No Involvement," enter NA for b. workload credit, and c. % FTEE

19f. Please provide information for the AS team members' activities and time effort.	**a) Team member involvement** *(Choose one)* ( ) Daily Involvement ( ) Periodic Involvement ( ) No Involvement ( ) NA	**b) Is Workload credit captured?** *(Choose one)* ( ) Yes ( ) No ( ) NA	**c) % of FTEE time designated for stewardship** *(Choose one)* 0% 1-10% 11-20% 21-30% 31-40% 41-50% 51-60% 61-70% 71-80% 81-90% 91-100% NA
1) ID Physician			
2) ID Fellow			
3) Medical Resident			
4) Medical Student			
5) Clinical Pharmacist/Clinical Pharmacy Specialist			
6) Pharmacy Resident (PGY1)			
7) Pharmacy Resident (PGY2)			

19f. Please provide information for the AS team members' activities and time effort.	**a) Team member involvement** *(Choose one)* ( ) Daily Involvement ( ) Periodic Involvement ( ) No Involvement ( ) NA	**b) Is Workload credit captured?** *(Choose one)* ( ) Yes ( ) No ( ) NA	**c) % of FTEE time designated for stewardship** *(Choose one)* 0% 1-10% 11-20% 21-30% 31-40% 41-50% 51-60% 61-70% 71-80% 81-90% 91-100% NA
8) Pharmacy Student			
9) MDRO Coordinator			
10) Infection Control Practitioner			
11) Outpatient Provider			
12) Clinical Microbiology Lab Director or Lab Staff			
13) Information Technology Staff			
14) Hospital Administration			

19f5d) If the AS team includes a lead Clinical Pharmacist/Clinical Pharmacy Specialist (CP/CPS), does he/she have ID training? ( ) Yes ( ) No ( ) No lead Clinical Pharmacist/Specialist

19f5d1. If the CP/CPS has ID training, please check the training that applies.
- [ ] a) Current BPS certification in Pharmacotherapy **with** added Qualifications in Infectious Diseases BCPS-AQID
- [ ] b) Current BPS certification in Pharmacotherapy **without** BCPS-AQID
- [ ] c) Completed an ASHP accredited specialty residency (PGY2) in ID
- [ ] d) Completed an ASHP accredited general residency (PGYI)
- [ ] e) Completed an ACCP accredited fellowship in ID
- [ ] f) Completed other (i.e., Critical care, etc.) accredited post graduate program
- [ ] g) SIDP certification
- [ ] h) MAD-ID certification
- [ ] i) Over 10 years experience as a CP/CPS for ID issues
- [ ] j) None of the above

19g. Who typically oversees the day-to-day operations of the AS team? *(Check all that apply)*
- [ ] 1) Clinical Pharmacist/Clinical Pharmacy Specialist
- [ ] 2) Pharmacy resident
- [ ] 3) ID attending
- [ ] 4) ID fellow
- [ ] 5) Other physician
- [ ] 6) Other *If other,* 6a) Please specify _____

19h. Under whose authority does the AS team function? *(Check all that apply)*
- [ ] 1) P&T Committee
- [ ] 2) Chief of Pharmacy
- [ ] 3) Chief of Medicine
- [ ] 4) Chief of ID
- [ ] 5) Chief of Staff
- [ ] 6) Infection Control Committee
- [ ] 7) Quality Management

[ ] 8) Other *If other,* 8a) Please specify _____

Section V: Antimicrobial Stewardship Activities

20. Does your facility have a written policy to promote substitution of oral antibiotics for parenteral antibiotics? (i.e., an IV to PO Conversion policy) ( ) Yes ( ) No *(If no, skip to Q20c)*

If yes,

a. What year did the policy begin?

( ) Before 2000 ( ) 2000 ( ) 2001 ( ) 2002 ( ) 2003 ( ) 2004 ( ) 2005
( ) 2006 ( ) 2007 ( ) 2008 ( ) 2009 ( ) 2010 ( ) 2011 ( ) 2012

b. Is this policy approved by the local P&T committee? ( ) Yes ( ) No ( ) Unknown

If no,

c. Does your facility have an informal policy to promote substitution of oral antibiotics for parenteral antibiotics (i.e., an IV to PO conversion Policy)? ( ) Yes ( ) No

21. *If an IV to PO conversion policy exists,* is the AS team authorized to unilaterally (without primary physician approval) change the route of therapy? ( ) Yes ( ) No ( ) No policy

If yes,

a. Who makes the changes? *(Check all that apply)*

[ ] 1) Physician
[ ] 2) Nurse Practitioner/Physician Assistant (NP/PA)
[ ] 3) Clinical Pharmacist/Clinical Pharmacy Specialist
[ ] 4) Other *If other,* 4a) Please specify _____

b. Which parenteral drugs are covered by the IV to PO conversion policy?	Yes	No
1) Azithromycin	•	•
2) Ciprofloxacin	•	•
3) Levofloxacin	•	•
4) Moxifloxacin	•	•
5) Clindamycin	•	•
6) Linezolid	•	•
7) Metronidazole	•	•
8) Minocycline	•	•
9) Doxycycline	•	•
10) Fluconazole	•	•
11) Rifampin	•	•
12) Trimethoprim/Sulfamethoxazole	•	•
13) Other _____	•	•

If other, 13a) Please specify _____

22. Does your facility restrict the use of antibiotic agents? ( ) Yes ( ) No *(If no, skip to Q23)*

If yes,

a. Please tell us how your facility restricts the use of the following agents?

Check all that apply each line	No restrictions	ID use only	Prior approval	Prospective audit for continued use	Local criteria for use	*If other restriction-* Please specify
1) Daptomycin	•	•	•	•	•	• _____
2) Linezolid	•	•	•	•	•	• _____
3) Vancomycin	•	•	•	•	•	• _____

Check all that apply each line	No restrictions	ID use only	Prior approval	Prospective audit for continued use	Local criteria for use	*If other restriction-* Please specify
4) Tigecycline	•	•	•	•	•	• _____
5) Ceftaroline	•	•	•	•	•	• _____
6) Imipenem	•	•	•	•	•	• _____
7) Meropenem	•	•	•	•	•	• _____
8) Doripenem	•	•	•	•	•	• _____
9) Ertapenem	•	•	•	•	•	• _____
10) Piperacillin/Tazobactam	•	•	•	•	•	• _____
11) Ticarcillin/Clavulanate	•	•	•	•	•	• _____
12) Cefepime	•	•	•	•	•	• _____
13) Ceftazidime	•	•	•	•	•	• _____
14) Aztreonam	•	•	•	•	•	• _____
15) Caspofungin	•	•	•	•	•	• _____
16) Micafungin	•	•	•	•	•	• _____
17) Anidulafungin	•	•	•	•	•	• _____
18) Voriconazole	•	•	•	•	•	• _____
19) Parenteral Fluconazole	•	•	•	•	•	• _____
20) Posaconazole	•	•	•	•	•	• _____
21) Lipid-based ampho B	•	•	•	•	•	• _____
22) Ciprofloxacin	•	•	•	•	•	• _____
23) Levofloxacin	•	•	•	•	•	• _____
24) Moxifloxacin	•	•	•	•	•	• _____
25) Amikacin	•	•	•	•	•	• _____
26) Gentamicin	•	•	•	•	•	• _____
27) Tobramycin	•	•	•	•	•	• _____
28) Colistin	•	•	•	•	•	• _____
29) Other	•	•	•	•	•	• _____

If other agent, 29a) Please specify _____

23. For antimicrobial agents that require prior approval, what mechanism is in place for urgent approvals?
(Check all that apply)
[ ] a. Written consultation in CPRS
[ ] b. Telephone consultation with Clinical Pharmacist/Clinical Pharmacy Specialist (CP/CPS) or ID provider
[ ] c. Face-to- face encounter with Clinical Pharmacist/Clinical Pharmacy Specialist (CP/CPS) or ID provider
[ ] d. No antimicrobial agents require approval *(Skip to Q24)*

Check all that apply each line	ID Clinical Pharmacist/ Clinical Pharmacy Specialist	Other Clinical Pharmacist/ Clinical Pharmacy Specialist	ID Physician	ID Fellow	Other Physician	Other	NA
23e. Who approves use during weekday normal working hours?	•	•	•	•	•	•	•
23f. Who approves use during nights and/or weekends?	•	•	•	•	•	•	•

24. Which of the following, if any, antimicrobial order forms/sets are available in CPRS for specific agents?
(Check all that apply)
[ ] a. Vancomycin
[ ] b. Aminoglycosides
[ ] c. Piperacillin/tazobactam
[ ] d. Cefepime
[ ] e. Meropenem
[ ] f. Imipenem
[ ] g. Ciprofloxacin
[ ] h. Moxifloxacin
[ ] i. Other *If other,* i1) Please specify _____
[ ] j. None of the above

25. Are written clinical pathways/antimicrobial therapy guidelines available for any specific conditions?
( ) Yes ( ) No
If yes,
a. Which inpatient conditions? *(Check all that apply)*
[ ] 1) Community acquired pneumonia
[ ] 2) Hospital acquired or health care associated pneumonia
[ ] 3) Skin and soft tissue infection
[ ] 4) Urinary tract infection
[ ] 5) *Clostridium difficile* colitis
[ ] 6) Surgical Prophylaxis
[ ] 7) No inpatient services
[ ] 8) Other *If other,* 8a) Please specify _____
[ ] 9) None
b. Which outpatient conditions? *(Check all that apply)*
[ ] 1) Community acquired pneumonia
[ ] 2) Upper respiratory tract infection
[ ] 3) Skin and soft tissue infection
[ ] 4) Urinary tract infection
[ ] 5) *Clostridium difficile* colitis
[ ] 6) Surgical Prophylaxis
[ ] 7) Other *If other,* 7a) Please specify _____
[ ] 8) None
c. Were these guidelines developed by the AS Team and/or ID Service? ( ) Yes ( ) No
d. How are these guidelines disseminated?
[ ] 1) Email
[ ] 2) Web site
[ ] 3) Pathways built into CPRS
[ ] 4) Other *If other,* 4a) Please specify _____

26. Does your facility provide dose optimization by pharmacokinetics and pharmacodynamics for any antimicrobial? ( ) Yes, upon request ( ) Yes, per protocol ( ) No
    a. *If yes,* for which agents? *(Check all that apply)*
    [ ] 1) Vancomycin
    [ ] 2) Aminoglycosides
    [ ] 3) Extended infusion of piperacillin/tazobactam or other β-lactam
    [ ] 4) Other *If other,* 4a) Please specify _____

27. Independent of vancomycin or aminoglycoside pharmacokinetic dosing protocols, does the AS team unilaterally (without primary physician approval) change the **dosing** of antimicrobial therapy?
( ) Yes/always ( ) Yes/usually ( ) Yes/seldom ( ) No ( ) NA
    If yes,
    a. Who makes the changes? *(Check all that apply)*
    [ ] 1) Physician
    [ ] 2) Nurse Practitioner/Physician Assistant (NP/PA)
    [ ] 3) Clinical Pharmacist/Clinical Pharmacy Specialist
    [ ] 4) Other *If other,* 4a) Please specify _____

    b. How are the AS Team's interventions conveyed? *(Check all that apply)*
    [ ] 1) Verbal communication
    [ ] 2) CPRS note
    [ ] 3) CPRS alert
    [ ] 4) Email
    [ ] 5) Other *If other,* 5a) Please specify _____

28. Independent of vancomycin or aminoglycoside pharmacokinetic dosing protocols, does the AS team unilaterally (without primary physician approval) change the **selection** of antimicrobial therapy?
( ) Yes/always ( ) Yes/usually ( ) Yes/seldom ( ) No ( ) NA
    If yes,
    a. Who makes the changes? *(Check all that apply)*
    [ ] 1) Physician
    [ ] 2) Nurse Practitioner/Physician Assistant (NP/PA)
    [ ] 3) Clinical Pharmacist/Clinical Pharmacy Specialist
    [ ] 4) Other *If other,* 4a) Please specify _____

    b. How are the AS Team's interventions conveyed? *(Check all that apply)*
    [ ] 1) Verbal communication
    [ ] 2) CPRS note
    [ ] 3) CPRS alert
    [ ] 4) Email
    [ ] 5) Other *If other,* 5a) Please specify _____

Check one	Yes	No
29. Does your facility have a policy/procedure for de-escalation of antimicrobials?	•	•

Check one	Always	Usually	Sometimes	Seldom	Never
30. How often does the AS team systematically review antimicrobial use for recommendations regarding de-escalation of antimicrobials?	•	•	•	•	•

Check one	Yes	No
31. Is there a process for timely review of positive blood cultures by the AS team to assure appropriate therapy is being given? (e.g., within 48 hours)	•	•

32. Does your facility require automatic ID consults for certain conditions? ( ) Yes ( ) No
    a. *If yes,* for which conditions? *(Check all that apply)*
    [ ] 1) Any bacteremia
    [ ] 2) *S. aureus* bacteremia
    [ ] 3) Other *If other,* 3a) Please specify _____

33. Does your facility have guidelines for antimicrobial duration? ( ) Yes ( ) No
    a. *If yes,* how are the guidelines distributed to providers? *(Check all that apply)*
    [ ] 1) Facility Intranet
    [ ] 2) Pocket card/reference
    [ ] 3) At charting locations
    [ ] 4) Upon order entry in CPRS
    [ ] 5) Other *If other,* 5a) Please specify _____

34. Are there automatic stop orders in place for antimicrobial duration? ( ) Yes ( ) No
    a. *If yes,* which antimicrobials? *(Check all that apply)*
    [ ] 1) All
    [ ] 2) Azithromycin
    [ ] 3) Ciprofloxacin
    [ ] 4) Moxifloxacin
    [ ] 5) Levofloxacin
    [ ] 6) Vancomycin
    [ ] 7) Piperacillin/tazobactam
    [ ] 8) Ertapenem
    [ ] 9) Imipenem
    [ ] 10) Meropenem
    [ ] 11) Doripenem
    [ ] 12) Aminoglycosides
    [ ] 13) Other 13a) *If other,* Please specify _____

35. Are there educational programs for prudent antimicrobial use available to prescribers? ( ) Yes ( ) No
    If yes,
    a. Which programs?
    [ ] 1) In-person group presentations, (i.e., lecture) ( ) Yes ( ) No
        a) *If yes,* how often is this program available?
        ( ) Weekly ( ) Monthly ( ) Quarterly ( ) Annually ( ) As needed ( ) Other
        If other, 1) Please specify _____
    [ ] 2) Individual provider academic detailing ( ) Yes ( ) No
        a) *If yes,* how often is this program available?
        ( ) Weekly ( ) Monthly ( ) Quarterly ( ) Annually ( ) As needed ( ) Other
        If other, 1) Please specify _____
    [ ] 3) Webinars ( ) Yes ( ) No
        a) *If yes,* how often is this program available?
        ( ) Weekly ( ) Monthly ( ) Quarterly ( ) Annually ( ) As needed ( ) Other
        If other, 1) Please specify _____
    [ ] 4) VISN programs ( ) Yes ( ) No
        a) *If yes,* how often is this program available?
        ( ) Weekly ( ) Monthly ( ) Quarterly ( ) Annually ( ) As needed ( ) Other
        If other, 1) Please specify _____

[ ] 5) Other ( ) Yes ( ) No
If yes,
a) Please specify _____
b) How often is this program available?
( ) Weekly ( ) Monthly ( ) Quarterly ( ) Annually ( ) As needed ( ) Other
If other, 1) Please specify _____

36. Are other resources used to ensure that providers get up-to-date information on the principles of antibiotic use? *(Check all that apply)*
[ ] a. Email alerts
[ ] b. Newsletters
[ ] c. Pharmacy alerts
[ ] d. Other *If other,* d1) Please specify _____
[ ] e. No other resources are used

37. Does your facility have an antimicrobial cycling program? ( ) Yes ( ) No
a. *If yes,* please provide an example of what agents are cycled. _____

Check one	Yes	No
38. Does your facility have a policy/review for intervention to limit use of non-*C. difficile* directed antibiotic exposure in order to improve outcomes for patients with *Clostridium difficile* infection?	•	•

Section VI: Antimicrobial Stewardship Resources

Mark one each line	Very helpful	Helpful	Neutral	Not very helpful	Not at all helpful	Not aware of National Events
39. How helpful do you find AS Taskforce National Webinars?	•	•	•	•	•	•
40. How helpful do you find face-to-face AS Task force meetings?	•	•	•	•	•	•

Mark one each line	Very likely	Likely	Neutral	Not very likely	Not at all likely	NA
41. Because of an AS Taskforce training event, how likely is your facility to: a. Address a specific AS ethical dilemma	•	•	•	•	•	•
b. Prepare or update a facility AS business plan for approval	•	•	•	•	•	•
c. Prepare or update AS policy (e.g., IV to PO conversion)	•	•	•	•	•	•
d. Prepare or update a policy limiting Dual Anaerobic Coverage	•	•	•	•	•	•
e. Prepare or update a policy limiting non-*C. difficile* directed antibiotic exposure in order to improve outcomes for patients with *Clostridium difficile* infection	•	•	•	•	•	•

Select the helpfulness of the following **National** items: *Mark one each line*	**Very helpful**	**Helpful**	**Neutral**	**Not very helpful**	**Not at all helpful**	**Not aware of this National item**	**NA**
42. AS Taskforce's sample *IV to PO Conversion Policy* in developing or augmenting your local facility's IV to PO conversion policy	•	•	•	•	•	•	•
43. Antimicrobial Stewardship SharePoint site	•	•	•	•	•	•	•
44. AS Taskforce's sample *Avoidance of Double Anaerobic Coverage Policy* in developing or augmenting your local facility's Avoidance of Double Anaerobic Coverage policy	•	•	•	•	•	•	•
45. AS Taskforce's sample *Intervention to Improve Outcomes for Patients with* C. difficile *Infection Policy* in developing or augmenting your local facility's Intervention to Improve Outcomes for Patients with *C. difficile* Infection policy	•	•	•	•	•	•	•
46. AS Taskforce's sample *Business Plan for AS* in developing or augmenting your local facility's Business Plan for AS	•	•	•	•	•	•	•

47. What is the status of your facility's Business Plan for AS?
( ) Approved ( ) Denied ( ) In process ( ) Not developed

48. Which of the following tools, if any, does your facility use to facilitate stewardship activities?
(Check all that apply)
[ ] a. CPRS
[ ] b. VistA
[ ] c. Proprietary software (e.g., TheraDoc)
[ ] d. Administrative electronic database (e.g., Corporate Data Warehouse, VISN data warehouse)
[ ] e. Pathfinder/Essence
[ ] f. Other *If other,* f1) Please specify _____
[ ] g. None

Section VII: Outcomes

49. Does your facility provide any group or provider-specific feedback regarding patterns of antimicrobial use?
( ) Yes ( ) No
If yes,
a. How often is this provided?
( ) Daily
( ) Weekly
( ) Monthly
( ) Quarterly
( ) Annually
( ) As needed
( ) Other *If other,* a1) Please specify _____
b. How is it done? *(Check all that apply)*
[ ] 1) Email alerts
[ ] 2) Other written correspondence

[ ] 3) Verbal presentation
[ ] 4) SharePoint
[ ] 5) Dashboard on regional or national databases
[ ] 6) Other *If other,* 6a) Please specify _____

50. Does your facility generate any reports based on the clinical outcomes related to antimicrobial use?
( ) Yes ( ) No
If yes,
a. Which reports are generated? *(Check all that apply)*
[ ] 1) Adverse drug effect
[ ] 2) Average length of therapy
[ ] 3) *C. difficile* infection rates
[ ] 4) Antimicrobial resistance rates (independent of the antibiogram, e.g., Carbepenem-resistant gram negatives, extended-spectrum ß-lactamase producing organisms)
[ ] 5) Other *If other,* 5a) Please specify _____
b. How often is this done?
( ) Daily
( ) Weekly
( ) Monthly
( ) Quarterly
( ) Annually
( ) As needed
( ) Other *If other,* b1) Please specify _____
c. Are presentations of the results made to any of the following? *(Check all that apply)*
[ ] 1) Providers
[ ] 2) P&T committee
[ ] 3) Infection Control Committee
[ ] 4) Other parts of administration
[ ] 5) Other *If other,* 5a) Please specify _____
[ ] 6) No presentations are made

51. Which of the following measurements of antimicrobial utilization and outcomes does your facility use?
(Check all that apply)
[ ] a. Defined daily dose (DDD)
[ ] b. Days of therapy (DOT)
[ ] c. Antimicrobial expenditures
[ ] d. Analyses of antimicrobial susceptibilities independent of the facility Antibiograms (i.e., tracking specific bacterial resistance)
[ ] e. Diagnosis Related Group (DRG) length of stay
[ ] f. Other *If other,* f1) Please specify _____
[ ] g. None

52. Has the AS team or your facility done a Medication Usage Evaluation (MUE) for any antibiotic(s) in the last 2 years? ( ) Yes ( ) No
a. *If yes,* please list which antibiotic(s) _____

53. Which of the following measurements of home infusion outcomes, if any, does your facility use?
(Check all that apply)
[ ] a. Line infections
[ ] b. Antimicrobial toxicities
[ ] c. Follow-up arranged
[ ] d. Labs
[ ] e. None

d1) *If "Labs" is checked*, which of the following outcomes are measured? *(Check all that apply)*
[ ] a) Labs are ordered appropriately
[ ] b) Labs are obtained per orders
[ ] c) Labs are sent to the appropriate persons for review
[ ] d) Lab review completed in a timely manner (e.g., within 48 hours)
[ ] e) Appropriate action performed, if needed, based on the labs
[ ] f) None

Section VIII: Antimicrobial Stewardship Barriers

54. What types of support would be beneficial at your facility in achieving optimal antimicrobial use?
(Check all that apply)
[ ] a. ID physician support
[ ] b. Pharmacy support
[ ] c. Administration support
[ ] d. Provider/prescriber buy-in
[ ] e. IT/data tools support
[ ] f. Educational tools support
[ ] g. Guidelines support
[ ] h. Other support *If other,* h1) Please specify _____

55. Please rank the individual services at your facility in their general receptiveness of antimicrobial stewardship - related interventions:

Mark one each line	**Very receptive**	**Receptive**	**Neutral**	**Not very receptive**	**Not at all receptive**	**No experience with that service**	**Service unavailable at facility**
a. Medicine (General)	•	•	•	•	•	•	•
b. Medicine (ICU)	•	•	•	•	•	•	•
c. Medicine (Subacute or Transitional Care)	•	•	•	•	•	•	•
d. Community Living Center	•	•	•	•	•	•	•
e. Emergency Department	•	•	•	•	•	•	•
f. Surgery (General)	•	•	•	•	•	•	•
g. Surgery (ICU)	•	•	•	•	•	•	•
h. Orthopedic Surgery	•	•	•	•	•	•	•
i. Cardiothoracic Surgery	•	•	•	•	•	•	•
j. Neurosurgery	•	•	•	•	•	•	•
k. Vascular Surgery	•	•	•	•	•	•	•

Mark one each line	Very receptive	Receptive	Neutral	Not very receptive	Not at all receptive	No experience with that service	Service unavailable at facility
l. Urology	•	•	•	•	•	•	•
m. Otolaryngology	•	•	•	•	•	•	•
n. Neurology	•	•	•	•	•	•	•
o. Psychiatry	•	•	•	•	•	•	•
p. Dental	•	•	•	•	•	•	•
q. Ophthalmology/ Optometry	•	•	•	•	•	•	•
r. Gynecology	•	•	•	•	•	•	•

Section IX: Additional Comments

56. If desired, please add any additional comments and/or clarifications.

Thank you for your time and cooperation!

Appendix C -- Definitions and Acronyms

Definitions

Antimicrobial Stewardship (AS) Program: The AS Guidelines (CID Jan 2007)[1] define an AS Program as a multidisciplinary activity that includes appropriate selection, dosing, route, and duration of antimicrobial therapy. The primary goal is to optimize clinical outcomes while minimizing unintended consequences of antimicrobial use, including toxicity, the selection of pathogenic organisms, and the emergence of resistance. Appropriate use of antimicrobials is an essential part of patient safety. The combination of effective AS with a comprehensive infection control program limits the emergence and transmission of antimicrobial-resistant bacteria. A secondary goal of AS is to reduce health care costs without adversely affecting quality of care.

Antimicrobial Stewardship Lead: Primary point of contact at the facility who is knowledgeable about AS activities.

Antimicrobial Stewardship (AS) Team: For the purposes of the survey, an AS team is defined as a multi-disciplinary group that is composed of at least a physician and Clinical Pharmacist/Clinical Pharmacy Specialist who routinely meet (daily or several times a week) to discuss patient-specific and/or facility-specific AS components.

AS Policy: A written policy document that pertains specifically to AS activities. The policy mandates action that includes appropriate selection, dosing, route, and duration of antimicrobial therapy for use in the program and is usually a directive, handbook, or VHA memorandum.

Clinical Pharmacist/Clinical Pharmacy Specialist: A Clinical Pharmacist/Clinical Pharmacy Specialist is a licensed pharmacist who has completed an American Council on Pharmaceutical Education (ACPE), accredited Doctor of Pharmacy (Pharm. D.) program or has at least 1 year of pharmacy equivalent experience at the next lower level. The Clinical Pharmacist/Clinical Pharmacy Specialist has duties and responsibilities as defined in VHA Handbook 5005, Part 2, Appendix G15, Licensed Pharmacist Qualification Standards. The Clinical Pharmacist/Clinical Pharmacy Specialist is considered a full performance pharmacist position. It is important to note that Clinical Pharmacists/Clinical Pharmacy Specialists may function under approved guidance and policy without requiring an individual medication prescriptive authority (advanced scope of practice).

Formal Policy: A written policy document mandating action for use in the program. This is usually a directive, handbook, or VHA memorandum.

Informal Policy: A general policy used at the facility; however no formal document has been created.

Pharmacy and Therapeutics (P&T) Approved Policy: A policy that has been submitted, reviewed, and approved by the facility's Pharmacy and Therapeutics (P&T) Committee.

Head Count: The actual count of employees, whether they are part-time or full-time.

Full-Time Equivalent Employee (FTEE): FTEE hours is the ratio of the regular 40 hours per week to the actual number of hours worked per week. One 40 hours per week = 1.0 FTEE for one full-time employee. Any employee working less than 40 hours per week is a part-time employee.

Sample FTEE Hours per Week Conversion:

1.0 FTEE = 40+ hours .750 FTEE = 30 hours .500 FTEE = 20 hours .250 FTEE = 10 hours

.200 FTEE = 8 hours .150 FTEE = 6 hours .100 FTEE = 4 hours .050 FTEE = 2 hours

AS Designated FTEE: The actual percentage of FTEE for an employee specifically dedicated to AS.

Workload credit captured: The amount of work performed on a specific task by a specific individual collected by a formalized mechanism to credit the individual performing that task.

Acronyms

ACCP	American College of Clinical Pharmacy
ASHP	American Society of Health-System Pharmacists
AS	Antimicrobial Stewardship
BCPS-AQID	Board Certified Pharmacotherapy Specialist - Added Qualifications in Infectious Diseases
BPS	Board of Pharmaceutical Specialties
CPRS	Computerized Patient Record System
DDD	Defined Daily Dose
DOT	Days of Therapy
DRG	Diagnostic Related Group
ED	Emergency Department
FTEE	Full-time Equivalent Employee
ICP	Infection Control Professional
ID	Infectious Diseases
IT	Information Technology
IV to PO	Intravenous to per/or by mouth
MAD-ID	Making a Difference in Infection Diseases Pharmacotherapy Certification
MDRO	Multiple Drug Resistant Organisms
MIC	Minimum Inhibitory Concentration
MRSA	Multidrug-Resistant Staphylococcus Aureus
MUE	Medication Usage Evaluation
NA	Not applicable
NP/PA	Nurse Practitioner/Physician Assistant
PGYI	Post-Graduate Year 1
PGY2	Post-Graduate Year 2
P&T	Pharmacy and Therapeutics Committee
SIDP	Society for Infectious Diseases Pharmacists
VistA	Veterans Health Information Systems and Technology Architecture
VHA	Veterans Health Administration
VISN	Veterans Integrated Service Network
WOC	Without Compensation

Appendix D -- Participating Facilities

VISN 1 (8)
Bedford, MA-518
Boston HCS-523
*Central Western Massachusetts HCS-631**
Connecticut HCS-689
Maine VA HCS-402
*Manchester, NH-608**
Providence, RI-650
White River Junction, VT-405

VISN 2 (5)
Albany, NY-528A8
Bath, NY-528A6
Canandaigua, NY-528A5
Syracuse, NY-528A7
Western New York HCS-528

VISN 3 (5)
Bronx, NY-526
Hudson Valley HCS-620
New Jersey HCS-561
New York Harbor HCS-630
Northport, NY-632

VISN 4 (10)
Altoona, PA-503
Butler, PA-529
Clarksburg, WV-540
Coatesville, PA-542
Erie, PA-562
Lebanon, PA-595
Philadelphia, PA-642
Pittsburgh HCS-646
Wilkes-Barre, PA-693
Wilmington, DE-460

VISN 5 (3)
Martinsburg, WV-613
Maryland HCS-512
Washington, DC-688

VISN 6 (8)
Asheville, NC-637
Beckley, WV-517
Durham, NC-558
Fayetteville, NC-565
Hampton, VA-590
Richmond, VA-652
Salem, VA-658
Salisbury, NC-659

VISN 7 (8)
Augusta, GA-509
Birmingham, AL-521
Central Alabama HCS-619
Charleston, SC-534
Columbia, SC-544
Decatur, GA-508
Dublin, GA-557
Tuscaloosa, AL-679

***No inpatient services**

VISN 8 (7)
Bay Pines HCS-516
Caribbean HCS-San Juan-672
Miami HCS-546
North Florida-South Georgia HCS-573
Orlando, FL-675
Tampa, FL-673
West Palm Beach, FL-548

VISN 9 (6)
Huntington, WV-581
Lexington, KY-596A4
Louisville, KY-603
Memphis, TN-614
Mountain Home, TN-621
Tennessee Valley HCS-626

VISN 10 (5)
Chillicothe, OH-538
Cincinnati, OH-539
Cleveland, OH-541
*Columbus, OH-757**
Dayton, OH-552

VISN 11 (7)
Ann Arbor HCS-506
Battle Creek, MI-515
Detroit, MI-553
Illiana HCS-550
Indianapolis, IN-583
Northern Indiana HCS-610
Saginaw, MI-655

VISN 12 (7)
Chicago HCS-537
Hines, IL-578
Iron Mountain, MI-585
Madison, WI-607
Milwaukee, WI-695
North Chicago, IL-556
Tomah, WI-676

VISN 15 (7)
Columbia, MO-589A4
Eastern Kansas HCS-589A5
Kansas City, MO-589
Marion, IL-657A5
Poplar Bluff, MO-657A4
St. Louis, MO-657
Wichita, KS-589A7

VISN 16 (10)
Alexandria, LA-502
Central Arkansas HCS-598
Fayetteville, AR-564
Gulf Coast HCS-520
Houston, TX-580
Jackson, MS-586
Muskogee, OK-623
Oklahoma City, OK-635
Shreveport, LA-667
*Southeast Louisiana HCS-629**

VISN 17 (4)
Central Texas HCS-674
North Texas HCS-549
South Texas HCS-671
*Texas Valley Coastal Bend HCS-740**

VISN 18 (7)
Amarillo HCS-504
*El Paso HCS-756**
New Mexico HCS-501
Northern Arizona HCS-649
Phoenix, AZ-644
Southern Arizona HCS-678
West Texas HCS-519

VISN 19 (6)
Cheyenne, WY-442
Eastern Colorado HCS-554
Grand Junction, CO-575
Montana HCS-436
Salt Lake City HCS-660
Sheridan, WY-666

VISN 20 (8)
*Alaska HCS-463**
Boise, ID-531
Portland, OR-648
Puget Sound HCS-663
Roseburg HCS-653
Spokane, WA-668
*Walla Walla, WA-687**
*White City, OR-692**

No inpatient services

VISN 21 (6)
Central California HCS-570
Northern California HCS-612A4
*Pacific Islands HCS-459**
Palo Alto HCS-640
San Francisco, CA-662
Sierra Nevada HCS-654

VISN 22 (5)
Greater Los Angeles HCS-691
Loma Linda HCS-605
Long Beach HCS-600
San Diego HCS-664
Southern Nevada HCS-593

VISN 23 (8)
Black Hills HCS-568
Central Iowa HCS-636A6
Fargo VA HCS-437
Iowa City VA HCS-636A8
Minneapolis VA HCS-618
Nebraska-Western Iowa HCS-636
Sioux Falls VA HCS-438
St Cloud VA HCS – 656

Appendix E -- References

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Association of inpatient antimicrobial utilization measures with antimicrobial stewardship activities and facility characteristics of Veterans Affairs medical centers

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Running title: VA antimicrobial utilization variability

Word count: 2791
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Abstract:

Background: Antimicrobial stewardship programs (ASPs) have been advocated to improve antimicrobial utilization, but program implementation is variable.

Objective: To determine associations between ASPs and facility characteristics and inpatient antimicrobial utilization measures in the Veterans Affairs (VA) system in 2012.

Design: In 2012, VA administered a survey on antimicrobial stewardship practices to designated ASP contacts at VA acute care hospitals. From the survey, we identified 34 variables across three domains (evidence, organizational context, and facilitation) that were assessed using Multivariable Least Absolute Shrinkage and Selection Operator (LASSO) regression against four antimicrobial utilization measures from 2012: aggregate acute care antimicrobial use, antimicrobial use in patients with non-infectious primary discharge diagnoses, missed opportunities to convert from parenteral to oral antimicrobial therapy, and double anaerobic coverage.

Setting: All 130 VA facilities with acute care services.

Results: Variables associated with at least 3 favorable changes in antimicrobial utilization included presence of postgraduate physician/pharmacy training programs, number of antimicrobial-specific order sets, frequency of systematic de-escalation review, presence of pharmacists and/or Infectious Diseases (ID) attendings on acute care ward teams, and formal ID training of the lead ASP pharmacist. Variables associated with 2 unfavorable measures included bed size, the level of engagement with VA Antimicrobial Stewardship Task Force online resources, and utilization of antimicrobial stop orders.

Conclusions: Formalization of ASP processes and presence of pharmacy and ID expertise are associated with favorable utilization. Systematic de-escalation review and order set establishment may be high-yield interventions.

Key words: antimicrobial stewardship, inpatient, antibiotics, infectious diseases

Introduction:

The deleterious impact of inappropriate and/or excessive antimicrobial usage is well recognized. In the United States, the Centers for Disease Control and Prevention (CDC) estimates that at least 2 million people become infected with antimicrobial-resistant bacteria with 23,000 subsequent deaths and at least $1 billion in excess medical costs per year.[1]

In response, many healthcare organizations have developed antimicrobial stewardship programs (ASPs). Guidelines co-sponsored by the Infectious Diseases Society of America (IDSA) and the Society for Healthcare Epidemiology of America, as well as recent statements from the CDC and the Transatlantic Taskforce on Antimicrobial Resistance (TATFAR), all recommend core ASP elements.[2-5] The guidelines provide general recommendations on ASP structure, strategies, and activities. The recommended ASP *structure* is a team of physicians and pharmacists that collaborate with facility governing committees and other stakeholders to optimize antimicrobial use. While personnel with expertise in infectious diseases (ID) often lead ASPs, hospitalists are also recognized as key contributors, especially in quality improvement.[6, 7] Recommended *strategies* include prospective audit of antimicrobial use with intervention and feedback and formulary restriction with preauthorization. Recommended *activities* include education, creation of guidelines, clinical pathways, and order forms, and programs to promote de-escalation and conversion from parenteral (IV) to oral (PO) antimicrobial therapy. However, limited evidence exists regarding the effectiveness of these ASP core elements.[8, 9] While Cochrane reviews found clear evidence that particular stewardship strategies (e.g., audit and feedback, formulary restriction, guidelines implemented with or without feedback, protocols, computerized decision support) can be effective in reducing antimicrobial usage and improving clinical outcomes over the long term, little evidence exists favoring one strategy over another.[8]

Furthermore, most individual studies of ASPs are single-center, making their conclusions less generalizable.

In 2012, the VA National Antimicrobial Stewardship Task Force (ASTF), in conjunction with the VA Healthcare Analysis and Information Group (HAIG administered a survey on the characteristics of ASPs at all 130 acute care VA facilities (Appendix A). We used these survey results to first build an implementation model and then assess associations between facility-level variables and four antimicrobial utilization measures.

Materials and methods:

Survey and Data

In 2011, the ASTF was chartered to develop, deploy, and monitor a strategic plan for optimizing antimicrobial therapy management. Monthly educational webinars and sample policies were offered to all facilities, including a sample business plan for stewardship and policies to encourage de-escalation from broad-spectrum antimicrobials, promote conversion from parenteral to oral antimicrobial therapy, avoid unnecessary double anaerobic coverage, and mitigate unnecessary antimicrobial usage in the context of *Clostridium difficile* infection.[10]

At the time that ASTF was chartered, the understanding of how ASP structures across VA facilities were structured was limited. Hence, to capture baseline institutional characteristics and stewardship activities, the ASTF in conjunction with HAIG developed an inventory assessment of ASPs that was distributed online in November 2012. All 130 VA facilities providing inpatient acute care services responded.

We derived 57 facility characteristics relevant to antimicrobial utilization and conducted a series of factor analyses to simplify the complex dataset and identify underlying latent

constructs. We categorized resulting factors ~~them~~ into domains of evidence, context, or facilitation as guided by the Promoting Action on Research Implementation in Health Services (PARiHS) framework.[11] Briefly, the evidence domain describes how the facility uses codified and non-codified sources of knowledge (e.g. research evidence, clinical experience).~~;~~ Oorganizational context is a facility's characteristics that ensure a more conducive environment to get evidence into practice (e.g. supportive leadership, organizational structure, evaluative systems).~~;~~ Ffacilitation emphasizes a facility personnel's "state of preparedness" and receptivity to implementation. ~~Then, in order to reduce the number of variables~~

~~We began our analyses~~Using factor analysis to identify facility factors as correlates of the outcomes, we , ~~to examine against our four outcomes, we examined~~by first examined~~ing~~ polychoric correlations among facility characteristics to ~~determine which characteristics were highly correlated with each other and could thus be combined into a single variable~~assess multicollinearity. We then performed ~~This was done using~~ independent component analysis to create latent constructs of variables that were defined by factor loadings (which indicated the proportion of variance accounted for by the construct) and uniqueness factors (which determined how well the variables were interpreted by the construct)~~, retaining~~ . Factors retained included variables ~~for combination~~ that had uniqueness values of less than 0.7 and factor loadings greater than 0.3. ~~Facility characteristic~~Those~~s~~ associated with uniqueness values greater than 0.7 were left as single items ~~in the final model~~, as were characteristics deemed *a priori* to be particularly important to antimicrobial stewardship. Factor scales that had only two items were converted into indices, while factors scores were generated for those ~~those~~factors that contained three or more ~~facility characteristics~~items~~represented as~~~~ether they were best represented as individual~~

~~variables, indices (summarizing 2 characteristics) or factor scores (which contain 3 or more characteristics) in a process fully described elsewhere (Chou, et al, manuscript submitted).~~[12-15~~12~~]

Data for facility-level antimicrobial utilization measures were obtained from the VA Corporate Data Warehouse from calendar year 2012. The analysis was conducted within the VA Informatics and Computing Infrastructure (VINCI). All study procedures were approved by the VA Central Institutional Review Board.

Measures

Four utilization measures were defined as dependent measures: (1) Overall antimicrobial use; (2) Antimicrobial use in patients with non-infectious discharge diagnoses; (3) Missed opportunities to convert from parenteral to oral antimicrobial therapy; and (4) Missed opportunities to avoid double anaerobic coverage with metronidazole.

Overall antimicrobial use was defined as total acute care (i.e., medical/surgical/intensive care) antibacterial use for each facility aggregated as per CDC National Healthcare Safety Network Antimicrobial Use Option guidelines (antimicrobial days per 1000 patient days present). A sub-analysis of overall antimicrobial use was restricted to **antimicrobial use among patients without an infection-related discharge diagnosis**, as we surmised that this measure may capture a greater proportion of potentially unnecessary antimicrobial use. International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)[16~~13~~] codes for infectious processes were identified by a combination of (1) those identified previously in the literature,[17~~14~~] and (2) those identified by finding the descendants of all infections identified in the Systematized Nomenclature of Medicine--Clinical Terms (SNOMED CT).[18~~15~~] Next, all remaining codes for principal discharge diagnoses for which antimicrobials were administered were reviewed for potential indications for systemic

antibacterial use. Discharges were considered non-infectious if no codes were identified when systemic antimicrobials were or could be indicated. For this measure, antimicrobial days were not counted if administered on or one day after the calendar day of surgery warranting antimicrobial prophylaxis.

Missed opportunities for conversion from parenteral to oral (IV to PO) formulations of highly bioavailable oral antimicrobials (ciprofloxacin, levofloxacin, moxifloxacin, azithromycin, clindamycin, linezolid, metronidazole, and fluconazole) were defined as the percentage of days of unnecessary IV therapy that were given when PO therapy could have been used among patients who were not in intensive care units at the time of antimicrobial administration who were receiving other oral medications, using previously described methodology.[19~~16~~] **Missed opportunities for avoiding redundant anaerobic coverage with metronidazole** were defined as the percentage of days in which patients receiving metronidazole also received antibiotics with activity against anaerobic bacteria, specifically beta-lactam/beta-lactamase inhibitors, carbapenems, cefotetan/cefoxitin, clindamycin, moxifloxacin, or tigecycline), using previously described methodology.[20~~17~~] Patients for whom *C. difficile* testing was either ordered or positive within the prior 28 days (indicating potential clinical concern for *C. difficile* infection) were excluded from this endpoint.

Analysis

The variables derived above were entered into a multivariable model for each of the 4 antimicrobial utilization measures. Least Absolute Shrinkage and Selection Operator (LASSO) regression was used to determine significant associations between variables and individual utilization measures.[21~~18~~] LASSO was chosen because it offers advantages over traditional subset selection approaches in large multivariable analyses by assessing covariates simultaneously

rather than sequentially, supporting prediction rather than estimation of effect.[22~~19~~] P-values were not reported as they are not useful in determining statistical significance in this methodology. A tuning parameter of 0.025 was determined for the model based on a cross-validation approach. Significant variables remaining in the model are reported with the percent change in each utilization measure per unit change in the variable of interest. For binary factors, percent change is reported according to whether the variable is present or not. For ordinal variables, percent change is reported according to incremental increase in ordinal score. For continuous variables or variables represented by factor or index scores, percent change is reported per each 25% increase in the range of the score.

Results:

Inpatient facility antimicrobial stewardship characteristics and antimicrobial utilization:

Frequencies of key facility characteristics that contributed to variable development are included in Table 1. Full survey results across all facilities are included in Appendix C. Factor analysis reduced the total number of variables to 32; we also included hospital size and VA complexity score. Thus, 34 variables were evaluated for association with antimicrobial utilization measures: 4 in the evidence domain, 23 in the context domain, and 7 in the facilitation domain (Table 2).

Median facility antimicrobial use was 619 antimicrobial days per 1000 days present (interquartile range (IQR) 554-700; overall range 346-974). Median facility non-infectious antimicrobial use was 236 per 1000 days present (IQR 200-286). Missed opportunities for conversion from IV to PO antimicrobial therapy were common, with a median facility value of 40.4% (391/969) of potentially eligible days of therapy (IQR 32.2-47.8%). Missed opportunities

to avoid double anaerobic coverage were less common (median 15.3% (186/1214) of potentially eligible days of therapy, IQR 11.8%-20.2%) (Figure 1).

Overall antimicrobial use:

Four variables were associated with decreased overall antimicrobial use, though with small magnitude of change: presence of postgraduate physician/pharmacy training programs (0.03% decrease per quarter increase in factor score; on the order of 0.2 antimicrobial days per 1000 patient days present), presence of pharmacists and/or ID attendings on general medicine ward teams (0.02% decrease per quarter increase in index score), frequency of systematic de-escalation review (0.01% decrease per ordinal increase in score), and degree of involvement of ID physicians and/or fellows in antimicrobial approvals (0.007% decrease per quarter increase in index score). There were no variables associated with increased overall antimicrobial use.

Antimicrobial use among discharges without infectious diagnoses:

Six variables were associated with decreased antimicrobial use in patients without infectious discharge diagnoses, while four variables were associated with increased use. Variables associated with the greatest magnitude of decreased use included facility educational programs for prudent antimicrobial use (1.8%; on the order of 4 antimicrobial days per 1000 patient days present), frequency of systematic de-escalation review (1.5% per incremental increase in score), and whether a facility's lead antimicrobial stewardship pharmacist had ID training (1.3%). Also significantly associated with decreased use was a factor summarizing the presence of four condition-specific stewardship processes (de-escalation policies, policies for addressing antimicrobial use in the context of *C. difficile* infection, blood culture review, and automatic ID consults for certain conditions) (0.6% per quarter increase in factor score range), the extent to which postgraduate physician/pharmacy training programs were present (0.6% per

quarter increase in factor score range), and the number of electronic antimicrobial-specific order sets present (0.4% per order set). The variables associated with increased use of antimicrobials included the presence of antimicrobial stop orders (4.6%), the degree to which non-ID physicians were involved in antimicrobial approvals (0.7% per increase in ordinal score), the level engagement with ASTF online resources (0.6% per quarter increase in factor score range), and hospital size (0.6% per 50-bed increase).

Missed opportunities for parenteral to oral antimicrobial conversion:

Missed opportunities for IV to PO antimicrobial conversion had the largest number of significant associations with organizational variables: 14 variables were associated with fewer missed opportunities, while 5 were associated with greater missed opportunities. Variables associated with the largest reductions in missed opportunities for IV to PO conversion included having guidelines for antimicrobial duration (12.8%), participating in regional stewardship collaboratives (8.1%), number of antimicrobial-specific order sets (6.0% per order set), ID training of the ASP pharmacist (4.9%), and VA facility complexity designation (4.2% per quarter increase in score indicating greater complexity).[23~~20~~] Variables associated with more missed opportunities included stop orders (11.7%), overall perceived receptiveness to antimicrobial stewardship among clinical services (9.4%), the degree of engagement with ASTF online resources (6.9% per quarter increase in factor score range), educational programs for prudent antimicrobial use (4.1%), and hospital size (1.0% per 50-bed increase).

Missed opportunities for avoidance of double anaerobic coverage:

Four variables were associated with more avoidance of double anaerobic coverage: ID training of the lead ASP pharmacist (8.8%), presence of pharmacists and/or ID attendings on acute care ward teams (6.2% per quarter increase in index score), degree of ID pharmacist

involvement in antimicrobial approvals, ranging from not at all (score=0) to both weekdays and nights/weekends (score=2) (4.3% per ordinal increase), and the number of antimicrobial-specific order sets (1.5% per order set). There were no variables associated with less avoidance of double anaerobic coverage.

Variables associated with multiple favorable or unfavorable antimicrobial utilization measures:

To better assess the consistency of the relationship between organizational variables and measures of antimicrobial use, we tabulated variables that were associated with at least 3 potentially favorable (i.e., reduced overall or non-infectious antimicrobial use or reduced missed opportunities) measures. Altogether, five variables satisfied this criterion: the presence of postgraduate physician/pharmacy training programs, the number of antimicrobial-specific order sets, frequency of systematic de-escalation review, the presence of pharmacists and/or ID attendings on acute care ward teams, and formal Infectious Diseases (ID) training of the lead ASP pharmacist (Table 3). Three other variables were associated with at least 2 unfavorable measures: hospital size, the degree to which the facility engaged with ASTF online resources, and presence of antimicrobial stop orders.

Discussion:

Variability in ASP implementation across VA allowed us to assess the relationship between ASP and facility elements and baseline patterns of antimicrobial utilization. Hospitalists and hospital policy-makers are becoming more and more engaged in inpatient antimicrobial stewardship. While our results suggest that having pharmacists and/or physicians with formal ID training participate in everyday inpatient activities can favorably improve antimicrobial utilization, considerable input into stewardship can be made by hospitalists and

policy-makers. In particular, based on this work, the highest yield from an organizational standpoint may be in working to develop order sets within the electronic medical record and systematic efforts to promote de-escalation of broad-spectrum therapy, as well as encouraging hospital administration to devote specific physician and pharmacy salary support to stewardship efforts.

While we noted that finding the ASTF online resources helpful was associated with potentially unfavorable antimicrobial utilization, we speculate that this may represent reverse causality due to facilities recognizing that their antimicrobial usage is suboptimal and thus seeking out sample ASTF policies to implement. The association between the presence of automatic stop orders and potentially unfavorable antimicrobial utilization is less clear since the timeframe was not specified in the survey; it may be that setting stop orders too far in advance may promote an environment in which critical thinking about antimicrobial de-escalation is not encouraged or timely. The larger magnitude of association between ASP characteristics and antimicrobial usage among patients without infectious discharge diagnoses versus overall antimicrobial usage also suggests that clinical situations where infection was of low enough suspicion to not even have the providers eventually list an infectious diagnosis on their discharge summaries may be particularly malleable to ASP interventions, though further exploration is needed in determining how useful this utilization measure may be as a marker for inappropriate antimicrobial use.

Our results complement those of Pakyz, *et al*, who surveyed 44 academic medical facilities in March 2013 to develop an ASP intensity score and correlate this score and its specific components to overall and targeted antimicrobial use.[24~~21~~] This study found that the overall ASP intensity score was not significantly associated with total or targeted antimicrobial

use. However, ASP strategies were more associated with decreased total and targeted antimicrobial use than were specific ASP resources. In particular, the presence of a preauthorization strategy was associated with decreased targeted antimicrobial use. Our particular findings that indicate order set establishment and de-escalation efforts are associated with multiple antibiotic outcomes also line up with the findings of Schuts, *et al,* who performed a meta-analysis of the effects of meeting antimicrobial stewardship objectives and found that achieving guideline concordance (such as through establishment of order sets) and successfully de-escalating antimicrobial therapy was associated with reduced mortality.[25, 26~~22, 23~~] This meta-analysis, however was limited by low rigor of studies included and potential for reverse causality. While our study has the advantages of capturing an entire national network of 130-acute care facilities with a 100% response rate, it too is limited by a number of issues, most notably the fact that the survey was not specifically designed for the analysis of antimicrobial utilization measures, patient-level risk stratification was not available, the VA population does not reflect the US population at-large, recall bias, and that antimicrobial prescribing and stewardship practices have evolved in VA since 2012. Furthermore, all of the antimicrobial utilization measures studied are imperfect at capturing inappropriate antibiotic use; in particular, our reliance on principal ICD-9 codes for non-infectious outcomes requires prospective validation. Many survey questions were subjective and subject to misinterpretation; other unmeasured confounders may also be present. Causality cannot be inferred from association. Nevertheless, our findings support many core indicators for hospital ASP recommended by the CDC and TATFAR,[3, 4] most notably, having personnel with infectious diseases training involved in stewardship and establishing a formal procedure for ASP review for the appropriateness of an antimicrobial at or after 48 hours from the initial order.

In summary, the VA has made efforts to advance the practice of antimicrobial stewardship system-wide, including a 2014 directive that all VA facilities have an ASP,[27,24] since the 2012 HAIG assessment that reported considerable variability in antimicrobial utilization and antimicrobial stewardship activities. Our study identifies areas of stewardship that may correlate with, positively or negatively, antimicrobial utilization measures that will require further investigation. A repeat and more detailed antimicrobial stewardship survey was recently completed and will help VA gauge ongoing effects of ASTF activities. We hope to re-evaluate our model with newer data when available.

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Table Legends:

Table 1: Frequencies of key facility antimicrobial stewardship characteristics at VA facilities contributing to variable development (n=130)

Table 2: Antimicrobial stewardship facility variables examined according to Promoting Action on Research Implementation in Health Services (PARiHS) domain*

Table 3: Variables associated with multiple (≥3 potentially favorable or ≥2 potentially unfavorable) antimicrobial utilization measures*

Figure Legends:

Figure 1: Distribution of Inpatient Antimicrobial Utilization Measures across VA Acute Care Facilities, 2012

(Box shows median and 25-75 percentiles; whiskers show 5-95% range; circles represent individual outlier VA facilities)

Figure 1A: Overall antimicrobial use and antimicrobial use among patients discharged with no infectious diagnoses

Figure 1B: Missed opportunities for parenteral-to-oral antimicrobial conversion and to avoid potentially unnecessary double-anaerobic coverage

Appendix A:

2012 Survey of Antimicrobial Stewardship in VHA: Survey Instrument

Appendix B:

2012 Survey of Antimicrobial Stewardship in VHA: Survey Results