

IMPROVING THE SAFE PREPARATION AND ADMINISTRATION OF ORAL MEDICATIONS VIA ENTERAL FEEDING TUBES

CLINICAL AUDIT & QUALITY IMPROVEMENT PROJECT

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ABSTRACT

Background: Safe administration of oral medications through enteral feeding tubes requires appropriate medication selection and formulation, separate preparation and administration, adequate tube flushing, appropriate management of medication–feed interactions, and accurate documentation. However, adherence to these practices may be inconsistent. This quality improvement project aimed to assess compliance with predefined standards for enteral medication administration and improve practice through a targeted Plan–Do–Study–Act (PDSA) intervention.

Methods: A prospective clinical audit and quality improvement project was conducted in Medical B Unit, Ayub Teaching Hospital, Abbottabad, Pakistan. Adult inpatients receiving oral medications through an enteral feeding tube were included using consecutive sampling. Baseline compliance was assessed from 1 July to 15 August 2025 against nine predefined medication-safety standards. Baseline findings were used to develop a multidisciplinary intervention comprising staff education, a standardised one-page medication administration protocol, bedside reminders, medication-specific guidance, reinforcement of appropriate equipment use, and improved documentation practices. A re-audit was conducted from 1 September to 10 October 2025 using the same standards and data-collection approach. Compliance was analysed descriptively and compared using absolute percentage-point changes.

Results: During the baseline audit, 175 eligible medication administrations among 45 adult inpatients were assessed. Compliance varied across the nine standards, with the lowest compliance observed for administration of medicines separately with an appropriate flush between medications (42.3%), pre-medication tube flushing (57.1%), management of medication–feed interactions (55.4%), and post-medication flushing (64.0%). During the re-audit, 147 medication administrations among 51 adult inpatients were assessed. Compliance improved across all nine standards. The greatest improvement was observed in separate medication administration with an appropriate flush between medicines, increasing from 42.3% to 87.5% (+45.2 percentage points). Pre-medication flushing increased from 57.1% to 91.8%, medication–feed interaction management from 55.4% to 89.5%, and post-medication flushing from 64.0% to 92.5%. Compliance with appropriate equipment use increased from 82.3% to 95.9%, while documentation improved from 84.0% to 95.2%. Predefined targets were achieved for appropriate equipment use and documentation, but not for all standards.

Conclusion: A targeted, multifaceted PDSA-based intervention was associated with substantial improvement in the safe preparation and administration of oral medications through enteral feeding tubes. The greatest gains were observed in medication separation, tube flushing, and management of medication–feed interactions. However, several standards remained below their predefined

targets, indicating the need for continued reinforcement and periodic re-audit through further PDSA cycles to sustain and further improve practice.

Keywords: Enteral feeding tubes; Medication administration; Medication safety; Quality improvement; Clinical audit; PDSA cycle; Medication–feed interactions

INTRODUCTION

Background

Enteral feeding tubes are commonly used in hospitalised patients who are unable to take medicines safely by mouth, including patients with dysphagia, neurological disorders, impaired consciousness and critical illness. In these patients, the feeding tube frequently becomes an important route not only for nutritional support but also for administration of oral medicines. However, administration of medicines through an enteral tube is not equivalent to routine oral administration and requires appropriate selection, preparation and administration of each medication. Factors such as tube type and position, dosage formulation, drug–feed interactions and the technique used for administration can all influence the safety and effectiveness of treatment.^{1,2}

Medication administration through enteral tubes is particularly vulnerable to preventable errors. Common problems include inappropriate crushing of modified-release or enteric-coated preparations, failure to use a suitable formulation, mixing several medicines together, mixing medicines directly with enteral feed, inadequate flushing of the tube and failure to recognise clinically important medicine–feed interactions. Such errors may result in reduced drug absorption or therapeutic effect, increased adverse effects, medication wastage and obstruction of the feeding tube.^{1,2}

The extent of the problem has been demonstrated in observational studies. In one study involving 94 intensive-care patients, 10,250 medication administrations were observed and 4,753 errors were identified during the preparation and administration of oral medicines in patients with enteral feeding tubes or swallowing difficulties. Errors included inappropriate dose preparation and administration, with substantial variation in the suitability of available dosage forms.³ A separate quality-improvement programme specifically addressing medication preparation and administration through nasogastric/nasoenteric tubes demonstrated that a structured intervention incorporating guidance, staff

education and medication-specific information could reduce several important preparation errors. However, the study also identified unintended consequences, including persistent problems with tube obstruction, highlighting the need for continuous monitoring rather than relying on education alone.⁴

Safe practice therefore requires a systematic approach. Current NHS Specialist Pharmacy Service guidance recommends assessing the suitability of the medication and formulation for the individual patient and tube, preparing medicines separately rather than mixing them, using an appropriate enteral syringe, flushing the tube before administration, flushing between individual medicines and flushing after the final medicine. The guidance also emphasises consideration of interactions between medicines and enteral feeds, with feeding interruptions used where clinically indicated.⁵

Despite the availability of such recommendations, evidence suggests that adherence to best practice during enteral medication administration remains inconsistent. Interventions described in the literature include pharmacist involvement, standard operating procedures, staff education, medication information resources and decision-support tools, with reported reductions in medication-related errors ranging from approximately 31% to 85% across different interventions. However, the available studies are heterogeneous, and sustained improvement requires local measurement of practice, targeted interventions and repeated assessment.⁶

In a busy medical ward, therefore, medication administration through feeding tubes represents an important and potentially modifiable patient-safety process. Identifying gaps between actual practice and recommended standards provides an opportunity for quality improvement. The present clinical audit was designed to assess the safety of oral medication preparation and administration through enteral feeding tubes, identify specific areas of non-compliance, implement targeted multidisciplinary interventions using the **Plan–Do–Study–Act**

(PDSA) approach, and determine whether these interventions improve compliance on re-audit.

Aim

To improve the safety and appropriateness of preparing and administering oral medications through enteral feeding tubes among adult inpatients by identifying gaps in current practice, implementing targeted interventions based on recognised medication-safety standards, and assessing improvement through a PDSA-based re-audit.

Objectives

1. To assess baseline compliance with recommended standards for the preparation and administration of oral medications through enteral feeding tubes among adult inpatients in the selected medical unit.
2. To identify specific medication-administration errors and practice gaps, including inappropriate formulation or crushing of medications, preparation of multiple medicines together, inadequate tube flushing, inappropriate administration with enteral feed, and inadequate documentation.
3. To achieve at least 90% overall compliance with the predefined audit standards following implementation of the quality-improvement interventions.
4. To improve compliance in each major area of medication administration, particularly

appropriate medication preparation, separate administration of medicines, pre- and post-medication tube flushing, management of medicine-feed interactions, and documentation.

5. To implement a structured PDSA-based intervention comprising staff education, standardised written guidance, medication-specific reference material and practical process improvements according to the deficiencies identified during the baseline audit.

6. To compare baseline and post-intervention compliance using the same predefined audit standards and data-collection tool, and to determine the extent of improvement following the intervention.

7. To identify persistent barriers to safe enteral medication administration during the re-audit and use these findings to develop a practical plan for sustaining improvement in routine clinical practice.

Audit Standards

The audit will assess the preparation and administration of oral medications through enteral feeding tubes against the current NHS Specialist Pharmacy Service standards. Each medication administration will be assessed individually.

No.	Audit standard	Target compliance
1	The medication formulation will be appropriate for administration through the patient's enteral feeding tube, taking into consideration the medication, formulation and tube termination site.	100%
2	Medications that should not be crushed or otherwise altered, such as inappropriate modified-release or enteric-coated preparations, will not be crushed or administered in an unsuitable form.	100%
3	Each medication will be prepared separately and will not be mixed with another medication or directly mixed with enteral feed.	≥95%
4	An appropriate enteral medication syringe and suitable water will be used for preparation and administration according to local policy and patient requirements.	≥95%
5	The enteral feeding tube will be flushed before administration of medication, using an appropriate volume of water according to the applicable guidance and patient's clinical condition.	≥95%

No.	Audit standard	Target compliance
6	When more than one medication is administered, each medication will be given separately, with an appropriate water flush between medications.	≥95%
7	Clinically important medication–feed interactions will be identified and managed appropriately, including withholding or restarting enteral feeding when specifically required.	100%
8	The enteral feeding tube will be flushed after administration of the final medication using an appropriate volume of water.	≥95%
9	Medication administration, including any relevant feeding interruption or special administration instructions, will be appropriately documented in the medication administration record.	≥95%

Operational definition of safe practice

For the purpose of this audit, **safe medication administration through an enteral feeding tube** will be considered to involve appropriate medication/formulation selection, preparation of medicines individually, appropriate use of the feeding tube and administration equipment, adequate flushing before and between medicines, appropriate management of clinically significant medication–feed interactions, post-administration flushing, and accurate documentation.

The **100% targets** have been reserved for standards where a failure could potentially result in a significant medication-safety problem, particularly inappropriate formulation and failure to recognise important medication–feed interactions. The **≥95% targets** are used for process measures where occasional deviations may occur because of patient-specific circumstances, such as fluid restriction, or other clinically justified reasons.

Methods

Study Design

This was a **prospective clinical audit and quality improvement project** conducted using a Plan–Do–Study–Act (PDSA) approach. The baseline audit assessed the existing practice of preparing and administering oral medications through enteral feeding tubes against predefined standards based on recognised recommendations for safe enteral medication administration. The findings from the baseline audit were used to identify specific areas of non-

compliance and to design targeted interventions. Following implementation of the interventions, the same standards and data collection process were used during a re-audit to assess improvement.

Setting

The project was conducted in **Medical B Unit, Ayub Teaching Hospital, Abbottabad, Pakistan**. The unit provides inpatient medical care to adult patients with a wide range of acute and chronic medical conditions.

Study Population

The study population comprised **adult inpatients receiving one or more oral medications through an enteral feeding tube** during the audit periods. Medication administrations were assessed against the predefined audit standards, including appropriate medication formulation, preparation, tube flushing, separate administration of medicines, management of medication–feed interactions and documentation.

Inclusion Criteria

Patients were eligible for inclusion if they:

- were admitted to Medical B Unit during the audit period;
- had an enteral feeding tube in situ; and
- received at least one oral medication through the enteral feeding tube during the audit period.

Exclusion Criteria

The following were excluded:

- medications administered exclusively through intravenous, intramuscular, subcutaneous or other non-enteral routes;
- patients who had an enteral tube but did not receive any medication through the tube during the audit period; and
- Medication administrations for which the required information could not be reliably assessed or verified.

Audit Period

The project was conducted in three sequential phases:

Baseline audit: 1 July 2025 to 15 August 2025

Intervention phase: 15 August 2025 to 31 August 2025

Re-audit: 1 September 2025 to 10 October 2025

The baseline audit was undertaken to establish the existing level of compliance with the predefined standards. Findings from this phase were reviewed before implementation of the intervention. The intervention phase was then used to introduce targeted measures addressing the identified deficiencies. A re-audit was subsequently conducted using the same standards and data-collection approach to determine whether practice had improved.

Sampling Method and Sample Size

A **consecutive sampling approach** was used. All eligible medication administrations observed or identified during the predefined audit periods were considered for inclusion.

Each medication administration was considered an individual audit opportunity where the relevant standard was applicable. Patient characteristics and tube-related information were recorded to provide appropriate clinical context.

Data Collection Procedure

Data were collected using a **structured audit data-collection form** developed from the predefined audit standards and relevant guidance on safe administration of medicines through enteral feeding tubes. Current Specialist Pharmacy Service guidance recommends consideration of the medication formulation and tube characteristics, separate preparation of medicines, appropriate flushing before and between medicines, appropriate

management of medication–feed interactions and post-administration flushing.

Quality Improvement Intervention and PDSA Cycle

The baseline findings were reviewed to identify the most frequent and clinically important areas of non-compliance. A **multidisciplinary, PDSA-based intervention** was then implemented during the intervention period.

The intervention included:

1. **Brief staff education** regarding safe preparation and administration of medicines through enteral feeding tubes.
2. **Standardised written guidance** describing the recommended sequence of medication administration.
3. **Practical reminders** regarding appropriate formulation selection, separate preparation and administration of medicines, tube flushing and medication–feed interactions.
4. **Medication-specific guidance** for commonly used medicines where formulation or administration through an enteral tube required particular attention.
5. **Reinforcement of appropriate documentation and medication-administration practices.**

The intervention was designed according to the deficiencies identified during the baseline audit.

Outcome Measures

The **primary outcome** was the change in overall compliance with the predefined enteral medication-administration standards between the baseline audit and re-audit.

Secondary outcomes included:

- compliance with individual audit standards;
- proportion of medication administrations involving inappropriate medication formulation or alteration;
- compliance with appropriate medication preparation;
- compliance with pre-, inter-medication and post-medication tube flushing;
- compliance with appropriate management of medication–feed interactions;
- compliance with medication documentation; and
- identification of persistent practice gaps following the intervention.

The overall compliance percentage was calculated from the number of compliant audit

opportunities divided by the total number of applicable audit opportunities, expressed as a percentage.

Data Analysis

Data from the baseline audit and re-audit were entered into a structured spreadsheet and analysed descriptively.

Categorical variables were presented as **frequencies and percentages**. Compliance with each audit standard was calculated separately for the baseline and re-audit cycles. Overall compliance was also calculated for each cycle. The baseline and re-audit results were compared to determine the **absolute change in compliance**, expressed as percentage-point improvement. Individual standards were examined separately to identify areas showing substantial improvement as well as standards where deficiencies persisted.

Ethical and Governance Considerations

The proposal for this quality improvement project was **submitted to and presented before the Quality Control Committee of Ayub Teaching Hospital, Abbottabad**, chaired by

Prof. Dr Irum Sarwar. The project was commenced only after review and approval by the committee.

Data were collected solely for audit and quality-improvement purposes. Patient identifiers were not included in the audit dataset, and the information was handled confidentially. Results were reported in aggregate form without identifying individual patients or healthcare workers.

1. Baseline Audit Results

During the baseline audit period from **1 July to 15 August 2025**, a total of **175 eligible medication administrations** through enteral feeding tubes were assessed among **45 adult inpatients** admitted to Medical B Unit, Ayub Teaching Hospital, Abbottabad. The median patient age was **63 years (IQR 52–71)**; 27 (60.0%) patients were male and 18 (40.0%) were female. Nasogastric tubes were used in 39 (86.7%) patients, while 6 (13.3%) had gastrostomy tubes. The common indications for enteral feeding included acute stroke, reduced level of consciousness, neurological disorders and severe systemic illness.

Table 1. Baseline characteristics

Characteristic	n (%)
Total patients	45 (100)
Age, median (IQR), years	63 (52–71)
<i>Sex</i>	
Male	27 (60.0)
Female	18 (40.0)
<i>Enteral tube type</i>	
Nasogastric tube	39 (86.7)
Gastrostomy tube	6 (13.3)
<i>Main indication for enteral feeding</i>	
Acute stroke	19 (42.2)
Reduced level of consciousness	11 (24.4)
Neurological disorder	7 (15.6)
Severe systemic illness/other conditions	8 (17.8)

Compliance with Audit Standards

Baseline practice showed variable compliance across the predefined standards. The main deficiencies were observed in **flushing between**

medications, pre-medication flushing, management of medication–feed interactions and post-medication flushing.

Table 2. Baseline compliance with audit standards

Audit standard	Applicable opportunities, n	Compliant, n (%)
Appropriate medication formulation	175	133 (76.0)
Unsuitable formulations not crushed/altered	175	160 (91.4)
Medicines prepared separately	175	119 (68.0)
Appropriate enteral syringe/equipment	175	144 (82.3)
Appropriate pre-medication tube flush	175	100 (57.1)
Medicines administered separately with appropriate flush between medicines	142	60 (42.3)
Medication–feed interaction appropriately identified and managed	65	36 (55.4)
Appropriate post-medication tube flush	175	112 (64.0)
Medication administration appropriately documented	175	147 (84.0)

Operational definition: A medication–feed interaction was considered present when the administered medication was known to have a clinically significant interaction with enteral nutrition requiring modification of feeding or medication timing. Examples included medications such as phenytoin, warfarin and levothyroxine. For such medications, compliance required appropriate management according to the relevant medication-specific recommendation, including feeding interruption or separation of medication and feed when indicated.

Overall, the baseline audit demonstrated **multiple gaps across the medication-use process rather than a single isolated problem**. The lowest compliance was observed for flushing between individual medications (42.3%), followed by pre-medication flushing (57.1%), appropriate management of medication–feed interactions (55.4%) and post-medication flushing (64.0%). Preparation of medicines separately was also suboptimal (68.0%). These findings supported the need for a structured, multifaceted intervention addressing both staff

practice and the medication-administration process.

2. Root-Cause Analysis

The baseline findings were reviewed by the QI team to identify the reasons for non-compliance. The deficiencies appeared to be multifactorial rather than related to a single step in the medication-administration process. A simple root-cause analysis identified four main areas: knowledge and training, availability of standardised guidance, medication preparation practices, and ward-level process and equipment issues.

Informal discussions with nursing staff and direct observation of medication-administration practices were used to explore potential barriers. There was no easily accessible standardised protocol outlining the correct sequence for administering medicines through enteral feeding tubes. Staff reported uncertainty regarding which formulations could safely be crushed or dispersed and when enteral feeding should be withheld because of a potential medication–feed interaction. In addition,

flushing practices were inconsistent, particularly between individual medications. Limited availability of appropriate enteral syringes and the absence of a simple bedside reminder were also identified as contributing factors. Documentation of medication administration was relatively better than other areas but was not consistently complete.

The root-cause analysis therefore suggested that education alone would be unlikely to address all identified deficiencies. A multifaceted intervention addressing staff knowledge, standardisation of practice, availability of practical guidance and medication-administration processes was planned.

3. QI Intervention and PDSA Cycle Plan

Based on the baseline findings, the QI team planned a short, ward-based intervention aimed at improving compliance with the predefined enteral medication-administration standards. The intervention was designed to be practical and achievable within the existing resources of Medical B Unit.

The main objectives of the intervention were to improve appropriate medication formulation and preparation, ensure separate administration of medicines, improve tube-flushing practices, increase recognition of medication-feed interactions and strengthen documentation.

Do

The intervention was implemented from **15 August to 31 August 2025** and included the following measures:

- A brief educational session was conducted for nursing staff regarding safe administration of medicines through enteral feeding tubes.
- A standardised one-page enteral medication administration protocol was introduced, outlining the recommended sequence of checking, preparation, flushing, administration and documentation.
- Staff were specifically reminded that medicines should be assessed individually for suitability for crushing or dispersion and that inappropriate modified-release or enteric-coated preparations should not be crushed.
- A simple bedside reminder was introduced emphasising the sequence: check formulation → flush → give medicine separately

→ flush between medicines → flush after final medicine → document.

- Guidance regarding clinically important medication-feed interactions was reinforced.
- Availability of appropriate enteral medication syringes was reviewed and deficiencies were communicated to the ward administration.
- Staff were encouraged to document medication administration and any relevant feeding interruption or special administration instructions clearly.

The intervention was implemented without changing the prescribed medications or feeding regimens of individual patients.

Study

Following completion of the intervention, a re-audit was conducted from **1 September to 10 October 2025** using the same audit standards and data-collection approach used during the baseline cycle.

Act

Based on the re-audit findings, the standardised enteral medication administration protocol and bedside reminder will be retained as routine practice in the Medical B Unit. Particular emphasis will be placed on the remaining gaps in medication formulation selection, flushing between individual medicines, and identification of medication-feed interactions. Medication-specific guidance will continue to be made available to doctors and nursing staff, with reinforcement during routine clinical teaching. Further monitoring may be undertaken as part of a subsequent PDSA cycle to assess whether the improvements are sustained over time.

4. Re-audit Results

A total of **147 eligible medication administrations from 51 adult inpatients** were assessed during the re-audit period using the same audit tool and standards applied during the baseline audit. The median age of patients was **64 years (IQR 54–72)**. There were **29 males (56.9%)** and **22 females (43.1%)**. Nasogastric tubes were used in **44 patients (86.3%)**, while **7 patients (13.7%)** had gastrostomy tubes. The overall clinical profile remained broadly comparable with the baseline audit, with acute stroke and reduced level of consciousness being the common indications for enteral tube use.

Post-Intervention Compliance

Table 3. Post-intervention compliance

Audit standard	Compliant administrations	Total assessed	Compliance
Appropriate medication formulation selected	136	147	92.5%
Unsuitable formulations not crushed/alterd	145	147	98.6%
Medicines prepared separately	135	147	91.8%
Appropriate enteral syringe/equipment used	141	147	95.9%
Appropriate pre-medication tube flush	135	147	91.8%
Medicines administered separately with appropriate flush between medicines*	105	120	87.5%
Medication-feed interactions appropriately identified and managed*	51	57	89.5%
Appropriate post-medication tube flush	136	147	92.5%
Medication administration appropriately documented	140	147	95.2%

Denominators differ because these standards were applicable only to medication administrations meeting the relevant criteria, as in the baseline audit.

Comparison with Baseline

Table 4. Comparison of compliance: baseline vs re-audit

Audit standard	Baseline	Re-audit	Absolute improvement
Appropriate formulation	76.0%	92.5%	+16.5 pp
Unsuitable formulations not altered	91.4%	98.6%	+7.2 pp
Medicines prepared separately	68.0%	91.8%	+23.8 pp
Appropriate syringe/equipment	82.3%	95.9%	+13.6 pp
Pre-medication flush	57.1%	91.8%	+34.7 pp
Separate administration + flush between medicines	42.3%	87.5%	+45.2 pp
Medication-feed interaction management	55.4%	89.5%	+34.1 pp
Post-medication flush	64.0%	92.5%	+28.5 pp
Documentation	84.0%	95.2%	+11.2 pp

pp = percentage points.

5. Target Achievement

This summary is especially useful because it maps performance against the explicit targets established for the project.

Table 5. Target achievement

Standard	Target	Baseline	Re-audit	Target achieved?
Appropriate formulation	100%	76.0%	92.5%	No
Avoid inappropriate crushing	100%	91.4%	98.6%	No
Separate preparation	≥95%	68.0%	91.8%	No
Appropriate equipment	≥95%	82.3%	95.9%	Yes
Pre-flush	≥95%	57.1%	91.8%	No
Between-medication flush	≥95%	42.3%	87.5%	No
Feed interactions	100%	55.4%	89.5%	No
Post-flush	≥95%	64.0%	92.5%	No
Documentation	≥95%	84.0%	95.2%	Yes

6. PDSA Intervention Summary

Table 6. PDSA intervention summary

Baseline problem	Intervention	Responsible staff	Implementation
Poor pre-flushing	Standardised flushing sequence	Nursing staff	Education + protocol
Medicines mixed together	Separate preparation instruction	Nursing staff	Bedside reminder
Formulation uncertainty	Medication-specific guidance	QI team/medical team	Reference sheet
Feed interactions	Feed-interruption guidance	Nursing/medical team	Education
Documentation gaps	Documentation reminder	Nursing staff	Protocol

Pictorial Depiction of Audit Data & QIP Flowchart

1. Audit Sample Overview

Audit Sample Overview — Baseline vs Re-audit

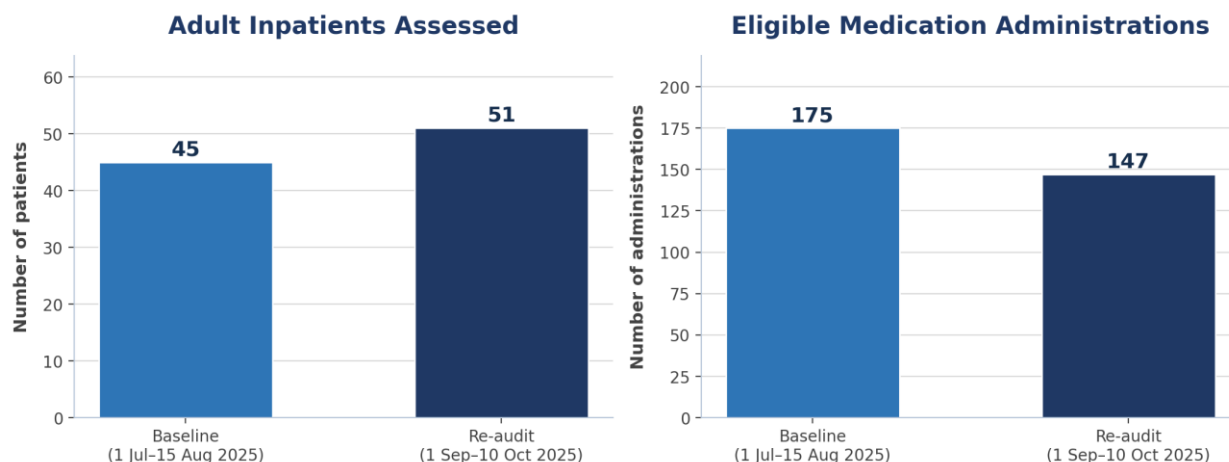


Figure 1. Audit sample overview — patients and medication administrations, baseline vs re-audit

2. Patient Demographics

Sex distribution, enteral tube type, and the main indications for enteral feeding are shown below

for the baseline and (where available) the re-audit cohorts, corresponding to the data in Table 1 of the report.

Patient Sex Distribution — Baseline vs Re-audit

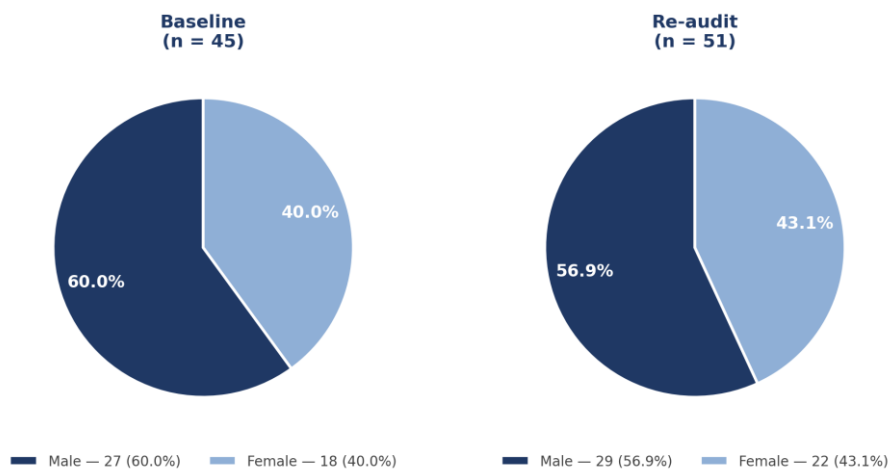


Figure 2. Patient sex distribution — baseline vs re-audit

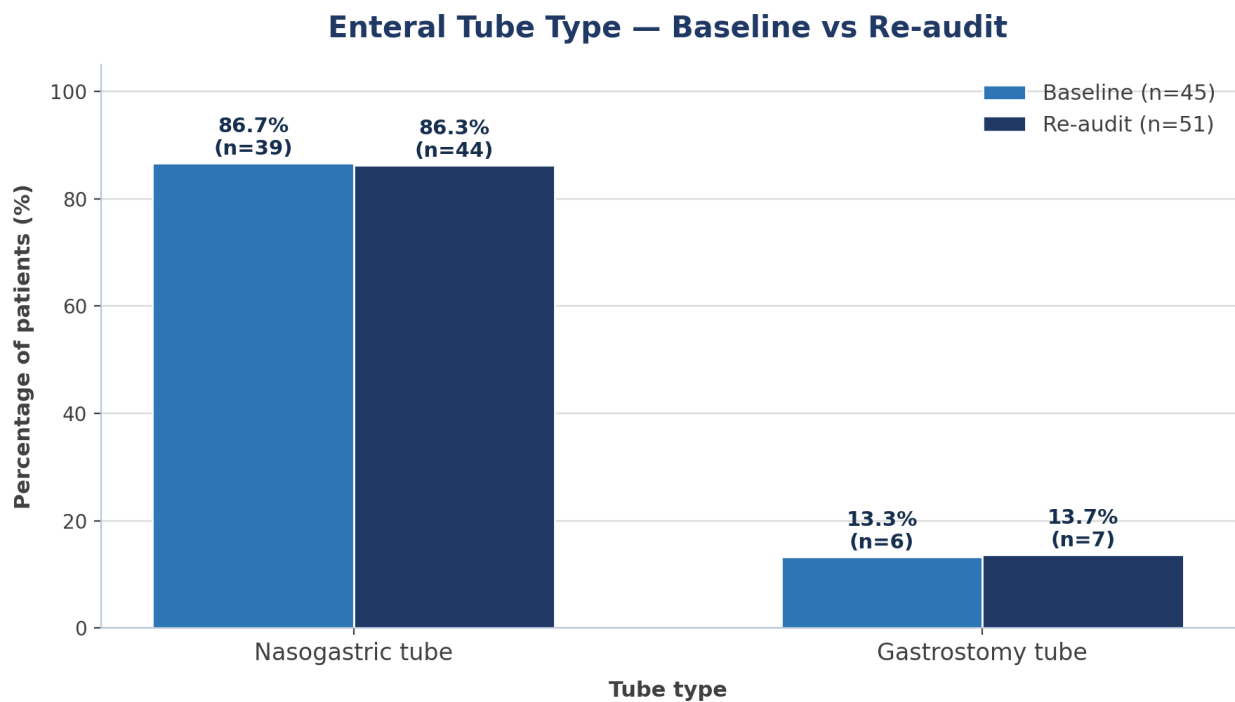


Figure 3. Enteral tube type — baseline vs re-audit

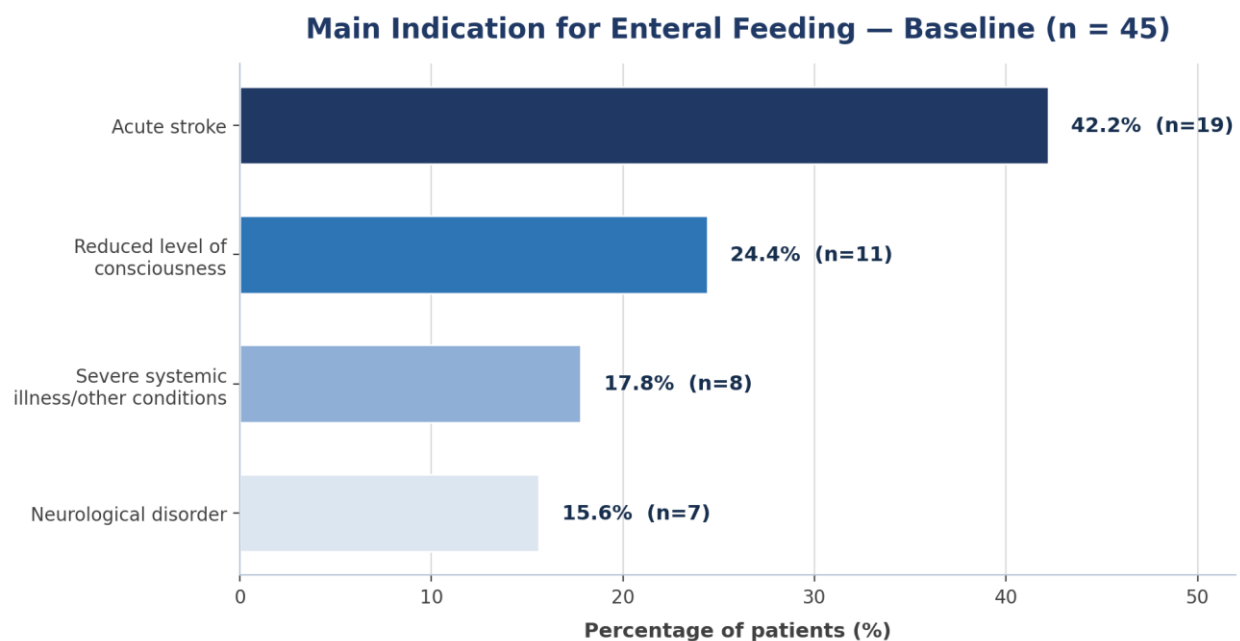


Figure 4. Main indication for enteral feeding — baseline cohort

3. Compliance with Audit Standards — Baseline vs Re-audit

The chart below compares compliance across all nine predefined audit standards before and after

the PDSA intervention, corresponding to the data in Tables 2, 3 and 4. A dashed reference line marks the commonly used 95% performance benchmark.

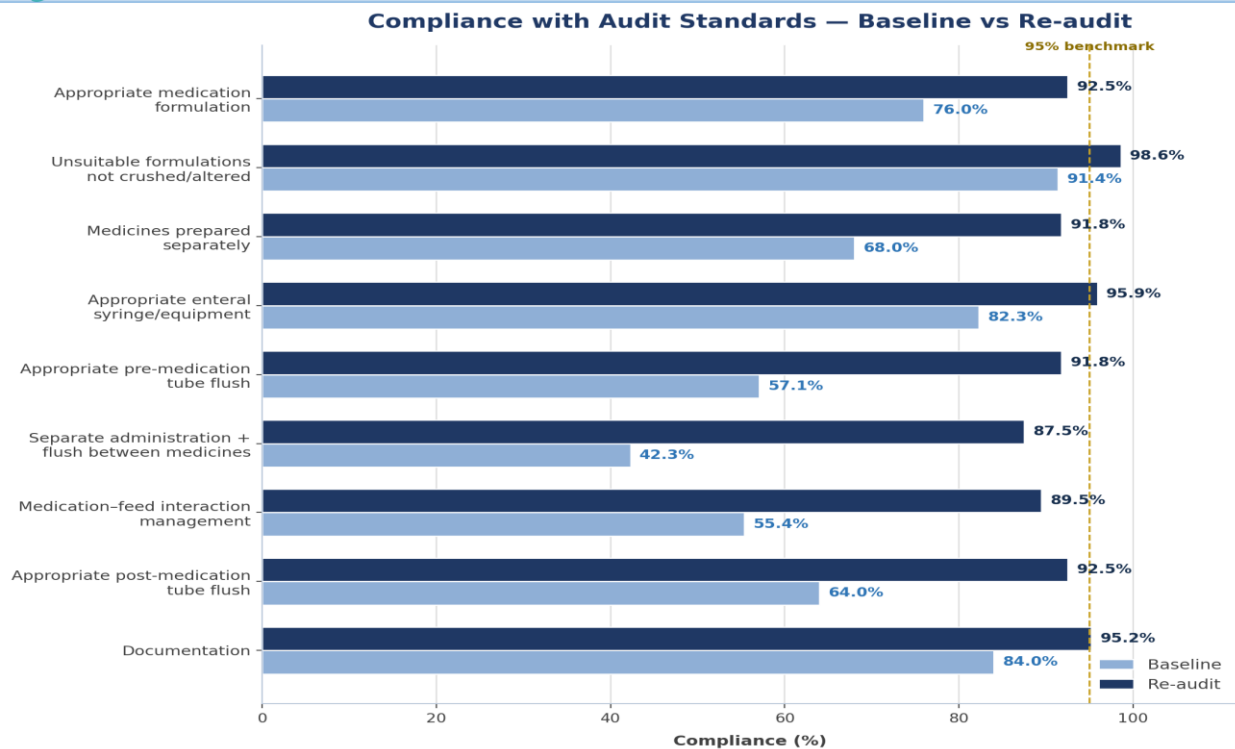


Figure 5. Compliance with audit standards — baseline vs re-audit

4. Magnitude of Improvement

Absolute improvement (in percentage points) for each audit standard is ranked below,

highlighting where the intervention produced the greatest gains — corresponding to Table 4 of the report.

Absolute Improvement in Compliance (Baseline → Re-audit)

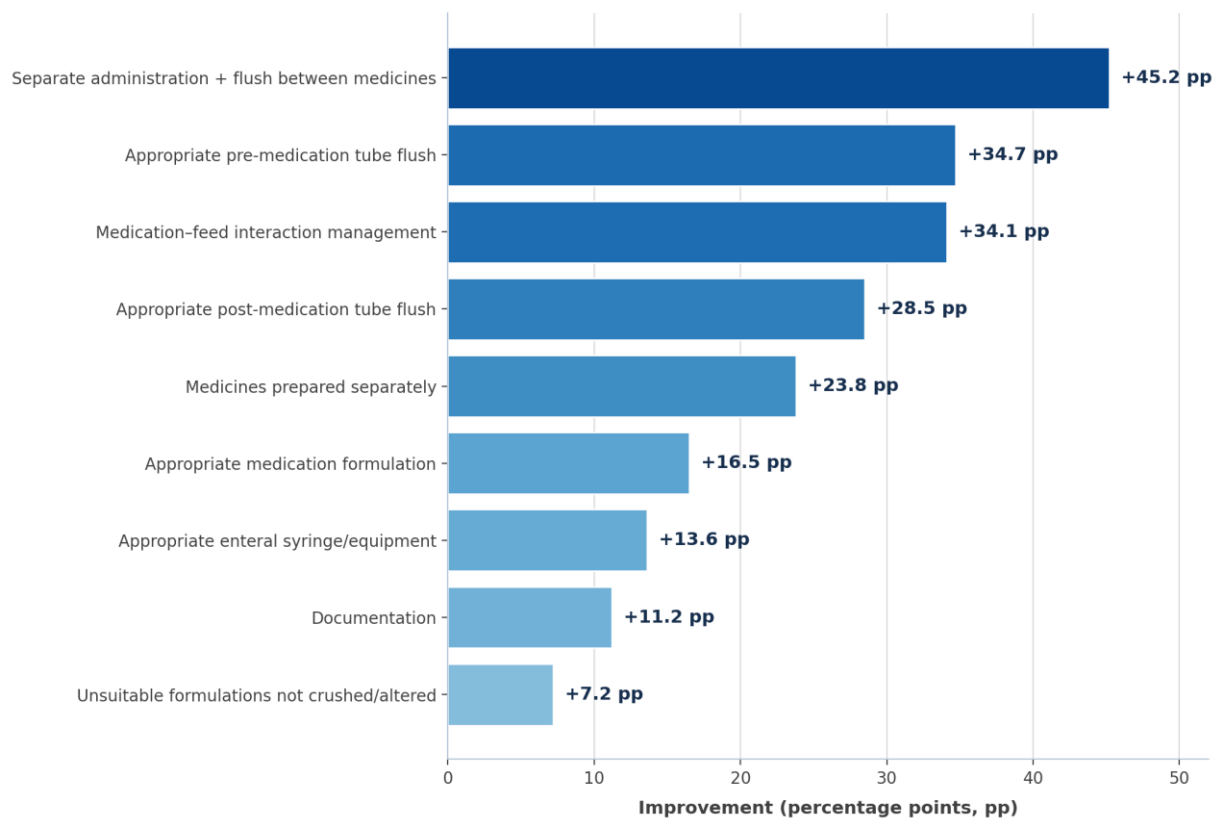


Figure 6. Absolute improvement in compliance, baseline to re-audit (ranked)

5. Performance Against Predefined Targets

Re-audit compliance is plotted here against the baseline figures and the predefined target for

each standard (corresponding to Table 5). Bars are colour-coded to indicate whether the target was met at re-audit.

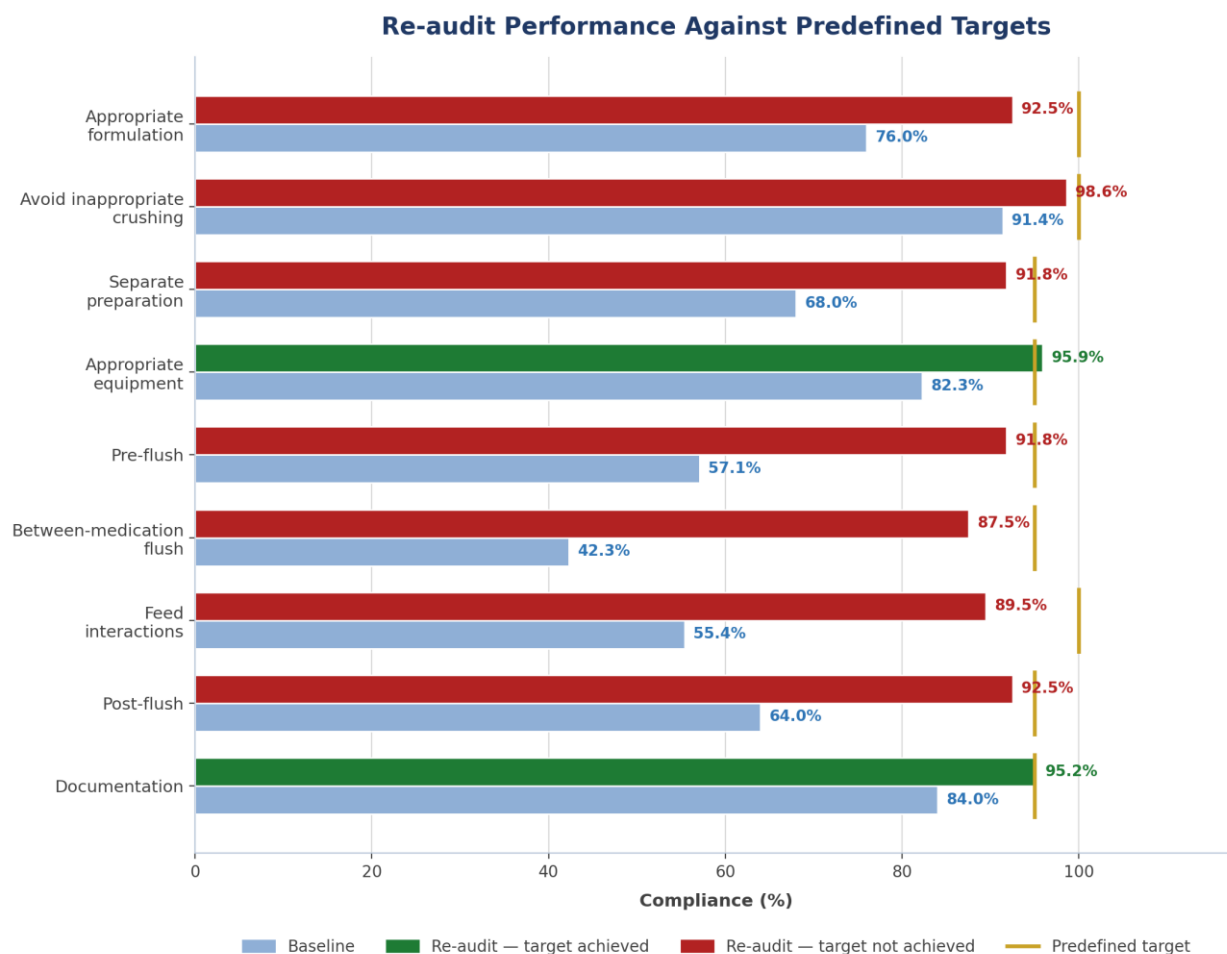


Figure 7. Re-audit performance against predefined targets

6. QIP Process Flow – PDSA Cycle

The flowchart below traces the full quality-improvement journey – from the baseline audit

and root-cause analysis, through the Plan-Do-Study-Act (PDSA) cycle, to the re-audit findings and the plan for sustaining improved practice.

Quality Improvement Project — Process Flow

Safe Preparation & Administration of Oral Medications via Enteral Feeding Tubes

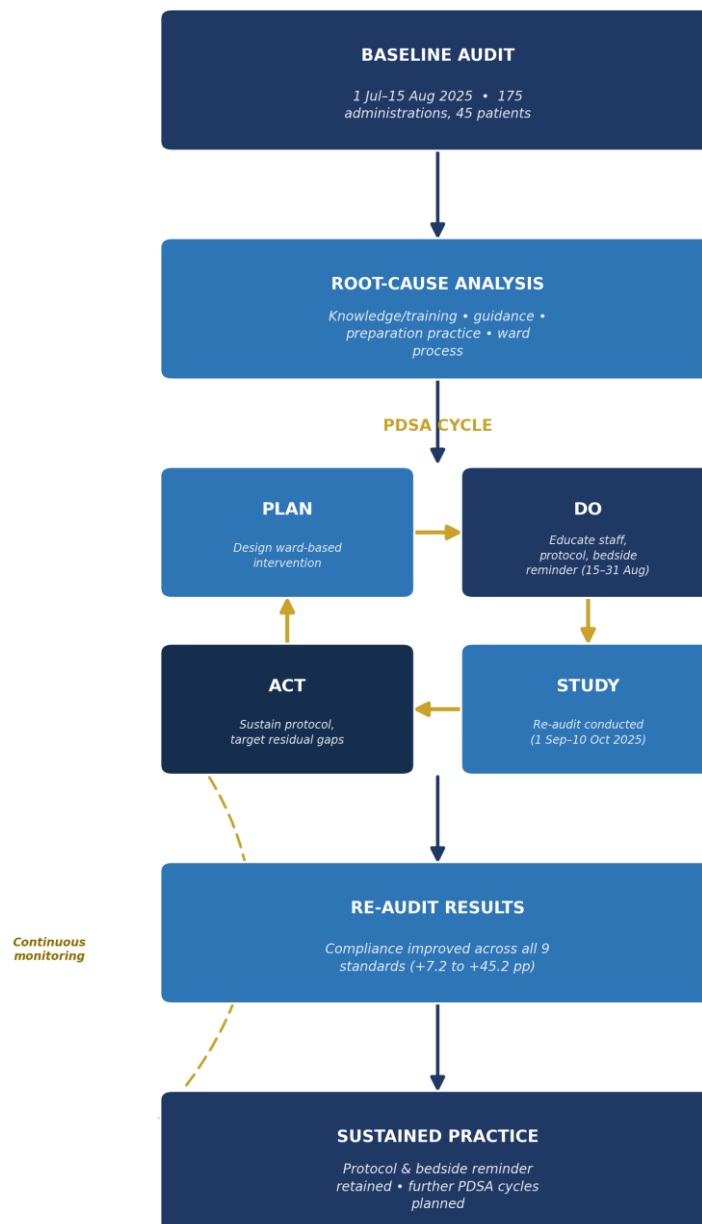


Figure 8. Quality improvement project — overall process flow (PDSA cycle)

7. Enteral Medication Administration Sequence

This sequence formed the basis of the bedside reminder introduced during the "Do" phase of

the PDSA cycle, guiding staff through each step of safe medication administration via an enteral feeding tube.

Bedside Reminder — Enteral Medication Administration Sequence

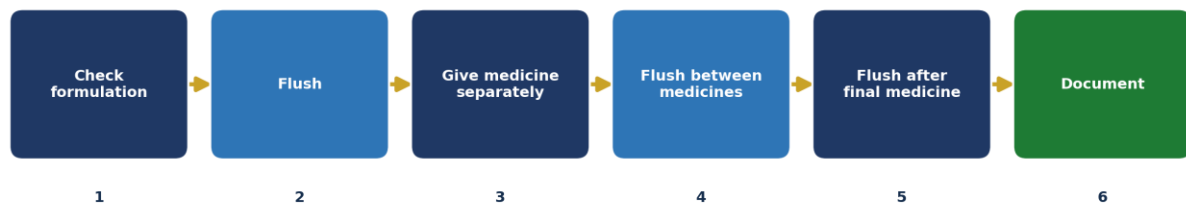


Figure 9. Bedside reminder — enteral medication administration sequence

Overall Impact and Discussion

Following implementation of the PDSA interventions, substantial improvement was observed across all audited standards. Compliance with appropriate medication formulation increased from **76.0% at baseline to 92.5%** during re-audit. The proportion of administrations in which unsuitable formulations were appropriately avoided increased from **91.4% to 98.6%**.

A marked improvement was observed in medication preparation and administration practices. Separate preparation of medicines increased from **68.0% to 91.8%**, while appropriate use of enteral syringes/equipment improved from **82.3% to 95.9%**. Compliance with the recommended pre-medication tube flush improved considerably, from **57.1% at baseline to 91.8%** during re-audit.

The greatest improvement was seen in **separate administration of medicines with an appropriate flush between medications**, which increased from **42.3% to 87.5%**, representing an absolute improvement of **45.2 percentage points**. Appropriate identification and management of medication–feed interactions also improved from **55.4% to 89.5%**. Post-medication tube flushing improved from **64.0% to 92.5%**, while documentation improved from **84.0% to 95.2%**.

Although substantial improvement was achieved across all domains, compliance did not reach the predefined target in every standard. The main residual gaps were related to **appropriate medication formulation, between-medication flushing, and management of medication–feed interactions**, indicating areas requiring continued reinforcement and further PDSA cycles.

Based on the re-audit findings, the standardised enteral medication administration protocol and bedside reminder will be retained as routine practice in the Medical B Unit. Particular emphasis will be placed on the remaining gaps in medication formulation selection, flushing between individual medicines, and identification of medication–feed interactions. Medication-specific guidance will continue to be made available to nursing staff, with reinforcement during routine clinical teaching. Further monitoring may be undertaken as part of a subsequent PDSA cycle to assess whether the improvements are sustained over time.

The proportion of medication administrations meeting the individual predefined process standards also increased substantially across the audit cycle. Importantly, the improvement was seen across several independent components of the medication-administration process rather than being limited to documentation or a single practice.

The re-audit nevertheless identified some residual deficiencies. Approximately 7% of medication administrations still involved an issue with formulation selection, while compliance with medication–feed interaction management remained below the predefined 100% target. These findings indicated that, although the intervention produced meaningful improvement, further reinforcement and periodic monitoring would be required to sustain safe practice.

The project therefore demonstrated a **closed-loop quality improvement process**, progressing from baseline measurement and identification of deficiencies to targeted intervention and subsequent re-measurement of practice.

Strengths

This project addressed a clearly defined medication-safety problem using predefined audit standards based on recognised guidance. The use of a structured PDSA approach allowed baseline deficiencies to be identified, targeted interventions to be implemented, and practice to be reassessed using the same audit standards and data-collection process. The intervention was multifaceted, incorporating staff education, standardised written guidance, a bedside reminder, medication-specific information and reinforcement of appropriate equipment and documentation. Assessment of individual medication administrations provided a practical measure of adherence to specific steps of the medication-administration process.

Limitations

The re-audit period was relatively short, so the sustainability of the observed improvements could not be established.

Conclusion

This quality improvement project demonstrated substantial improvement in the safe preparation and administration of oral medications through enteral feeding tubes following implementation of a targeted PDSA-based intervention in Medical B Unit, Ayub Teaching Hospital, Abbottabad. Improvement was observed across all audited standards, with particularly marked gains in medication separation, pre- and post-medication flushing, and management of medication-feed interactions. The predefined targets were achieved for appropriate equipment use and documentation, while several other standards remained below target, particularly formulation selection, flushing between medicines and medication-feed interaction management. These findings indicate that standardised guidance, staff education and practical bedside reminders can improve enteral medication-administration practices. Continued reinforcement and periodic re-audit through further PDSA cycles will be important to address the remaining gaps and sustain the improvements achieved.

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