Incredible Care QIX Award (Process Excellence)

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Project Title: Reducing inappropriate surgical antibiotic prophylaxis use in elective surgeries

Department: Medicine	Period: April 2025 to January 2026	Facilitators: A/Prof Dennis Hey, Dr Jeremy Chee
Sponsors (HODs): Adj A/Prof Jolene Oon Ee Ling	Team Leader/s: Dr Mo Yin	

Team Members: Chen Hui Hiong, Wu Jia En, Dr Quah Joan, Dr Nares Smitasin
(Acknowledgements: Atharvi Gupta, Geraldine Foo, Rofina, Darren Teo, Goh Wen Jun, Wendy Ng, Heng Lin, Wei Liang, Qing Xiao, Hui Wen, Lim Kian Huat)

A. Define the Problem (PLAN)

High national burden of surgical antibiotic prophylaxis use
The 2019 National Point Prevalence Survey found that **surgical antibiotic prophylaxis (SAP) accounted for 10% of all antimicrobials prescribed** in Singapore public hospitals. Notably, **64% of SAP was continued beyond 24 hours**, exceeding recommended durations.

National & NUHS priority
Reducing inappropriate prolonged surgical antibiotic prophylaxis supports NUHS's vision of shaping medicine and transforming care through safer, more cost-effective, and evidence-based practice. This project reflects NUHS core values of excellence and patient-centredness by minimising harm, optimising antimicrobial use, and strengthening teamwork across surgical department (ortho, ent) , department of medicine (infectious disease) and pharmacy (antimicrobial stewardship programme) .

Clinical relevance
Surgical site infections are the second most common healthcare-associated infection (HAI) in Singapore, accounting for **17.3% of all HAIs.** In addition, **multidrug-resistant HAIs** are increasing in Singapore. Together, they highlight the importance of **judicious and appropriate use of antibiotics**.

Evidence
- Robust international and local evidence demonstrate **no additional benefit from prolonged SAP beyond 24 hours in clean orthopaedic and otolaryngology surgeries.** All international and local guidelines consistently recommend a **single dose (≤24 hours) of prophylaxis.**
- Inappropriate prolonged SAP is associated with **antimicrobial resistance, adverse drug events, *Clostridioides difficile* infection, and avoidable healthcare costs,** without improving patient outcomes.

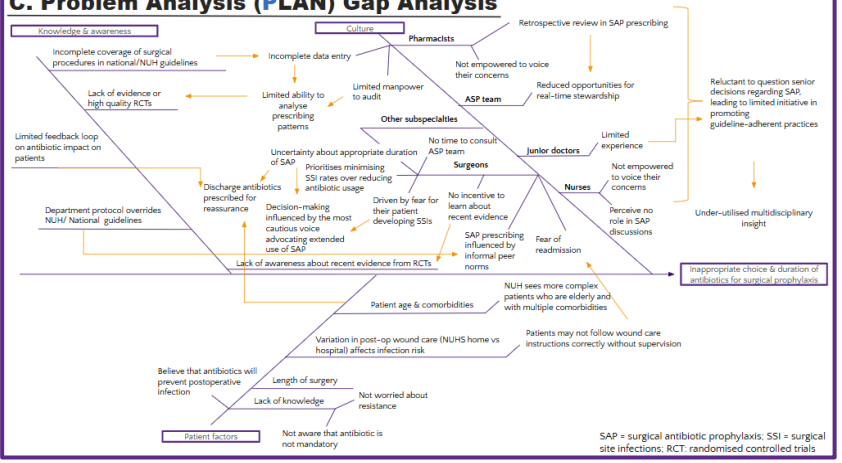
Evidence-practice gap
Despite clear evidence and established guidelines, **routine prescription of 5 to 7 days of postoperative antibiotic remain common practice in NUH.**

B. Goal (PLAN)

Aim statement

To reduce inappropriate surgical antibiotic prophylaxis (SAP) duration in elective orthopaedic and otolaryngology surgeries by 50% from baseline.

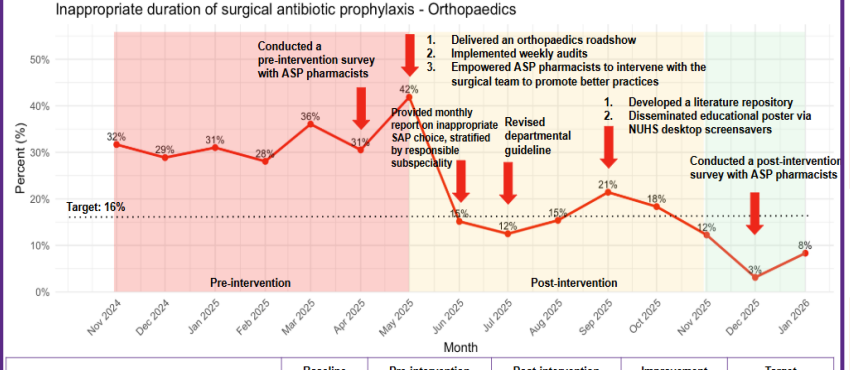
C. Problem Analysis (PLAN) Gap Analysis



D. Interventions & Action Plan (Do)

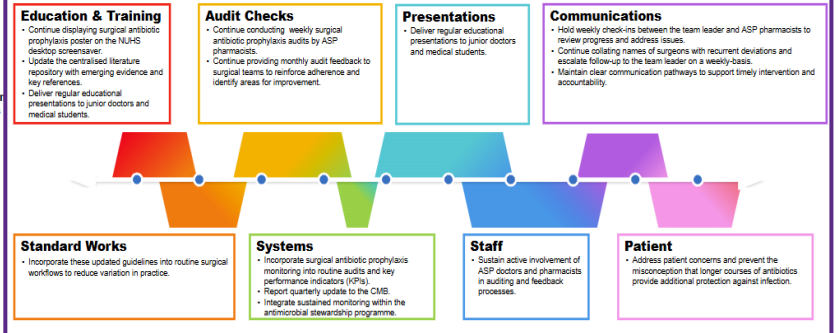
Problem	Intervention	Date of implementation
Limited leadership engagement in the implementation and oversight of surgical antibiotic prophylaxis (SAP).	Engage the Chairman Medical Board to acknowledge the issue and lead the Heads of Orthopedics and Otolaryngology in committing to and supporting the SAP improvement plan.	3rd April 2025
Hierarchical structures and communication barriers hinder open dialogue regarding SAP practices.	Cultivate a team culture that empowers all members to voice concerns and encourage surgeons to actively engage in interdisciplinary discussions on SAP decision-making.	19th May 2025
Misalignment between departmental, NUH, and national SAP guideline.	Review and implement a unified SAP guidance document that is consistent with institutional and national guidelines.	19th May 2025
Inadequate awareness and knowledge of appropriate SAP practices.	Conduct retrospective data analysis, prepare educational materials, and conduct presentations to relevant stakeholders to strengthen evidence-based knowledge and awareness.	19th May 2025

E. Benefits / Results (CHECK)



	Baseline	Pre-intervention mean	Post-intervention mean	Improvement sustained for three months	Target exceeded
Inappropriate duration of surgical antibiotic prophylaxis (%)	32.0	32.7	13.0	Yes	Yes

F. Strategy for Spreading/ Sustaining (ACT)



A. Define the Problem (PLAN)

High national burden of surgical antibiotic prophylaxis use

The 2019 National Point Prevalence Survey found that **surgical antibiotic prophylaxis (SAP) accounted for 10% of all antimicrobials prescribed** in Singapore public hospitals. Notably, **60% of SAP was continued beyond 24 hours**, exceeding recommended durations.[1]

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- Inappropriate prolonged SAP is associated with **antimicrobial resistance, adverse drug events, *Clostridium difficile* infection, and avoidable healthcare costs,** without improving patient outcomes.[3]

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Aim statement

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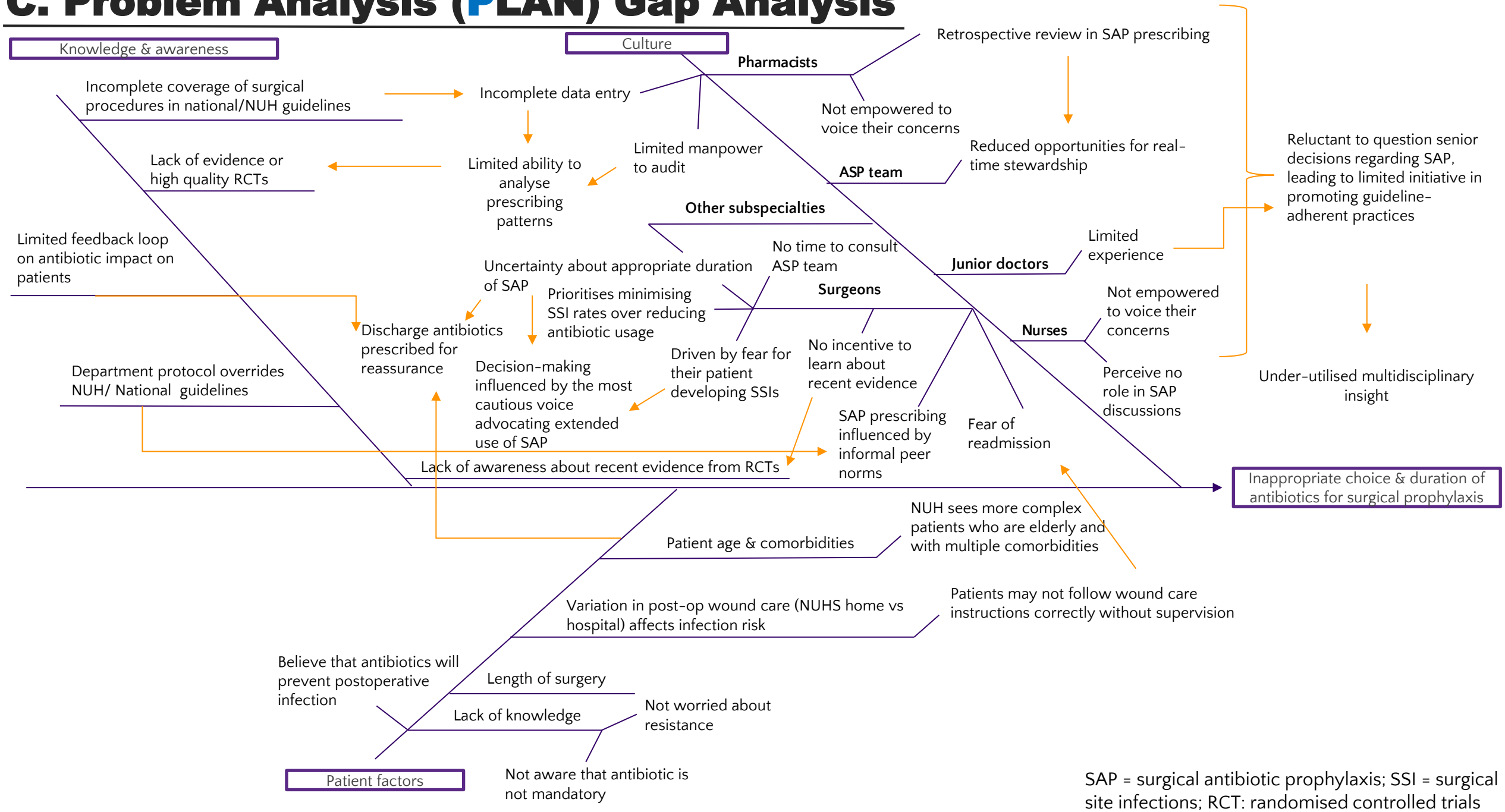
C. Problem Analysis (PLAN) Gap Analysis

Culture	Knowledge and awareness	Patient factors
Experience-driven prescribing overrides standard protocols / clinicians' previous experiences of patients developing surgical site infections while prescribing surgical antibiotic prophylaxis according to the guidelines.	Some surgical procedures are not included in the surgical prophylaxis guideline.	Older patients.
Defensive prescribing / clinicians believe that prescribing antibiotics is necessary to protect themselves when retrospectively defending their decision / conferring a sense of having done everything possible for the patient to prevent surgical site infections.	Lack of high-quality randomised controlled trials to guide which surgical procedures require antibiotics and the optimal duration of administration.	Patients with compromised immune system and multiple comorbidities.
Discharge with antibiotics for reassurance of the consultant / extra layer of safety needed by surgeons because surgical site infections are viewed as personal responsibility for an infectious complication.	Lack of awareness about updated evidence from randomised controlled trials.	Wound care and drainage.
Prescribing habits shaped by what is commonly done in the team, not by scientific evidence.	No feedback channel from patients and antibiotic stewardship team on antibiotic side effects and efficacy.	Longer duration of surgery.
Decision-making around surgical antibiotic prophylaxis often occurs in silos (e.g. the antibiotic stewardship team is not involved during the decision-making stage.)	Outdated and conflicting departmental, hospital, and national guidelines	Surgical complexity requiring multidisciplinary input, leading to divergent perspectives.
Believes that antibiotics are inherently effective and harmless, and that prescribing longer durations longer duration is safe and preferable for preventing surgical site infections.	Preference for department guideline rather than hospital-wide guidelines.	Lack of awareness about the harms of antibiotics.
Time constraints in surgical settings and post-op wards.	Disagreements between departments involved in the care of same patients.	Expectation of postoperative antibiotic use.
Unclear responsibility for starting, reviewing, and stopping antibiotics across team members.	Uncertainty about the length of prophylaxis recommended in the hospital guideline.	Focus on immediate risks (e.g. surgical site infections) over longer-term consequences (e.g. antimicrobial resistance).

C. Problem Analysis (PLAN) Gap Analysis



SAP = surgical antibiotic prophylaxis; SSI = surgical site infections; RCT: randomised controlled trials

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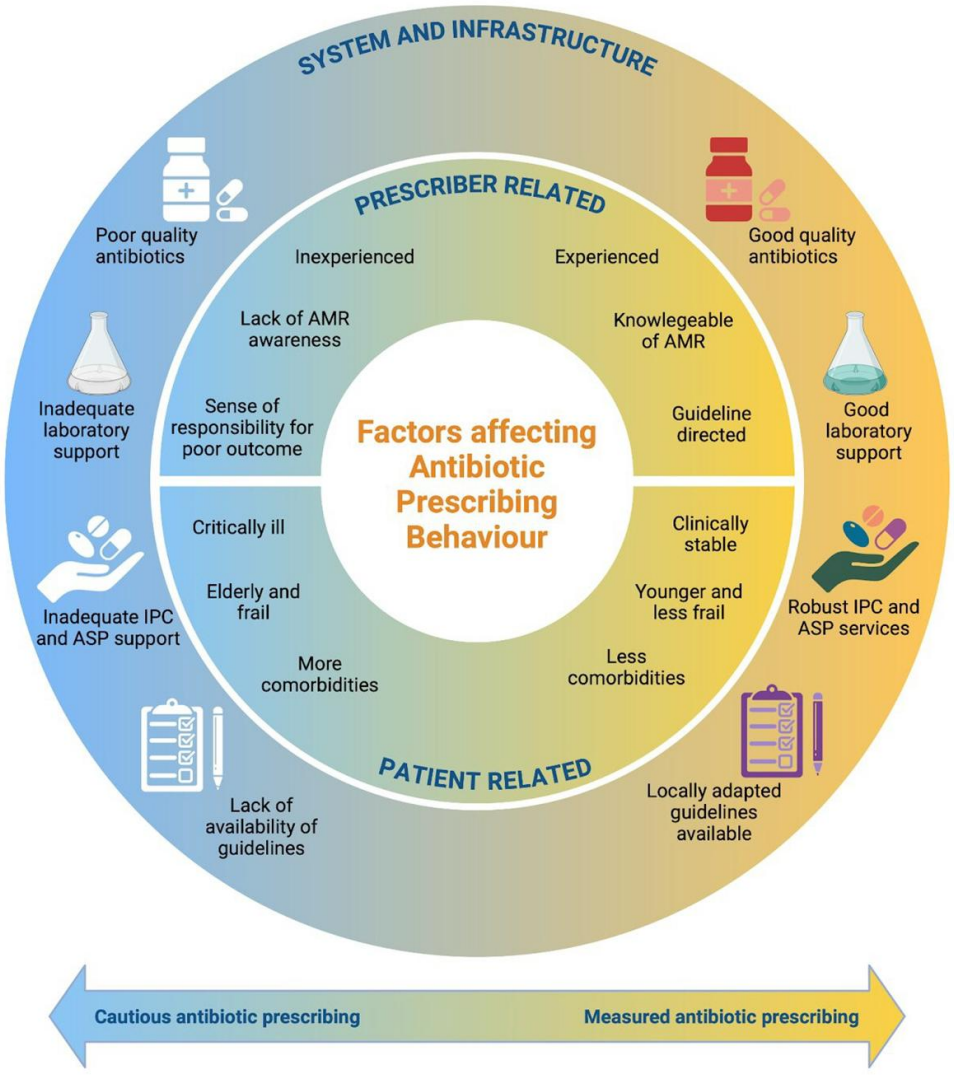

Figure 1. Factors resulting in more cautious vs measured antibiotic prescribing behaviour

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Factors influencing antibiotic prescribing behavior

Methodological background:

- Drawn from 194 semi-structured interviews and ethnographic observations
- Participants included doctors, nurses, pharmacists, and management staff

For optimal antibiotic use, efforts must be made to:

- Improve prescriber training and guideline access
- Support clinical decision-making & robust lab and infrastructure
- Provide systematic support like effective stewardship programs

Chhabra, et al. under review

C. Problem Analysis (PLAN) Value Stream Map

Stage	Pre-operative	Immediate pre-operative	During surgery	Discharge	Audit
Actions	Review surgical indication and classify procedure type (clean, clean-contaminated, etc.) Evaluate patient-specific risks (e.g., allergies, prior infections, MRSA colonisation).	Confirm antibiotic prescription in chart or electronic system. Antibiotic to be given 30-60 mins prior to incision (or 120 mins for specific agents). Document exact time of antibiotic administration.	Confirm that antibiotic is given on time. Re-dose intra-operatively if surgery is prolonged or if major blood loss occurs. Document any intra-operative redosing.	Pharmacists should confirm antibiotic prescription with the surgeon.	Review of SAP compliance and outcomes. Provide feedback to surgical and anaesthesia teams.
Stakeholders	Surgeons Anaesthetists	Surgeons Nurses	Surgeons Anaesthetists Nurses	Pharmacist Surgeons	Pharmacist
Decision	Are antibiotics needed?		Should the length of antibiotic treatment be increased?	Are antibiotics to be continued post-op?	Should the surgical team's decision be questioned?
Intervention	1. Conduct a pre- and post-intervention survey with ASP pharmacists. 2. Conduct a departmental presentation to share performance statistics and discuss concerns. 3. Implement weekly audits and provide monthly reports to departments. 4. Empower ASP pharmacists to intervene with the surgical team to promote better practices. 5. Develop a literature repository with latest evidence. 6. Disseminate educational poster via NUHS desktop screensavers.				Pharmacists discuss treatment plan with the surgical team.

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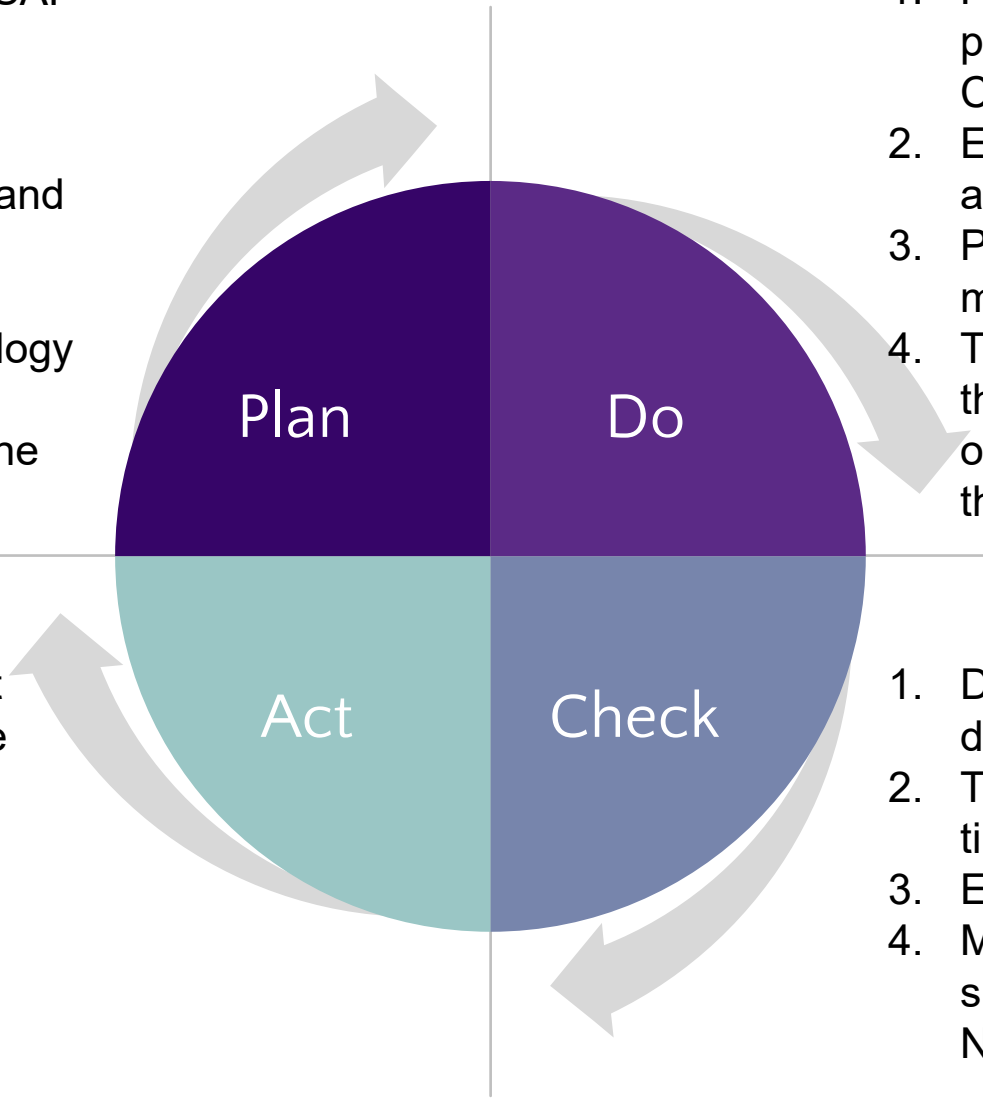
PDCA 1: Promoting leadership in SAP

Plan

1. Review and present current SAP practice data.
2. Engage key stakeholders (Chairman Medical Board, surgeons, ASP consultants, and pharmacists).
3. Provide monthly feedback to orthopaedics and otolaryngology departments.
4. Prompt departmental guideline review and updates.

Do

1. Present point prevalence survey data and proposed intervention plan to the Chairman Medical Board.
2. Engage ASP team and pharmacists to analyze SAP practices.
3. Provide department-specific charts monthly.
4. The Chairman Medical Board will support the Heads of orthopaedics and otolaryngology departments to review their departmental guidelines.



Act

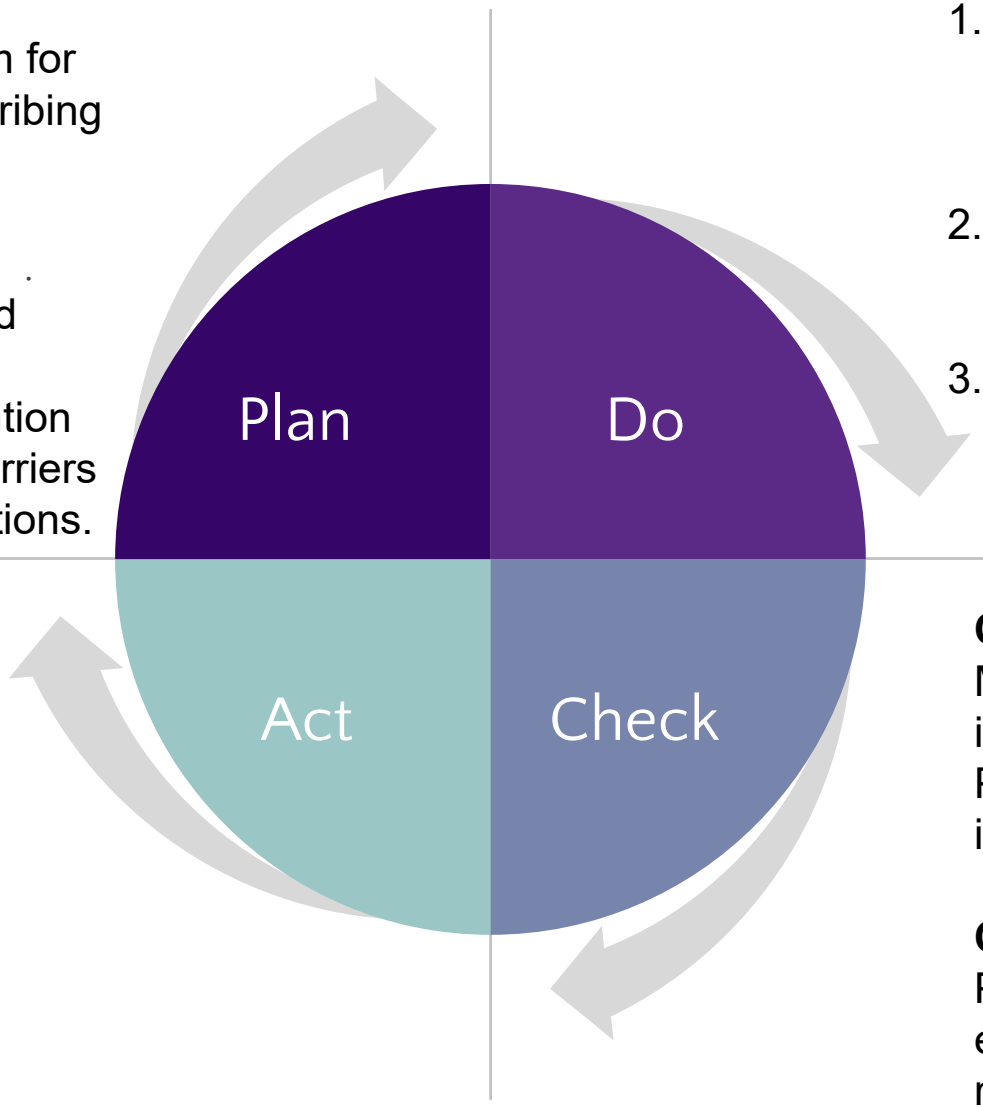
1. Revised guidelines and audit antibiotic prescribing practice based on revised guide.
2. Prospective evaluation and feedback to align with local consensus.

Check

1. Document leadership support and departmental response.
2. Track progress against agreed timelines.
3. Evaluate changes in commitment.
4. Monitor whether revised guidelines are submitted and align with NUH and National guidelines.

PDCA 2: Strengthening communication & team culture to improve SAP compliance

1. Establish a standardised system for pharmacists to track SAP prescribing and document interventions for inappropriate SAP.
2. Analyse intervention records to identify acceptance patterns and reasons for rejection.
3. Conduct pre- and post-intervention surveys to identify perceived barriers to pharmacist-surgeon interventions.



1. Pharmacists to document all SAP interventions, including clinical team response (accepted/ rejected) and rationale.
2. Introduce informal, collegial reminders to surgeons to support timely SAP review and discussion.
3. Conduct anonymous pre- and post-intervention surveys and reinforce programme leadership support for ASP pharmacists.

1. Conduct regular check-ins with ASP pharmacists to review barriers, enablers, surgeon responses, and unresolved matters.
2. Revise NUH SAP guideline to support risk stratification, audit, and targeted interventions.

Quantitative:
Monthly count of pharmacist SAP interventions.
Proportions of accepted versus rejected interventions.

Qualitative:
Pharmacists' reflections on confidence, engagement, and quality of SAP-related discussions with surgeons.

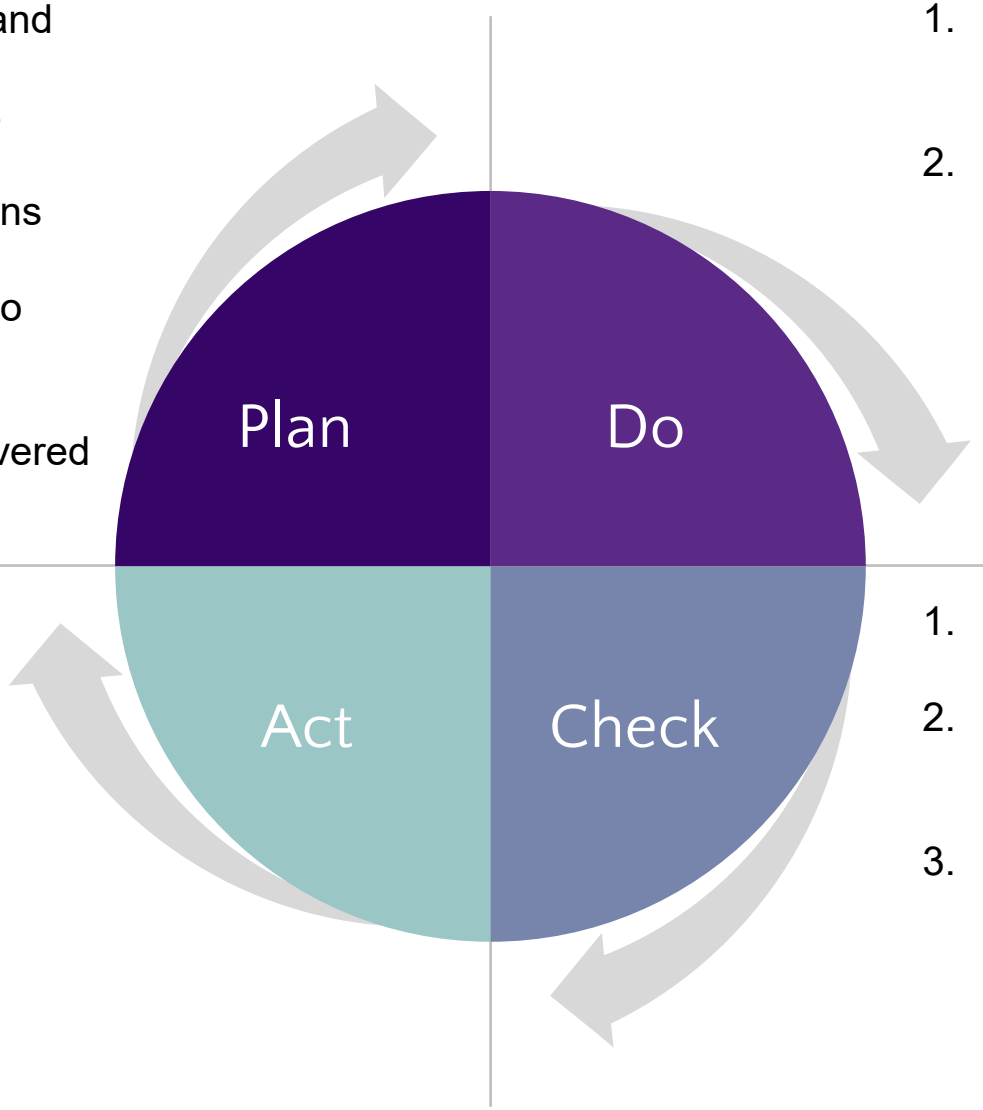
PDCA 3: Develop unified SAP compliance guidance

Plan

1. Request each speciality to review and revise SAP guideline to:
   - Align with national and NUHS standards.
   - Document and justify deviations using supporting literature.
2. Highlight intra-specialty variations to promote ownership and peer benchmarking.
3. Identify surgical procedures not covered in existing SAP guidelines.

Do

1. Present specialty-specific SAP data at departmental meetings and via monthly reports.
2. Share key evidence from the literature to support standardisation and informed deviations.



Act

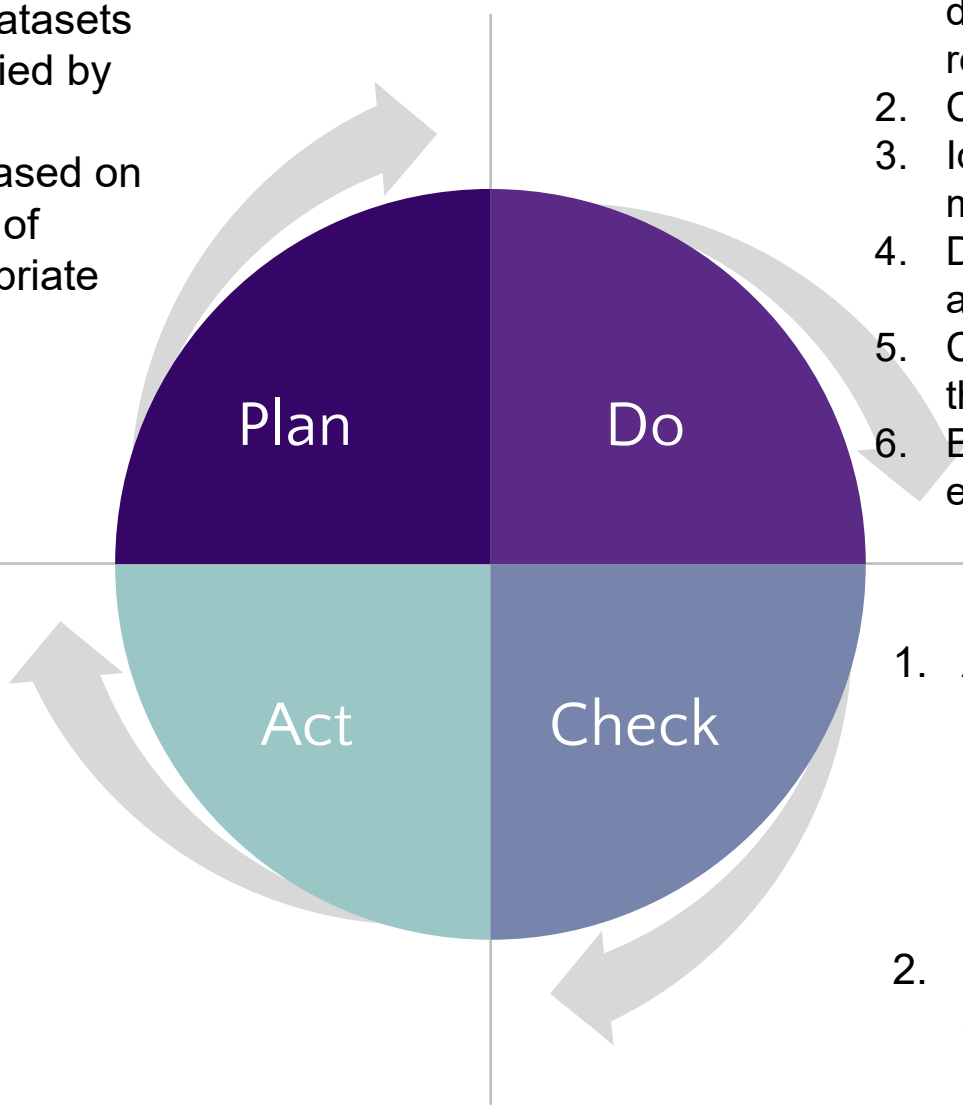
1. Facilitate cross-specialty discussions to critically appraise current SAP practices.
2. Incorporate agreed additions and clarifications into unified NUH SAP guideline.

Check

1. Assess specialty engagement and readiness to revise NUHS SAP guideline.
2. Receive updated speciality SAP guidelines, including documented justifications and proposed additions.
3. ASP team to review revised guidelines for alignment with NUHS priorities.

PDCA 4. Improving knowledge & awareness of SAP

1. Retrospective analysis of SAP datasets to evaluate SSI incidence, stratified by procedure type.
2. Target trial emulation analysis based on EPIC data to estimate the effect of guideline-concordant vs inappropriate SAP on SSI risk.

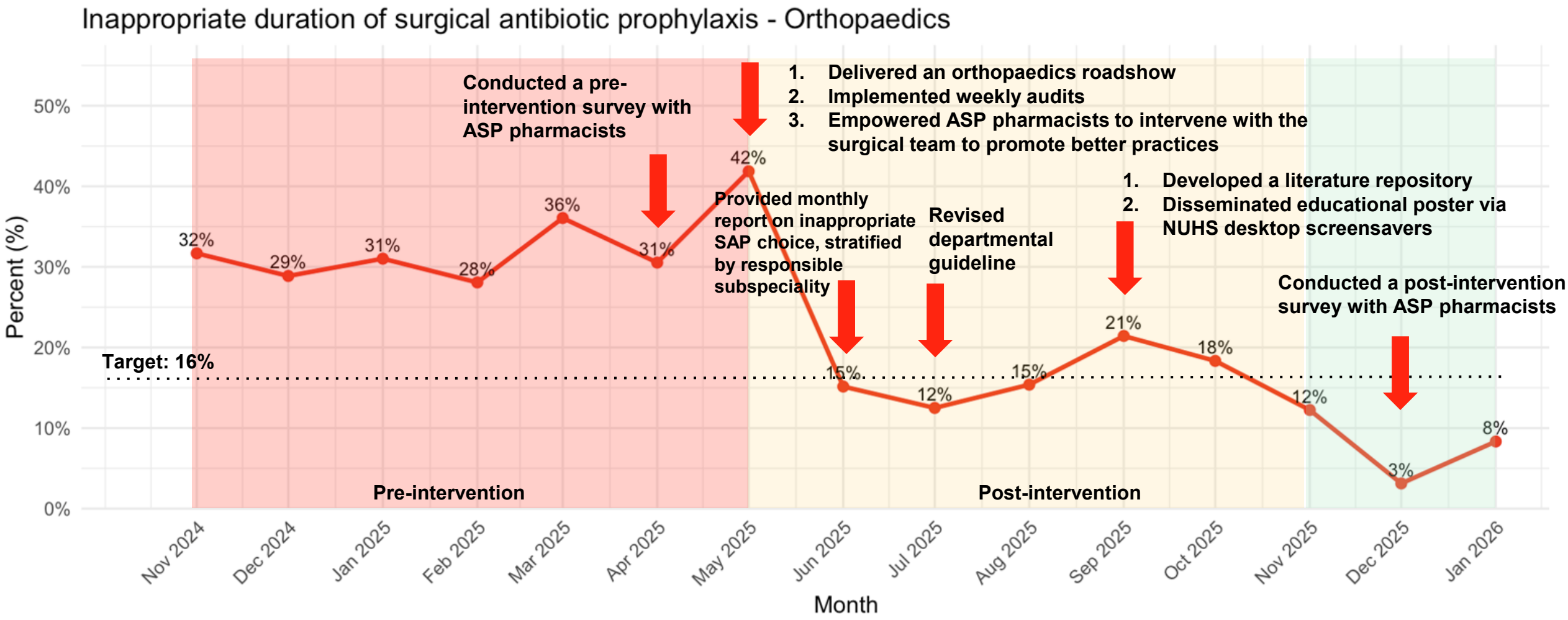


1. Collaborate with orthopedics and otolaryngology departments and ASP pharmacists to access retrospective SAP data.
2. Conduct target trial emulation.
3. Identify patterns of antibiotic overuse and misalignment with guidelines.
4. Deliver sessions for surgeons, junior doctors, and pharmacists.
5. Create an informative poster and display it on the NUHS screensaver for 6 months.
6. Establish a literature repository with updated evidence.

1. Deliver an educational talk during World Antimicrobial Awareness Week 2025 to disseminate findings and reinforce evidence-based SAP practices.

1. Analyse the retrospective data to quantify:
   - Proportion of patients receiving inappropriate antibiotic choice and/or duration.
   - Association between SAP non-compliance and SSI risk
2. Review Q&A following the educational sessions to identify common misconceptions and behavioral barriers.

E. Benefits / Results (CHECK)



	Baseline	Pre-intervention mean	Post-intervention mean	Improvement sustained for three months	Target exceeded
Inappropriate duration of surgical antibiotic prophylaxis (%)	32.0	32.7	13.0	Yes	Yes

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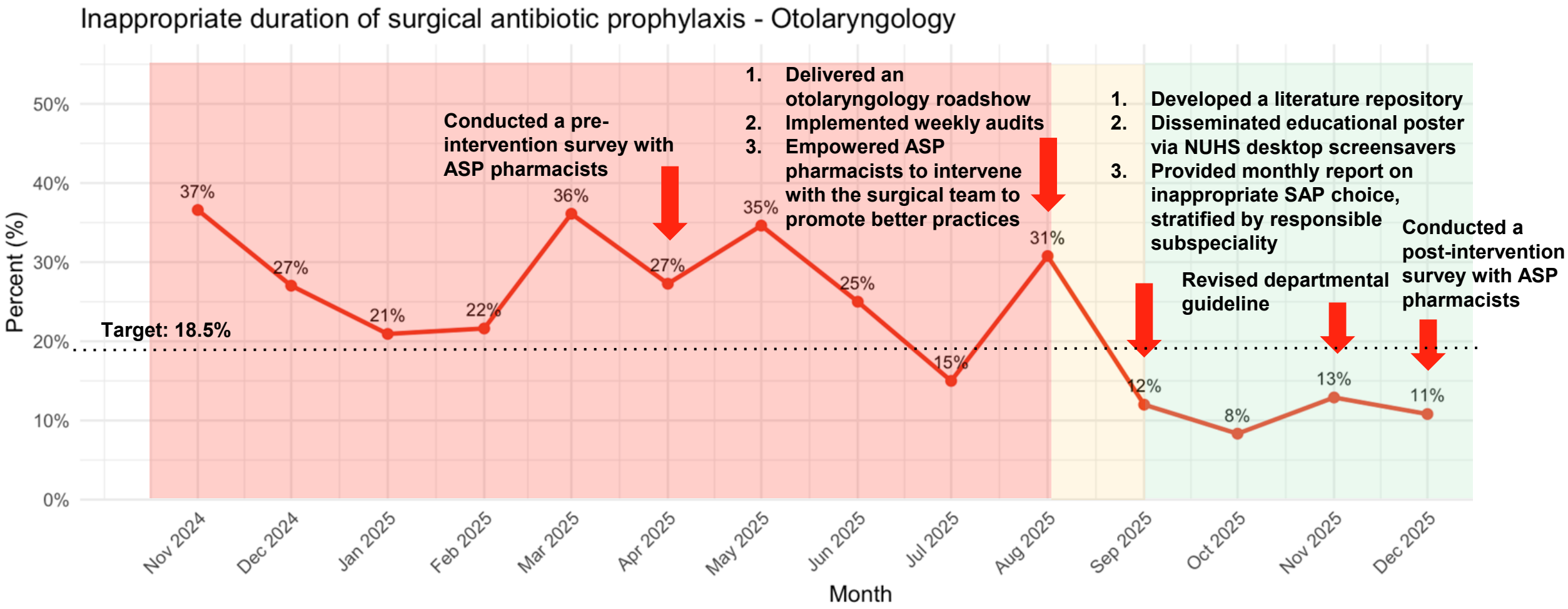


	Baseline	Pre-intervention mean	Post-intervention mean	Improvement sustained for three months	Target exceeded
Inappropriate duration of surgical antibiotic prophylaxis (%)	37.0	27.6	11.0	Yes	Yes

E. Benefits / Results (CHECK)

Projected cost saving for reduced surgical antibiotic prophylaxis duration*

Drug cost saved

$320/ month

Manpower saved

$4750/month

Total monthly savings

$5070

Total yearly savings

$60, 840

*Projected cost based on:

1. Augmentin $0.40/tab for 7 days (prolonged SAP course)
2. Improvement of prolonged SAP from 30% to 15%
3. Time spent on each SAP case: 30 minutes
4. Average total manpower cost of $250/hour for ASP consultants, surgeons, and pharmacists.

Average duration of prophylactic antibiotics prescribed for orthopaedic and otolaryngology surgeries

	Pre-QIP	Post-QIP
Average duration of surgical antibiotic prophylactic for elective orthopaedic surgeries (days)	6.39	2.15
Average duration of surgical antibiotic prophylactic for elective otolaryngology surgeries (days)	7.81	1.38

F. Strategy for Spreading/ Sustaining (ACT)

Education & Training

- Continue displaying surgical antibiotic prophylaxis poster on the NUHS desktop screensaver.
- Update the centralised literature repository with emerging evidence and key references.
- Deliver regular educational presentations to junior doctors and medical students.

Audit Checks

- Continue conducting weekly surgical antibiotic prophylaxis audits by ASP pharmacists.
- Continue providing monthly audit feedback to surgical teams to reinforce adherence and identify areas for improvement.

Presentations

- Deliver regular educational presentations to junior doctors and medical students.

Communications

- Hold weekly check-ins between the team leader and ASP pharmacists to review progress and address issues.
- Continue collating names of surgeons with recurrent deviations and escalate follow-up to the team leader on a weekly-basis.
- Maintain clear communication pathways to support timely intervention and accountability.

Standard Works

- Incorporate these updated guidelines into routine surgical workflows to reduce variation in practice.

Systems

- Incorporate surgical antibiotic prophylaxis monitoring into routine audits and key performance indicators (KPIs).
- Report quarterly update to the CMB.
- Integrate sustained monitoring within the antimicrobial stewardship programme.

Staff

- Sustain active involvement of ASP doctors and pharmacists in auditing and feedback processes.

Patient

- Address patient concerns and prevent the misconception that longer courses of antibiotics provide additional protection against infection.

F. Strategy for Spreading/ Sustaining (ACT)

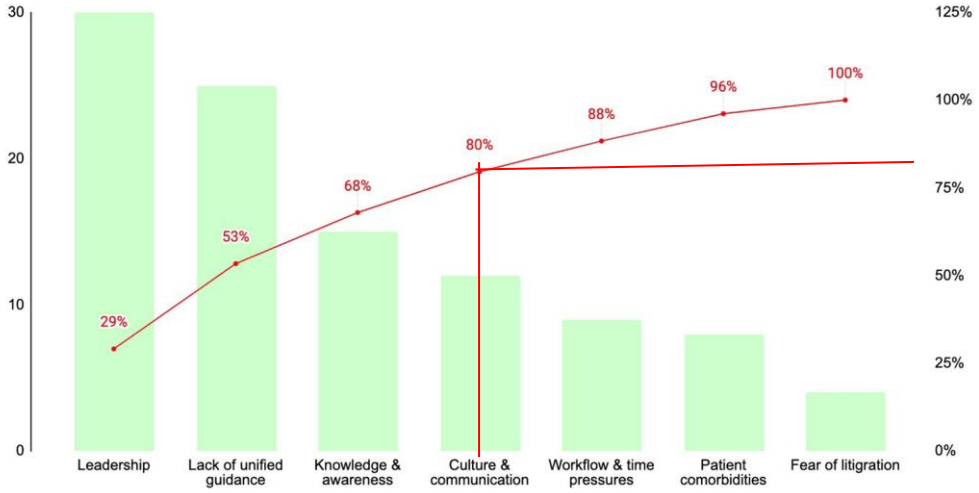
- **Sustaining**
  - Weekly prospective audit and feedback for SAP prescription.
  - Roadshow to more surgical departments to share progress and gather feedback for continuous improvement.
  - EPIC medication panel for specific elective surgeries with predefined SAP duration.

- **Vertical spread**
  - Surveillance of surgical site infections following elective surgeries.
  - Train junior doctors and medical students on institution SAP guide and documentation of indication.

- **Horizontal spread**
  - Sharing this quality improvement initiative and engage more surgical departments to expand SAP optimisation.
  - Collaboration with National Antimicrobial Stewardship Expert Panel (NASEP) to disseminate initiatives to other hospitals.
  - Peer-reviewed publication to support adoption beyond NUH.

Appendix

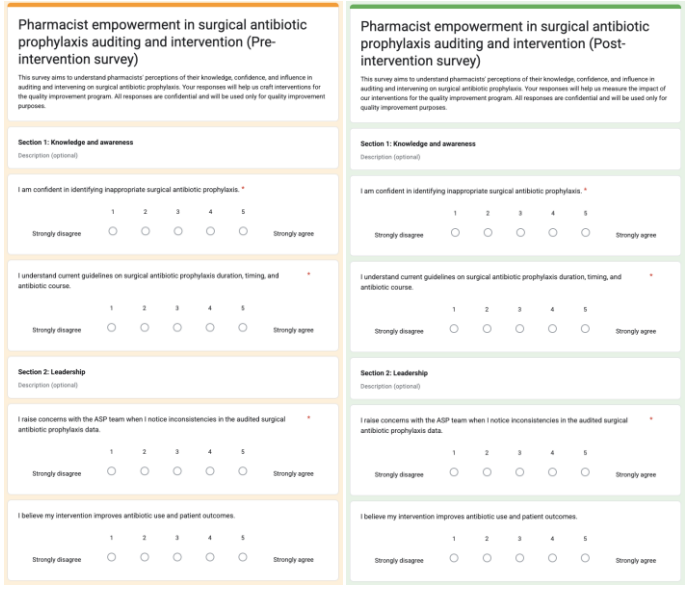
1. Pareto chart
2. Pre- and post-intervention survey with ASP pharmacists
3. Literature repository with updated evidence
4. Informative SAP poster
5. Monthly feedback to departments
   a. Choice
   b. Duration
   c. Sub-specialty
6. Revised orthopaedics and otolaryngology guidelines
7. Educational talk during World Antimicrobial Awareness Week 2025
8. Incidence of surgical site infections
9. References



1. Pareto chart

Pareto analysis showed that leadership, lack of unified guidance, knowledge and awareness gaps, and culture and communication accounted for about 80% of barriers to reduce inappropriate SAP.

3. Literature repository with updated evidence



2. Pre- and post-intervention survey

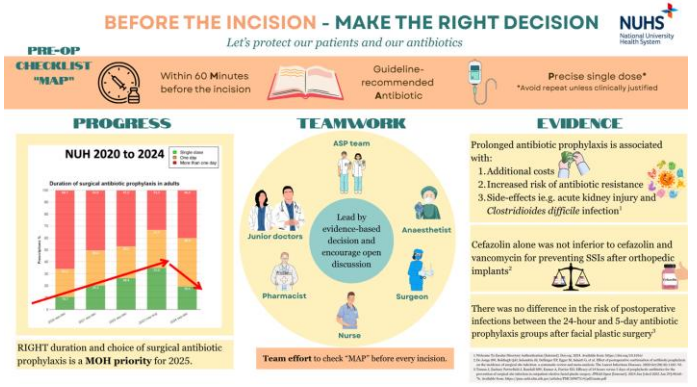
Pre-intervention survey results:

Key barriers include difficulty in interpreting surgical details (e.g., implants, contamination complications) and uncertainty when cases fall outside guidelines due to limited evidence for SAP duration in complex procedures or high-risk patients. Additionally, resistance from surgeons to stewardship interventions makes it challenging to reduce or stop prolonged surgical prophylactic antibiotics.

Post-intervention survey results:

Pharmacists report feeling empowered by clearer and more defined guidelines, improved documentation, and communication from surgical teams (including infection status and rationale for prolonged duration), regular feedback, and greater engagement from surgeons.

	Pre-QIP	Post-QIP
Knowledge & awareness	3.25	4.83
Leadership	4.00	5.00
Communication & culture	2.72	4.67

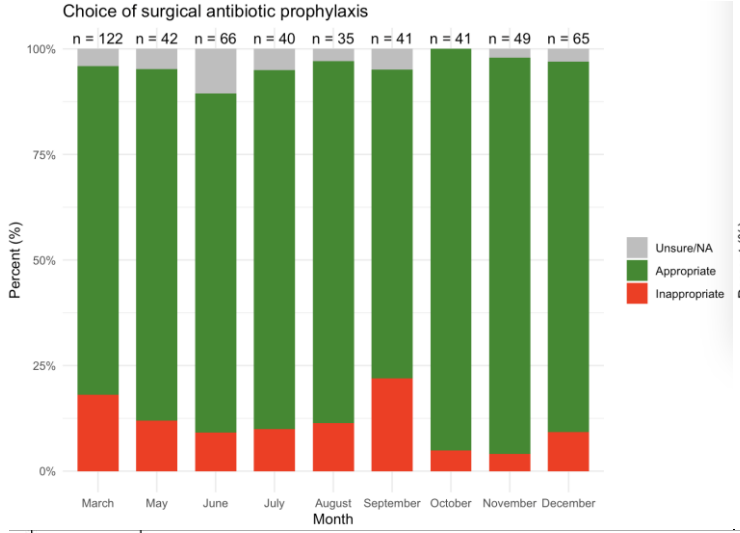


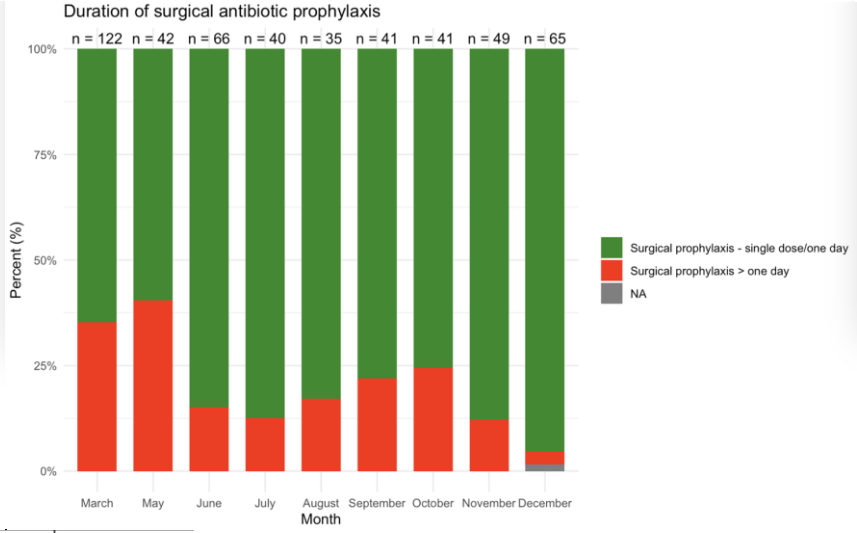
4. Informative SAP poster

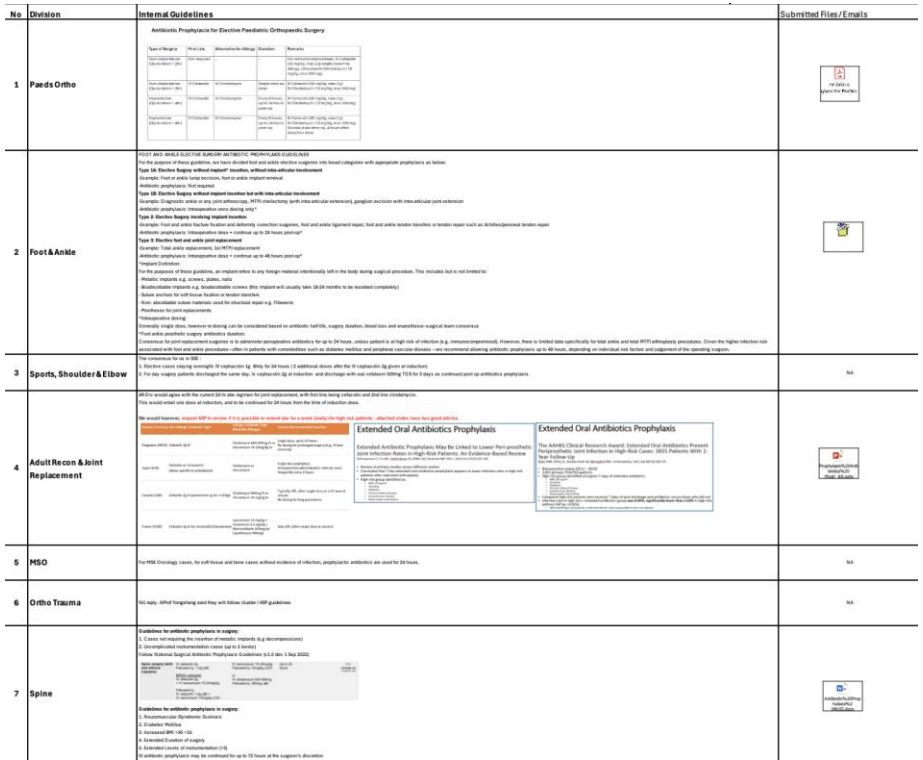
Informative poster displayed on the NUHS screensaver for 6 months.

Appendix

5. Monthly feedback to departments







No	Division	Internal Guidelines	Submitted Files / Emails
1	Paeds Ortho	Antibiotic Prophylaxis for Elective Paediatric Orthopaedic Surgery	
2	Foot & Ankle	FOOT AND ANKLE ELECTIVE SURGERY ANTIBIOTIC PROPHYLAXIS GUIDELINES	
3	Sports, Shoulder & Elbow		NA
4	Adult Recon & Joint Replacement	Extended Oral Antibiotics Prophylaxis	
5	MSO		NA
6	Ortho Trauma		NA
7	Spine		

ADULT ELECTIVE SURGICAL ANTIBIOTIC PROPHYLAXIS GUIDELINES

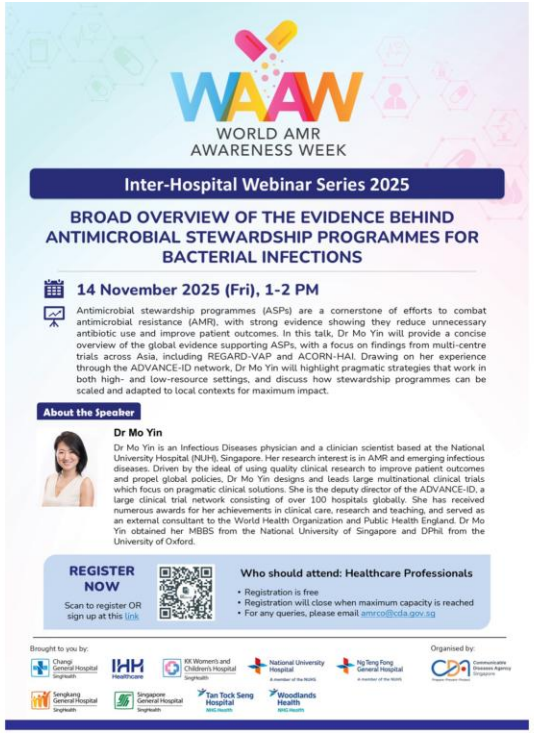
(aligned with National Surgical Antibiotic Prophylaxis Guideline (Singapore))

1. OTORHINOLARYNGOLOGY

Division	Type of Surgery	1st line antibiotic	Alternative antibiotic	Duration	Comments
Ear	Clean otologic procedures - Excision of Keloid/ Sebaceous cyst/ Pseudocyst - Myringoplasty (standard/endaural/postaural) - Mastoidectomy - Ossicular chain reconstruction (OCR) /Ossiculoplasty - Aural toilet	Not recommended	Not recommended	NA	
	Otologic procedures involving Implants - Cochlear implant - Bone conduction implant Clean-contaminated otologic procedures	IV Augmentin 1.2g 8H OR IV Cefazolin 2g, followed by 2g 8H (if <45kg, use 1g 8H) + IV Metronidazole 500mg 8H	IV Clindamycin 600-900mg, followed by 600mg 8H +/- IV Gentamicin 5mg/kg once	Up to 24H	Continuation of antibiotic prophylaxis up to ??? may be considered for patients with major risk factors such as - Exposed dura - Irradiated patients - Gusher - Skin conditions
	Stapedotomy	IV Augmentin 1.2g 8H OR IV Cefazolin 2g, followed by 2g 8H (if <45kg, use 1g 8H) + IV Metronidazole 500mg 8H	IV Clindamycin 600-900mg, followed by 600mg 8H +/- IV Gentamicin 5mg/kg once	Up to 24H	Continuation of antibiotic prophylaxis up to 1 week may be considered for patients with major risk factors such as - Gusher

6. Revised orthopaedics and otolaryngology guidelines

7. Educational talk during World AMR Awareness Week



Appendix

8. Orthopaedics surgery- surgical site infection incidence

	Pre-QIP							Post-QIP	
	November 2024	**December 2024**	**January 2025**	**February 2025**	**March 2025**	**April 2025**	**May 2025**	**June 2025**	**July 2025**
Total elective surgeries	254	234	211	228	250	231	208	253	245
Total surgical site infections	2	7	2	8	5	5	6	9	4
Surgical site infection rate (%)	0.79	2.99	0.95	3.51	2.00	2.16	2.88	3.56	1.63

Surgical site infection rate did not increase despite reduction in antibiotic duration.

9. References

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