# Analysis of Nested Interruptions in Intensive Care

**Farzan Sasangohar**, Jaquelyn Monis Rodriguez, Birsen Donmez, Patricia Trbovich, Anthony Easty

1. **Background**

   Interruptions are a contributing factor to medical errors (Institute of Medicine, 2000). Given the limitations of human working memory and attentional resources (Just and Carpenter, 1992), it is likely that multiple interruptions resulting in multiple task switches facilitate errors (Coiera et al., 2002).

   **Hypothesis**: Nurses may experience several nested interruptions (defined in section 2) which may affect their workload and performance.

   **Study Aim**: To investigate the occurrence of nested interruptions in the cardiovascular ICU of a Canadian teaching hospital.

2. **Definitions**

   **Interruption**: An external intrusion of a secondary task, which leads to a discontinuity in primary task.

   **Nested Interruptions**: Interruptions that happen when the nurse is performing activities related to the interruption task. For example, nurse may get interrupted by an MD during medication preparation (1st task) who asks her to order a medication (2nd task), and while performing the medication ordering, the nurse gets interrupted by a pump alarm (3rd task).

3. **Anatomy of Nested Interruptions**

   **Recursive nature**: Each interrupted task needs to be resumed/completed. This may result in nurses forgetting to resume some tasks.

   **Nesting levels**: The number of task switches (figure is an example of 3-level nested interruption).

   **Working memory**: During nested interruptions, memory of the first interrupted task may decay and the nurse may have more difficulty with task resumption.

4. **Data Collection Method**

   **Observation of Nurses in the ICU**
   - Toronto General Hospital CVICU
   - 56 observations of approximately 1 hour in length
   - Observations conducted between 8 AM and 6 PM

   **Data Acquisition**
   - Quantitative: Interruptions occurrence and length using Remote Analysis of Team Environment (RATE) software on tablet PCs
   - Qualitative: scenario description direct observation and short interviews with nurses during the observations

5. **Results**

   - 107 instances of two-level (92 instances), three-level (13 instances), and four-level (2 instances) nested interruptions (10.65% of observed interruptions).
   - Personnel (e.g., nurses, MDs) were responsible for 44.44% of all nested interruptions.
   - 50% of nested interruptions happened during high-severity tasks (e.g., pump programming, medication administration, etc.) and 40.85% occurred during medium-severity tasks (e.g., documentation, discussion).
   - The content of overlapping interruptions were mostly work-related (30.86%) and patient-related (30.86%), but 13.58% had personal content.

6. **Conclusion & Future Work**

   Nested interruptions are common in the ICU settings. Research is warranted to investigate the effects of nested interruptions on nursing performance.

   **Hypothesis**: Nested interruptions 1) increase the resumption lag, 2) negatively impact the working memory of the primary task.

   **In progress**: A controlled experiment to investigate the effects of nested interruptions on task-resumption, and performance.

Acknowledgements: This research is funded by Natural Science and Engineering Council (NSERC) and Canadian Institute for Healthcare Research (CIHR) Health Care, Technology, and Place (HCTP) program.