# Implementation and evaluation of a pharmacist-managed pediatric vancomycin protocol

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## Background

- The 2011 IDSA clinical practice guidelines for the treatment of MRSA infections in adults and children recommend targeting vancomycin trough concentrations between 15 and 20 ug/L for serious infections[1]
- Target trough concentrations serve as surrogate markers for achieving an $AUC_{24}$/MIC ratio > 400, shown to be associated with clinical efficacy
- Published literature lacks consensus on optimal dosing in pediatrics, such that achieving target trough concentrations in this population remain a challenge
- At Boston Medical Center, 74% of pediatric patients did not achieve initial therapeutic troughs and 34% did not achieve therapeutic trough within 3 days in the past year
- Pharmacy-managed vancomycin protocols have improved time to initial target vancomycin trough concentrations, decreased duration of vancomycin therapy, shortened time to clinical stability, and decreased length of hospital stay[2]

## Aims

**By September 1, 2018:**

**Primary Aims**

- Increase percentage of initial therapeutic troughs from 26% to 60%
- Increase percentage of therapeutic troughs within 3 days from 66% to 90%

**Secondary Aims**

- Decrease incidence of supratherapeutic troughs from 9% to 5%
- Decrease incidence of vancomycin-associated nephrotoxicity from 5% to 0%

## Metrics

| | |
|---|---|
| Outcome | • Percentage of patients achieving initial therapeutic trough<br>• Percentage of patients achieving therapeutic trough within 3 days |
| Process | • Percentage of appropriately drawn trough levels<br>• Provider adherence to new dosing protocol |
| Balancing | • Incidence of supratherapeutic troughs<br>• Incidence of vancomycin-associated nephrotoxicity |

## Methods

The Institute for Healthcare Improvement (IHI) model was utilized to conduct this quality improvement initiative, testing change through Plan-Do-Study-Act (PDSA) cycles. Project met institutional criteria approval based on the quality initiative versus research checklist such that formal IRB review was not required.

**Project Timeline**

| | |
|---|---|
| September 2017 | • Baseline data collection |
| October 2017 | • Developed new standardized initial dosing table<br>• Developed new pharmacist workflow for verifying new start pediatric vancomycin orders |
| November 2017 | • Educated central and ED pharmacists on new pharmacy-driven protocol<br>• **PDSA Cycle 1** Implemented standardized initial dosing for new start pediatric vancomycin orders |
| January 2018 | • Educated nurses and physicians on new pharmacy-driven protocol<br>• **PDSA Cycle 2** Added AUC-guided dosing in patients who met pre-determined criteria |
| March 2018 | • Educated remaining pharmacists on new pharmacy-driven protocol<br>• Developed official pediatric vancomycin per pharmacy protocol |
| October 2018 | • **PDSA Cycle 3** Hospital-wide implementation of pharmacy-managed pediatric vancomycin protocol |

**Neonates**

| Postmenstrual age* | Postnatal age | Dose | Interval |
|---|---|---|---|
| ≤29 weeks | all | 10 mg/kg/dose | Q12 hours |
| 30-36 weeks | 0-14 days | 15 mg/kg/dose | Q12 hours |
| | >14 days | 15 mg/kg/dose | Q8 hours |
| 37-44 weeks | 0-7 days | 15 mg/kg/dose | Q12 hours |
| | >7 days | 15 mg/kg/dose | Q8 hours |

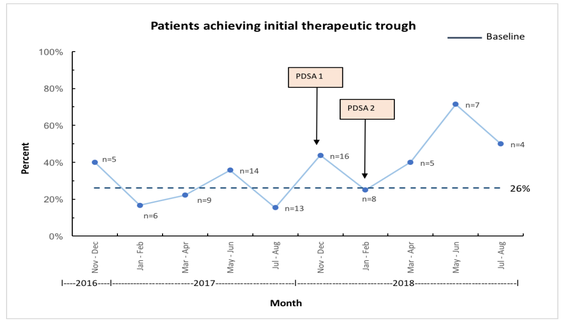
*Postmenstrual age = gestational age + chronological age

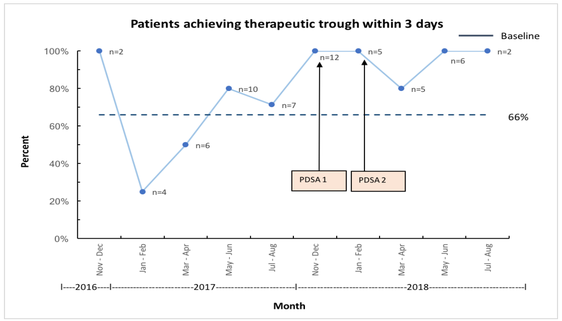
**Infants ≥ 44 weeks Postmenstrual age, Children, Adolescents**

| Age | Dose | Interval |
|---|---|---|
| 1 month – 12 years | 15 mg/kg/dose | Q6 hours |
| 13 years – 18 years | 15 mg/kg/dose | Q8 hours<br>Q6 hours (critically ill) |

Note: Maximum empiric maintenance dose is 4500mg/day

## Results




| | Patients achieving initial therapeutic troughs | Patients achieving therapeutic troughs within 3 days | Supratherapeutic troughs | Vancomycin-associated nephrotoxicity | Appropriately drawn troughs | Provider adherence to protocol |
|---|---|---|---|---|---|---|
| Pre-implementation | 12 (25.5%) | 19 (65.5%) | 4 (8.5%) | 2 (5.3%) | 90 (71.4%) | N/A |
| Post-intervention | 19 (47.5%) | 29 (96.7%) | 1 (2.4%) | 0 (0.0%) | 69 (70.4%) | 40 (81.6%) |

## Discussion

**Successful pharmacy-driven interventions:**

- Higher initial starting doses, daily vancomycin monitoring, standardized dose adjustments in response to low troughs, appropriate timing of levels

**Did we meet our aims?**

- Increase percentage of initial therapeutic troughs from 26% to 60% X
  - Not seeing full effects with short period of implementation
  - Ambitious goal (21%[3] and 40%[4] reported in literature)
  - Need for higher initial doses
- Increase percentage of therapeutic troughs within 3 days from 66% to 90% ✓
- Decrease incidence of supratherapeutic troughs from 8% to 5% ✓
- Decrease incidence of vancomycin-associated nephrotoxicity from 5% to 0% ✓

**Study limitations:**

- Variable documentation by nursing, extrapolation of levels using population kinetics (except for neonates), pre-steady state trough levels, did not exclude patients on concomitant nephrotoxins and/or pressors

## Conclusions

- A pharmacy-driven quality improvement initiative increased both the percentage of patients achieving initial therapeutic troughs and percentage of therapeutic troughs within 3 days
- The implementation of a standardized pharmacy-driven protocol reduced inconsistent dosing practices
- Expansion to hospital-wide implementation will further evaluate the long-term effects of pharmacy-managed vancomycin in the pediatric population

## Next Steps

- Hospital-wide implementation of pediatric vancomycin per pharmacy protocol

## References

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## Disclosure

All authors of this presentation have nothing to disclose concerning possible financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter of this presentation

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