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# A 2-Year Analysis of 30-Day Hospital Readmissions and Cost Benefits of Septicemia Outpatient Treatment in a Physician Office Infusion Center (POIC)


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## ABSTRACT


**Background:** Septicemia constitutes a major cause for 30-day readmissions and is the most expensive condition treated in U.S. hospitals according to the Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project (HCUP). For patients (pts) with uncomplicated septicemia, outpatient parenteral antimicrobial therapy (OPAT) may offer benefit in preventing 30-day readmissions and reducing hospital costs.

**Methods:** Medical records from pts treated at 12 Infectious Disease (ID) POICs over 2 years from 1/1/2013 to 12/31/2014 were retrospectively reviewed. Data include demographics, therapy characteristics, unplanned 30-day hospital admissions, causes and risk factors. Costs were measured by comparing 30-day readmission rates with average length of stay and inpatient costs derived from national HCUP data for septicemia. Statistical analysis was done by Fisher's exact and ANOVA tests.

**Results:** Among 525 septicemia pts, 71 (13.5%) were admitted to the hospital within 30 days of OPAT initiation including 35 for worsening infections, 17 for catheter-associated complications, 9 for new infections, 7 for adverse drug reactions, and 3 for reasons unrelated to diagnosis. Significant risk factors associated with readmissions were 3 or more comorbidities (OR 4.78, p=0.0001), 6-month prior hospitalization (OR 3.90, p<0.0001) and presence of malignancy (OR 1.76, p=0.032). Upon readmission, the average length of hospitalization post OPAT was 8.1 days compared to 11.1 days for national average. POIC-based OPAT of septicemia resulted in a 6.2% lower 30-day readmission rate than the national average of 19.7% (p=0.009). Based on HCUP data on length of stay and costs of the second admission of septicemia, the estimated hospital costs for the 71 OPAT readmissions would be $1.36 million. This compares to $2.72 million based on national average. The lower readmission rate combined with the shorter length of stay generated substantial OPAT cost savings of 50% (p<0.001).

**Conclusion:** OPAT management and treatment of septicemia in an ID POIC resulted in a significantly lower readmission rate and shorter length of hospital stay following readmission. Costs were 50% lower than national averages with an overall savings of $1.36 million, significantly impacting overall healthcare expenditures.


## INTRODUCTION

Hospitalizations associated with septicemia have more than doubled over the past decade [1]. Moreover, 19.7% of septicemia pts will be readmitted to the hospital within 30 days of discharge with a generally longer inpatient stay than pts with any other diagnosis [1, 2]. As a result, septicemia is the most expensive condition treated in U.S. hospitals [3].

OPAT provided by a POIC offers safe and effective antimicrobial management of clinically stable pts under the direct supervision of an ID physician, therefore avoiding prolonged hospitalization [4]. It has been demonstrated that POIC-based OPAT resulted in lower 30-day hospital admissions for a variety of diagnosis compared to national average estimates [5].

This study investigates the 30-day hospital readmission rate for POIC-based OPAT of pts with septicemia as principal diagnosis and elucidates reasons, potential risk factors and costs.

## METHODS

Retrospective chart review of 525 septicemia pts receiving OPAT in 2013 and 2014 at 12 ID POICs nationwide.

- Variables collected: demographics including comorbidities, prior 6-month hospitalization, source of septicemia, any unplanned hospitalization within 30 days of hospital discharge or OPAT initiation, their causes, risk factors and antimicrobial usage.
- Risk factors were determined using the Altman method including odds ratio (OR) and 95% confidence interval (CI) with a p-value <0.05 to be statistically significant [6].
- Cost of inpatient stay for readmissions from all outpatient settings: national average for readmission rate calculated for total no. of pts [2] x length of 2nd hospital stay [1] x national average for daily cost of inpatient stay using HCUP data for septicemia [2].
- Cost analysis of inpatient stay for readmissions from POIC: readmission rate applied to total no. of pts x length of 2nd hospital stay from POIC x national average for daily cost of inpatient stay using HCUP data for septicemia [2].
- Cost benefit = inpatient readmission cost estimated for all pts – inpatient readmission cost following POIC-based OPAT. Costs are quoted in US dollars (USD).
- Statistical analysis was performed using Fisher's exact, Chi-squared, and ANOVA tests with p<0.05 being significant [6].

## STUDY POPULATION

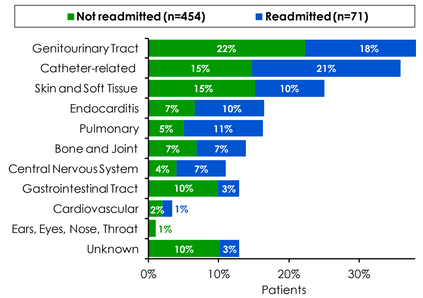
### DEMOGRAPHICS

- 525 septicemia pts were treated at 12 nationwide ID POICs
- 71/525 pts (13.5%) were readmitted within 30 days of hospital discharge or OPAT initiation

| Characteristics | Not readmitted (n=454) | Readmitted (n=71) | P value |
|---|---|---|---|
| **Gender, no. of pts** | | | |
| female | 171 (38%) | 26 (37%) | 0.976 |
| **Age at POIC admission** | | | |
| mean (range), years | 59 (20-90) | 61 (26-89) | 0.292 |
| ≥ 65 years, no. of pts | 166 (36%) | 29 (41%) | 0.496 |
| **Co-morbidities, no. of pts** | | | |
| hypertension | 233 (51%) | 43 (60%) | 0.199 |
| body mass index ≥ 30 | 153 (34%) | 28 (39%) | 0.491 |
| cardiovascular disease | 160 (35%) | 27 (38%) | 0.720 |
| diabetes mellitus | 142 (31%) | 20 (28%) | 0.710 |
| history of cancer | 128 (28%) | 29 (41%) | 0.032* |
| immunocompromised | 19 (4%) | 3 (4%) | 0.744 |
| **Co-morbidities per pt** | | | |
| 0 | 26 (6%) | 3 (4%) | 0.689 |
| 1 | 55 (12%) | 1 (1%) | 0.009* |
| 2 | 76 (17%) | 3 (4%) | 0.008* |
| ≥ 3 | 297 (65%) | 64 (90%) | 0.0001* |
| **Prior hospitalization, no. of pts** | 419 (92%) | 67 (94%) | 0.727 |
| mean stay, days (range) | 6.6(1-25) | 7.3 (2-28) | 0.153 |
| **POIC-initiated OPAT, no. of pts** | 35 (8%) | 4 (6%) | 0.728 |

*: statistically significant (p<0.05) using Chi-squared test [6].

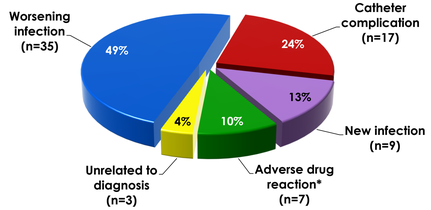
### SOURCE OF SEPTICEMIA




## 30-DAY READMISSIONS

### REASONS FOR READMISSION

- Reasons for 30-day hospital readmissions of 71 septicemia pts are presented below:




*: acute kidney injury (vancomycin, n=1), neutropenia (vancomycin, n=1), rhabdomyolysis (daptomycin, n=1), possible drug reactions due to vancomycin (n=1), daptomycin (n=1), oral nitrofurantoin (n=1), and oral rifampin (n=1).

### ANTIMICROBIAL USAGE

| Intravenous antimicrobial | No. used (%) | Median treatment days (range) |
|---|---|---|
| vancomycin | 23 (28) | 11(3 - 72) |
| cefazolin | 14 (17) | 23 (2 -86) |
| daptomycin | 12 (15) | 12 (5 - 35) |
| ceftriaxone | 11 (13) | 14 (5 - 31) |
| ertapenem | 8 (10) | 11 (2 - 29) |
| piperacillin/tazobactam | 3 (4) | 14 (13 - 40) |
| others* | 11 (13) | 26 (6 - 72) |

*: nafcillin (n=2), ampicillin, ampicillin/sulbactam, aztreonam, cefepime, doripenem, gentamicin, linezolid, meropenem, penicillin G (n=1, each).

- 71 pts received 82 antimicrobials over the therapy course

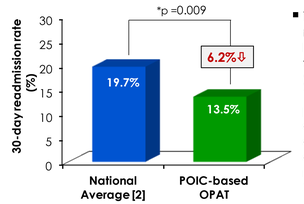
### RISK FACTORS

| Potential Predictors | OR | 95% CI | P value |
|---|---|---|---|
| **comorbidities ≥ 3** | **4.78** | **2.14 to 10.69** | **0.0001*** |
| **prior 6-month hospitalization** | **3.90** | **2.27 to 6.68** | **<0.0001*** |
| **history of cancer** | **1.76** | **1.05 to 2.94** | **0.032*** |
| **vancomycin usage[1]** | **2.46** | **1.41 to 4.29** | **0.0015*** |
| age ≥ 65 | 1.19 | 0.72 to 1.99 | 0.488 |
| device complication | 1.24 | 0.72 to 2.15 | 0.448 |
| diabetes mellitus | 0.86 | 0.49 to 1.49 | 0.598 |
| immunocompromised | 1.21 | 0.34 to 4.26 | 0.769 |
| obesity | 1.28 | 0.76 to 2.14 | 0.352 |

[1]; other intravenous antimicrobials were analyzed but did not indicate significant ORs*; statistically significant (p<0.05) using Chi-squared test [6].

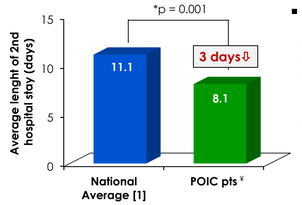
### COST ANALYSIS

#### 30-Day Septicemia Readmission Rate




- The average 30-day readmission rate for POIC-based OPAT was 13.5%; 71/525 pts (2013: 40/276 pts, 14.5%; 2014: 31/249 pts, 12.4%) resulting in a significant reduction of 6.2% (p=0.009) compared to the national average of 19.7% [2].

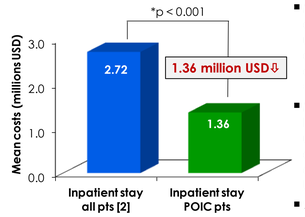
#### Length of Hospital Readmission for Septicemia




- The average length of 2nd hospital stay following POIC-based OPAT was 8.1 days indicating a significant decline by 3 days (p=0.001) compared to the national average of 11.1 days [1].

¥: includes 4 POIC pts with 1st hospital admission.

#### Hospital Cost Savings for Septicemia Pts




- Mean inpatient cost of all septicemia pts using readmission rate of 19.7% x 11.1 hospital days for 2nd admission = 2.72 million USD [2].
- Mean inpatient cost of POIC septicemia pts using readmission rate of 13.5% x 8.1 hospital days = 1.36 million USD.
- Significant cost savings of 1.36 million USD (p<0.001).

*: statistically significant (p<0.05) using ANOVA test.

## DISCUSSION

We evaluated the 30-day hospital readmission rate of septicemia pts treated at an outpatient POIC and determined causes, risk factors, length of 2nd hospital stay and cost benefits over a 2-year time period:

- 71 of 525 septicemia pts (13.5%) were readmitted within 30 days of POIC-based OPAT in 2013 and 2014. This compares to a 19.7% nationwide average for 30-day hospital readmissions of pts with septicemia as principal diagnosis, indicating a 6.2% reduction [2].
- Most overall frequent sources of septicemia were genitourinary (40%), catheter-related (36%) and skin and soft tissue infections (25%).
- Prominent reasons for readmissions were worsening infection (49%) and catheter complication (24%) followed by new infection (13%), adverse drug reaction (10%) and conditions unrelated to primary diagnosis (4%).
- Significant risk factors associated with 30-day hospital readmissions in septicemia pts included ≥3 comorbidities (OR 4.78, p=0.0001), prior 6-month hospitalization (OR 3.90, p<0.0001), history of cancer (OR 1.76, p=0.032) and vancomycin usage (OR 2.46, p=0.0015).
- POIC-based OPAT yielded a significantly lower readmission rate compared to national average estimates (13.5% vs. 19.7%, p=0.009) [2].
- POIC pts readmitted to the hospital had a significantly shorter length of stay compared to the average national length of stay reported for 2nd admission of septicemia pts (8.1 vs. 11.1 days, p=0.001) [1].
- Inpatient readmission cost following POIC-based OPAT were significantly lower than inpatient readmission costs based on national average (1.36 million USD vs. 2.72 million USD, p<0.001) indicating significant cost saving of 50%.
- OPAT of septicemia pts at a POIC provides optimal therapy under direct supervision of the prescribing physician with a high potential to prevent costly 30-day readmissions.

## CONCLUSION

In conclusion, this study has shown that OPAT management and treatment of septicemia pts at an ID POIC resulted in a significantly lower readmission rate (13.5%) and shorter length of 2nd hospitalization (8.1 days). In comparison to all outpatient settings, POIC-based OPAT for treatment of septicemia suggests significant cost savings of 50%.

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