

Utilization of Intravenous Antimicrobials over a One-Year Period in Physician Office Infusion Centers (POICs)



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Abstract (revised)

Background: POICs provide a safe and effective treatment (tx) site for patients with moderately severe infections, including bacterial, fungal and viral infections. Parameters necessary for provision of intravenous antimicrobials (IVAM) suitable in this setting include: effectiveness, safety, stability, and economics, allowing for tx of a broad range of diagnoses. The purpose of this study was to evaluate all IVAM used in Healix-managed POICs nationwide over one year and describe the ideal characteristics of these agents for outpatient use.
Methods: A retrospective database review was conducted of patients receiving IVAM in 2011. Data was analyzed for all agents used by location, including antibiotics (ABX), antivirals and antifungal agents. Each was evaluated for utilization by patient, diagnosis (dx), treatment duration, device, method of administration and stability.
Results: 11,616 patients received 15,256 multiple therapy regimens consisting of 15,499 drugs in 65 POICs from Jan 1 to Dec 31, 2011. Of all drugs utilized, 15,198 (98%) were ABX, 76 (<1%) were antivirals, and 225 (1%) were antifungals, with data for primary agents noted below.

Primary IVAM Used by Class	n	%	Mean Tx Days	Elastomeric Stability	Ambulatory Pump Stability
Antibiotics					
Vancomycin	3,641	24	24	Y	72
Ceftriaxone	2,099	14	22	Y	72
Daptomycin	1,993	13	20	Y	N ³
Cefazolin	1,171	8	26	Y	72
Cefepime	1,160	8	25	Y	72
Piperacillin/tazobactam	1,148	8	23	Y	72
Ertapenem	1,116	7	18	Y	N ³
Impipenem cilastatin ²	538	4	25	Y	30
Antifungals					
Micafungin	166	74	21	Y	72
Antivirals					
Acyclovir	57	75	11	Y	N ²

Patients were treated for over 50 diagnoses. Cellulitis was the most predominant followed by bone infections, both accounting for almost half. The primary device utilized to administer IVAM was an elastomeric device, available for patients to take home for self-administration, with a mean stability after compounding of 8 days refrigerated (range 3 to 9 days). Secondly, infusions were provided in the office by infusion or ambulatory pumps. **Conclusion:** A wide variety of IVAM, including high-risk agents, can be utilized in POICs for a broad range of diagnoses. The use of elastomeric devices was found to be the most significant factor in utilization, allowing for patient freedom and ease of use.

Introduction

Historically, patients with moderately severe infections have been treated with prolonged courses of IVAM in the hospital setting. However, outpatient administration of antimicrobials to patients otherwise well enough to leave the hospital is growing to more than 250,000 annually (1). This growth is attributed to an increased emphasis upon cost containment, availability of antibiotics that can be administered once or twice daily, increased acceptance by patients and physicians, technological advances in vascular access and infusion devices and the increasing availability of structured services. Outpatient parenteral therapy (OPAT) not only reduces treatment associated costs but also improves patient quality of life and decreases the risk of nosocomial infections (2, 3). Additionally, pharmacy services allow for drugs to be administered for the treatment of a broad range of infections with a wide formulary of antimicrobial agents. A more comprehensive review of medications used in the outpatient setting and their corresponding stability and compatibilities is yet to be available. Additionally, detailed literature review and internal stability testing supports the stability and compatibility of IV antibiotics beyond standard use as indicated by product information. Our study objective was to retrospectively review the use of OPAT antimicrobial agents over a 12-month period in the POIC setting.

Methods

A multicenter retrospective database review was conducted to identify all patients treated with an IV antimicrobial from January 1 - December 31, 2011 in 65 POICs nationwide.
Inclusion Criteria:
 • Patients treated with an intravenous antibiotic, antiviral, or antifungal agent at a POIC from January 1 - December 31, 2011.
Exclusion Criteria:
 • None.
Data Analysis:
 • Data collected was analyzed for patient demographics, antimicrobial utilization, diagnoses, drug therapy received, duration of therapy, administration device utilization, and administration device stability and compatibility.

Results

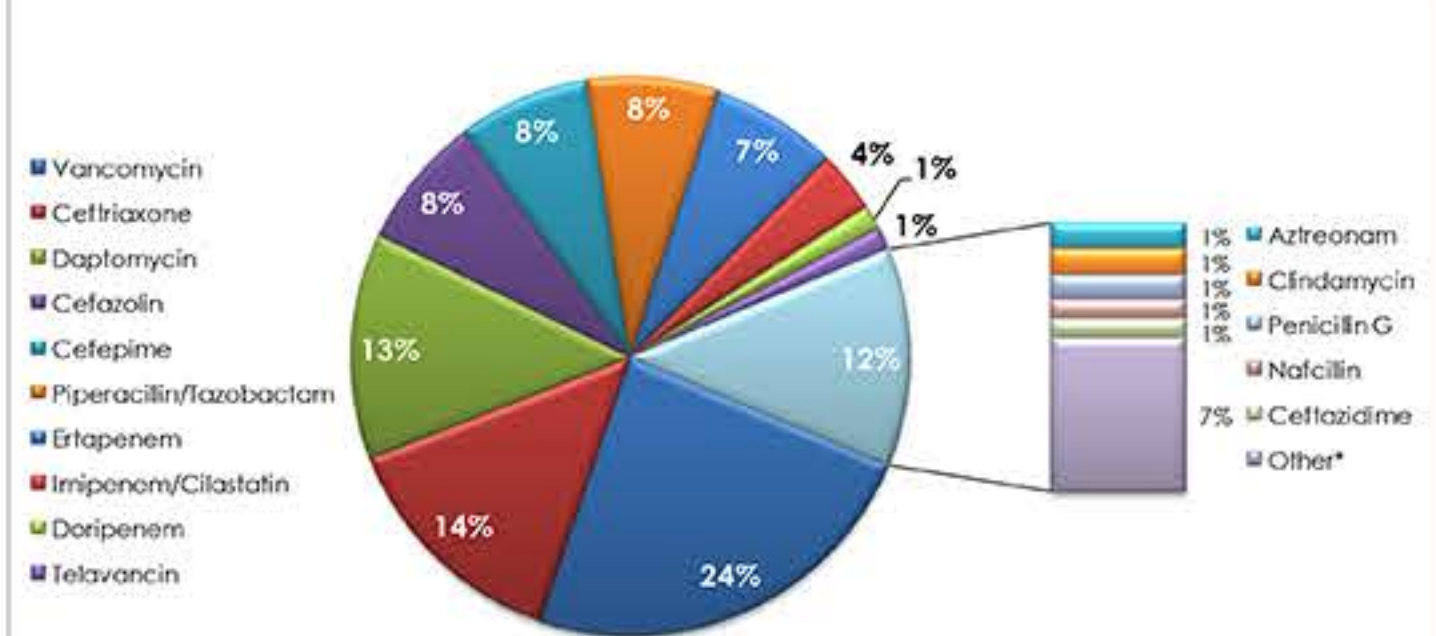
Demographics

Characteristics	Patients (n = 11,616)	Antibacterials (n = 11,437)	Antifungals (n = 211)	Antivirals (n = 74)
Gender				
Male (%)	6170 (53)	6092 (53)	96 (45)	35 (47)
Female (%)	5446 (47)	5345 (47)	115 (55)	39 (53)
Age				
Mean (Years)	58	58	61	52
Range (Years)	1 - 103	1 - 103	18 - 88	20 - 87

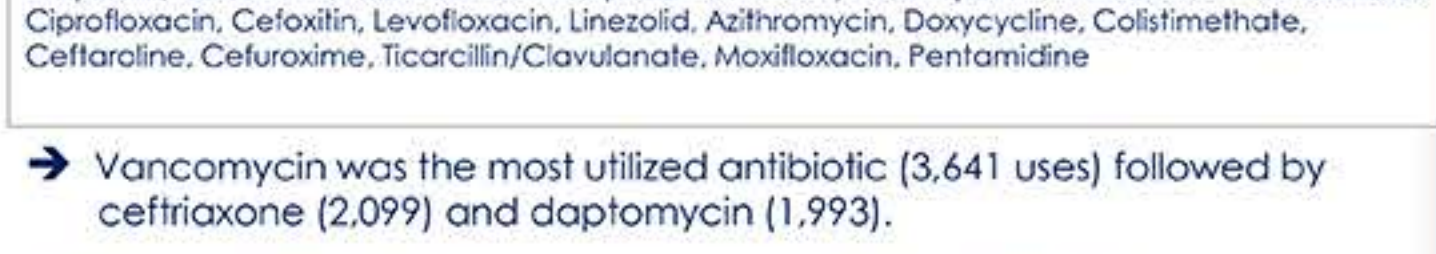
→ 15,499 drugs were utilized to treat 11,616 patients during 2011.
 • 15,198 antibacterials (98%)
 • 225 antifungals (1.5%)
 • 76 antivirals (0.5%)
 → 119 patients received treatment with multiple agents from different antimicrobial classes for mixed infections.

Utilization

Antibacterial Utilization



Antifungal Utilization



Antiviral Utilization



→ Vancomycin was the most utilized antibiotic (3,641 uses) followed by ceftriaxone (2,099) and daptomycin (1,993).
 → Micafungin was the most utilized antifungal drug (166 pts) followed by amphotericin B (25 pts) and fluconazole (18 pts).
 → Acyclovir was the most utilized antiviral drug (57 pts) followed by ganciclovir (12 pts) and cidofovir (6 pts). Only one pt was on foscarnet.

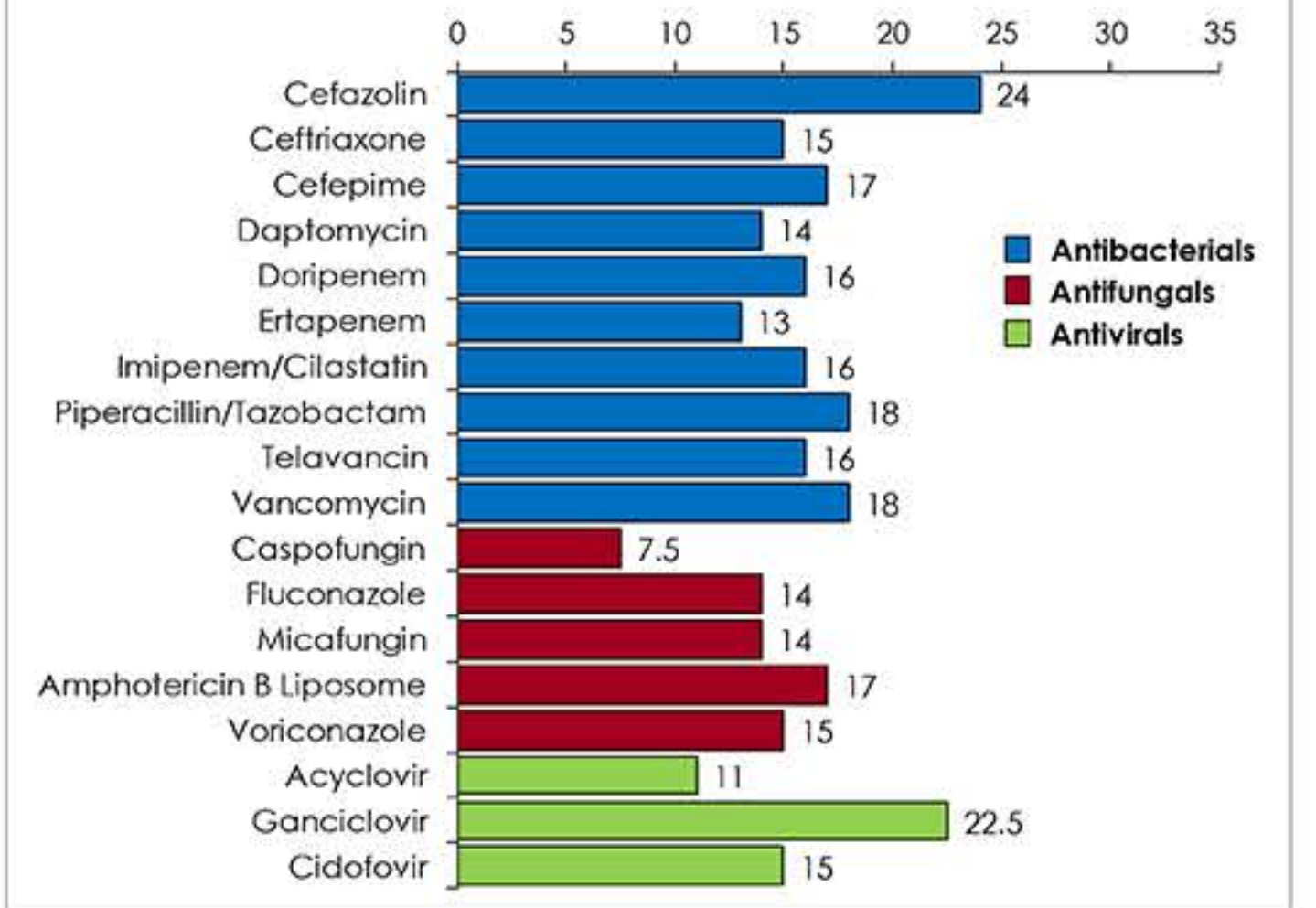
Diagnosis

Diagnosis and Primary Antibiotics Used

Most Prevalent Diagnoses	Occurrence	Most Frequently Prescribed Drugs per Diagnosis (% Usage)
Skin and Skin Structure Infections	27%	Daptomycin (24%), Vancomycin (24%), Ceftriaxone (15%), Cefepime (8%), Cefazolin (8%)
Osteomyelitis	16%	Vancomycin (22%), Ceftriaxone (14%), Cefazolin (14%), Daptomycin (13%), Cefepime (11%)
Genitourinary Infections	10%	Ertapenem (25%), Cefepime (15%), Ceftriaxone (15%), Imipenem/Cilastatin (11%), Piperacillin/Tazobactam (6%)
Bacteremia/Septicemia	7%	Ceftriaxone (20%), Cefazolin (19%), Vancomycin (18%), Daptomycin (11%), Ertapenem (6%)
Respiratory Infections	5%	Ceftriaxone (21%), Cefepime (19%), Piperacillin/Tazobactam (13%), Vancomycin (10%), Imipenem/Cilastatin (7%), Ertapenem (5%)
Joint Infections	4%	Vancomycin (24%), Cefazolin (24%), Ceftriaxone (18%), Daptomycin (12%), Cefepime (7%)
Intraabdominal Infections	3%	Piperacillin/Tazobactam (34%), Ertapenem (23%), Ceftriaxone (12%), Imipenem/Cilastatin (7%), Doripenem (6%)

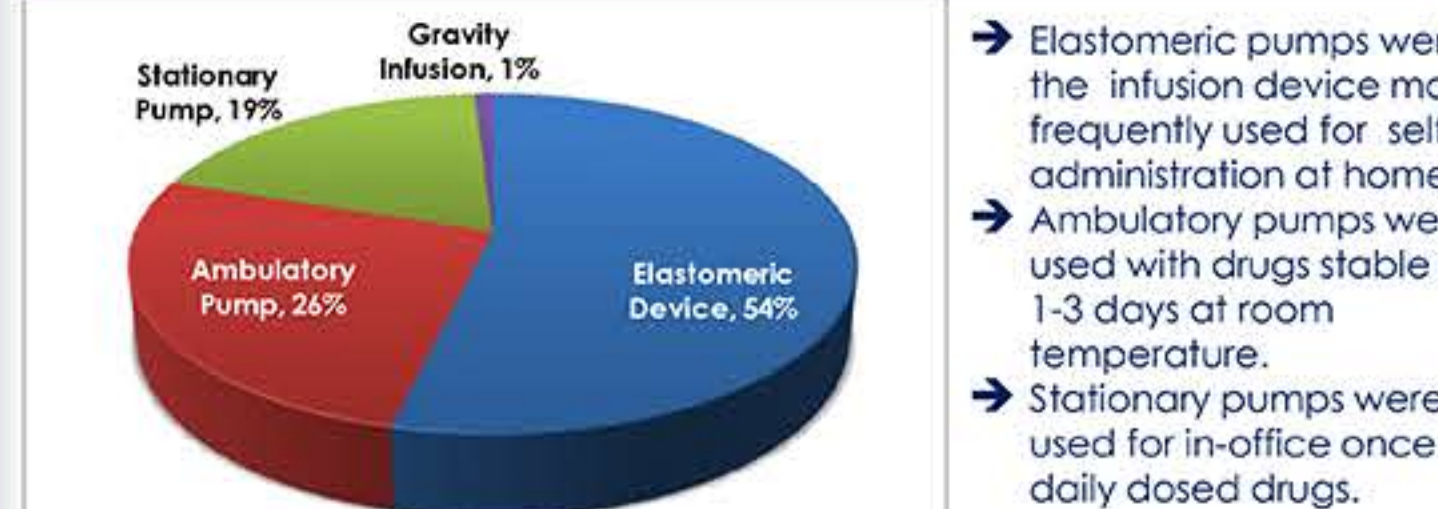
Duration of Therapy

Mean Duration of Therapy (days)



→ The mean was used to represent the duration of therapies for the most prescribed IVAMs across all diagnoses

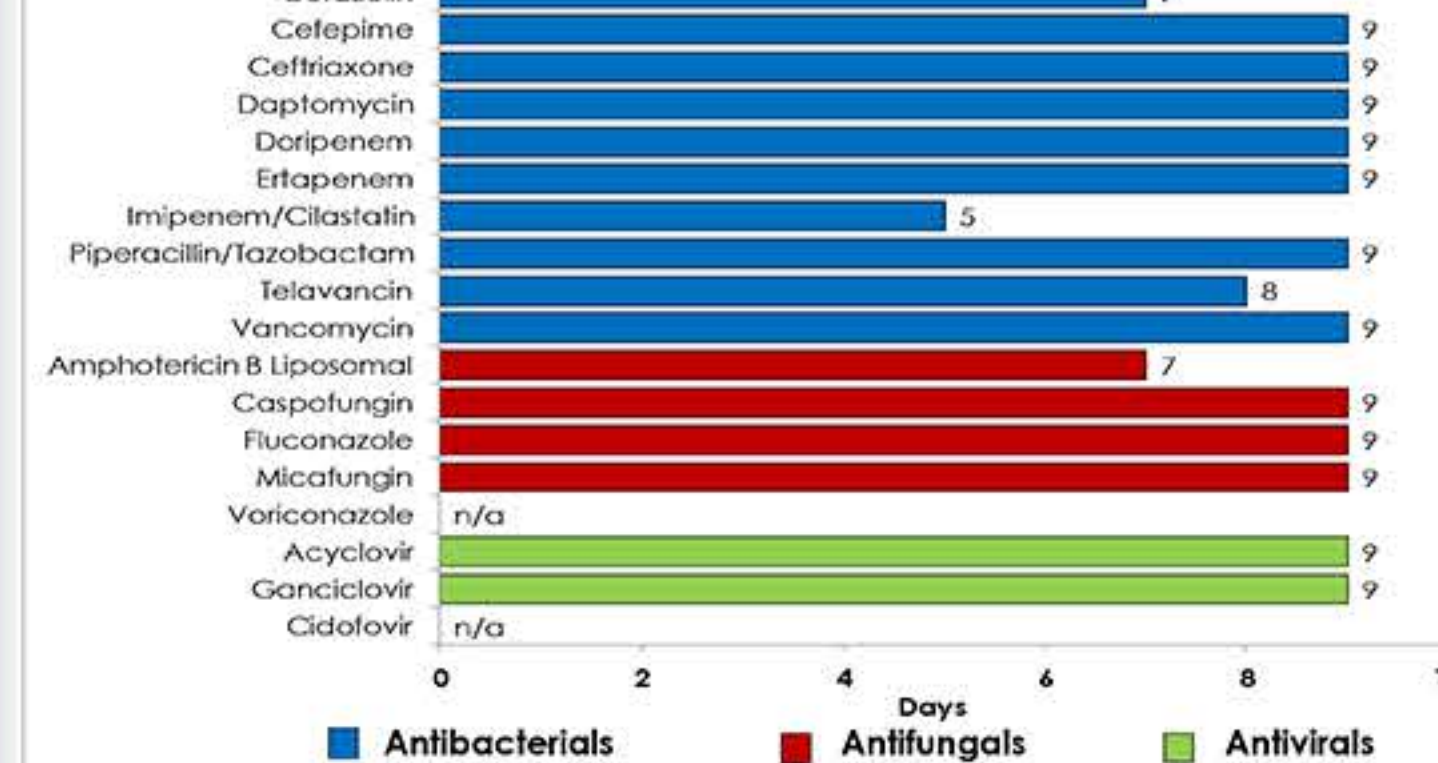
Infusion Devices



→ Elastomeric pumps were the infusion device most frequently used for self-administration at home.
 → Ambulatory pumps were used with drugs stable for 1-3 days at room temperature.
 → Stationary pumps were used for in-office once daily dosed drugs.
 → Devices were selected based upon payor criteria, patient factors and drug stability in the device.
 → Elastomeric stability is determined by refrigerated storage at home.
 → IVAMs for ambulatory pump bags must have at least 24 hr stability at room temperature, but dispensed for no more than 72 hrs in accordance with INS guidelines.

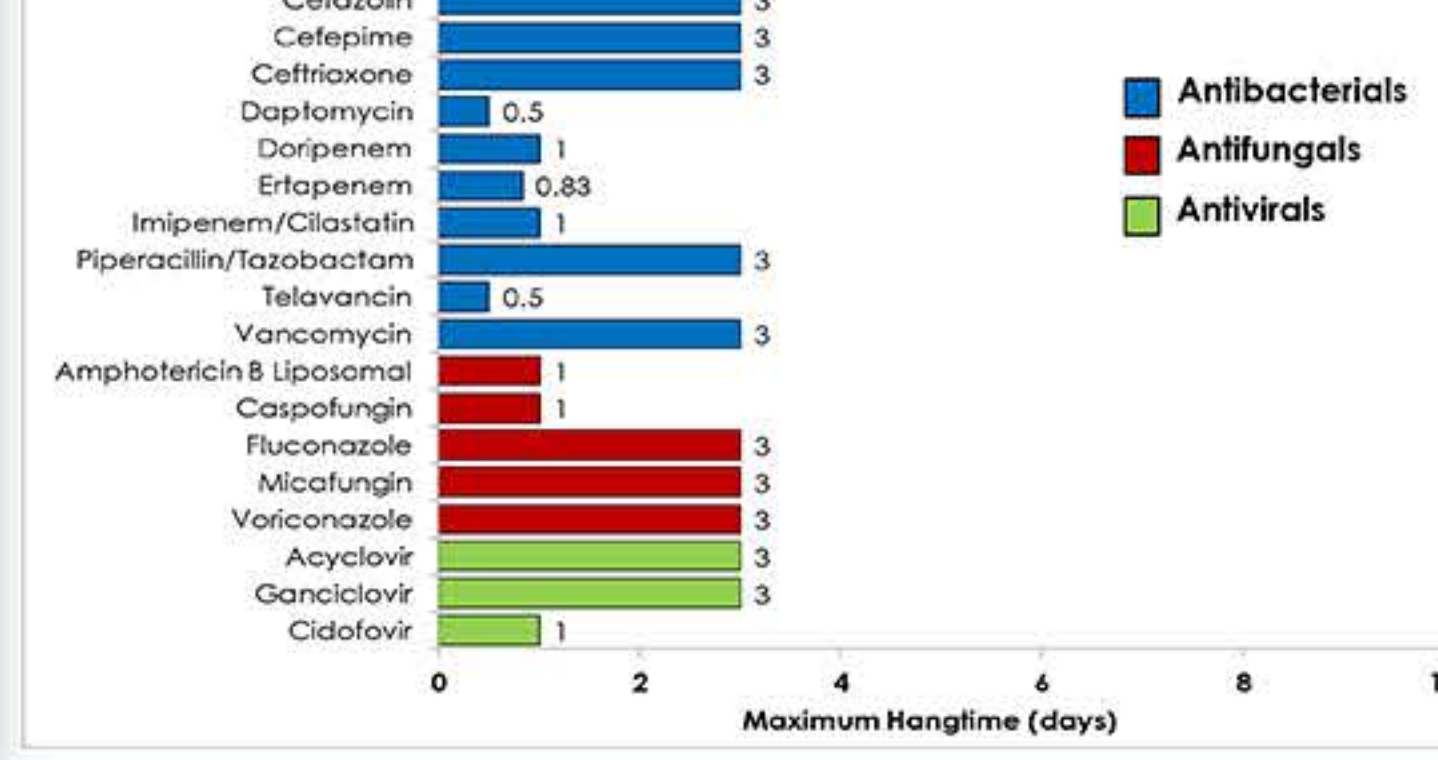
Stability of IVAMs

Refrigeration in Elastomeric Device (4-8°C)



→ Although chemical stability for many compounded products indicates long term stability, USP Chapter <797> guidelines for medium-risk compounded products only allows a maximum refrigerated stability of 9 days.
 → After compounding, the mean stability of refrigerated IVAMs was 8 days. These stability data relate to medium-risk chemical stability of the drugs tested, and not to sterility.

Room Temperature in Polyvinyl Chloride (PVC) bag



Discussion

→ This retrospective study reports a wide variety of IVAMs, including high-risk antimicrobial agents, utilized in POICs for a broad range of diagnoses.
 → Antibacterials accounted for 98% of the overall antimicrobial use, with a range of 37 drugs utilized. Vancomycin was the most widely used drug.
 • MRSA agents (vancomycin, daptomycin, telavancin) together accounted for 38% use overall
 • Cephalosporins usage combined were 33%
 • Carbapenems represented 13% of overall use
 → Skin and skin structure and bone infections represented the most prevalent diagnoses.
 → The median duration of therapy ranged from 7 to 24 days, consistent with expected clinical treatment periods.
 → The use of elastomeric pumps was found to be the most significant infusion device allowing for safe and early discharge of those patients able to self-administer medications.
 → The most frequently used antimicrobials in each category correlated highly with elastomeric stability.
 → Ambulatory bags allow for varied dosage administration, but stipulates a requirement of at least 24 hr room temp stability, thus prohibiting the use of drugs such as daptomycin, ertapenem, telavancin.
 → In this study, a very large population of patients were treated with 49 different intravenous agents for various diagnoses using multiple methods of administration.

Conclusion

→ In retrospect, 15,256 drug regimens were utilized in 65 POICs nationwide with 98% antibiotic regimens, 1.5% antifungal regimens and 0.5% antiviral regimens.
 → Patients were treated for over 50 diagnoses, with 49 different agents, all receiving outpatient antimicrobials, the largest collection of data to date.
 → Elastomeric devices were the most frequently used device likely due to patient ease of use and increased patient freedom between infusions.
 → The data indicate that most intravenous antimicrobial agents can be utilized in outpatient treatment, allowing for both hospital avoidance and early hospital discharges.

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