

Can Temperature Probe Removal Be a Reliable Indicator for Case Finishing?

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Summary:

Operating room coordinators and personals frequently search for information on cases are about to end, to facilitate workflow and decision making, especially for large OR suits. Our study demonstrated the feasibility of using live temperature probe removal information as a leading indicator for early prediction of case end in real-time.

Introduction:

Operating room (OR) managers and others frequently search for information on cases are about to end, so that they can facilitate workflow and anticipate in their decision making, especially for large OR suits. Reliable, automatic methods to provide prediction of when a case is about to finish may reduce the burden of information gathering, and may potentially improve decisions [1]. We tested the hypothesis that temperature probe removal was a reliable indicator for cases about to end.

Methods:

Over a period of two months in a large tertiary hospital with 19 ORs, real-time OR patient vital signs data were collected. Data collected included non-invasive blood pressures, heart rates from electrocardiograms, temperature, pulse oximetry saturations and heart rates. Case ending time was determined by the algorithm described in [2]. Scheduled case durations were obtained through operations logs. The time between temperature removal and case ending was determined as "lead time." Statistical properties of lead times and predictors of case remaining times were calculated using multiple linear regression. Predictors included were elapsed time of a case and case scheduled duration.

Results:

The median [10-90 percentile] of lead times for cases with durations of 1, 2, 3, 3-5, and > 5 hours were 13[3-34], 19[5-20], 16[4-34], 25[12-76], and 21[6-74] minutes. When the temperature probe was removed, the case would end with 10 minutes as 30%, 45%, 37%, 9%, and 19% of the time for 1, 2, 3, 3-5, and >5 hour cases, respectively. Regression for data over 1676 cases with the temperature data available during 68 days resulted the following regression equation:

$$\text{Case remaining time} = 0.2934 * \text{ElapsedTime} + .2598 * \text{ScheduledDuration} + 5.2664$$

Where ElapsedTime was the time since the case starting time till the temperature probe was removed. The standard error for this regression model is 6.43.

Discussion:

The study demonstrated the feasibility of using temperature probe removal as an indicator of case finishing for cases with duration of less than 3 hours, with 90% of the cases that would end within 34 min. The regression results showed that the probe removal event could predict the case remaining times, with the knowledge of scheduled case durations, for the different cases with an error of ± 7 minutes. With combination of other automated signal processing, such as video image analysis, future algorithms may be developed using temperature probe removal as one of the indicators to predict when a case is about to finish.

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References:

1. Dexter F, Epstein RH, Traub RD, & Xiao Y. Making Management Decisions on the Day of Surgery Based on Operating Room Efficiency and Patient Waiting Times. *Anesthesiology*, 101(6):1444-1453. 2004
2. Y. Xiao, P. Hu, H. Hu, D. Ho, F. Dexter, F.C. Mackenzie, J.F. Seagull, and P.R. Dutton. An algorithm for processing vital sign monitoring data to remotely identify operating room occupancy in real-time. *Anesthesia and Analgesia*, 101(3):823-829. 2005

