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SUSQI PROJECT REPORT

PUSH TO GREEN—ENCOURAGING SLOW IV PUSH OF ANTIBIOTICS (TAZOCIN, TEICOPLANIN, CEFTRIAZONE) IN NNUH ED

Start date of Project: May 2025
Date of Report: August 2025

Team Members:

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Background:

Administration of antibiotics as slow IV push when clinically appropriate saves money, time and ensures effective patient care (Hayward et al., 2024). In the Emergency Department (ED), antibiotics such as Tazocin were routinely administered via 100mL infusion bags. While this method is clinically acceptable, it raised concerns related to cost, sustainability, and timely medication administration.

The preference for bag-based administration in the ED stemmed from reports of transient hypotension following IV push administration, prompting a departmental policy shift. However, this approach was in contrast to the practices in other wards, where Tazocin has been safely administered as a slow IV push for a long time. This discrepancy highlighted the need to re-evaluate current protocols in light of both clinical evidence and operational efficiency.

From a sustainability perspective, the use of 100 mL saline bags and associated infusion sets contributes to increased plastic waste and higher consumable costs that are particularly important given ongoing concerns about departmental budget overruns.

Timeliness of antibiotic administration is another critical factor. In the UK, sepsis accounts for approximately 48,000 deaths annually (The UK Sepsis Trust). The SEPSIS-6 protocol emphasizes the importance of administering antibiotics within one hour of sepsis recognition. Antibiotics administration via 100 ml N/S infusions can delay treatment due to setup time and prolonged infusion duration, whereas slow IV push administration, when clinically appropriate, offers a timely and efficient way of antibiotic administration.

Further literature review revealed concerns about underdosing when antibiotics are administered via infusion bags. Medication can remain in the infusion set, potentially compromising therapeutic efficacy. To mitigate this, it is recommended that a 50 mL normal saline flush be administered post-infusion to ensure complete drug delivery (Fady & Bennett, 2023), an extra step that adds to resource use and workflow complexity.

We identified two additional antibiotics that can be safely administered via slow IV push over five minutes per Medusa guidelines. Medusa is a multidisciplinary NHS project that provides guidance on the preparation and administration of injectable medicines in adult and paediatric settings. This

presents an opportunity to standardise and optimise administration practices, reduce waste and improve cost-efficiency.

Specific Aims:

To encourage nurses to choose slow IV push to administer clinically accepted antibiotics (Tazocin, ceftriaxone, teicoplanin) instead of via 100 mls saline bag (N/S) in the emergency department (ED).

Methods:

Study the system

A survey of current practice and staff perceptions in ED was undertaken to understand the scale of the problem, support in planning change, and to evaluate social impacts. Details of social impacts are summarised in the results section.

The survey was completed by 48 staff. The results confirmed that there was opportunity to change administration methods with almost all staff providing these medications (27% of staff were administering via IV saline bag, 67% were using both slow IV push and via 100ml saline bag, just 6% were using just Slow IV push as their choice of administration for the selected antibiotics.

More than half of respondents strongly agreed 54% and 21% somewhat supported the proposed change in administration technique. whereas 5% oppose the change.65% of staff will prefer the more environmentally sustainable method whiles 23% said they would prioritise other factors. 38% staff reported they believed the change would have a positive impact on patients, a small number (6%) staff had concerns there would be a negative impact regarding efficacy of meds, time required for medication and/or due to staff confidence in technique.

> *"While I support the push administration of these medications, as and when clinically necessary, I am more concerned about the risk to patient safety. Whether by IV push or through a bag, patient safety should be prioritised."*

> *"Hopefully we can arrive at a decision that will prioritise patient safety and save ED some money, as well as reduce plastic waste"*

It was clear from the survey that current guidance was not clear:

> *"Most times people follow Medusa and it gives 2 options, so people will always try to go with the safer option"*

> *"I think there should be a rule or guidelines to follow so everyone can be on the same page on administration"*

> *"Clearer guidance on pushing medications"*

> *"There would need to be a real on the floor education drive and cultural change to make the shift across to IV push"*

The survey showed there is room to improve practice and increase usage of IV push administration. Reasons for current and varied practice were mixed however appeared linked to staff preference or confidence and beliefs about efficacy or patient safety.

In addition to the survey, we reviewed practice across the Trust and found there was variation. Other wards in the hospital already used push administration as their standard practice whereas in ED the protocol for administration was using saline bags. Discussion with some of the older staff indicated that there was an incident where a patient dropped his blood pressure after Tazocin had been pushed. Despite this being the reason, tazocin has continuously been safely administered via slow IV push on the wards. The medusa guideline considers both administrations clinically accepted.

This supported us to develop our improvement plan ensuring staff concerns were addressed.

Implementing change

A team was formed comprising two experienced staff nurses and one ED matron. The nurses were highly familiar with the selected antibiotics, while the matron's involvement reflected strong departmental support for the initiative.

Key stakeholders were engaged throughout the project:

- ED Pharmacy Team: Advised on identifying antibiotics suitable for slow IV push administration. They directed us to medusa and go by that guideline
- EPMA Team: Provided prescribing data for the selected antibiotics over a one-year period via the hospital's electronic prescribing system.
- ED Education Team: Supported communication and staff engagement efforts.
- Centre for Sustainable Healthcare and Trust Sustainability Team: Offers ongoing guidance and strategic input to align the project with broader environmental goals.

Following analysis of the baseline survey, a one-month educational intervention was launched to encourage administration via slow IV push. Components of the intervention included:

- Posters placed in all drug preparation rooms to prompt nurses to consider slow IV push.
- Tally tables in drug rooms for nurses to record their chosen administration method (slow IV push vs. 100ml saline infusion). These facilitated real-time data collection on practice change. (Copies can be found in the Appendix)
- Email communications sent via the ED Education Team, highlighting the benefits of slow IV push and encouraging adoption.
- Verbal reinforcement during shift handovers by Band 7 nurses, who reminded staff of the initiative and invited feedback.

At the end of the intervention period, tally data were collected to quantify the proportion of antibiotics administered via slow IV push versus saline infusion.

A post-intervention survey was then distributed to evaluate changes in practice and perceptions following the educational campaign and these are some the feedback we received after a month of intervention.

67% of staff gave the selected antibiotics via slow IV push, 30% used a mix of both methods. Among the 30%, the reasons that influence their choice between the 2 methods were; workload, acuity of patient, time pressures, size of cannula, priority needs of the patient, transfer to other areas of the department or ward.

48% of staff felt much more confident using slow IV push for the selected antibiotics whereas 39% said their confidence did not change. No one responded by saying they were not confident with pushing the selected antibiotics. We had 42% saying slow IV push improved workflow, 24% said it made no difference but 27% responded it delayed workflow. According to Burger and Degnan 2016, nurses may find the process of slow IV push quicker and less cumbersome compared to preparing and monitoring IV saline bag infusions. Similar percentage of staff, 69%, said they will go with the environmentally sustainable option

Measurement:

Patient outcomes:

Patients will continue to receive the medication they require. National guidance continues to be followed as per the Medusa system and pharmacy colleagues, ensuring quality of care continues to be met. Safety may be optimised through improved clarity of local guidance in line with the above.

Care may be more efficient and timely in terms of sepsis management as medication is administered more quickly. It was not possible to measure this within the scale of the project, however incident reports linked to medication delay will be monitored. Literature that supports the change has potential to improve patient safety is summarised in the results section.

There is the risk of staff pushing medications too fast which could lead to push/speed shock. The reaction to pushing too fast can be dropping blood pressure, tachycardia, even cardiac arrest. However, this applies to almost all IV medications. There is an In-phase system that allows staff to report incidents and also with our education to staff on choosing slow IV push we provide a means of feeding back and concerns and challenges that come up to us or the education team.

Environmental sustainability:

GHG emissions associated with the 100ml saline bottle have been estimated using an Environmentally Extended Input Analysis (EEIOA) in which the cost of a saline bottle (provided by NNUH) was converted into carbon using the pharmaceutical emission factor from the UK Government 2022 SIC database. For disposal emissions, the weight of an empty bottle was provided by NNUH. It was assumed the bottle would be disposed of into the clinical waste bin and disposal emission factors have been taken from Rizan et al. (2021).

GHG emissions associated with the given set was estimated using a cradle-to-grave, process based carbon footprint analysis, encompassing primary and packaging material manufacture, transport and disposal. Activity data was converted into carbon using emission factors taken from the DESNZ 2025 database.

Item	GHG emissions per item (kgCO2e)
100ml saline bottle	0.113
Giving set	0.201

Per dose administered via IV push instead of saline, we will save 0.314 kgCO2e.

Economic sustainability:
Costs of saline bottles/bags and giving sets were provided by the Trust procurement team. The price for a 100ml Saline bottle is £0.47, Gravity Infusion set is £0.48 each and the Volumetric line cost £1.76 each. The combination for administration could be a Saline bottle and a gravity infusion set,[0.47 + 0.48 = 0.95] or saline bottle and a volumetric line (if an infusion pump is used) [0.47 + 1.76 = 2.23].

Per administration, between £0.95 and £2.23 would be saved from using an IV push administration method. To calculate a potential financial saving, we have assumed an average cost of £2.06.

Social sustainability:
A staff survey was implemented before and after the change to understand perceptions of the change and impacts on staff.

It was not appropriate to seek direct feedback from patients regarding this change in medication administration, as they would not generally be aware that their care had been altered. The adjustment primarily affects clinical workflow rather than patient perception. However, the new method shortens administration time (approximately 5 minutes for IV push versus 30 minutes for saline infusion), which can increase patient comfort by allowing greater mobility (e.g., easier to use the bathroom) as they are not attached to a drip for 30 minutes.

Results:

Patient outcomes:
Patients will continue to receive the medication they require as per evidence based guidance. Clarity of guidance across the team has potential to optimise patient safety, though risks were already minimal.

Care may be more efficient and timely in terms of sepsis management as medication is administered more quickly. IV push administration can significantly reduce the time from when an antibiotic is ordered to when it is actually administered (Brady et al., 2024). As part of Sepsis 6 protocol, antibiotics need to be given within 1 hour when sepsis is recognised. This is especially beneficial for initiating first-dose empiric antibiotics in time-sensitive environments such as the Emergency Department (Academia et al., 2020).

Based on survey results, we estimate that at baseline approximately 40% of antibiotic doses were administered via IV push**.** This estimate is derived from 6% reporting exclusive IV push, 27% of staff reporting exclusive use of saline bags and 67% using a mix of both methods (assuming a 50/50 split). Post-intervention data showed a shift in practice with 67% of staff administering selected antibiotics via IV push, with an additional 30% using both methods (we assumed a 50/50 split). This indicates a projected future usage of around 82%. Overall, this is an increase of 42%.

Environmental and economic sustainability:
Data from EPMA showed a total of 3,413 doses of Tazocin, Teicoplanin, and Ceftriaxone were prescribed over 12 months (April 2024 to March 2025) across ED Resus, Trolley Bay, RATS, and Ambulatory areas.

- Baseline IV push doses (40%): 1,365 doses
- Post-intervention IV push doses (82%): 2,799 doses
- Increase in IV push doses: 1,434 doses

This represents an estimated increase of 1,434 doses administered via IV push, saving an estimated **£2,954.04** and **450.3 kgCO2e** per year, equivalent to driving 1,325 miles in an average car.

Tally data (see Appendix) supported this by showing 85% of 146 doses administered during the intervention period were given via slow IV push. For Tazocin specifically, 91% (101) of the 110 doses were administered using this method. We have opted to estimate savings conservatively at 82% to account for variation in practice across different areas of ED, individual clinical judgement, and operational pressures that may influence administration method.

This data also could not capture the many prescriptions done on a paper chart, which means this is likely an underestimation of the actual numbers of the selected antibiotics prescribed. The savings from this project may therefore be higher.

Social sustainability:
As above, following the change 67% of staff reported they gave the selected antibiotics via slow IV push with 30% using a mix of both methods compares to just 6% using push and 67% a mix of methods before the project.

Among the 30% continuing to use both methods, the reasons that influence their choice were workload, acuity of patient, time pressures, size of cannula, priority needs of the patient and transfer to other areas of the department or ward.

Comments from the staff survey were

> *"I think its generally more cost-effective and environmentally friendly. It also enhances workflow and ensures timely administration. Thanks for this initiative."*

Studies have shown that IV push methods can lead to improved nursing satisfaction and efficiency (Lee et al 2021).

48% of staff reported feeling more confident using slow IV push for the selected antibiotics whereas 39% said their confidence did not change. No one responded by saying they were not confident with pushing the selected antibiotics. 42% reported slow IV push improved workflow and 24% said it made no difference. 27% responded it delayed workflow. This contradicts with existing research by Burger and Degnan 2016, which reports nurses may find the process of slow IV push quicker and less cumbersome compared to preparing and monitoring IV saline bag infusions. 69% of staff said they will go with the environmentally sustainable option.

For patients, the new method shortens administration time (approximately 5 minutes for IV push versus 30 minutes for saline infusion), which can increase patient comfort by allowing greater mobility (e.g., easier to use the bathroom) as they are not attached to a drip for 30 minutes.

Discussion:

This project highlighted a variation in antibiotic administration practices within the Norfolk and Norwich University Hospital (NNUH). While Tazocin was routinely administered via a 100 mL saline infusion in the Emergency Department (ED), other hospital wards had long adopted slow IV push as their standard approach.

Literature recommends the use of slow IV push for initial antibiotic administration in sepsis, where clinically appropriate. Given that the ED is often the first point of contact for critically ill patients, and considering the urgency outlined in the SEPSIS-6 protocol, which recommends antibiotic administration within one hour of sepsis recognition, slow IV push offers a timely and efficient choice. It reduces setup time and ensures rapid drug delivery, which is critical in life-threatening scenarios.

Initial survey to establish choice of administration of the selected antibiotics (Tazocin, Teicoplanin and Ceftriaxone) in ED revealed that only 6% of ED nurses routinely used slow IV push for the selected antibiotics. This proportion showed the need for targeted education and departmental support.

A one-month intervention was launched, incorporating visual prompts (posters), emails, verbal reinforcement during shift handovers, and real-time tracking via tally sheets in drug rooms. These strategies were designed to raise awareness, build confidence, and normalize slow IV push as a safe and efficient practice.

Post-intervention data showed a marked improvement. Survey responses indicated that 67% of staff had adopted slow IV push as their preferred method. Tally data revealed that 85% of the 146 doses administered during the intervention period were given via slow IV push. Notably, for Tazocin specifically, 91% (101) of the 110 doses were administered using this method—demonstrating strong uptake and departmental engagement. We opted to estimate our savings conservatively.

Several limitations were identified. The survey grouped three antibiotics together, which led to confusion among staff. For example, Tazocin is frequently prescribed, whereas Ceftriaxone is less common in the ED. Future surveys should separate medications to allow for more accurate responses. Additionally, the project did not incorporate patient experience or feedback, which could provide valuable insights into comfort, and satisfaction with the change.

Concerns around safe administration lingers, particularly regarding technique and confidence with IV push. To address this, ongoing support is being provided by the ED Education Team and senior colleagues. Staff are continually encouraged to consult Medusa; the NHS Injectable Medicines Guide, for evidence-based preparation and administration protocols.

Looking ahead, there is potential to scale this initiative to our sister facilities, The Queen Elizabeth Hospital King's Lynn NHS Foundation Trust and James Paget University Hospitals NHS Foundation Trust, where Tazocin is still routinely administered via 100 mL saline bags. Expanding the intervention could lead to significant reductions in plastic waste, lower carbon emissions, and improved cost-efficiency—aligning clinical practice with both environmental and financial sustainability goals.

Conclusions:

In concluding our project on the administration of Tazocin, Teicoplanin, and Ceftriaxone via IV push versus 100ml saline bags, several key factors contributed to its success. The project was supported by strong collaboration across multiple teams, including nursing, pharmacy, the education team, EPMA, the Centre for Sustainable Healthcare, Trust sustainability leads, quality improvement, and nursing management. This multidisciplinary input was instrumental in ensuring both clinical safety and sustainability outcomes were achieved.

Despite the overall success, the project faced some challenges. One of the main issues was the low response rate to the staff survey. Additionally, staff reported difficulty interpreting questions that grouped multiple antibiotics together, as this made it harder to distinguish between medications with different usage patterns and associated risks. This feedback highlighted the need for clearer survey design in future initiatives.

Concerns were also raised regarding the slow IV push method, particularly around the risk of administering medication too quickly or causing a drop in blood pressure. To address this, staff were advised to consult Medusa for guidance on administration techniques and were encouraged to seek support from colleagues. This approach helped build confidence among staff, and survey responses reflected a sense of reassurance from having access to reliable information and peer support.

Moving forward, visual prompts have been placed in drug rooms to serve as ongoing reminders that, when clinically appropriate, slow IV push is a more sustainable and efficient method of administration. The education team has endorsed IV push as a supported practice and continues to offer training and guidance to staff who may lack confidence. Senior staff have also engaged with the initiative, and policy changes are currently being finalised in collaboration with the education team to formally embed this practice into routine care.

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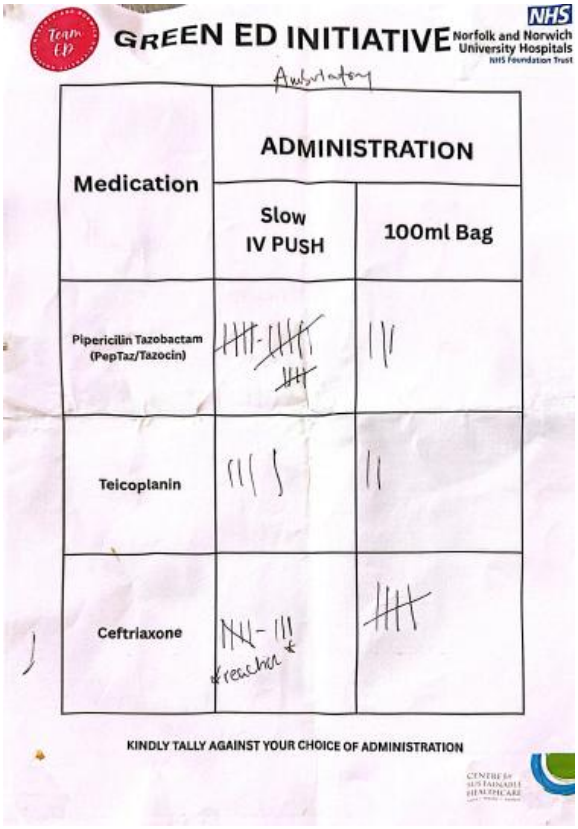
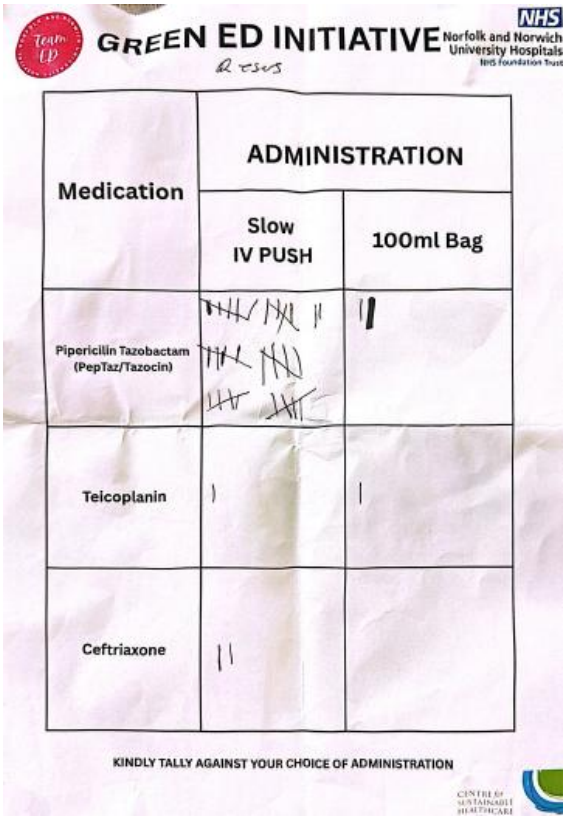
Appendix

Tally forms for staff to complete following administration





Critical success factors

Please select one or two of the below factors that you believe were most essential to ensure the success of your project changes.

People	Process	Resources	Context
☐ Patient involvement and/or appropriate information for patients - to raise awareness and understanding of intervention X Staff engagement ☐ MDT / Cross-department communication ☐ Skills and capability of staff X Team/service agreement that there is a problem and changes are suitable to trial (Knowledge and understanding of the issue) X Support from senior organisational or system leaders	X clear guidance / evidence / policy to support the intervention. ☐ Incentivisation of the strategy – e.g., QOF in general practice ☐ systematic and coordinated approach ☐ clear, measurable targets ☐ long-term strategy for sustaining and embedding change developed in planning phase ☐ integrating the intervention into the natural workflow, team functions, technology systems, and incentive structures of the team/service/organisation	☐ Dedicated time ☐ QI training / information resources and organisation process / support ☐ Infrastructure capable of providing teams with information, data and equipment needed ☐ Research / evidence of change successfully implemented elsewhere ☐ Financial investment	☐ aims aligned with wider service, organisational or system goals. X Links to patient benefits / clinical outcomes ☐ Links to staff benefits ☐ 'Permission' given through the organisational context, capacity and positive change culture.