

Impact of smart pump-electronic medical record interoperability on patient safety – A single centre study

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Introduction

Intravenous (IV) infusion errors, account for almost 20% of medical injuries.¹ IV infusion errors which involve high risk medications delivered directly into a patient blood stream have been identified as having the greatest potential for patient harm.²⁻⁵ Smart pumps have been implemented across many health services to reduce medication errors. This is because they include Dose Error Reduction Software (DERS) which alerts the user when predetermined parameters are exceeded. When integrated with electronic medical records (EMR), they contribute to a closed loop medication management system. This will further drive down medication errors and has the potential to also reduce user errors as it relies on a fully integrated digital system.⁵

Aim

This study describes the impact on patient safety when smart pumps are integrated with EMR in a fully integrated digital hospital in Australia.

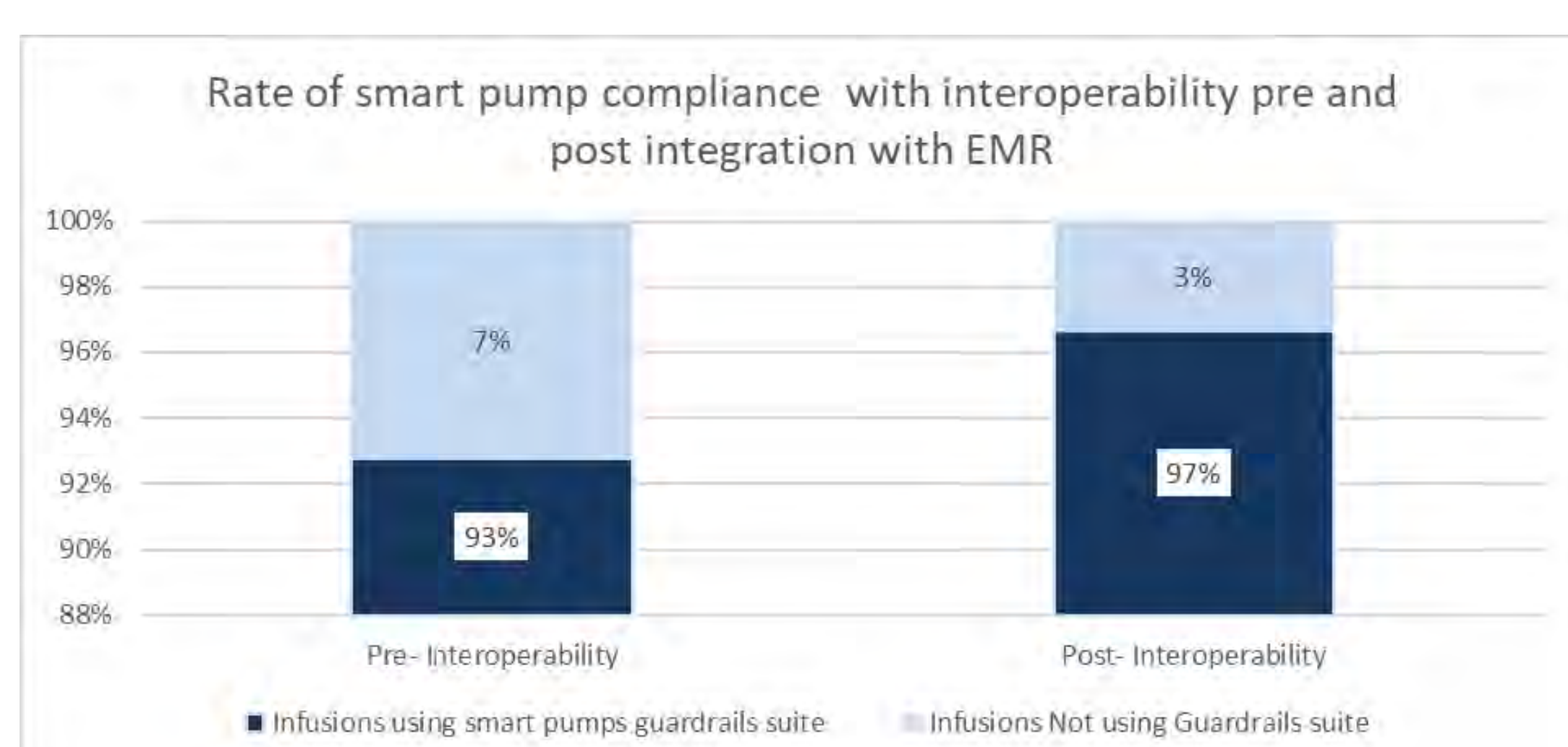
Methodology

Smart pump interoperability was deployed in the first cardiac specialist fully digitalised 180 bed hospital in Australia as part of implementing a closed loop medication management system. Baseline data was collected from Oct 2022 to Dec 2022 from a coronary care specific medication library in a tertiary hospital without smart pump integration. Post implementation data was collected at the new hospital from March 2023 to May 2023. The new hospital medication library was built based on the same cardiac medication library assessed in the pre-implementation phase. Rates of medication library compliance, alerts from pump reprogramming, as well as high risk medication alerts were collected. Patients' safety metrics such as the number of overridden alerts and the high-risk medication overrides were evaluated.

Evaluation

Medication library compliance has increased with interoperability from 93% to 97%, $P < 0.00001$. Figure 1. Pump reprogramming alerts have increased with interoperability (from 9% to 11%, $P = 0.03027$). Similarly, override limits alerts have also increased from 57% to 61%, $P < 0.00001$. Figure 2. On a medication level, high risk medication alerts rates have also increased with interoperability from 30% to 34%, $P < 0.00001$. Figure 3 shows the number and pattern of various alerts for a range of high-risk medications.

Figure 1: Rate of medication library compliance pre and post smart pump interoperability with EMR



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Figure 2: Number and type of smart pump alerts pre and post EMR integration

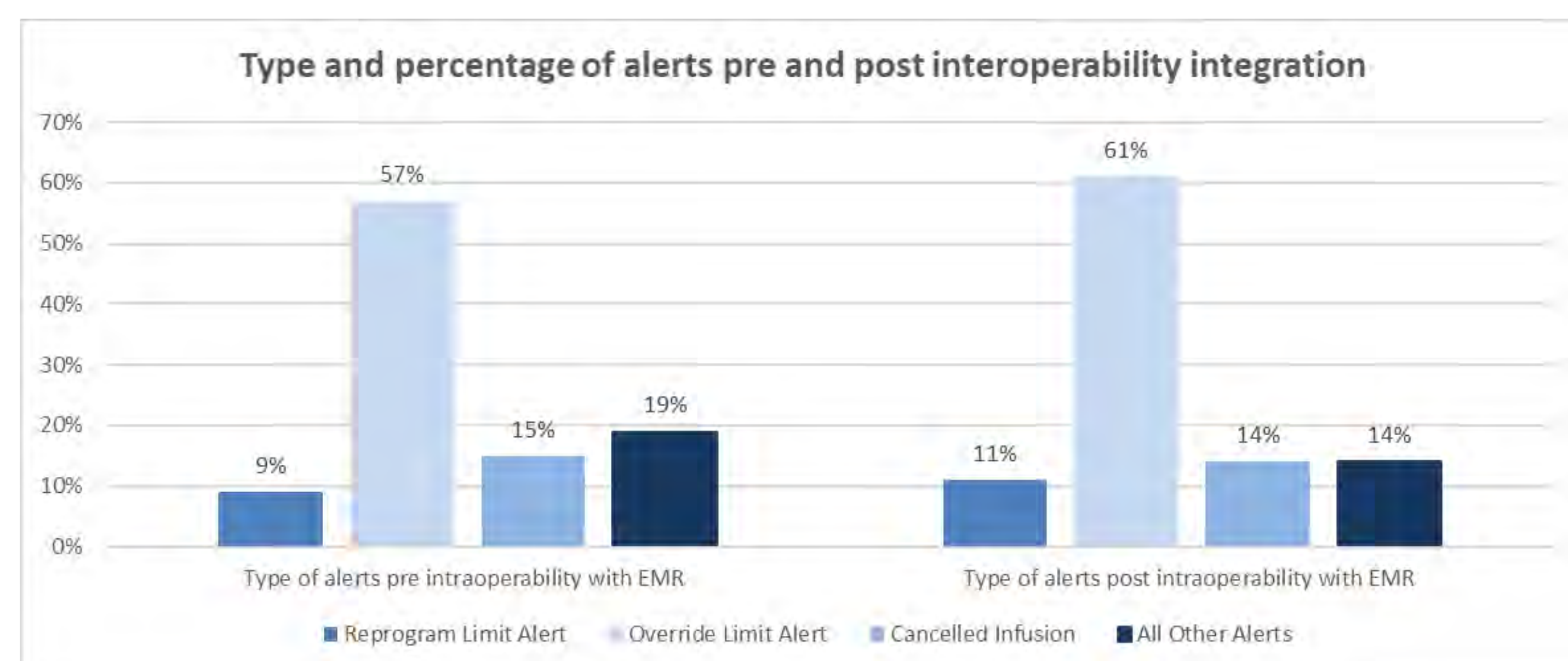


Figure 3: Top 10 intravenous medication generating alerts (A) before implementation of pump-electronic health record interoperability and (B) after implementation of pump-electronic health record interoperability

Chart A

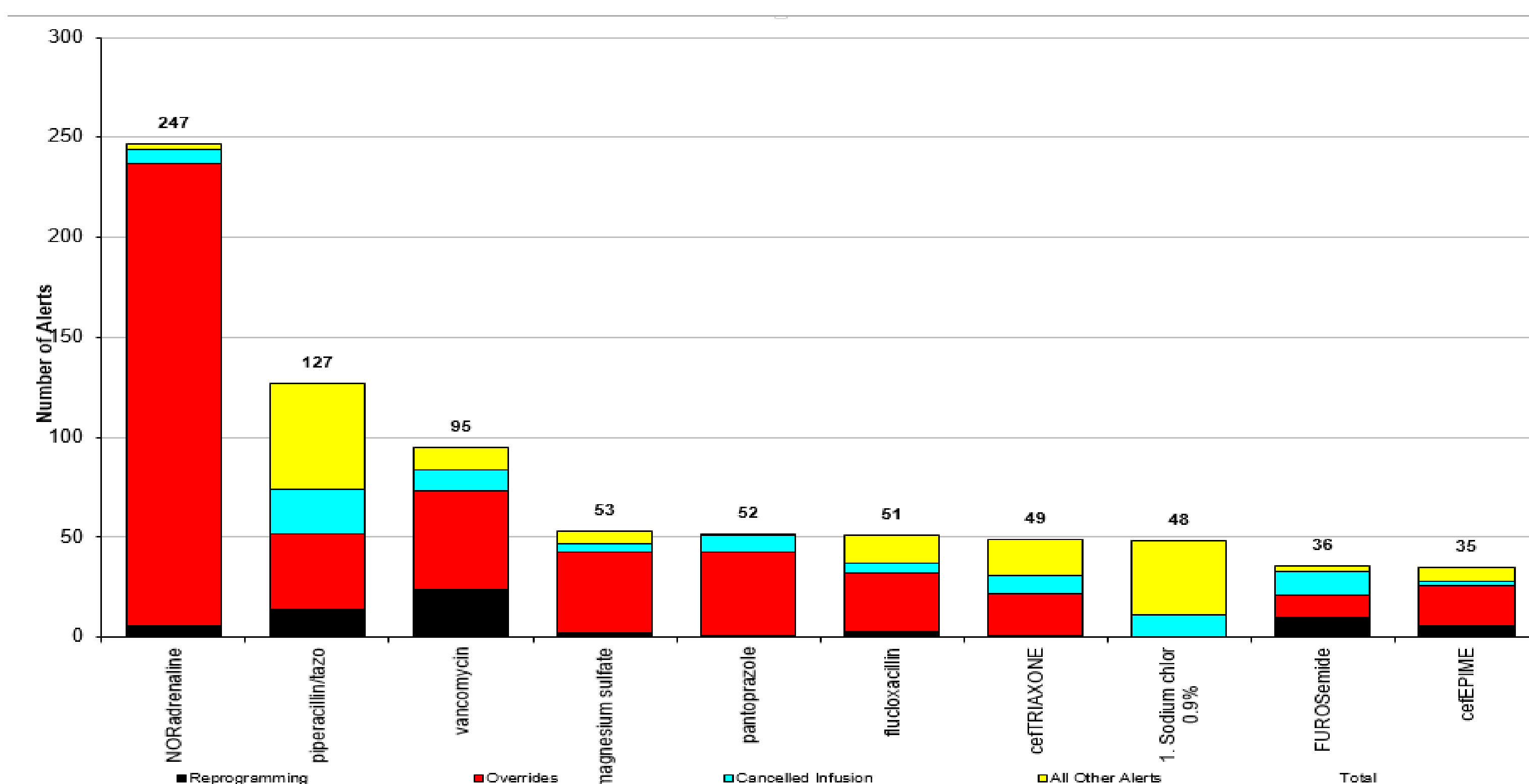
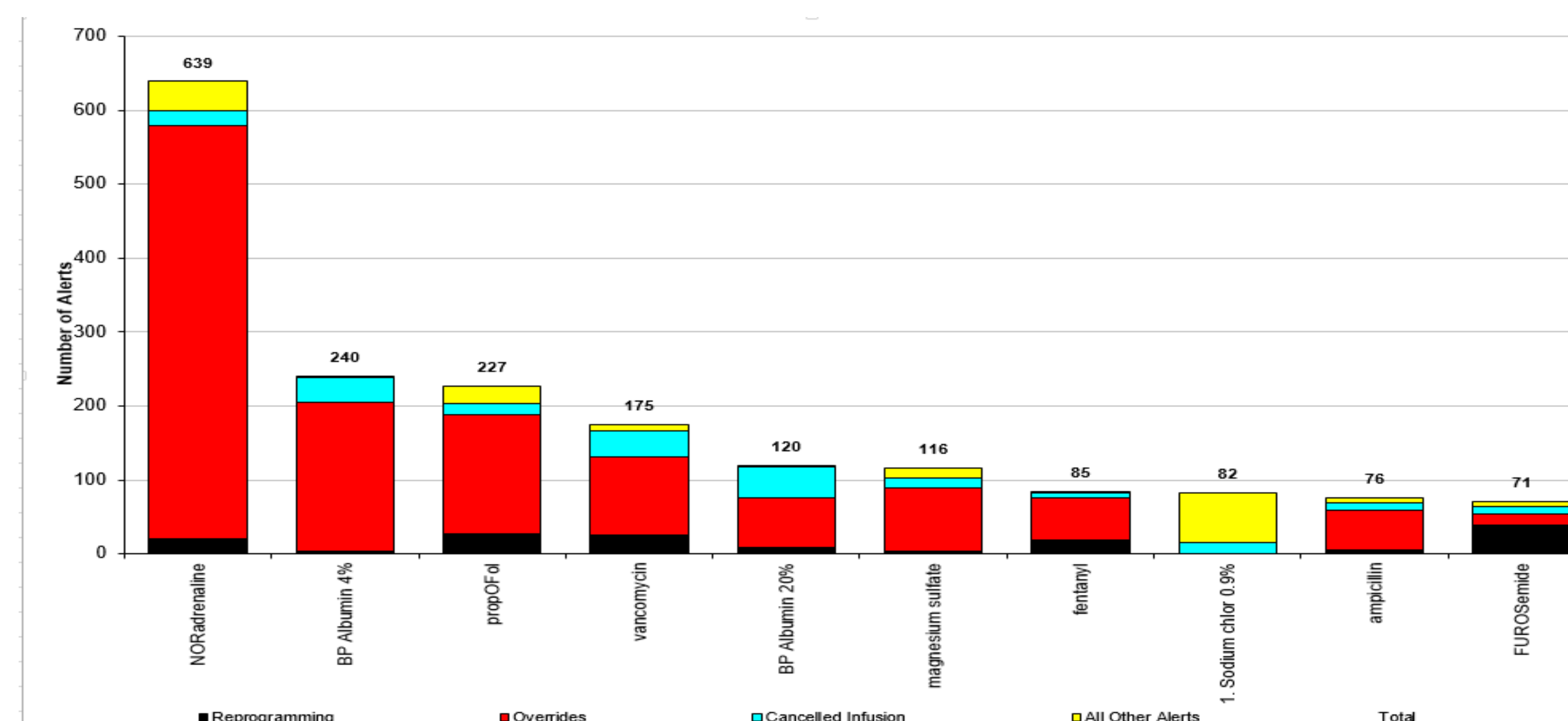


Chart B



Discussion

Similar to published data, our study revealed a significant increase in medication library compliance after introduction of pump-EMR interoperability.⁵ Additionally, our data showed EMR integration with smart pumps resulting in more alerts being generated such as reprogramming and overriding alerts. These observations could be due to various reasons including; inadequate education for end users regarding integrated workflows, illegible smart pump bar code labels required for scanning as well as possible misalignment of dose ranges for medications within the EMR and smart pump library dataset. Further research is required to explore this area.

Conclusion

Smart pump-EMR interoperability leads to safer administration of intravenous medications based on improved medication library compliance and more accurate smart pump programming.

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