Background
We wanted to test whether the results from a program of simulation-based research would generalize to clinical practice. The study involved observing anesthesiologists using the HMD in the clinical environment and recording their behavior on video. The concern was that changes to standard practice could create additional risk for the patient or hospital staff, while concessions could compromise the success of the study.

Aims
We attempted to strike a balance by minimizing the impact of the study on the operating theatre (both in safety and productivity) while still maintaining adequate power to detect potential effects.

Methods
We identified the four types of problems most likely to arise and implemented strategies either to prevent them from occurring or to mitigate their effects.

1) Patient issues
The risk of microshock was eliminated by ensuring that the HMD equipment was battery-powered and wirelessly connected.
Privacy concerns were addressed by having an anesthesiologist (not performing the procedure) seek written informed consent from the patient.

2) Workplace and productivity
The HMD was wirelessly connected so that participants could provide anesthesia in the OR unencumbered. Early identification of suitable patients allowed participants to attend their cases even when not allocated the entire operating list. To avoid delaying other procedures, the experimental equipment was on a trolley so it could be moved to a central area.

3) HMD technology
The HMD was interfaced with the existing Philips IntelliVue™ MP70 patient monitor and Anesthetic Gases Module. Due to limitations of the MP70 (no CO₂ waveform export), and to maintain the participant’s familiarity with the equipment, CO₂ was measured using a secondary MP30 patient monitor hidden from the participant’s view.

To avoid equipment malfunctions from cutting power to the anesthetic and surgical equipment, the video recording equipment on the trolley was powered using an isolation transformer and was connected to an independent circuit. Wireless technology was tested without patients present, prior to its use in the OR, to ensure no interference.

4) Experimental method
To maximize statistical power from a sample of only 36 cases (due to practical limitations), a highly specific set of case selection criteria and a repeated measures design were used to minimize clinical variability.

Furthermore, detailed video data were recorded from two field cameras, a head-mounted camera, and the patient monitor for objective data analysis offline.

Results and Conclusions
The study was successfully run with no adverse effects from the introduction of equipment into the operating room or from “swapping” anesthesiologists into the lists. The study demonstrated the utility of the HMD for monitoring, and the feasibility of performing advanced display evaluations in the clinical environment.

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