

Safer Surgical Site Marking for patients undergoing Eye Surgery by using Human Factors Engineering Approach

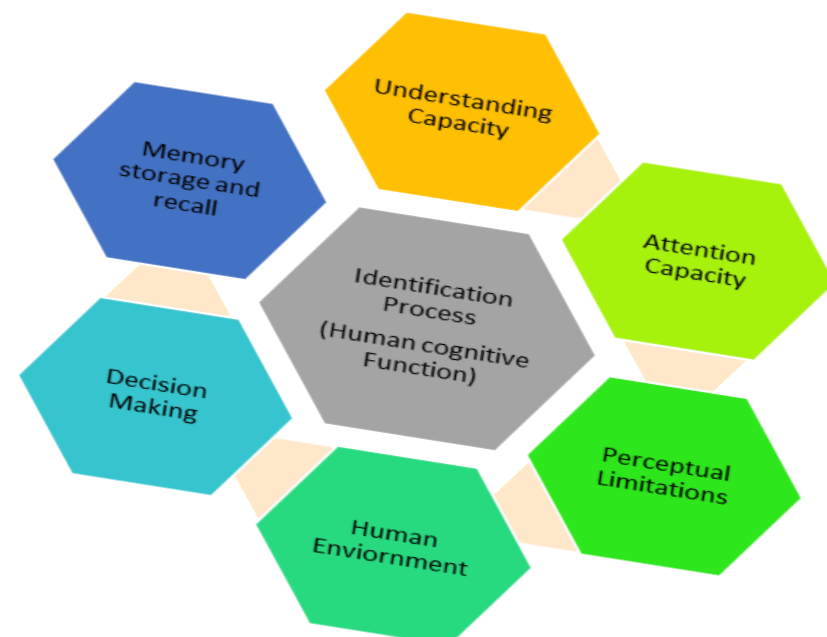
Lai F.W.¹, Tan S.L.¹, Liaw C.M.³, Margareth U.K.³, Suriagandhi S.⁴, Chang B.²
¹Day Surgery Centre, ²Ophthalmology & Visual Sciences, ³Anaesthesia, ⁴Operations

Aim

A multi-disciplinary project that aims to:

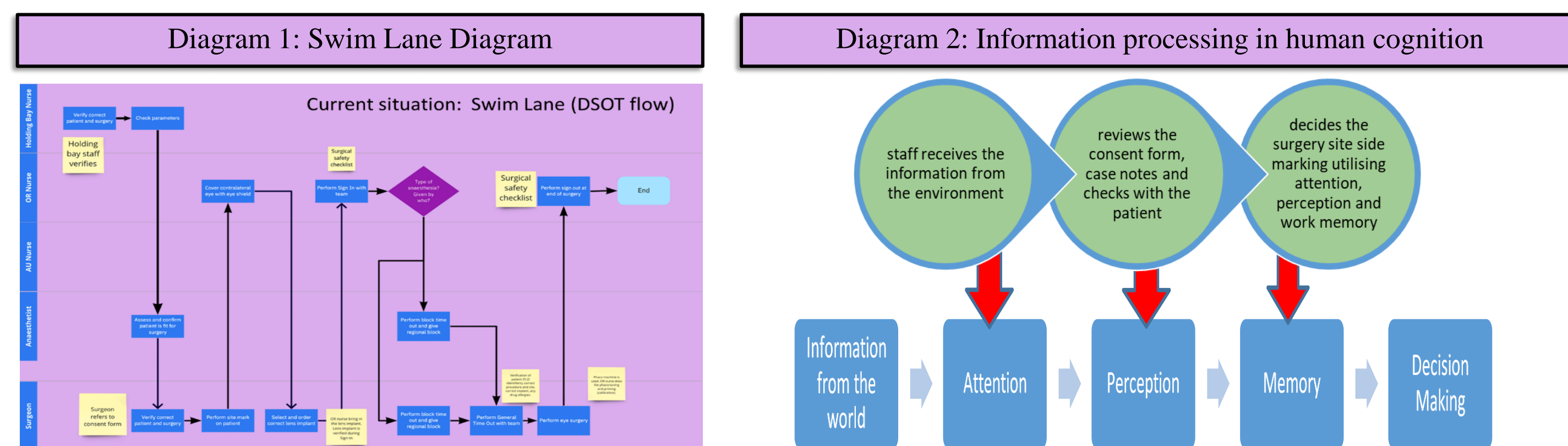
- **Identify** and **address** the **human factors ergonomics** that contribute to wrong surgical site identification.
- **Reduce wrong site eye surgery to zero incidences** enhancing patient safety during the process of surgery site identification

Mitigate errors in misidentification of surgery site, Joint Commission International (JCI) provides guidance in **three key steps**:



Background

DSC had encountered 2 wrong site eye surgeries. The team mapped out a swim lane diagram (diagram 1) on Eye patient's perioperative care process. Studied the work ergonomics of the stakeholders involved in surgery site marking - information processing (diagram 2).



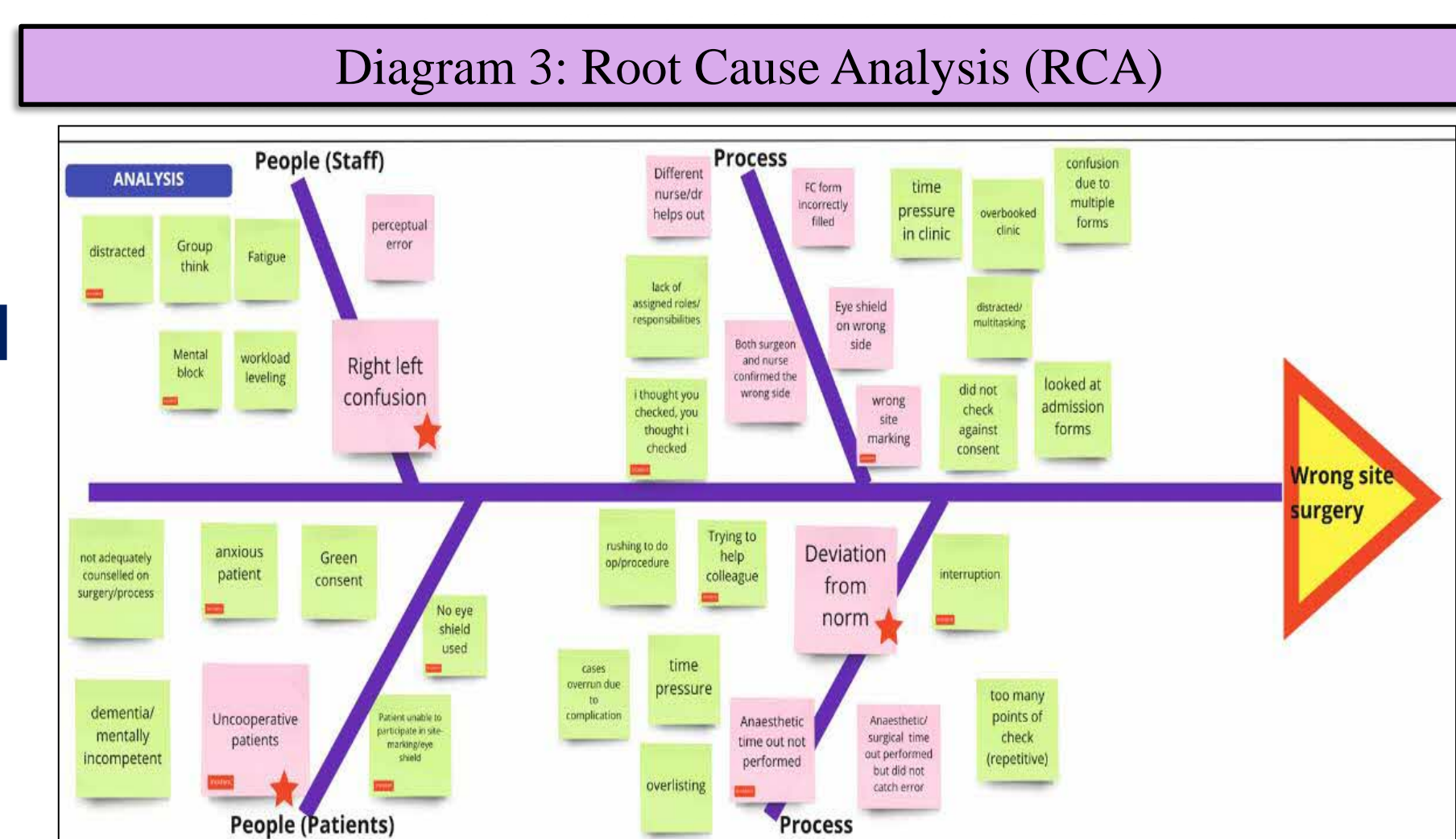
Team Members

Name	Designation	Department
Benjamin Chang	Senior Consultant	OVS
Liaw Chen Mei	Deputy CMB	OCG
Margareth	Consultant	AU
Lai Foon Wan	Senior Nurse Manager	DSC
Tan Sok Lan	Nurse Clinician	DSC
Suria	Executive	Operations

Interventions / Implementation

Swim lane and Ergonomic studies identified areas to have high levels of human error preconditions: **(1) poor communication, (2) distraction, (3) stress, (4) complacency, (5) lack of teamwork, and (6) lack of awareness.** These preconditions heavily influence cognitive processes such as learning, perception, memory and communication.

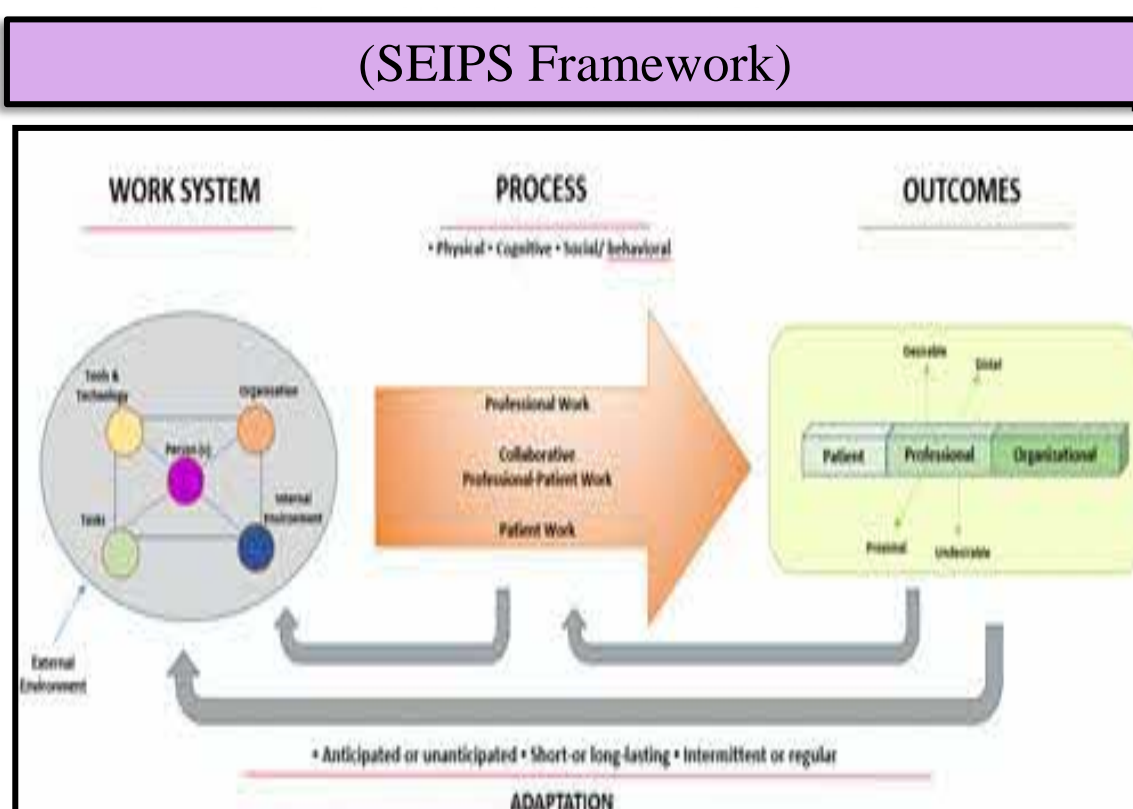
The **RCA** suggested that **information overload** and **limited attentiveness** can result in **right-left confusion** and wrong site identification.



SEIPS Human Factors framework was used to understand the human factors relationship within the perioperative environment.

Application of SEIPS to Surgical Site Marking

Work system component can interact simultaneously, shaping performance processes & outcomes. (e.g. *many potential people - nurses, assistants, etc*), tasks (*site-marking*), tools (*permanent marker & site marking*), organisations, & environments (*DSC*) are intertwined simultaneously.



Onward 2026

This initiative aligns with strategic priorities by driving an ambulatory-first approach and advancing elective surgery, while upholding the foundation of quality care and patient safety.

A **[RIGHT LEFT]** label was designed to ameliorate these encountered cognitive and auditory distractions and interruptions during surgical site marking. The team believes that this label will **assist in reducing the cognitive load** needed in the **decision-making process** of marking the correct site.

Results & Outcomes

The Eye label has identified and addressed the human factors during surgical site marking process. **To date, there is zero wrong site surgery.**

Users performed usability and prototype testing in a survey on **32 staff** and collected results.

Likert scale revealed a **majority (69%)** found the label useful and felt that the **big, brightly coloured label effectively captured their attention, helping them to identify the correct site for surgery.**

A **minority (31%)** expressed that the labels were not helpful for site marking with some opining that the label was visually too loud and not aesthetically pleasing.

The Eye label seeks to address human factors in the surgical site marking work process, **taking into account human weaknesses and strengths as they heavily impact staff behaviour** in safety-critical situations. The following **impacts and alignment on all 3 YH focused areas were observed.**

Cost avoidance in the long run	Improve staff readability	Improvement in human performance
<ul style="list-style-type: none"> • Potential litigation cost is reduced and avoided • translates cost benefits for the hospital, improving organization trust and patient safety. 	<ul style="list-style-type: none"> • improving perceptual mechanisms by using bright colored labels • Simple, big font size words utilized for positive surgery site identification. No matter where the staff stands, the site orientation will remain unchanged 	<ul style="list-style-type: none"> • through engagement through visual stimulation in a autopilot environment • staff member who performs the site marking is more aware of their conscious thoughts during the site marking process

When surgery site marking process is enhanced, wrong site surgery rate and potential litigation will be reduced, making the process safer for all Eye patients, minimising disruptions (**improved operational resilience**). This translates to cost benefits for the hospital, improving organisation trust and patient safety as well as **enhanced patient safety and quality of care and improved staff well being** by eliminating these errors, leading to more confidence in their work.

SOLUTION



The Eye label is mandated for use in all Eye surgery patients since October 2022. The project is sustained with 6-sigma methodology. **1) Standardised workflow & operating procedures in place:** All staff are educated and trained to perform correct placement of the labels.

2) Mistake Proofing: Education for staff on site marking, and photos illustration to show staff how to apply the sticker.

3) Continuous monitoring on the progress of the project includes tracking site marking errors, the reasons for the error and non-compliance. Similar 'Safer Surgical Site Marking' projects can be initiated for **other disciplines.**

Conclusion

In conclusion, the Eye label is a **simple and effective tool** in improving patient safety during surgery site identification. To date, it has reached its one-year milestone of zero error since the start of the project and the department has mandated this as the standard of care.

Special acknowledgement to Prof Tan KY for his contribution on Safer Surgical Site Marking practices.