

Vancomycin Infusion:

Algorithmic Analysis of Unstructured Real-World Data Captured from Automated Infusion Devices

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Background

- Large scale research on antimicrobial usage in real-world populations traditionally does not consist of infusion data.
- With automation, detailed infusion events are captured in device systems, providing opportunities to harness them for patient safety studies.
- Due to the unstructured nature of infusion data, the scale-up of data ingestion, cleansing, and processing is challenging.

Methods

- Applied algorithmic techniques to quantitate and visualize vancomycin administration data captured in real-time by automated infusion devices.
- The device data included timestamped infusion events:
 - infusion started, paused, restarted, alarmed, and stopped.
- Used time density-based segmentation algorithms to depict infusion sessions as bursts of event activity.
- Examined clinical interpretability of the cluster-defined sessions in defining infusion events, dosing intensity, and duration.

Results

- The algorithms identified 13,339 vancomycin infusion sessions from 2,417 unique patients (mean = 5.5 sessions per patient).
- Clustering captured vancomycin infusion sessions consistently with correct event labels in >98% of cases.
- It disentangled ambiguity associated with unexpected events (e.g. multiple stopped/started events within a single infusion session).
- Segmentation of vancomycin infusion events on an example patient timeline is illustrated in Figure 1.
- The median duration of infusion sessions was 1.55 (1st, 3rd quartiles: 1.14, 2.02) hours, demonstrating clinical plausibility. The frequency distribution is in Figure 2.

Discussions and Conclusions

- Passively captured vancomycin administration data from automated infusion device systems provide ramifications for real-time bed-side patient care practice.
- With large volume of data, temporal event segmentation can be an efficient approach to generate clinically interpretable insights.
- This method scales up accuracy and consistency in handling longitudinal dosing data.
- It can enable real-time population surveillance and patient-specific clinical decision support for large patient populations.
- Better understanding of infusion data may also have implications for vancomycin pharmacokinetic dosing.¹

Fig 1. Illustration of dosing complexity. The treatment period (shaded light green area) can be further auto-clustered into individual infusion sessions (shaded dark green areas). Each session consists of multiple events within a dose administration period that delayed or prolonged a session (see upper panel).

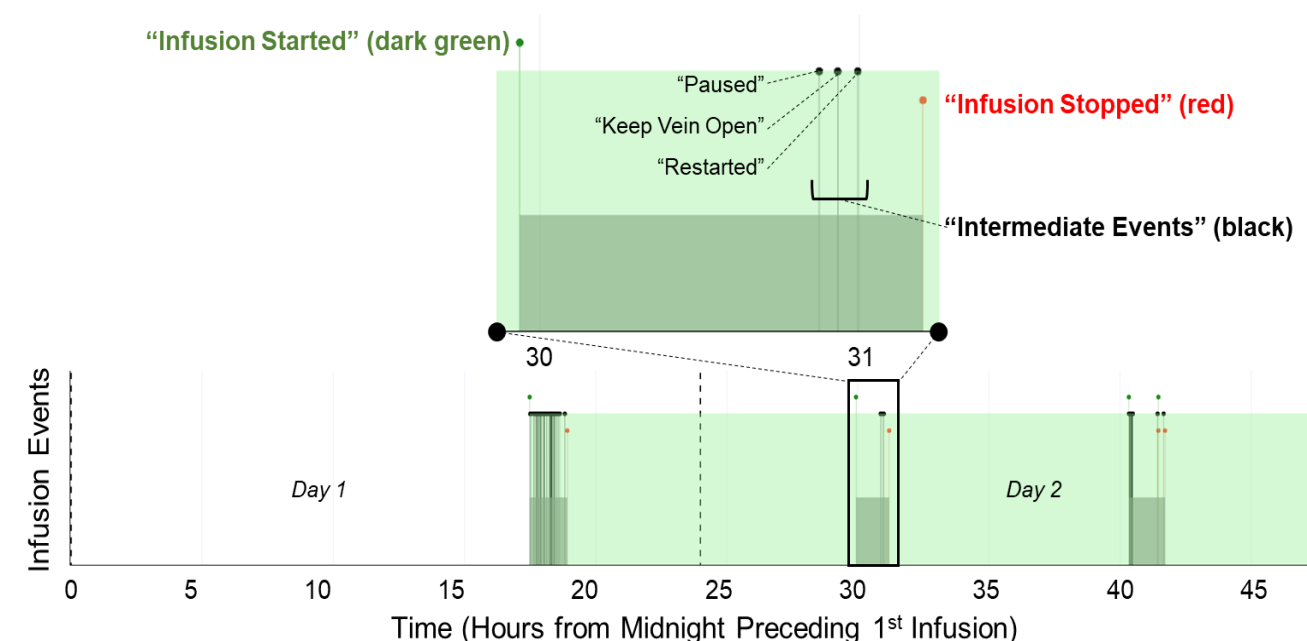
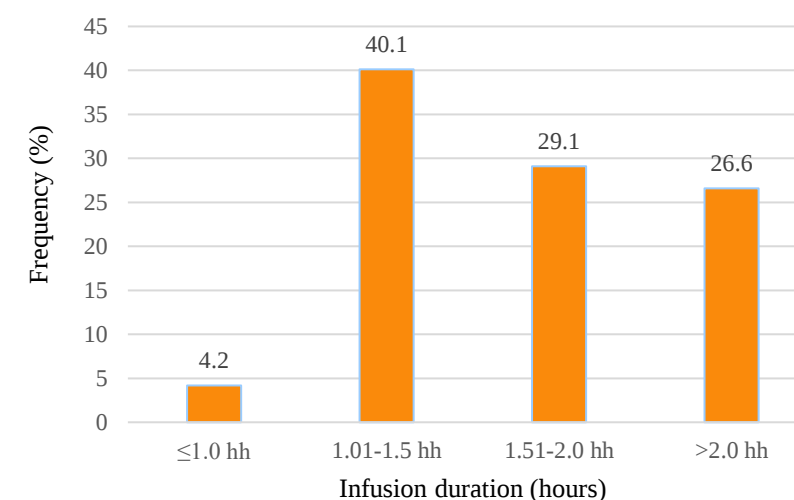


Fig 2. Distribution of Infusion Duration (hours)



Reference:

1. Rybak MJ, Le J, Lodise TP, et al. Therapeutic monitoring of vancomycin for serious methicillin-resistant *Staphylococcus aureus* infections: A revised consensus guideline and review by the American Society of Health-System Pharmacists, the Infectious Diseases Society of America, the Pediatric Infectious Diseases Society, and the Society of Infectious Diseases Pharmacists. *Am J Health Syst Pharm.* 2020;77(11):835-864.