

## **Information Improves Risk Management during a Crisis**

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### Introduction

Patient safety in acute care settings like the operating room and intensive care units rests on physicians' ability to make quick and accurate decisions. During patient monitoring, clinicians are presented data directly from sensors (oxygen saturation, blood pressure, and airway pressure). To detect life-threatening events, clinicians extract patterns from the data to make informed clinical decisions. Modeling combines sensor data and reveals patterns that might not be detectable when only sensor-based variables are available. Because they minimize the mental transformations required to make use of sensor-based variables, model-based visual presentations could enhance the clinical value of basic sensory measurements. In addition, integrating multiple discrete measures into patterns can make complex systems appear simpler, improving the user's perception of the patient's status.

### Methods

Thirty six anesthesiologists underwent 15 minutes of training on the use of a graphic cardiovascular display. Half the subjects viewed both the traditional and the graphic cardiovascular display and the other half viewed only the traditional monitor while managing simulated critical events. A second study was conducted with 24 anesthesiologists using a drug management display. In a third, 19 anesthesiologists used a pulmonary display to manage adverse respiratory events.

### Results

When the display was used, there was a significant improvement in the time to detect and treat myocardial ischemia and SpO<sub>2</sub> was higher and the CVP was closer to its pre-event baseline. The average performance ranking for those who used the cardiovascular display was 5.75 compared to 11.3 for those without the display (1 = top performer, 16 = worst). Subjects who used the drug display managed drug delivery more effectively by keeping heart rate and blood pressure closer to normal, reducing the rise in heart rate and blood pressure associated with painful surgical manipulations and the fall in heart rate and blood pressure associated with drug overdose. The average time to begin treatment of an obstructed upper airway was 1.6 minutes shorter for the subjects that used the pulmonary display. Use of the display significantly reduced the clinician's mental demand, frustration level, and effort, and enhanced their perceived clinical performance.

### Conclusions

When the cardiovascular and pulmonary displays were used by anesthesiologists, the evolution of myocardial ischemia was detected three times faster and an obstructed endotracheal tube was treated 40% faster. These findings support the hypothesis that graphical presentation of clinical information improves clinicians' ability to detect, diagnose, and treat cardiovascular events and improves drug management in the operating room.