

Use of a See-Through Head-Worn Display of Patient Monitoring Data to Enhance Anesthesiologists' Response to Abnormal Clinical Events

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Abstract

One obstacle to safety in the operating room is anesthesiologist distraction -- having to shift attention back and forth from the patient to vital sign monitor while performing either routine or emergency procedures. The purpose of this study was to measure the decrease in anesthesiologist distraction made possible by using a head-mounted, see-through personal display (HMD) using retinal scanning technology. With the head-up display, they were able to focus their attention exclusively on the patient and the task at hand. The Nomad reduced the number of times the anesthesiologist had to shift their attention by a more than a third (17 times versus 58 times). This allowed them to spend more time focused on the patient.

1. Background/Problem

Anesthesia researchers at the University of Washington School of Medicine conducted a series of tests evaluating the Nomad™ Personal Display (Microvision, Inc., Bothell, WA), as a situational awareness tool for the anesthesiologist. The Nomad is an augmented vision personal head-mounted display system (HMD) that provides anesthesiologists with useful clinical information without requiring them to shift attention away from the patient. One of the biggest obstacles to safety in the operating room is anesthesiologist distraction -- having to shift attention back and forth from the patient to vital sign monitors, while performing either routine or emergency procedures. The purpose of this study was to measure the decrease in anesthesiologist distraction made possible by using a head-mounted, see-through personal display (HMD) using retinal scanning technology.

2. Purpose of the Study

The hypothesis presented by researchers at the U of W is that the Anesthesiologist's attention is often split between the patient and the monitoring equipment. This

is especially a problem in dealing with extremely critical in life threatening situations or with critically ill patients. It is anticipated that having a see-through display will allow them to keep their focus on the patient.



Figure 1- Anesthesiologist views vital signs using Nomad display

3. Method and Tools

Using a computer-driven Human Patient Simulator (HPS) anesthesia mannequin (Medical Education Technologies, Sarasota, FL), test subjects, all staff anesthesiologists at U of W were given two events (from list below) to perform or respond to during each trial run. Both of these events were presented with and without wearing the Nomad. In this study, both the monitor and head-up display provided the anesthesiologist with vital sign data including: heart rate, respiration, arterial BP, SpO₂, PaO₂ and ECG.

The order of wearing the Nomad was altered from the 1st event to the last event every other subject, in order to compare response between the events of those wearing the Nomad and those not. Events included: Cardiac Arrest, Heart Block, Respiratory Arrest, Airway disconnect, IV disconnect, Hypoxia, and Bradycardia with low blood pressure.

The anesthesiologists performed the following tasks created by the HPS to simulate a real case as closely as possible:

- Perform procedures (defibrillation, start airway, drug administration, gas flow, insert PA line, start I.V., etc)
- Observe Patient for clinical signs (i.e. skin color, pupil size, etc)
- Monitor physiologic data
- Check and record vital signs



Figure 2- Vital signs visible in Nomad head-worn display allowing Anesthesiologist to focus on patient



Figure 3- Without the Nomad, Anesthesiologist constantly looks away to a monitor behind them for vital signs.

4. Results and Observations

The subjects' actions were observed and timed using video cameras, stopwatches and data collection forms. The results were compared with regard to response time, focus of attention, and awareness with, and without the head-worn display.

Compared to using a standard display, using the Nomad resulted in:

- Increase time focused on patient 48%
- Decrease in task time during event 29%
- Decrease in overall change of attention 54%
- Decrease in # of times switching focus to monitor 89%

The subjects were asked to report their impressions and to fill out a questionnaire at the end of the study. Their comments can be summarized as follows:

The see-through head-up display felt natural, it increased their confidence, it was easier to perform interventions

without having to look back at a monitor.

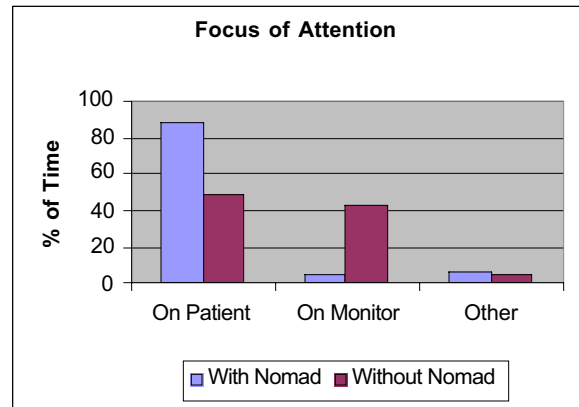


Figure 4-Focus of Attention

5. Conclusion

Anesthesiologists spend a significant amount of time transitioning back and forth between observing the patient and viewing vital sign monitors. During some procedures such as Swan-Ganz catheter insertion or treatment of cardiac arrest, up to 60% of the time was spent looking at monitors, not at the patient. This is a potentially dangerous situation, because it can lead to a loss of clinical awareness.

The HMD allows the physician an opportunity to simultaneously view the patient and the patient's vital signs, potentially enhancing the speed, accuracy and safety of clinical decisions.

6. References

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