

Implementing the practice of flushing intravenous medication administration sets to minimise under dosing of prescribed treatments in critical care.

Ruth Dando, Head of Nursing, Theatres, Anaesthetics and Critical Care

Abstract

Under dosing of IV antibiotics has emerged as a growing concern in healthcare settings. Under dosing occurs as residual IV antibiotic fluid remains in the dead space of administration sets, resulting in 20% - 40% of the prescribed drug not being administered (Figure 1).

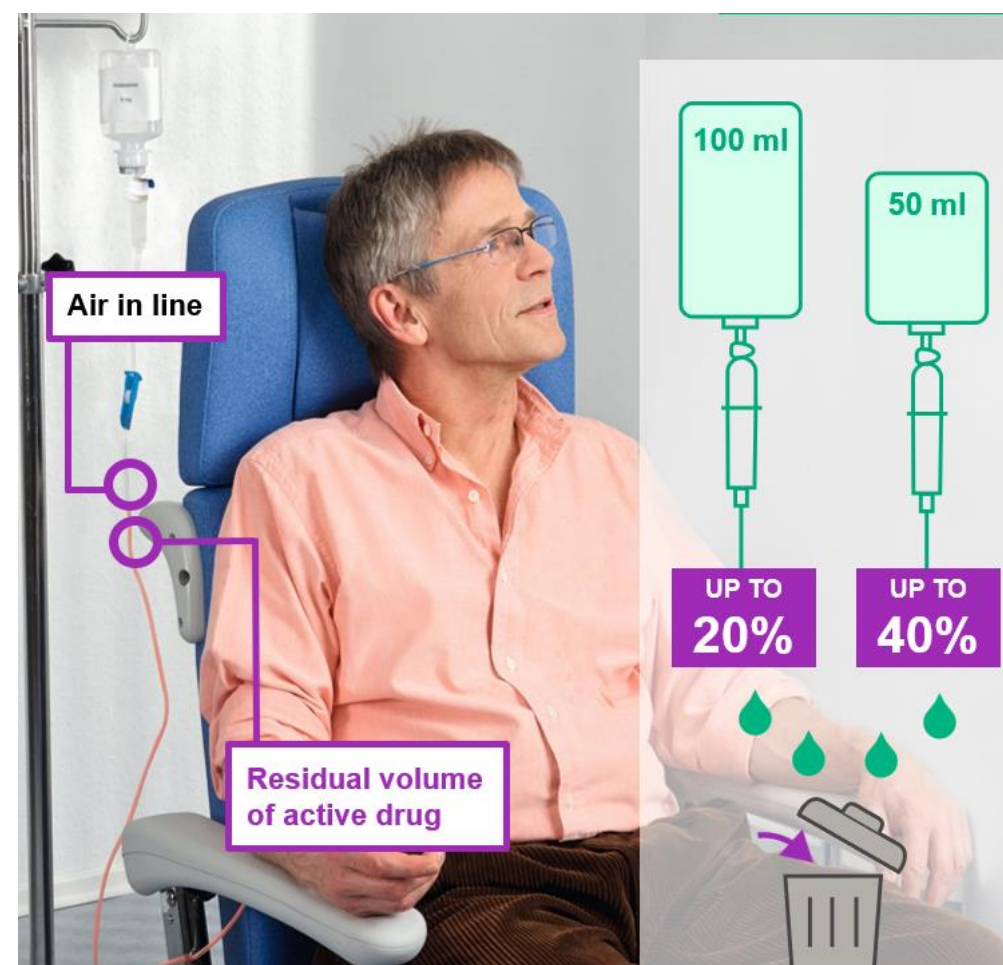


Figure 1. How under dosing occurs

The significant percentage of drug loss indicates the importance of reducing this impact¹. Consequences of unintentional dose reduction includes risk of not attaining the minimum inhibitory concentration (MIC) required to treat the infection, longer time to achieve the required serum levels and deterioration in clinical condition, which may lead to sepsis¹.

Inadequate delivery of the total prescribed dose may fail to fully eradicate the infecting pathogen, increasing the risk of treatment failure and the development of antibiotic resistance (Figure 2).

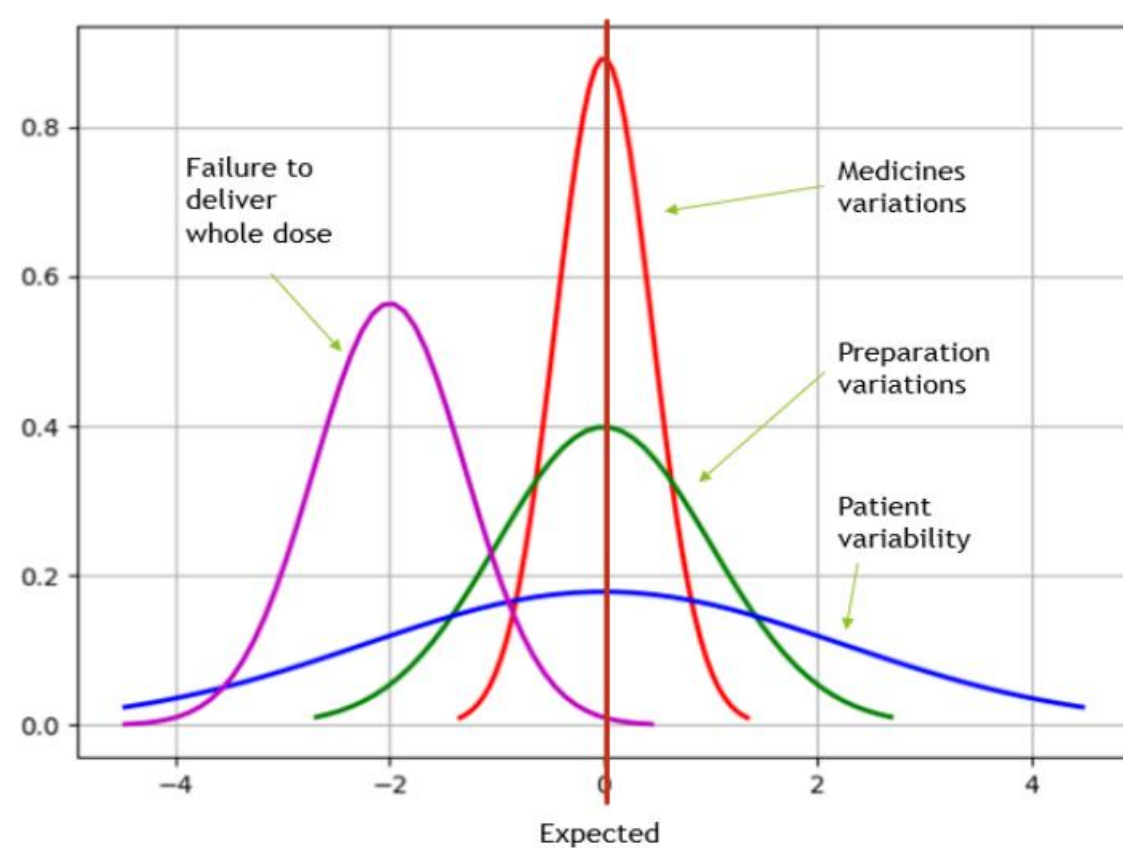


Figure 2. Impact of under dosing

Flushing the administration set with saline or other compatible diluent is a straightforward yet effective solution to this issue and a report has urged for coordinated, UK-wide efforts to implement antibiotic line flushing².

Introduction

Under delivery of medications in clinical care leads to significant deficits in healthcare efficiencies with consequences for clinical outcomes, financial and operational management, and the environment we live in.

Patients who are critically ill have substantially varied pharmacokinetics compared with patients who are not critically ill. Additionally, patients who are critically ill are more likely to be infected by bacteria that are less susceptible to antibiotic treatment³. Optimization of dosing strategies for antibiotics in any single patient may help to improve clinical and microbiological outcomes⁴. Increased lengths in critical care stays and the need for second- or third-line antibiotics to be prescribed are also consequences of underdosing.

Under delivery of antibiotics is also a contributor to the development of resistant strains. Antimicrobial resistance is now one of the biggest threats to global health and carries huge cost implications; in the UK alone, drug resistant infections costs the NHS £1 billion annually.

Ensuring that patients receive the full amount of a drug that they have been prescribed is a fundamental part of healthcare and a key priority for staff responsible for administering intravenous drugs.

Methods and Materials

A project brief was developed and a trial of undertaking the practice was requested and approved through procurement processes. Final approval was sought through procurement and financial groups in conjunction with key stakeholder engagement; medical, nursing, pharmacy, microbiology, IPC. The development of a Standard Operating Procedure (SOP) gaining approval at clinical governance groups, medicine's optimisation group. A pharmacy position statement was obtained to establish any risks associated with the practice.

Introduction of the practice was launched in Critical Care in January 2023, with a training roll out supported by the PDN team and Clinical Therapy Specialists who educated 137 Critical Care nurses.

Results

There has been a significant reduction in administration sets used from 40,450 sets per annum in financial year 2021-2022 to 15,175 sets per annum in years 2024 – 2025 resulting in a 62% reduction in single use plastic.

Comparison of IV antibiotic prescribing/usage data in Critical Care shows a 21% reduction when comparing December 2022 with 2023, when adjusted for patient bed occupancy producing savings in antibiotic spend of £5K per month / £60K per annum (Figure 3)

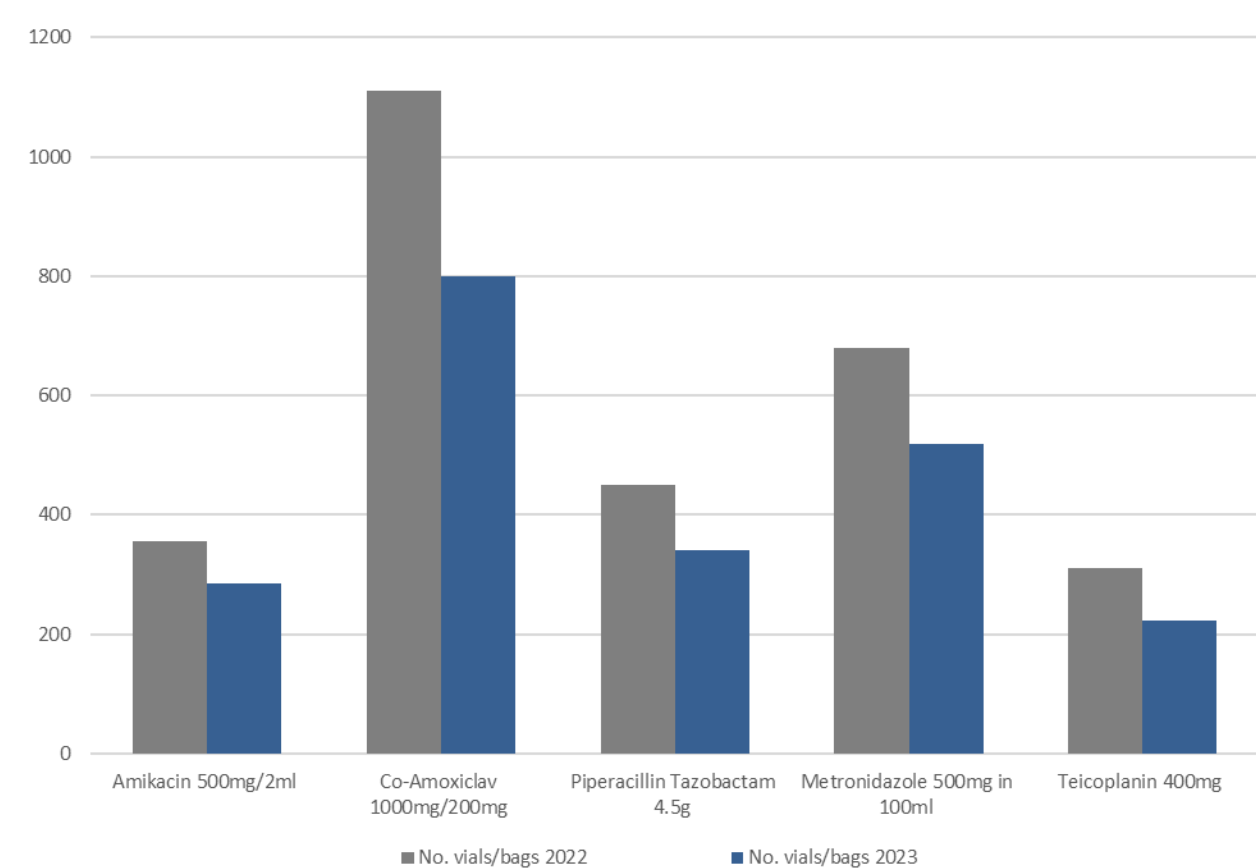


Figure 3. Reduction in IV antibiotic prescribing

There were variations in findings between the general critical care units and the neuro specialist unit in regard to length of stay and ventilatory days. Analysis of critical care lengths of stay showed a reduction in bed days in our general units and no impact in the number of ventilatory days (Figure 4). Whereas the Neuro ITU saw an increase in length of stay and ventilatory days likely related to the specific cohort of patients having a higher reliance on ventilatory support and more complex needs to be considered prior to stepping down.

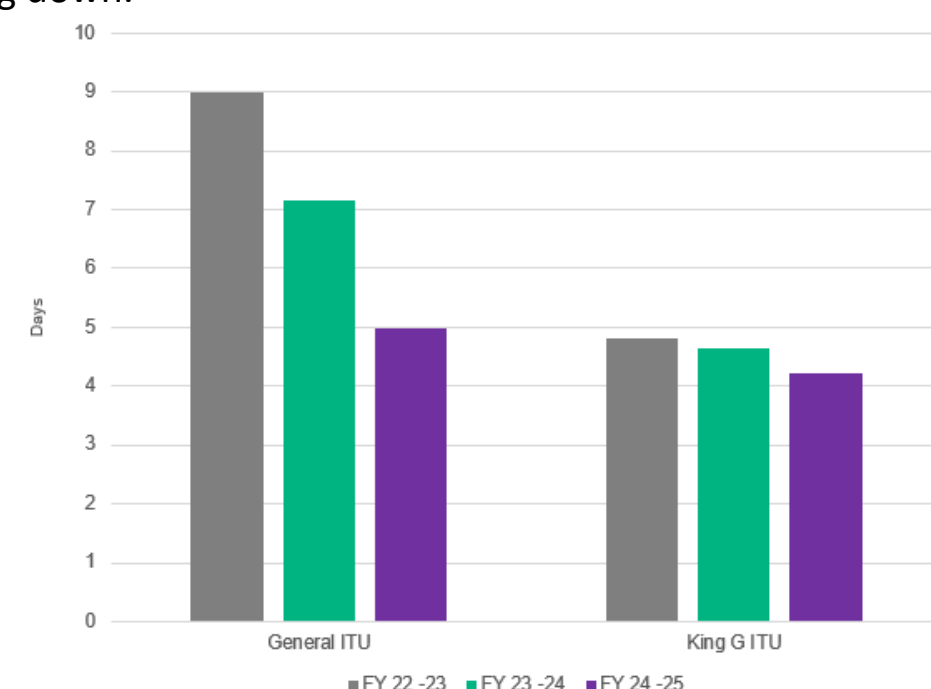


Figure 4. Reduction in length of stay

Discussion

Introducing a change in practice is not without its challenges. Strategies for overcoming these barriers were:

- Change in practice, not easy but worth persevering
- Communication and collaborative working is key
- Working in partnership with PDNs and IPC teams
- Use communication platforms to spread awareness; posters, team huddles, meetings WhatsApp groups
- Practice changes take time to embed stay patient.

Providing full dose delivery underpins our ability to provide safe effective care to produce the best patient outcomes, combat antimicrobial resistance processes reduce drug resistant infections whilst driving down unnecessary costs.

The findings broadly realised our expectations of implementing the practice of full dose administration. Taking into consideration the many variables that exist that can impact on antimicrobial requirements, efficacy, costs clear benefits have been demonstrated. We all know that the critical care and the NHS as a whole are experiencing enormous operational pressures, any measures that improve patient outcomes and reduce additional burdens from ineffective practices are fundamental

Conclusions

The flushing of intravenous line following infusion of prescribed medication needs to be reinstated as routine practice in critical care. Patient safety is at the heart of this change and is the foremost important reason for the implementation. Consequential financial and sustainability benefits resulting from the implementation have been a welcome addition to this quality improvement initiative.

Full dose delivery helps to prevent the misuse and overuse of antibiotics and drives down anti microbial resistance. AMR is an existing and real threat, so action is needed now to reduce this threat and ensure we have some weapons remaining in our antibiotic arsenal for future generations.

Further studies need to be done to continue to evidence the clinical, financial and sustainability improvements that can be realised on implementing full dose delivery practices.

At a time of increasing financial pressures any element of improving healthcare efficiencies and reduction in use of consumables needs to be embraced, along with the sustainability benefits for a greener approach to our health care delivery.

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