

Infection Incidence and Utilization of Antimicrobials in Physician Office Infusion Centers (POICs)



IDWeek™ 2018
#2367

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Abstract

Background: POICs offer a controlled setting for safe and effective outpatient treatment of moderate to severe infections with intravenous antimicrobial agents (IVAA) and agents used in the treatment of *Clostridium difficile* infection (CDI). These therapies are provided via in-office or home administration. This study provides an overview of nationwide incidence of outpatient infections and utilization of IVAA through POICs.

Methods: A retrospective review of our centralized database was conducted of patient (pt) infections and therapy courses provided in POICs nationally that included complete data for 2017. All pts receiving IVAA and drugs for CDI were included, along with dose, frequency, duration and method of administration. Descriptive measures were used to analyze data.

Results: A total of 12,930 therapies were provided to 10,136 pts during 2017 among 77 POICs. Of those, 42% were treated directly from the community setting, avoiding hospitalization. Age distribution was <18 years <1%, 18-65 years 63% and >65 years 37%. Infections comprised 11 major diagnostic groups, with 47 subgroups. The most common diagnoses treated were bone and joint (35%), skin and skin structure (23%), genitourinary (14%) and bacteremia/septicemia (8%). 101 pts (1%) were treated for CDI. Geographical distribution occurred in the Midwest, Northeast, South, and West portion of the U.S., where diagnoses were similar for all areas except the Northeast. This area had a significantly lower incidence of bone and joint infections (p<0.0001) and a higher incidence of genitourinary infections (p<0.0001). Overall utilization included 52 different agents, with 98.5% antimicrobials, 1% antifungals and 0.5% antivirals. Ceftriaxone was the most frequently used antimicrobial representing 16% of the total use followed by vancomycin (14.5%), daptomycin (14.2%) and ertapenem (11%). The most prevalent infections and utilization of respective drug therapy is noted.

Conclusion: This study provides an annual overview of outpatient infection incidence with the utilization of IVAA and therapy for CDI. A wide range of moderate to severe infections were treated, often avoiding hospitalization. Treatment regimens were broad, utilizing a wide variety of drugs and enabling extensive patient management in the POIC setting.

Background

Due to the emergence of bacterial resistances and rising healthcare expenses, systematic reviews and meta-analyses are needed to reliably determine infection incidences nationwide and appropriately manage the use of IVAA in all healthcare settings.¹ Moderate to serious infections often require treatment with IVAA in the outpatient setting.² A Physician Office Infusion Center (POIC) provides a high quality, controlled setting of care with fully integrated access to patient diagnoses and treatment data.³

The purpose of this study was to evaluate infections treated in Healix-managed Infectious Disease (ID) POIC site of care in 2017 and quantify use of antimicrobial agents in the management of these infections.

Methods

Study design

A retrospective drug utilization evaluation was performed. Nationwide infection incidence was retrospectively assessed by geographic region:

$$\text{Incidence rate (\%)} = \frac{\text{No. of cases of infection}}{\text{total No. of pts per year}}$$

Study data

Healix-centralized databases were queried for pts of all ages and diagnosis treated in 2017 at ID POICs nationwide. Reporting of infectious diagnoses were in accordance with the International Classification of Disease, 10th revision (ICD-10). Detailed drug therapy provided was also captured from the database.

ID-POIC sites n=77

Data analysis

- Pt demographics: age grouped into 3 categories (<18; 18-64; ≥65 years), gender, location prior to OPAT
- Infectious disease category and subgroups in order of incidence rate (%)
- Incidence rate of 5 most frequent infections stratified by U.S. census region
- Utilization of antibiotics, antivirals, and antifungals and bezlotoxumab
- Median LOT (days) stratified by diagnosis and 5 most frequently used IVAA
- Comparison of infection incidence and IVAA use in POICs in 2017 and 2012³
- Device utilization in POIC for all pts treated in 2017

Results

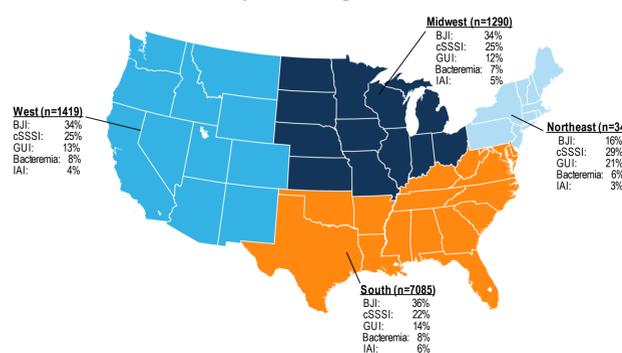
Table 1. Demographics

Characteristics	Results (N=10,136)
Patient age (mean years ± SD)	59 ± 15
< 18 years	41 (0.4%)
18 to 64 years	6,359 (62.7%)
≥ 65 years	3,736 (36.9%)
Gender, male, n (%)	5,541 (55%)
Location prior to OPAT, n (%)	
Hospital	5,919 (58%)
Community	4,217 (42%)

Table 2. Infection Incidence by Diagnosis

Infectious Disease Category	N	%
Bone and Joint Infection (BJI)	3,519	34.7%
Osteomyelitis	2,105	20.8%
Prosthetic joint infection	641	6.3%
Septic arthritis	616	6.1%
Discitis	157	1.5%
Complicated Skin and Skin Structure (cSSSI)	2,332	23.0%
Cellulitis	1,955	19.3%
Skin abscess	319	3.1%
Mastitis	16	0.2%
Lymphangitis	13	0.1%
Myositis	12	0.1%
Hidradenitis	12	0.1%
Other	5	0.05%
Genitourinary Infection (GUI)	1,403	13.8%
Complicated urinary tract infection	1,013	10.0%
Pyelonephritis	205	2.0%
Prostatitis	82	0.8%
Sexually transmitted disease	50	0.5%
Genitourinary abscess	30	0.3%
Other	23	0.2%
Bacteremia/Septicemia	787	7.8%
Intra-abdominal Infection (IAI)	580	5.7%
Intraabdominal abscess	275	2.7%
Diverticulitis	187	1.8%
Appendicitis	28	0.3%
Cholangitis	27	0.3%
Peritonitis	26	0.3%
Pancreatitis	15	0.1%
Pelvic inflammatory disease	13	0.1%
Other	9	0.1%
Respiratory (Resp)	530	5.2%
Pneumonia	437	4.3%
Empyema	42	0.4%
Bronchitis	26	0.3%
Lung Abscess	25	0.2%
Cardiac Infections	354	3.5%
Endocarditis	296	2.9%
Cardiac valve infections	44	0.4%
Other	14	0.1%
Central Nervous System (CNS)	244	2.4%
Spinal infection	83	0.8%
Meningitis	69	0.7%
Cranial infection	37	0.4%
Neurosyphilis	31	0.3%
Encephalitis	16	0.2%
Other	8	0.1%
Head, Ears, Eyes, Nose and Throat (HEENT)	227	2.2%
Sinusitis	135	1.0%
Otitis	32	0.3%
Mastoiditis	19	0.2%
Esophagitis	19	0.2%
Abscess of HEENT	13	0.1%
Other	9	0.1%
Gastrointestinal Infection (GI)	112	1.1%
<i>C. difficile</i> infection	101	1.0%
Enteric infection	11	0.1%
Lyme Disease	48	0.5%

Infection Incidence by U.S. Region



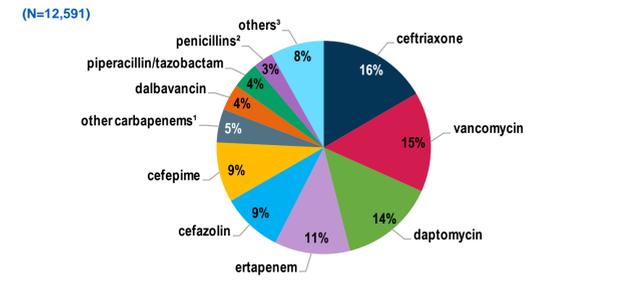
- The Northeast had a significantly lower incidence of BJI (16%, p<0.0001) and a higher incidence of GUI (21%, p<0.0001) compared to other U.S. regions

Annual Use of Antimicrobial Agents in POICs

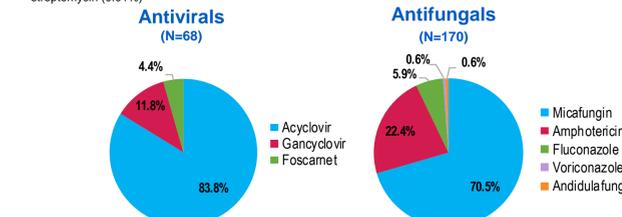
- Antibiotics were the majority of OPAT agents. Of these 12,930 drugs were used, 17% concomitant and 8% consecutive therapies of 2 or more IVAA
- Bezlotoxumab and oral vancomycin were given for CDI in 86 pts and 15 pts, respectively



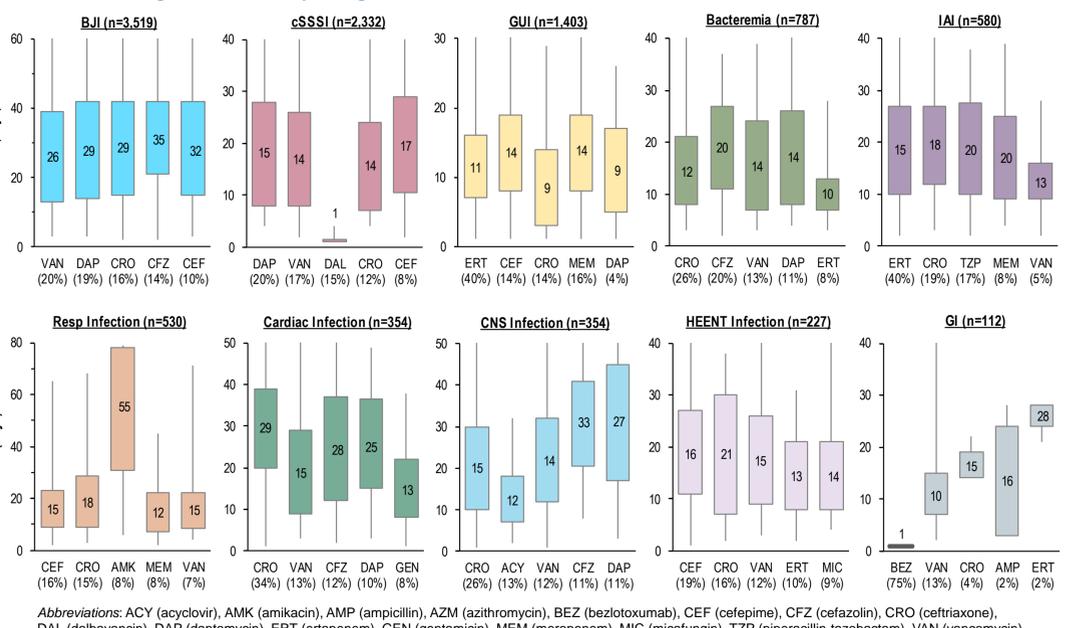
Annual Utilization of Antimicrobials (N=12,591)



¹ other carbapenems: meropenem (3%), imipenem/cilastatin (1%), doripenem (1%)
² penicillin (1.4%), oxacillin/nafclillin (0.8%), ampicillin/sulbactam (0.5%), ampicillin (0.3%)
³ other incl. clindamycin (1%), amikacin (0.8%), aztreonam (0.8%), gentamicin (0.8%), telavancin (0.7%), bezlotoxumab (0.7%), ceftazidime (0.5%), oritavancin (0.4%), tobramycin (0.4%), azithromycin (0.3%), ceftriaxone (0.3%), ceftolozane/tazobactam (0.3%), tigecycline (0.3%), ciprofloxacin (0.2%), levofloxacin (0.2%), metronidazole (0.2%), ceftioxin (0.1%), doxycycline (0.1%), colistimethate (0.08%), ceftazidime/avibactam (0.03%), cefotaxime (0.02%), cefuroxime (0.02%), linezolid (0.02%), cefotetan (0.01%), minocycline (0.01%), streptomycin (0.01%)

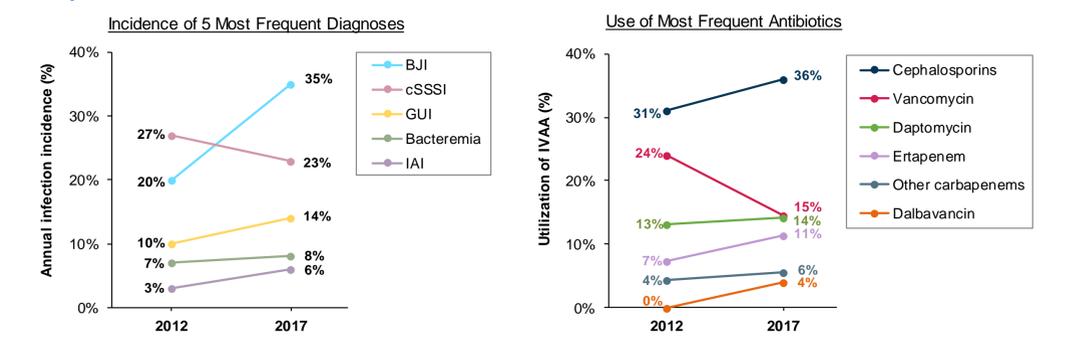


Median Length of OPAT by Diagnosis and 5 Most Prevalent IVAA



- Lyme Disease (n=48) was treated with CRO (95%) at a median LOT of 28 days (range: 7 to 42 days)

Outpatient Infection Incidence and Antibiotic Utilization in POICs: 2017 vs. 2012³



- In 2017, BJI, GUI and IAI had higher incidences and cSSSI a lower incidence compared to 2012
- In 2017, there was a 5% increase in use of cephalosporins and a 9% decline in use of vancomycin

Table 3. Utilization of Infusion Devices for OPAT in POICs

Infusion Device	No. of Therapies	(%)
Elastomeric device	6,154	48%
Stationary pump	3,389	26%
Ambulatory pump	3,123	24%
Gravity	249	2%

- Elastomeric devices were most frequently used for self administrations of IVAA at home (refrigerated storage)
- Stationary pumps were used for in-office visits
- Ambulatory pumps were used for IVAA stable at room temperature
- Gravity was used at home for drugs not stable in elastomeric devices

Discussion

The present study provides an overview of infection incidences treated at Physician Office Infusion Centers by U.S. geographic region and details the annual utilization of IV antimicrobial agents (IVAA) and therapies for CDI in this site of care.

- In 2017, a total of 12,930 therapies were administered to 10,136 pts across 77 POICs nationwide.
- Overall, 42% of pts were treated without prior hospitalization. Age distribution was wide and gender distribution was similar.
- The Northeast had the lowest incidence of BJI (16%) and the highest incidence of GUI (21%) compared to other U.S. regions.
- The primary IVAA were antibiotics (98.5%). Antifungals and antivirals accounted for less than 2% of total annual use.
- Ceftriaxone and vancomycin were the most frequently prescribed antibiotics in 2017, constituting more than 50% of annual POIC use. The lowest utilization was reported for quinolones and tetracyclines (0.4% each). Most frequently administered antifungals and antivirals were micafungin (70%) and acyclovir (84%).
- In 2017, BJI had a higher incidence in POICs than in 2012 (35% vs. 20%). This increase can likely be explained by the substantial rise of joint replacement procedures over the last two decades.⁴ Based on national data, the prevalence of hip and knee arthroplasty increased by 2-fold and 5-fold from 1990 to 2010 in the aged population, respectively.⁴
- In 2017, the utilization of cephalosporins, carbapenems and dalbavancin increased and use of vancomycin decreased compared to 2012. Of note, cephalosporins were used in 40% of BJI.
- The majority of antimicrobials were given via elastomeric self-administration devices (48%) at home following training provided in the POIC.

Conclusion

This study provides the most comprehensive and detailed national data on infection incidences and utilization of outpatient IV antimicrobials in the physician office site of care.

In 2017, BJIs have become the leading infection treated in POICs over skin infections in 2012. This correlates with a growing number of prosthetic joint replacements with subsequent infections and osteomyelitis. This also links to an increased use of cephalosporins in POICs.

Understanding trends in infectious disease and antimicrobial use in POICs provide important data for all stakeholders involved in the management of infections including providers, payors, and manufacturers.

References

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