

Successful, Cost-Saving OPAT Therapy Initiated in a Physician Office Infusion Center (POIC) for Treatment of Osteomyelitis and Complicated Skin and Skin Structure Infections, a 3-Year Analysis

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Abstract (revised)

Background: OPAT therapy is well-described as safe and effective for patients (pts) requiring continuation of intravenous antibiotics (IVAB) upon discharge. Many of the >500,000 hospital stays for cellulitis or osteomyelitis (OSTEO) could be avoided, with significant direct and indirect cost savings. We report a 3-yr analysis of pts treated for complicated skin and skin structure infections (cSSSI) and OSTEO with IVAB in an Infectious Disease POIC.

Methods: A retrospective review was conducted of all pts receiving IVAB from 2008-2010. This was further refined to those treated for cSSSI or OSTEO who received their entire treatment in the POIC without prior hospitalization. Data included demographics, co-morbidities, infecting organism, drug therapy, adverse events (AEs) and outcomes. Primary outcome was percentage of clinical success, defined as cured + improving. Recurrences within 90 days were assessed as failed. Cost benefit was measured by comparing the POIC costs to the mean hospital stay and associated costs avoided. Inpatient stay and costs were obtained from a public database. Data was analyzed by Chi Square or Fisher's test. Regression analysis with a 95% confidence interval was used to assess trends over the 3-yr period.

Results: From 2008-2010, 820 pts received OPAT through the POIC, with 579 (70%) treated for OSTEO or cSSSI. Of these, 219 (38%) (79 OSTEO, 140 cSSSI) met criteria, a statistically consistent trend over 3 yrs. Mean age was 53, 51% were male and diabetes was the predominant comorbidity (44%). MRSA was consistently the predominant pathogen in both diagnoses. Clinical success was consistently (p = 1.0) 90% for both diagnoses over 3 yrs. AEs were also statistically consistent (p=1.0) at 22%. Regression analysis demonstrated homogeneity over 3 yrs for diagnoses, treatment success, adverse events, and incidence of MRSA (F < 0.8). Catheter infection rate was 0.34 days/1000 catheter days. Estimated 3-yr cost savings were over \$1.5 million.

Conclusion: Trended data indicates that management and treatment of OSTEO and cSSSI is consistently safe and effective when provided in the community setting through a POIC. Cost savings are significant compared to inpatient costs for the mean treatment days.

Introduction

Hospital-acquired infections with the associated costs continue to rise. The prospect of treating patients requiring IV antibiotic therapy (IVAB) without requiring hospitalization poses significant opportunity for cost savings. The study was conducted from 2008 to 2010 to assess the safety, efficacy and cost benefit of IVAB for cSSSI and osteomyelitis when the therapy is initiated in a POIC.^{1,2} The POIC provided full pharmacy and infusion services. This 3-year trend analysis was completed to assess consistencies over time in patient characteristics, outcomes, safety and costs for this specific provision of health care services.

Methods

We retrospectively reviewed the Infectious Diseases Associates POIC and pharmacy database and recorded demographic, clinical and safety data using an electronic reporting form.

Inclusion Criteria

- IVAB initiated in the IDA POIC between January 1, 2008 and December 31, 2010.
- Receipt of POIC-provided IVAB for a minimum of 48 hours.
- Age 18 years and older.
- One of the following documented diagnoses:
 - Osteomyelitis (with and without hardware)
 - Complicated skin and skin structure infections
 - Deep soft tissue infection, major abscess, surgical wounds, diabetic infections/ulcers, necrotizing fasciitis, infections with underlying vascular insufficiency, gastrointestinal or urogenital site infections, traumatic wounds, and animal bites.
- POIC-initiated treatment, defined as no inpatient hospitalization within 72 hours of receiving IVAB in the POIC.

Demographic Data

- Age, gender, weight, ethnicity.
- Concurrent disease states: diabetes, renal failure, and immunosuppression.

Clinical Data

- Infection diagnosis.
- IVAB name, dose, duration of therapy.
- Oral antibiotic use (pre-POIC and concurrent).
- Culture results (pre-POIC and during POIC treatment).
- Adverse events (AEs):
 - Mild: Resolution with or without discontinuation of IVAB, use of medication or short term treatment allowed.
 - Serious: Results in IVAB-related hospital admission and/or permanent change in patient status and/or requires IVAB discontinuation to prevent patient status change.
- Adverse event rate defined as (Mild + Serious events)/(total # of patients).
- IVAB efficacy at time of POIC discharge:
 - Cure: Clinical signs/symptoms resolved, and/or no additional antibiotic therapy needed, and/or negative culture at end of therapy.
 - Improved: Partial resolution of clinical signs/symptoms, and/or additional antibiotic therapy necessary.
 - Failed: Resistant, worsening, or new clinical signs/symptoms, recurrence of same infection within 90 days, and/or the need to change antibiotic therapy, and/or hospital admission due to worsening infection.
- Success rate defined as (Cure + Improved)/(total # of patients).
- POIC costs were calculated as a mean reimbursement rate per day. Inpatient costs, also calculated as a mean reimbursement rate were obtained from inpatient reimbursement rates from the Healthcare Cost and Utilization Project Nationwide Inpatient Sample for the OSTEO and cSSSI diagnostic related group (DRG) and mean inpatient LOS.³

Data Analysis

- Descriptive statistics (mean, standard deviation, min/max) were used for demographic data.
- Percentages were used for efficacy and safety data; Chi Square or Fisher's test was used for data analysis; Regression analysis was used to assess trends over the 3-year period.
- Cost savings were calculated by comparing differences in the mean daily reimbursement for inpatients (based on DRG) to the daily reimbursement in the POIC. The total savings were calculated based upon days of inpatient stay saved over three years.

Results

Patient Demographics and Characteristics:

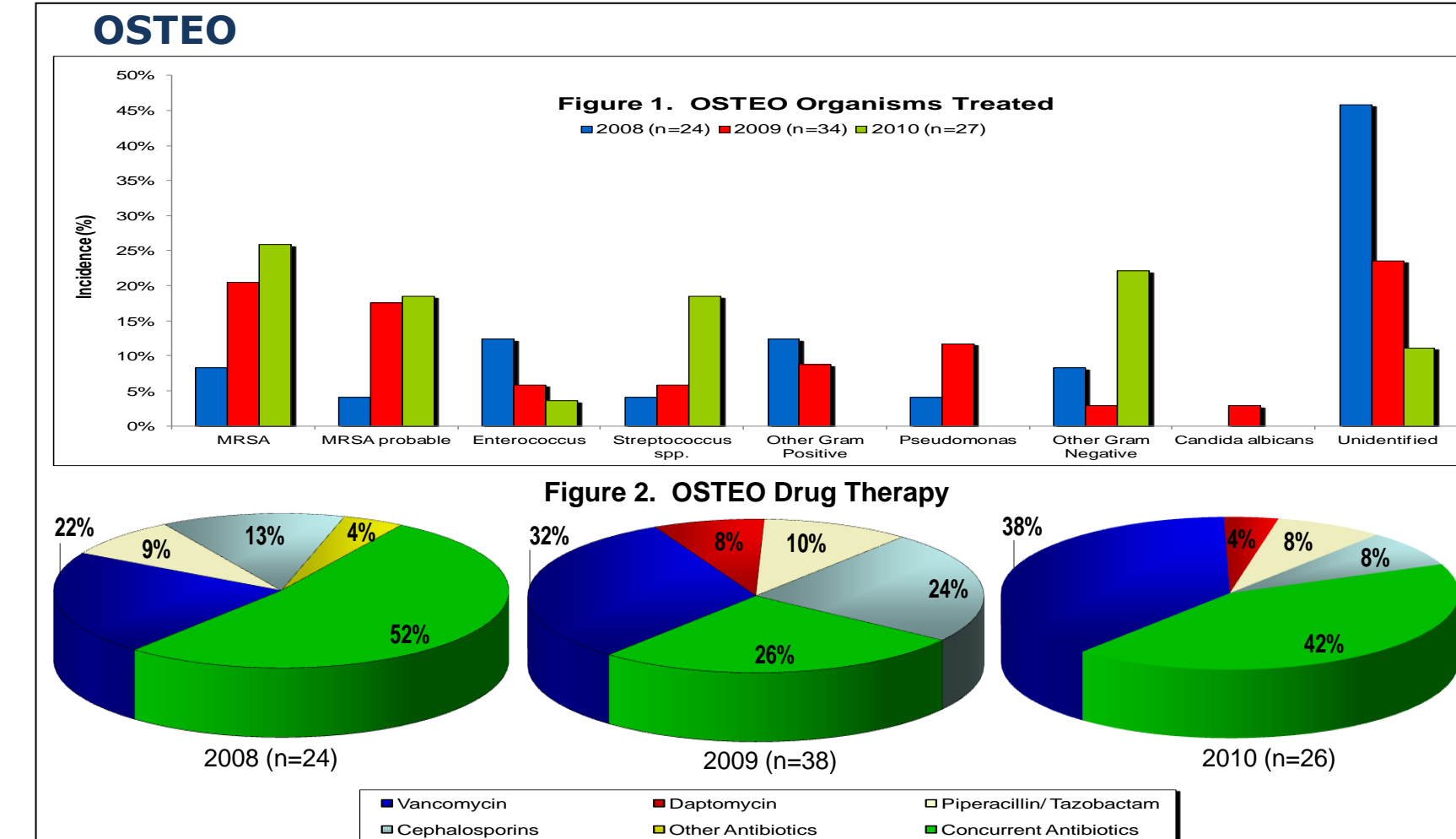
Characteristics	2008 (n=89)	2009 (n=73)	2010 (n=57)	F-value	Total (n=219)
	OSTEO (24) cSSSI (65)	OSTEO (29) cSSSI (44)	OSTEO (28) cSSSI (29)		OSTEO (79) cSSSI (140)
Gender (%)					
Male	43 (48%)	35 (48%)	33 (58%)	F=1	111 (51%)
Female	46 (52%)	38 (52%)	24 (42%)	F=0.1875	108 (49%)
Mean Age in years (range)	52 (20-80)	54 (29-80)	53 (20-73)		53 (20-80)
Ethnicity (%)					
Caucasian	53 (59%)	39 (53%)	39 (68%)	F=4	131 (60%)
African American	30 (34%)	12 (17%)	16 (28%)	F=0.3333	58 (26%)
Other	6 (7%)	2 (3%)	1 (2%)	F=3	9 (4%)
Unknown	0 (0%)	20 (27%)	1 (2%)	F=2.0097	21 (10%)
Comorbidities (%)					
Diabetes	41 (46%)	29 (40%)	28 (49%)	F=0.0833	97 (44%)
Chronic Kidney Disease	21 (24%)	5 (7%)	12 (21%)	F=1	35 (16%)
Immune Disorders (non-HIV)	12 (13%)	1 (1%)	1 (2%)	F=3	13 (6%)
Immunosuppressive Drugs	10 (11%)	4 (5%)	3 (5%)	F=0.0833	13 (6%)
Comorbidities Per Patient (%)					
None	34 (39%)	30 (41%)	19 (34%)	F=0.6667	83 (38%)
One	28 (31%)	33 (45%)	23 (40%)	F=5.6789	84 (38%)
Two	25 (28%)	10 (14%)	12 (21%)	F=0.3333	47 (22%)
Three	2 (2%)	0 (0%)	3 (5%)	F=3	5 (2%)

- A single POIC treated 820 pts with IVAB during the 2008-2010 study period.
- 219 (38%) were treated without prior hospitalization.
 - 79 (36%) had OSTEO and 140 (64%) had cSSSI.
- 121 (55%) pts failed oral antibiotics prior to POIC admission.
- Diabetes was the most common comorbidity present (44%).
- Predominant site of infection was the foot for both diagnoses and across all 3 years.

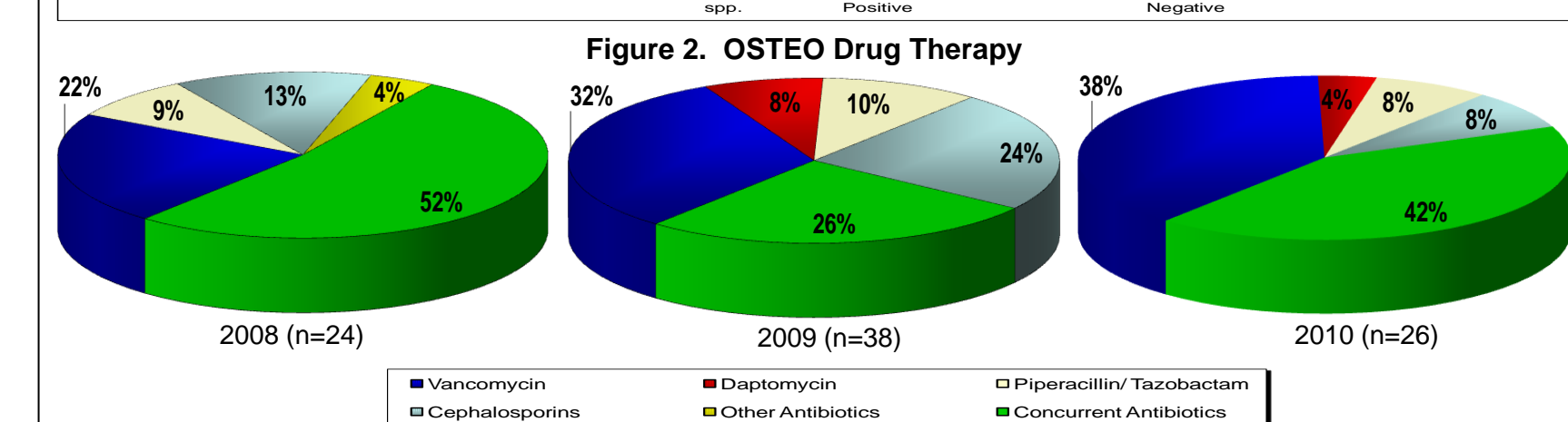
	OSTEO (n=79)				cSSSI (n=140)			
	2008	2009	2010	Total	2008	2009	2010	Total
Foot	11	11	13	35	14	8	8	30
Lower leg	0	1	2	3	12	7	6	25
Toe	8	6	5	19	2	0	1	3
Finger	0	4	0	4	4	4	1	9
Multi-Site	2	1	0	3	5	2	0	7
Other*	3	6	6	15	28	23	15	66

*Other includes: hip, ankle, spine, BKA stump and head

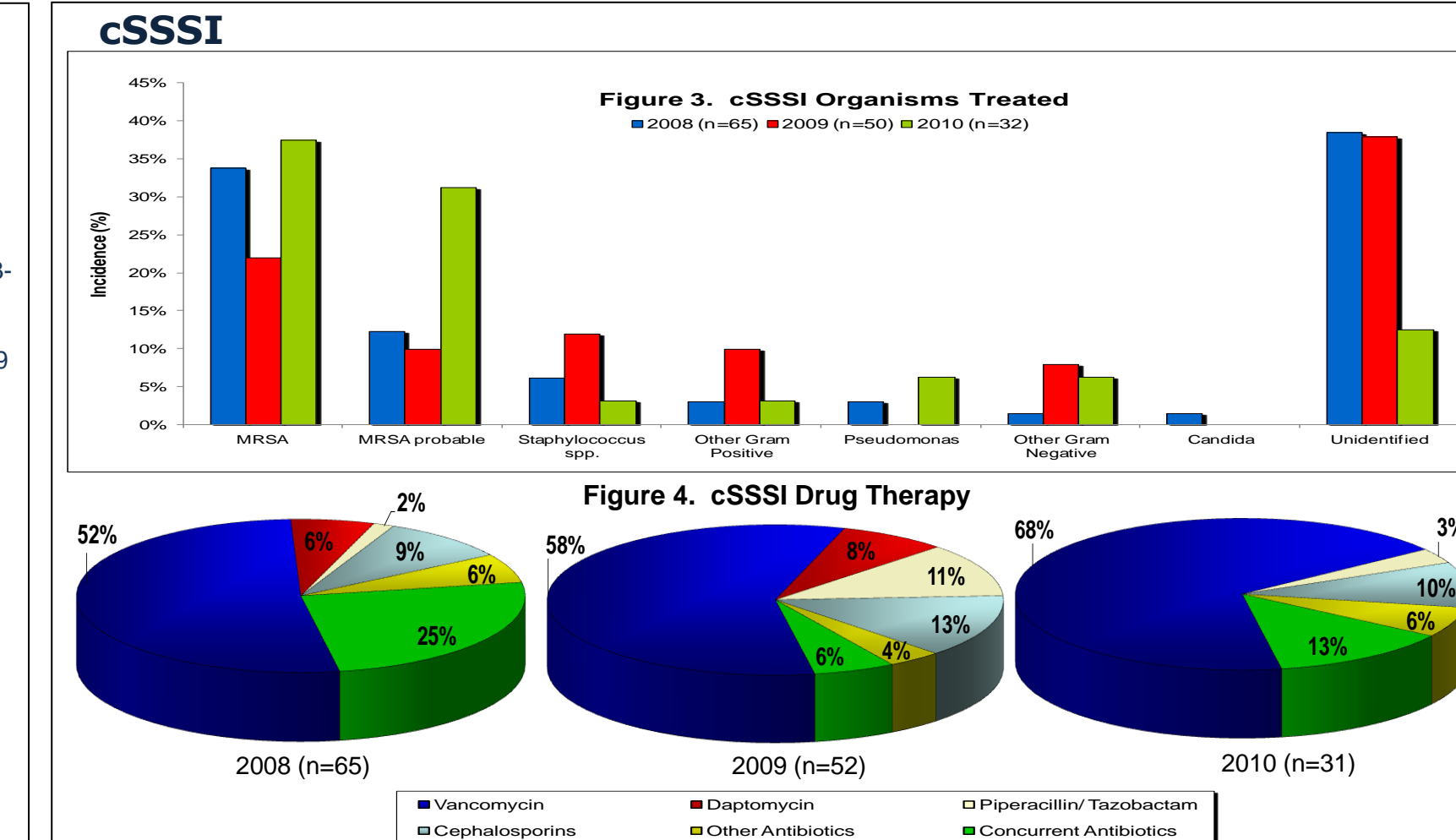
Drug Therapy:



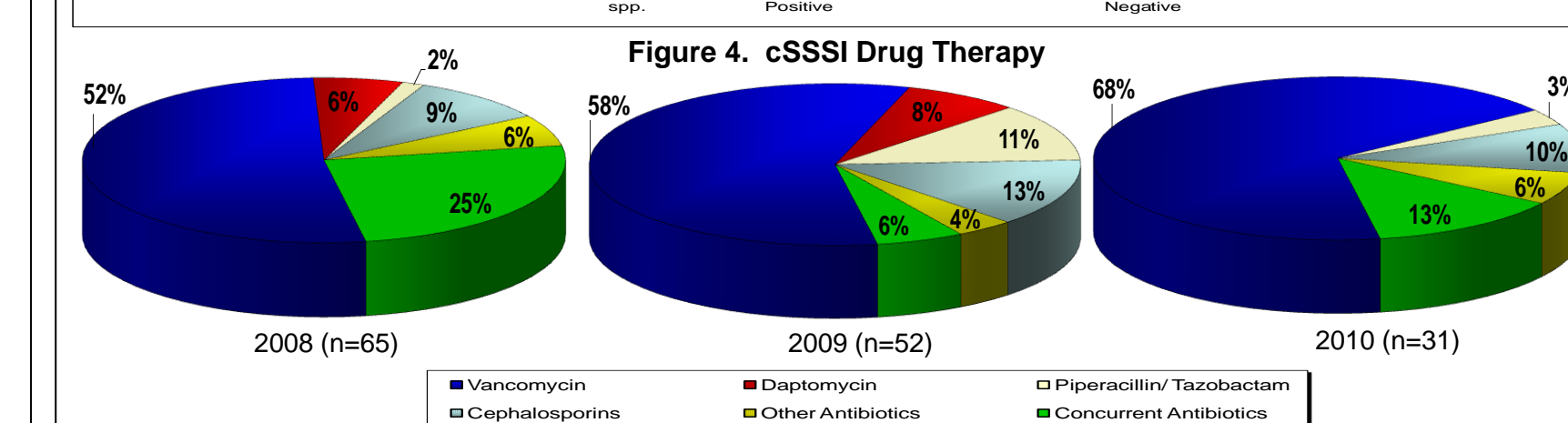
- The most commonly identified pathogen in 2008 was Enterococcus; however, MRSA (confirmed + probable) was consistently (F=5.4913) the most predominant pathogen over the 3-year period.
- The number of pts with >1 identified pathogen was 2 in 2009 and 1 in 2010.



- The most frequently used IVAB was vancomycin for all 3 years.
- The mean duration of therapy was 33 days in 2008, 41 days in 2009, and 35 days in 2010 (F=4.8567).
- Concurrent IVAB therapy was used 52%, 26%, and 42% each year respectively.

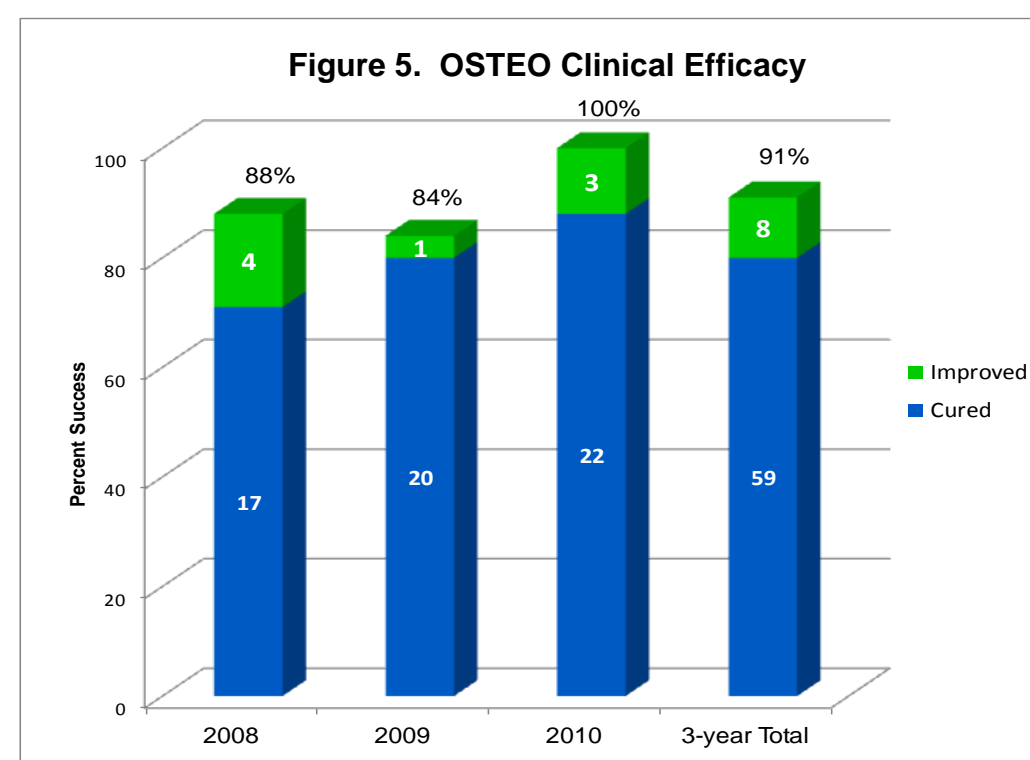


- The most commonly identified pathogen for all 3 years was MRSA (F=0.08333).
- There were 4 pts in 2009 with >1 pathogen; pts in 2008 and 2010 only had 1 identified pathogen.

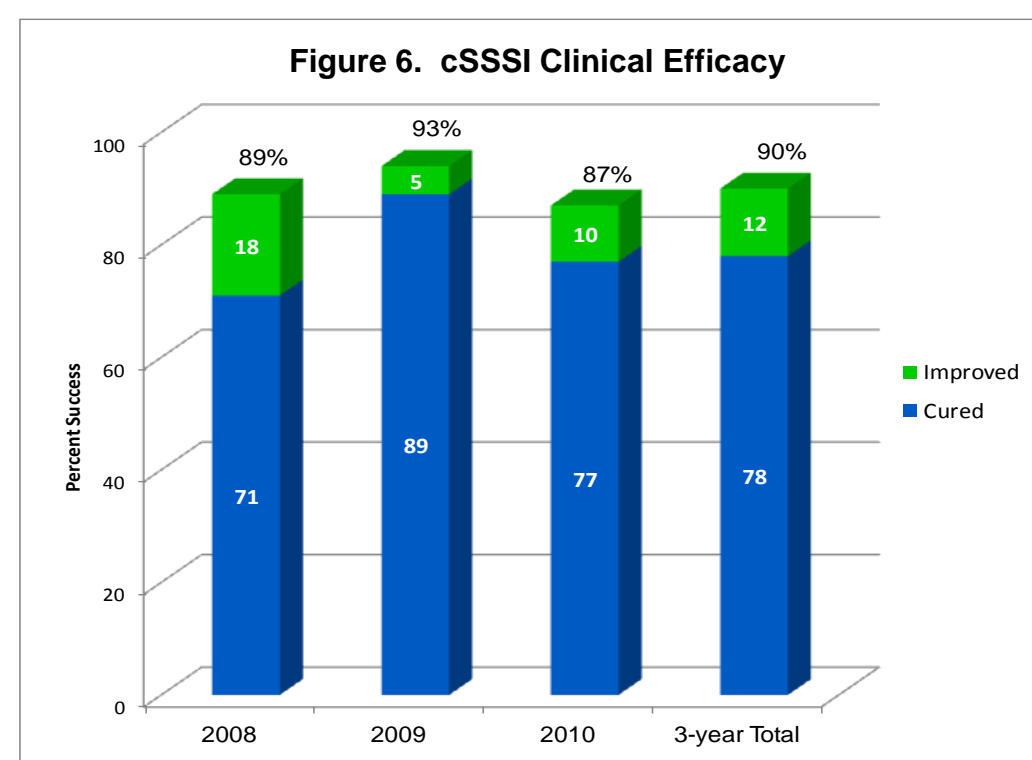


- The most frequently used IVAB for all 3 years was vancomycin.
- The mean duration of therapy was 21 days in 2008, 20 days in 2009, and 21 days in 2010 (F=1).
- Concurrent IVAB therapy was used 25%, 6%, and 13% each year respectively.

Clinical Outcomes:

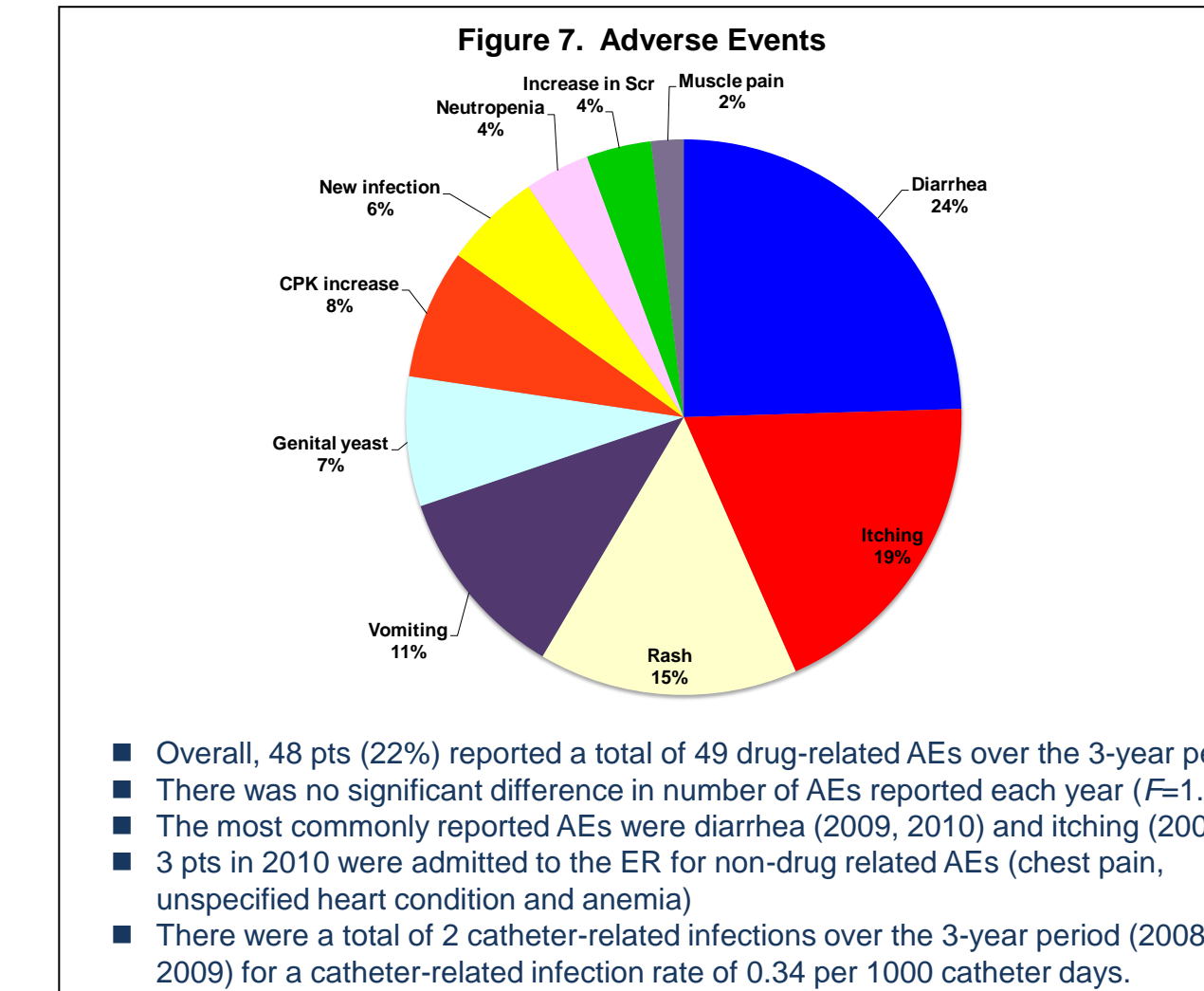


- Overall clinical success rate for treatment in OSTEO pts was 91% (80% cure + 11% improving).
- Clinical efficacy was statistically consistent over the 3-year period (F=12).
- 5 OSTEO pts were lost to follow-up, 4 in 2009 and 1 in 2010.



- Overall clinical success rate for treatment in cSSSI pts was 90% (78% cure + 12% improving).
- Clinical efficacy was statistically consistent over the 3-year period (F=0.0833).

Safety:

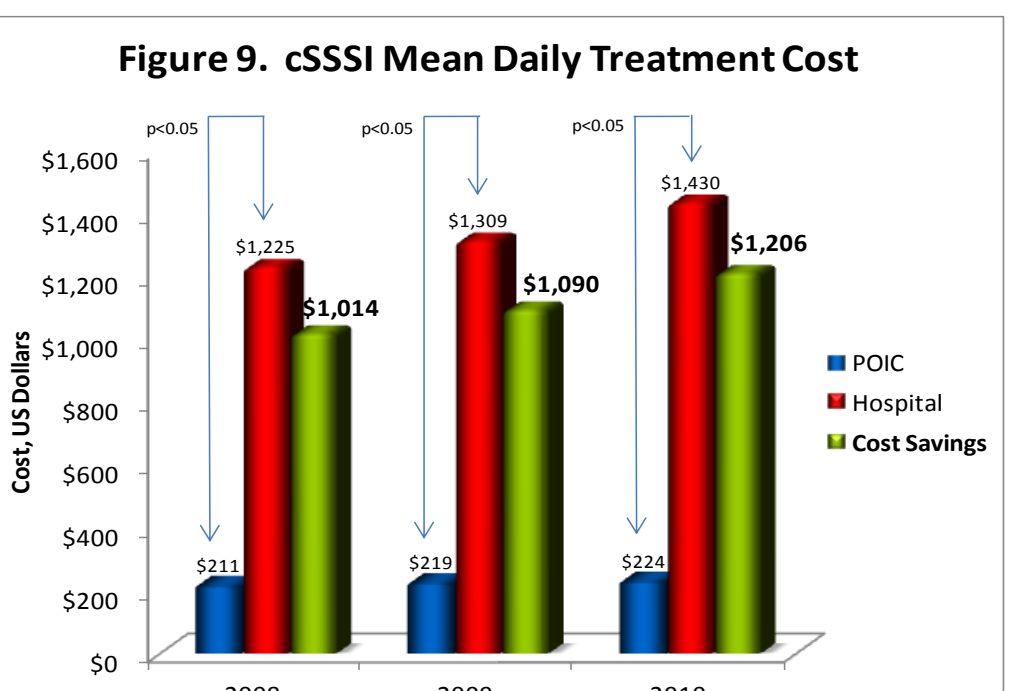
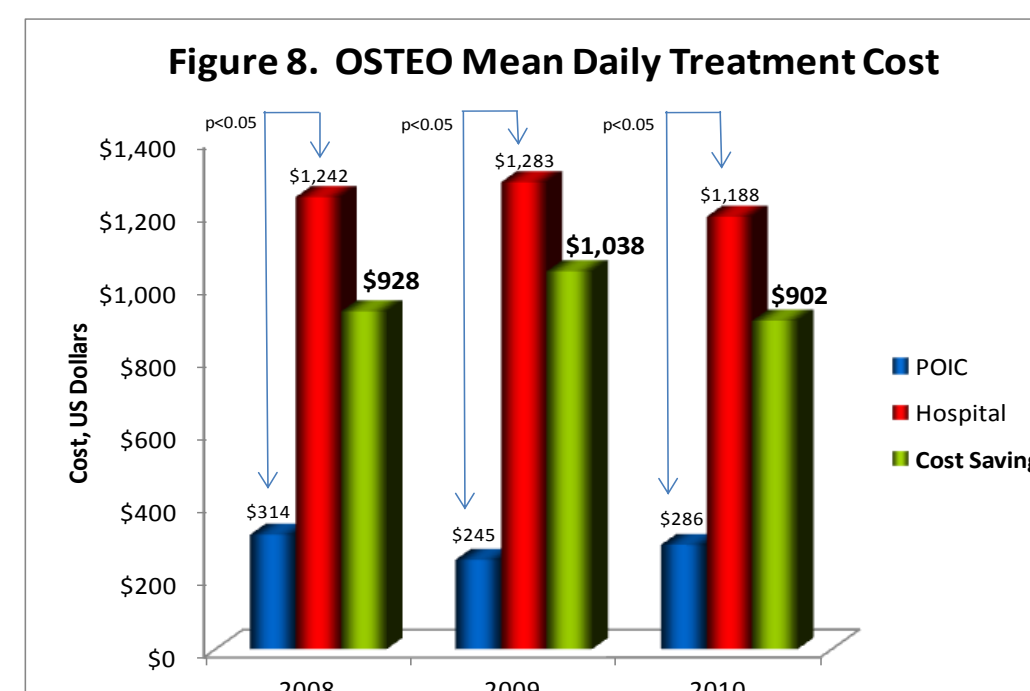


- Overall, 48 pts (22%) reported a total of 49 drug-related AEs over the 3-year period.
- There was no significant difference in number of AEs reported each year (F=1.0).
- The most commonly reported AEs were diarrhea (2009, 2010) and itching (2008).
- 3 pts in 2010 were admitted to the ER for non-drug related AEs (chest pain, unspecified heart condition and anemia)
- There were a total of 2 catheter-related infections over the 3-year period (2008, 2009) for a catheter-related infection rate of 0.34 per 1000 catheter days.

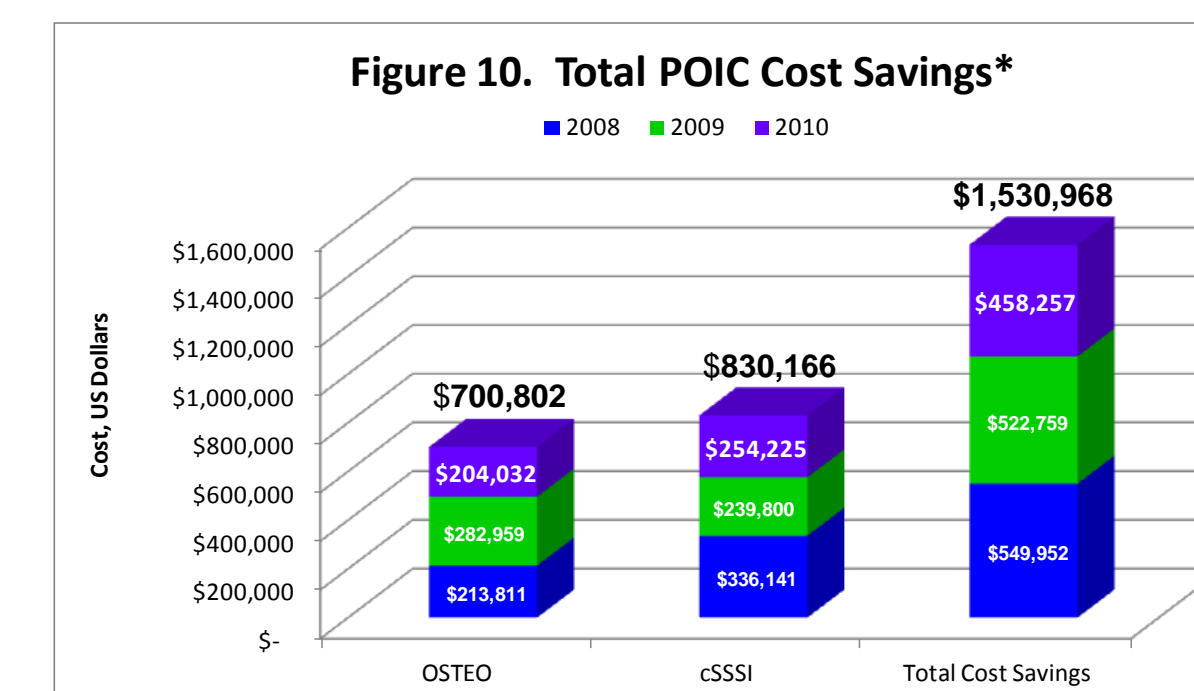
Agent	Adverse Event	Year			Intervention Required
		2008 (n=8)	2009 (n=7)	2010 (n=12)	
Serious					
Vancomycin	Rash	1	0	0	1
Vancomycin + Cefepime	Rash	1	0	0	1
Mild-Moderate					
Cefazolin	Rash	0	1	0	1
Cefepime	Rash	0	1	0	1
Ceftriaxone	Genital Yeast	0	0	1	1
Oral Clindamycin	Diarrhea	1	0	0	1
Daptomycin	CPK Increase*	3	0	1	4
Daptomycin	Rash	1	1	0	2
Imipenem/Cilastatin	Genital Yeast	0	0	1	1
Meropenem	Diarrhea	1	0	0	1
Pip/Tazo**	Diarrhea	0	1	2	3
Vancomycin	Neutropenia	0	0	1	1
Vancomycin	Renal insufficiency†	1	0	0	1
Vancomycin + Cefepime	Nausea/Vomiting	1	1	4	6
Vancomycin + Cefazidime	Diarrhea	0	3	0	3
Vancomycin + Cefazidime	Rash	1	0	0	1
Vancomycin + Pip/Tazo**	Itching	5	2	2	9
Vancomycin + Pip/Tazo**	Genital Yeast	0	0	1	1
Vancomycin + Pip/Tazo**	Rash	0	0	1	1
Vancomycin + Cefepime	Genital Yeast	1	0	0	1
Vancomycin + Cefazidime	Leukopenia	0	1	0	1
Vancomycin + Pip/Tazo**	Renal insufficiency†	0	0	1	1
Vancomycin + Pip/Tazo**	Diarrhea	1	1	3	5
Vancomycin + Pip/Tazo**	Itching	1	0	0	1
3-YR TOTAL		19	12	18	49

*Creatine Phosphokinase (CPK) **Piperacillin/tazobactam. †Serum creatinine rise of ≥0.5

Cost Savings:



- Cost of mean daily treatment in a POIC was significantly less when compared to treatment in the hospital setting.



- Total cost savings were calculated based on one infectious disease group practice over a 3-year period.

Discussion

- 3-year statistically consistent trends Included:
 - Direct admission rates of OSTEO and cSSSI (38%)
 - Overall demographics
 - Methicillin-resistant *S. aureus* as the most common pathogen
 - Vancomycin as the most commonly used antibiotic
 - Adverse event rates
 - Catheter infection rates
 - Cost savings per day and year
- Significant 3-year statistical differences were noted in the mean daily treatment costs between POIC versus hospital setting.
- Adverse event rates were low and comparable to other retrospective studies.^{4,5}
 - AEs were most often reported with Vancomycin, with an increased use trending over time (non-significant).
 - There were 2 serious AEs over 3 years with no long-term sequelae.
- Catheter-related infection rates were low, below nationally reported data.⁶
- Cost savings over 3 years were over \$1.5 million.

Conclusion

- An Infectious Disease POIC can provide safe and effective IVAB therapy for treatment of OSTEO and cSSSI.
- Initiation and treatment of OSTEO and cSSSI patients in an Infectious Disease POIC has been statistically demonstrated to save healthcare expenditures over time compared to national data for mean inpatient days and costs.

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