Benchmarking Towards Surgical Excellence- The Pursuit of Value Driven Colorectal Surgery

Singapore Healthcare Management **2022**

SingHealth — *Defining Tomorrow's Medicine*

Wenjie Lin, MBBS, MMed, FRCS, Singapore General Hospital
Nicholas Graves, PhD, Duke-NUS Medical School
Aik Yong Chok, MBBS, MMed, FRCS, Singapore General Hospital
Marcus Eng Hock Ong, MBBS, FRCS, FAMS, MPH, Singapore General Hospital; Duke-NUS Medical School
Kenneth Kwek, CEO, Singapore General Hospital
Ruban Poopalingam, MBBS, MMed, Singapore General Hospital
Kwok Ann Ang, CFO, Singapore General Hospital
Hiang Khoon Tan, MBBS, FRCS, FAMS, PhD, Singapore General Hospital
Ivan En-Howe Tan, MBA, SingHealth Community Hospitals
Rachel Shiyi Lee, SingHealth Community Hospitals
Emily Yun Zhao, PhD, SingHealth Community Hospitals
Kai Xun Yew, Singapore Management University
Emile Kwong Wei Tan*, MBBS, MD, FRCS, Singapore General Hospital (corresponding author)

Background

SGH has embarked on a value driven care journey in 2018 by submitting to the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) an outcomes based program for colorectal resections, enabling benchmarking procedures against hospitals in America and internationally. Developed by surgeons, ACS NSQIP collects data that provides detailed and insightful analysis, allowing hospitals to gauge the quality of their surgical programs with unrivalled precision and improve surgical outcomes.
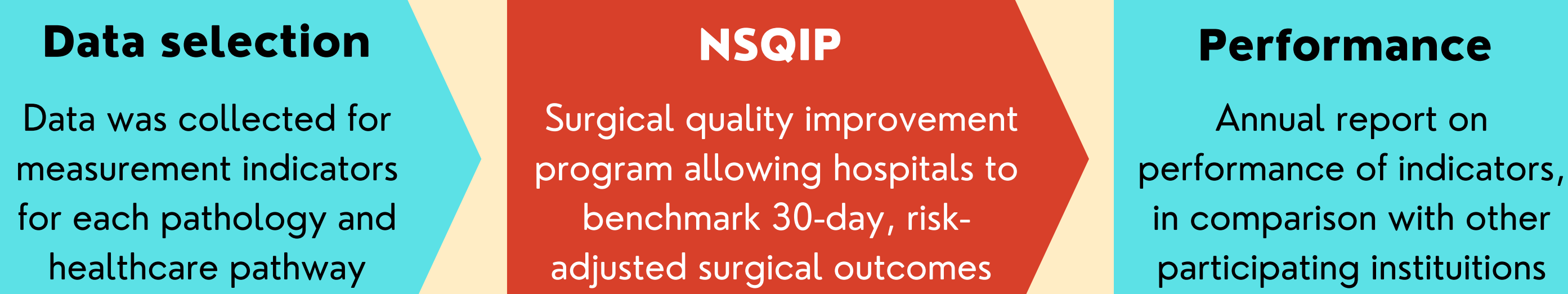
Objective

- A retrospective study was conducted at SGH to describe the application of a value driven care programme for elective colorectal resections
- Surgical outcomes and cost data collected are utilized to develop and identify initiatives for improvements in value and quality of care
- Outcomes are benchmarked against selected clinical quality indicators
- Value of care is determined by assessing performance of outcomes against cost

Methodology

Standardization of measurement outcomes

Data was collected and submitted to the NSQIP database

Data selection
Data was collected for measurement indicators for each pathology and healthcare pathway

NSQIP
Surgical quality improvement program allowing hospitals to benchmark 30-day, risk-adjusted surgical outcomes

Performance
Annual report on performance of indicators, in comparison with other participating instituitions

Participants

2018 → All patients undergoing elective colorectal cancer surgery at SGH were prospectively included. Information was harvested from the hospital electronic medical records on a monthly basis ← **2020**

Patients are tracked for 30 days post discharge to capture any post-op complications

Selected Clinical Quality Indicators

- wound occurrences
- cardiac occurrences
- respiratory occurrences
- urinary occurrences
- 30-day readmission rate
- post-op length of stay (< 6 days)
- inpatient mortality rate
- 30-day complication rate
- 30-day return to operating theatre rate
- other occurrences

Quality measurement

- Clinical Quality Indicator (CQI) scores are computed in an all-or-nothing fashion
- Failure to meet any of the indicator items within the score matrix is considered a fail
- It is a measure of the "perfect" post-operative patient journey or the percentage of patients satisfying all indicator items

Cost assessment

disaggregated cost data for patients were harvested from the hospital's finance department for the entire hospitalization journey from surgery to discharge → specific cost breakdowns →
- consumables
- daily treatment
- investigation
- surgeon

Evaluation of outcomes

- CQI scores are measured against cost data to assess cost-effectiveness of health services
- Performance gaps are identified to drive initiatives for improvements in quality of care
- Establish best practices amongst surgeons
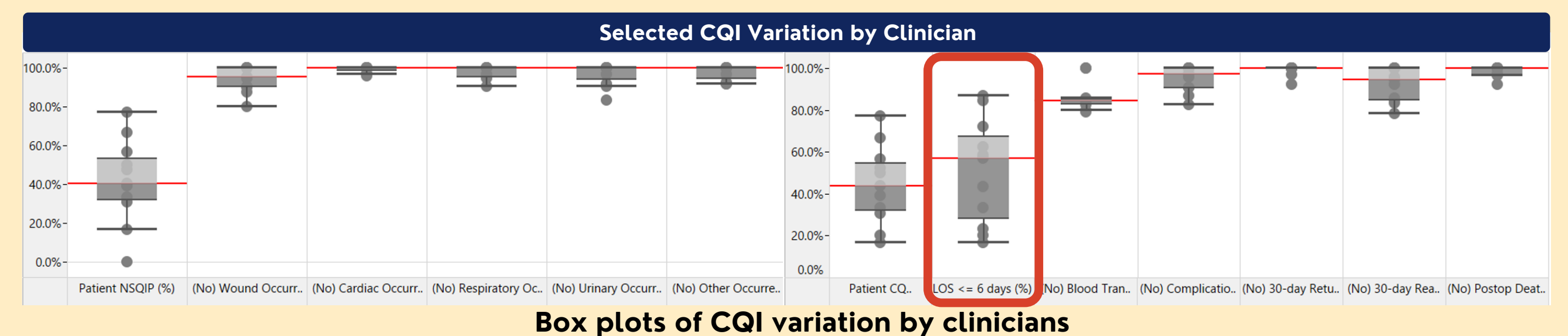
Analysis

The data tracked was illustrated using an interactive data visualization dashboard with Tableau. Deeper insights could be derived through the analysis of **CQI scores, performance variation across surgeons** as well as **cost effectiveness of surgical outcomes**. Key areas for surgical improvements towards specific cost drivers could be identified precisely.

Dashboard overview

	Previous Year	Comparison Period:	Select Start	Select End	Select Doctor Department	Select TOSP Code	Surgery Count	Admit Type
	2019	2020 Q1 - 2020 Q4	2020 Q1	2020 Q4	COLORECTAL SURGERY			Elective
No of Cases	173	206	51	64				
No of CQI Not Met Cases	79	102	24	31				
Patient NSQIP (%)	52.0%	49.0%	51.0%	50.0%				
LOS < 6 days (%)	64.2%	60.7%	56.9%	57.8%				
(No) Blood Transfusion Rate (%)	87.3%	84.0%	82.4%	89.1%				
(No) Complication Rate (%)	94.8%	92.7%	96.1%	92.2%				
(No) 30-day Return Rate (%)	97.7%	99.0%	100.0%	98.4%				
(No) 30-day Readmission Rate (%)	93.1%	89.3%	92.2%	89.1%				
(No) Postop Death Rate (%)	97.1%	98.1%	96.1%	98.4%				
(No) Wound Occurrence Rate (%)	93.6%	93.7%	92.2%	92.2%				
(No) Cardiac Occurrence Rate (%)	99.4%	98.5%	98.0%	100.0%				
(No) Respiratory Occurrence Rate (%)	98.8%	96.1%	98.0%	95.3%				
(No) Urinary Occurrence Rate (%)	100.0%	97.1%	100.0%	100.0%				
(No) Other Occurrence Rate (%)	98.3%	96.6%	94.1%	98.4%				

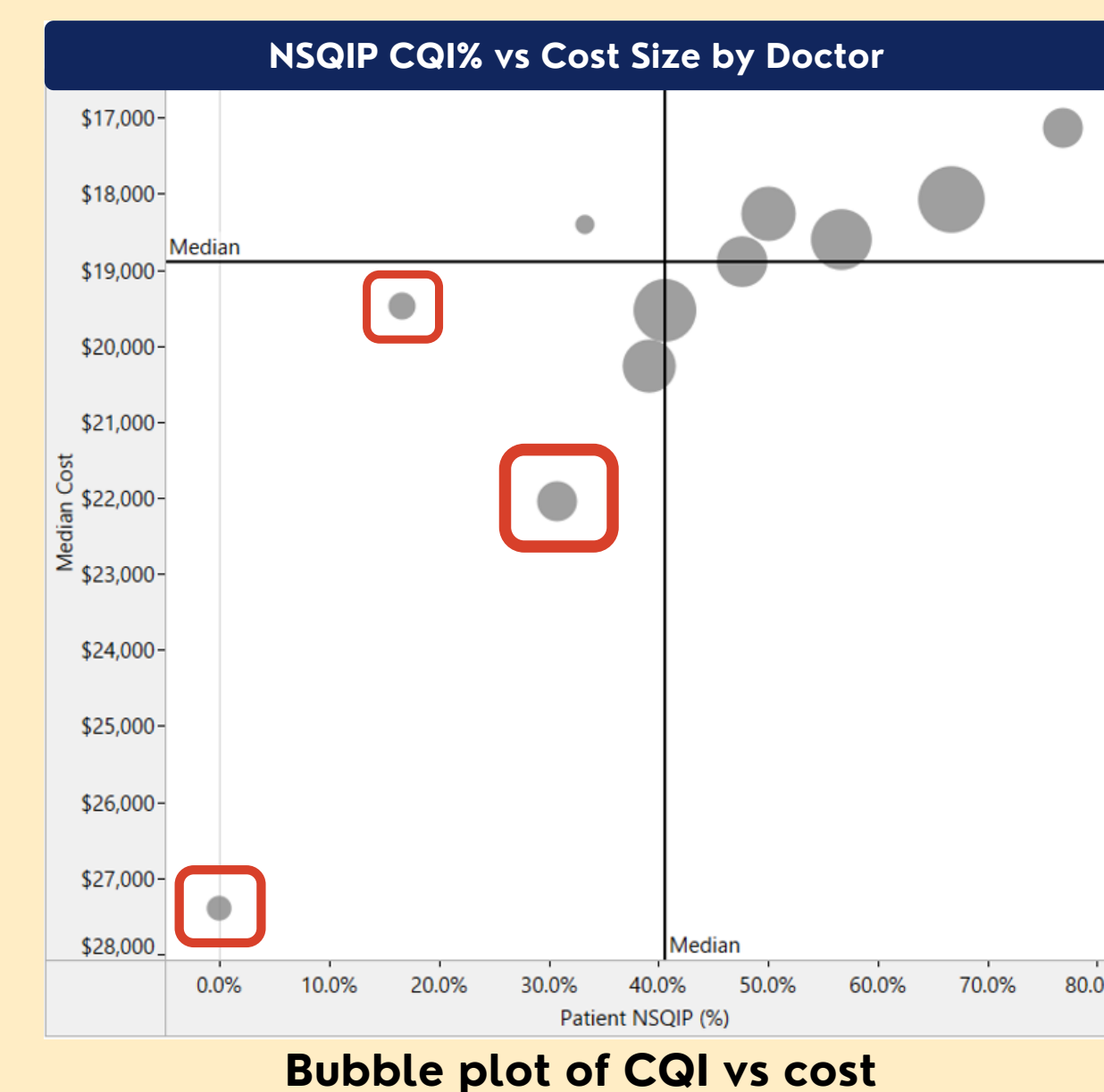Overview of the selected clinical quality indicators (CQI) for Colectomy

- The dashboard allows for comparison of quality indicator metrics on a yearly and quarterly basis
- Clinical performance was generally exemplary
- **Length of stay** rubric was identified as an area requiring significant improvement

Inter-surgeon variation

Box plots of CQI variation by clinicians

Each bubble represents a surgeon, while the red line represents the overall surgeons' median performance. The plot allows for comparison of quality indicator performances across surgeons. More granular immediate post-op outcomes are examined. There is considerable variation in quality of care provided amongst surgeons, with the main contributor being **length of stay**. Outliers below the first quartile are targeted as areas of improvement.

Cost effective assessment
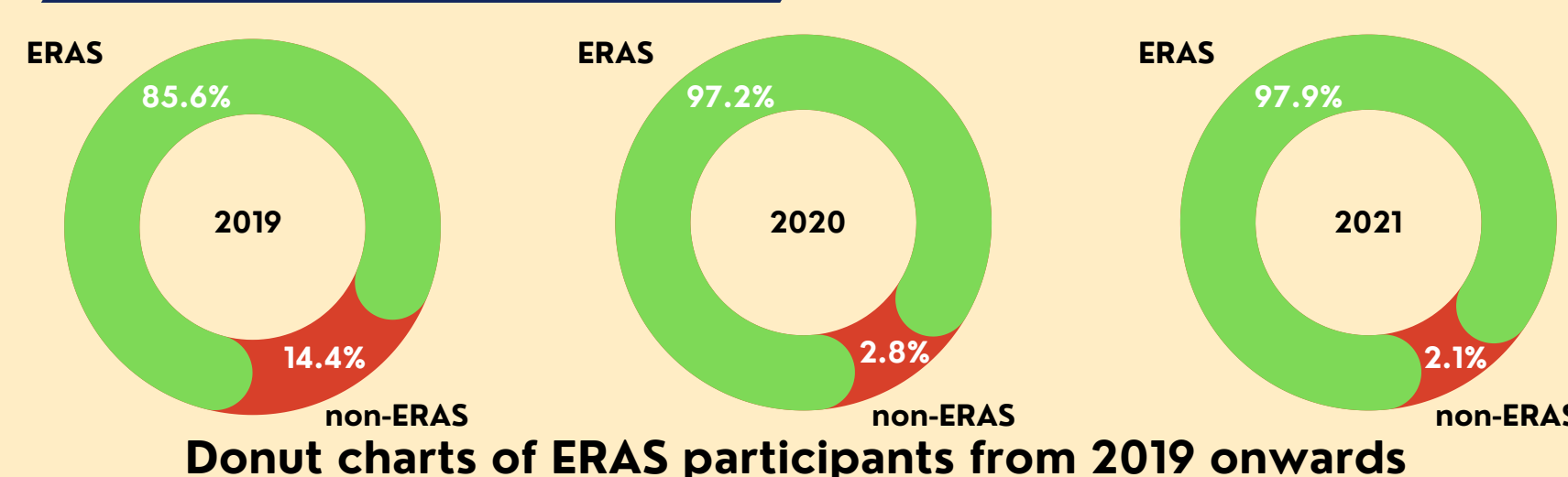

Bubble plot of CQI vs cost

- Bubble plot illustrates each surgeon's relative performance in terms of cost against CQI performance
- Outlying procedures with **large costs** and **poor CQI performance** were extensively examined
- **Cost drivers** were further broken down and examined on a granular level with **length of stay** and **consumables** identified as the main contributors, the latter of which showing significant variation amongst surgeons

ERAS Initiative

To achieve improvements in quality of care, the Enhanced Recovery After Surgery (ERAS) protocol was explored as a method to ensure systemic adherence to recommended processes of care. ERAS is a multimodal perioperative care pathway designed with evidence-based best practices to achieve **early recovery** for patients undergoing major surgery. With **length of stay (LOS)** identified as a key area for improvement, the effects of ERAS on post-operative outcomes were investigated in the field of colectomy.

ERAS Participation

ERAS 2019: 85.6% / non-ERAS 14.4%
ERAS 2020: 97.2% / non-ERAS 2.8%
ERAS 2021: 97.9% / non-ERAS 2.1%

Donut charts of ERAS participants from 2019 onwards

Percentage of patient enrolment for ERAS in colectomy increased yearly since its implementation in **2019**

Improvements from ERAS

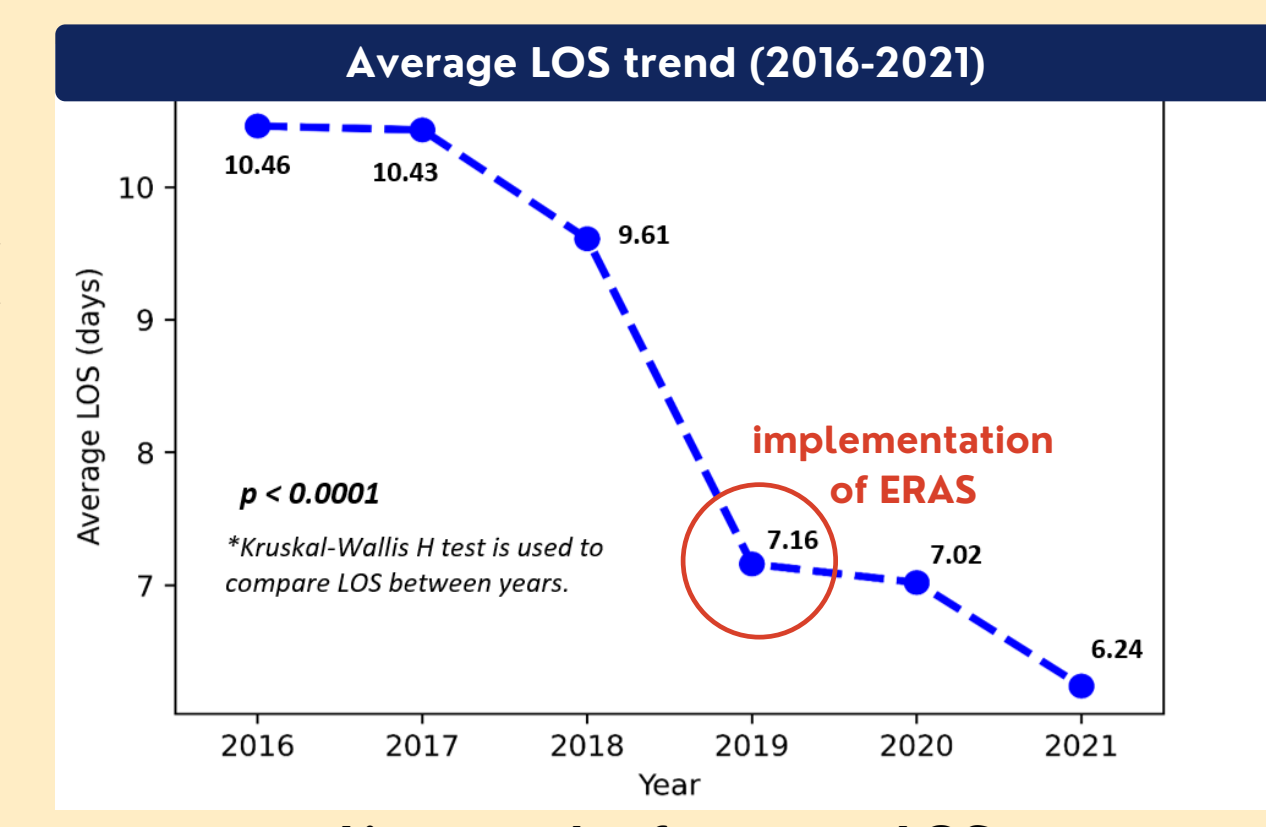| Year	Before ERAS			After ERAS			p-value
	2016	2017	2018	2019	2020	2021	
Median LOS (days)	7	7	6	5	5	5	
Average LOS (days)	10.46	10.43	9.61	7.16	7.02	6.24	< 0.0001*
Reduction in average LOS (with reference from 2018)				2.45	2.59	3.37	
Average bed days saved (2019-2021)				2.45 + 2.59 + 3.37 = **8.41**			

Table of comparison on LOS outcome with ERAS

There is a **clinically & statistically significant reduction** in post-operative **LOS** after ERAS

SGH ward type	A	B1	B2	C
Rates (per day)	508.46	251.45	79	35
Daily treatment fee	242.66 per day for all wards			
Average bed day cost	(508.46 + 251.45 + 79 + 35)/4 + 242.66 = **$461.14**			
Cost savings (estimated 2019-2021)	461.14 × 8.41 (bed days saved) × 300 (300 beds) = **$1,163,456**			

Valuation of cost savings

Average LOS trend (2016-2021): 10.46, 10.43, 9.61, 7.16 (implementation of ERAS), 7.02, 6.24
p < 0.0001
Kruskal-Wallis H test is used to compare LOS between years.

Line graph of average LOS

The observed **reduction in LOS** of our patient cohort would have resulted in **cost savings** of $1,163,456 following the implementation of **ERAS** (at an estimated bed day cost of $461.14)

Conclusion

- Standardization of outcome measurements alongside cost assessment allows for concrete determination of value in care
- Data analytics plays a vital role in enhancing quality control and the development of improvement initiatives towards reducing healthcare costs while maintaining standards of healthcare services
- Value driven care programme in surgical oncology is feasible with benchmarking of surgical outcomes allowing for the establishment of best practice protocols