



KEY POINT SUMMARY

OBJECTIVES

The purpose of the study was to investigate how environment stressors (e.g. noise) in simulated operating rooms impact surgeon performance on a laparoscopic task.

DESIGN IMPLICATIONS

The acoustic condition of operating rooms should be designed to reduce noise level for the optimal surgeon performance.

The Effect of Stress-Inducing Conditions on the Performance of a Laparoscopic Task

Moorthy, K., Munz, Y., Dosis, A., Bann, S., Darzi, A.
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Key Concepts/Context

Surgeon performance in operating rooms directly impacts quality of care, healthcare productivity, patient satisfaction, and many other healthcare outcomes. However, while performing complex surgical tasks, surgeons are often exposed to fatigue and stress caused by organizational, environmental and team-related factors. Common stressors in operating rooms include noise, inappropriate temperature, sleep deprivation, time pressures due to scheduling, workload, and unsuitable ergonomics. Laparoscopic surgeries are more stressful than open surgeries and require surgeons to be more concentrated therefore performance on laparoscopic tasks may be more deteriorated by stressors.

High noise levels (sometimes reach 80 to 100 dB) have often been recorded in operating rooms. Research in other similar settings found that noise might interfere with communication and the performance of complex tasks. However, the effects of noise on surgeon performance have seldom been empirically examined.

Methods

In this experimental study, 13 right-handed surgeons with varying levels of surgical experience performed laparoscopic transfer task (moving cylindrical pieces of sponge from one disc to another) on a virtual reality simulator under five conditions: quiet condition as the baseline, operating room noise at 80 to 85 dB, a simple verbal mathematical task, request to perform as quickly as possible, and all three stressors combined. The surgeons were assigned in a randomized lattice-square experimental design. A motion analysis system was used to measure the number of movements and the path length traversed by each hand of a surgeon by tracking sensors attached to the hand. Both skill-based errors (e.g. dropped objects, inaccurately



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placed objects) and knowledge-based errors (e.g. objects placed in wrong zones) were recorded. A total error score was calculated by summing the number of errors under each condition. Statistical analysis focused on comparisons of surgeon performance between the five conditions and correlation between errors and motion data.

Findings

All three stressors (noise, mental stress, and time pressure) led to impaired dexterity and increases in error rate. There were increases in path length per movement of the right hand and the left hand (insignificant trends in the noise condition and significant in all other stress-inducing conditions). All stress-inducing conditions were associated with significantly higher total error scores and significantly more knowledge-based errors. Noise alone resulted in a significant increase in the number of total errors, 38% of which were knowledge based.

Limitations

There were several limitations of this study:

- Because the study was conducted on a simulated surgical task in a simulated environment, the results may not be readily applied to real operating settings.
- Surgeon's experience and cognitive style may be important factors impacting surgical performance (including error rate). Although the study included surgeons with various levels of experience in the study and all 13 surgeons performed under all five conditions, it was not clear whether noise impacted surgeons with different levels of experience in different ways (for example, noise might have very little effect on more experienced surgeons). Cognitive style was not taken into account as the probable confounding variable.