



## Background

Health care faces a “60-30-10 Challenge” – 60% is care according to guidelines, 30% is of low or no value, and 10% contributes to iatrogenic harm<sup>1</sup>. Choosing Wisely is an international movement that seeks to tackle this issue by reducing unnecessary tests, medications and interventions that do not improve patient outcomes.

Local and international guidelines do not recommend routine pre-operative chest X-rays (CXRs) in low-risk surgical patients with no symptoms or significant findings as they do not alter clinical management or outcomes. However, significant overuse persists despite these guidelines<sup>2</sup>.

## Mission Statement

To increase appropriateness of pre-operative chest x-rays for patients planned for elective surgery attending Pre-Admission Centre (PAC) by 5% from 67.7% to 72.7% (median rates) in 6 months.

## Analysis of problem

Data analysis of patients attending SGH PAC between July 2022 – June 2023 (n=4193) showed 27.1% of pre-op CXRs were unnecessary despite having hospital guidelines.

Further analysis of patients with unnecessary pre-op CXRs was done to identify trends in patient demographics and type of surgery. We identified the following demographics with a tendency for overuse as areas for improvement:

- 1938 cases (49.8%) of overuse were between 61-70 years old (Figure 1).

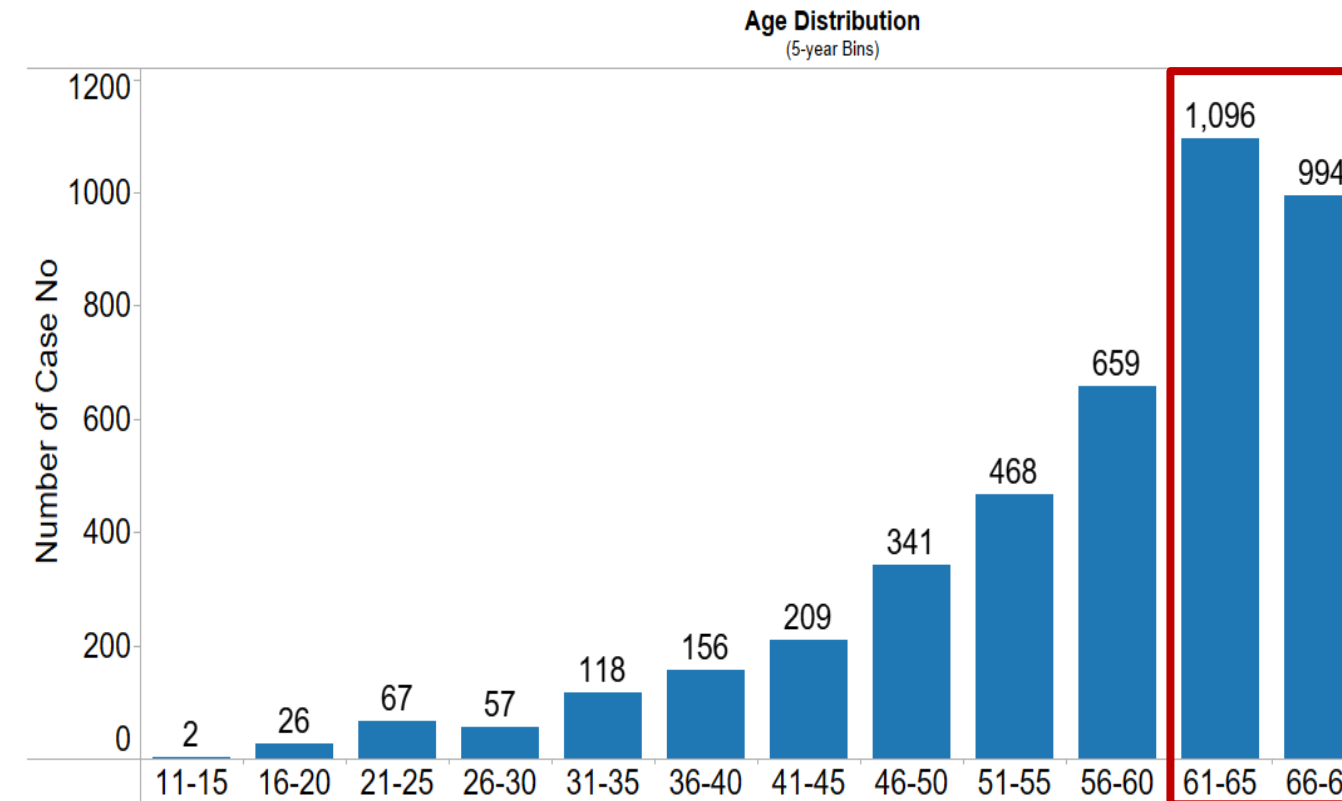


Figure 1 - Age demographic of patients with inappropriate pre-op CXR between Jul 22–Jun 23

- Process mapping revealed that pre-selection of investigations in Electronic Admission Form was not aligned with current guidelines

- Significant overuse were also found in ASA 1-2 patients undergoing moderate risk, high table surgeries (1941 cases, 46.3%), followed by low table, low risk surgery (1127 cases, 26.9%) (Table 1).

	ASA 1-2		ASA 3-6	Total
	Low Risk	Moderate Risk	Low Risk	
<b>Table 0-3</b>	26.9%	1.4%	4.5%	32.8%
	1127	58	190	1375
<b>Table 4-7</b>	18.6%	<b>46.3%</b>	2.3%	67.2%
	780	<b>1941</b>	97	2818

Table 1 – Surgical risk and Surgery type in patients with inappropriate pre-op CXR between Jul 22–Jun 23

Focus-group discussions were held with surgeons, PAC doctors and nurses where we found the main reasons for over-ordering of pre-op CXRs, including:

Root causes	4Es Approach <sup>3</sup>	Interventions
Lack of familiarity with current guidelines	Educate	PDCA 1: Education – Department Teaching
	Embed	PDCA 1: Education – Clinic Guide
Fear of surgery cancellation due to incomplete pre-op workup	Empower	PDCA 1: Implementation of modified workflow
Electronic Admission Form did not reflect current guidelines	Enforce stewardship	PDCA 2: Updating of Electronic Admission Form

Table 2 – Underlying reasons for over-ordering of pre-operative Chest X-Rays and their respective interventions

1: Braithwaite, J., Glasziou, P. & Westbrook, J. The three numbers you need to know about healthcare: the 60-30-10 Challenge. BMC Med 18, 102 (2020). <https://doi.org/10.1186/s12916-020-01563-4>  
 2: Müskens JLM, Kool RB, van Dulmen SA, et al. Overuse of diagnostic testing in healthcare: a systematic review. BMJ Quality & Safety 2022;31:54-63.  
 3: Silverstein WK, Leis JA, Moriates C. “4 E’s” Ways That Clinicians Can Reduce Low-Value Care on Medical Wards. JAMA Intern Med. Published online January 29, 2024. doi:10.1001/jamainternmed.2023.7632

## Interventions / Initiatives

### PDCA 1 – July 2023

- Revised workflow was implemented to address over-ordering due to fear of case cancellations and guard against underuse.
  - Surgeons to follow pre-selected investigations in EAF and input indications for investigations ordered for reasons outside of pre-op workup
  - PAC nurses would review all investigations ordered and manually add on or cancel based on patient’s clinical condition.
- Multimodal education to departments including department teachings, email blasts (Figure 2) and clinic guides (Figure 3) put up in clinics for easy reference to the guidelines and workflow.

### PDCA 2 – August 2023

Age cut-off for pre-selection of CXRs in the Electronic Admission Form was raised from 60 to 70 years old to reflect current guidelines.

Monthly audit was done and reported to PAC to identify areas and departments with high overuse and underuse. Email blasts were sent to departments with high overuse to feedback on performance and reinforce guidelines.

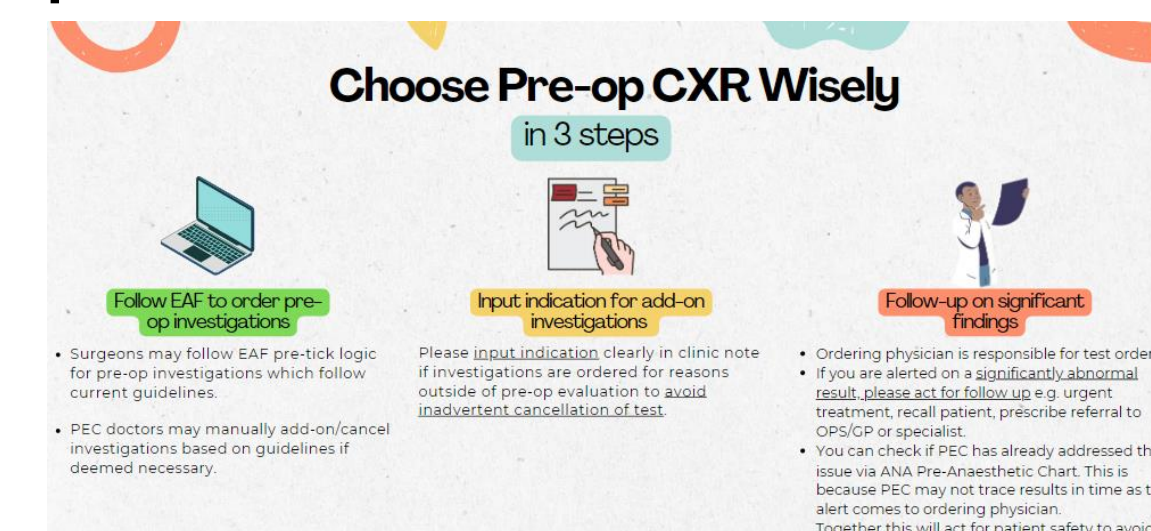


Figure 2 – Email blast infographic

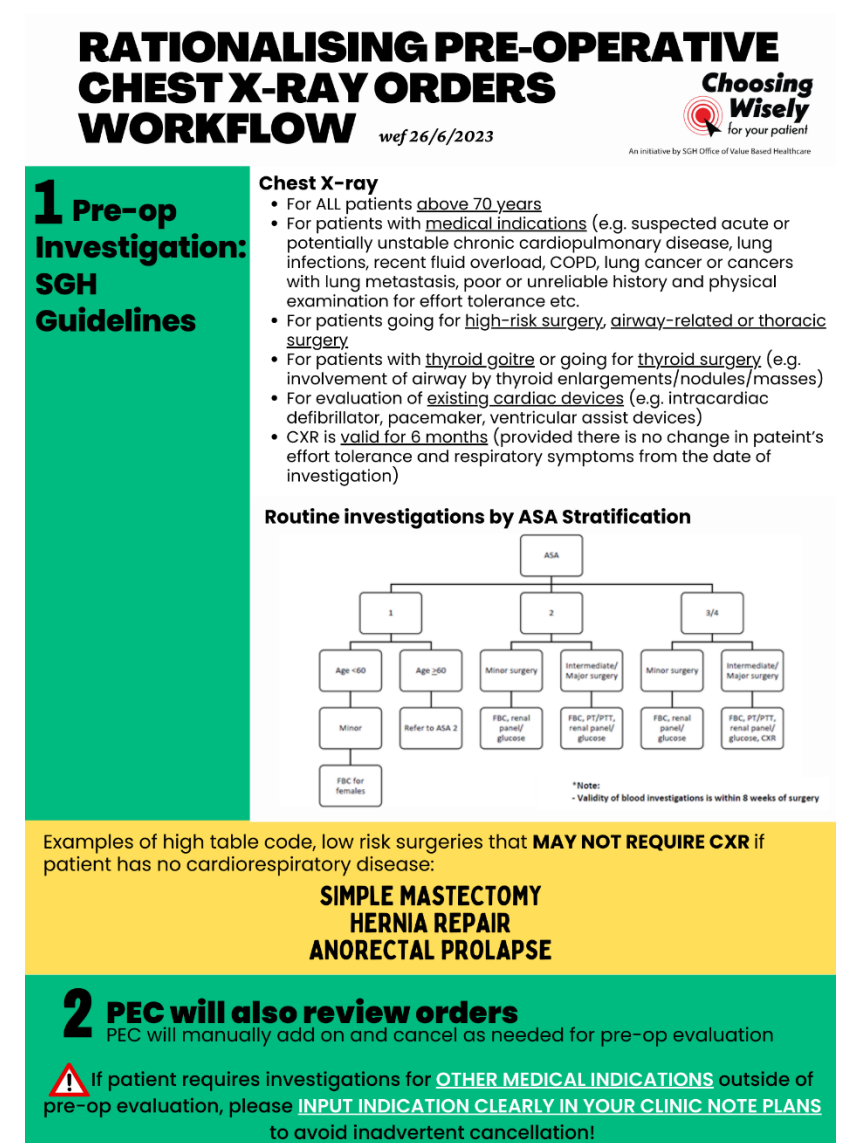


Figure 3 – Clinic guide

## Results

The team exceeded project target with an improvement in appropriateness of pre-op CXRs from 67.7% to 75.9% (8.2%) within 6 months. Overuse of CXRs dropped from 26.4% to 17.1% (9.3%)

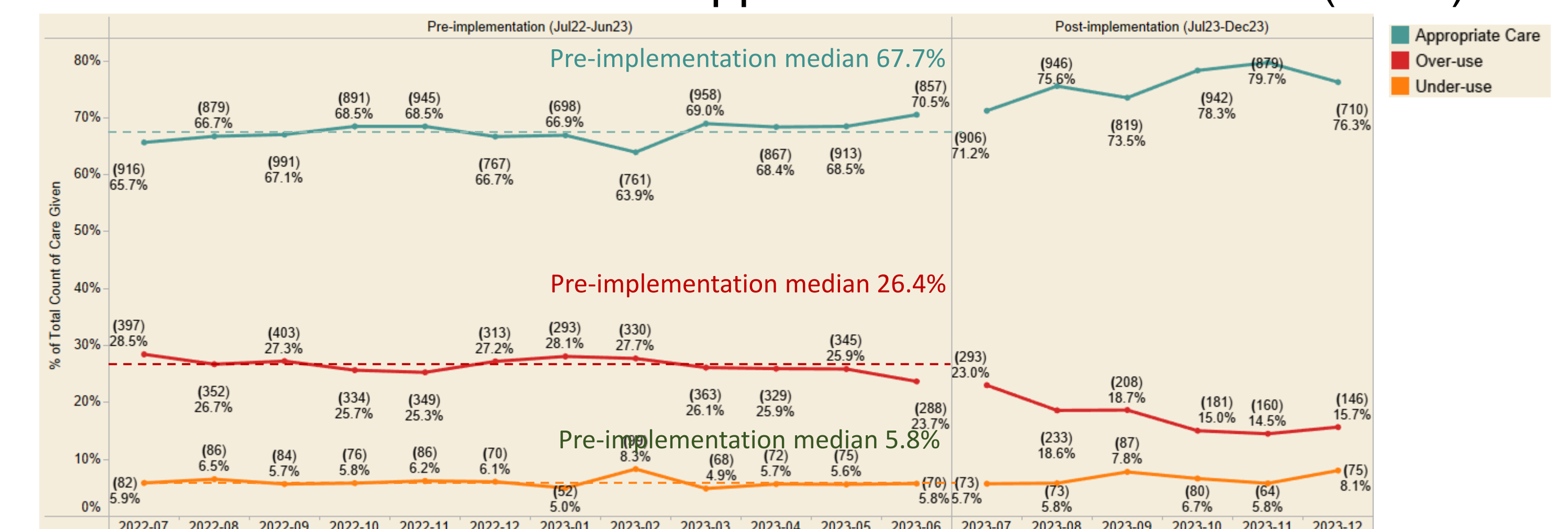


Figure 4 – Breakdown of care for patients attending PAC between Jul 2022 – Dec 2023

An average of 1146 patients attended PAC monthly post-intervention (Jul-Dec 23), compared to 1288 pre-intervention (Jul 22-Jun 23). Based on the average patient volume post-intervention, 604 unnecessary CXRs were avoided during the post-intervention period, translating to approximately 120 man-hours saved and cost avoidance of over S\$56,000 in the 6 months post-intervention (Jul-Dec 2023)

	Pre-intervention (Jul 22 - Jun 23)	Post-intervention (Jul 23 - Dec 23)
Appropriate Care	67.2% (10,386)	75.3% (5,178)
Over-use	27.1% (4,193)	18.3% (1,261)
Under-use	5.7% (880)	6.3% (435)
<b>Grand Total</b>	<b>100.0% (15,459)</b>	<b>100.0% (6,874)</b>

Table 3 – Change in trends of appropriate care, over-use and under-use pre- and post-intervention.

## Sustainability Plans

Performance will continue to be monitored regularly via automated dashboards. To ensure sustained education to the departments and rotating junior doctors, the team is looking at leveraging on automation for education (e.g. automation of periodic email blasts via robotic process automation).