**Project Title:** Understanding the Impact of Extraneous Cognitive Burdens of Clinical Environments Upon Objective Cognitive Workload and Technical Performance: An fNIRS Study.

**Project Background:**

Cognitive workload load (CWL) is a good predictor of the psychomotor skill acquisition and task performance[[1]](#endnote-1),[[2]](#endnote-2). Cognitive ‘overload’ leads to impaired clinical decision-making and performance decline[[3]](#endnote-3). Recognising an operator’s CWL could enable interventions to alleviate burden and improve patient safety[[4]](#endnote-4).

Central Venous Catheterisation (CVC) is a technical skill employed by Anaesthetists, Intensivists and Emergency physicians to obtain access to the internal jugular for intravenous administration of drugs and central pressure monitoring. Often, this skill is required in acutely unwell patients, in challenging clinical environments with high extraneous cognitive workload. Such extraneous burdens include: auditory stimuli (bleeps or patient monitoring); temporal demand, cognitive interruptions and ergonomic constraints (e.g. PPE).

High cognitive workload (CWL) states, particularly extraneous sources, account for 87.1% of medical errors[[5]](#footnote-1). Recognising the factors contributing to cognitive overload could reduce surgical errors and enhance patient safety.fNIRS has become a well-established, safe, non-invasive optical neuroimaging modality, utilising a near-infrared-range to measure neural activation in areas implicated during bimanual tasks such as the prefrontal cortex (PFC) – an objective measure of CWL.

**Project Aims:**

To understand how independent extraneous load components affect CWL and objective technical performance.

**Research Plan & Methodology:**

This research project will be laboratory-based. Residents (n=30) will carry out a simulated CVC insertion under varying clinical burdens in a simulated clinical environment. Outcome measures will include: 1) objective CWL assessment tools (fNIRS, ECG); 2) subjective CWL tool (SURG-TLX); and 3) technical performance of simulated task. IRAS ethical approval.

Students will be involved in data collection, data analysis and presentation of findings.

**Key References:**

1. Van Merrienboer, J.J. and Sweller, J., 2005. Cognitive load theory and complex learning: Recent developments and future directions. Educational psychology review, pp.147-177. [↑](#endnote-ref-1)
2. Constantinidis, C. and Klingberg, T., 2016. The neuroscience of working memory capacity and training. Nature Reviews Neuroscience, 17(7), pp.438-449 [↑](#endnote-ref-2)
3. Shaker D. Cognitivism and psychomotor skills in surgical training: from theory to practice. Int J Med Educ. 2018 [↑](#endnote-ref-3)
4. E. HE, Dharanikota H, Gunn E, Ambler O, Dias R, Wigmore SJ, et al. Cognitive Load Management: An Invaluable Tool for Safe and Effective Surgical Training. Journal of surgical education. 2023;80(3). [↑](#endnote-ref-4)
5. [↑](#footnote-ref-1)