



Title Surgical Simulation: A Systematic Review (Update and Re-Appraisal)

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Aim

To evaluate the effectiveness of surgical simulators, in comparison to each other, no training, or other methods of surgical training.

Conclusions and results

Thirty-one randomized controlled trials (RCTs) with 806 participants were included, but the quality of the RCTs was often poor. Computer simulation generally showed better results than no training, but was not convincingly superior to standard training (eg, surgical drills) or video simulation. Video simulation did not show better results than groups with no training, and the data were inadequate to determine if video simulation was better than standard training or the use of models. Model simulation may have been better than standard training, and cadaver training may have been better than model training. None of the RCTs compared computer simulation and model training.

Recommendations

The ASERNIP-S Review Group agreed on the following classifications and recommendations:

Evidence rating: Poor. The evidence was insufficient since most of the RCTs were flawed, and outcomes were often not comparable across studies.

Safety: Not applicable for this review.

Efficacy: Efficacy cannot be determined. The inconclusive outcome of this review may be related to small sample sizes and the validity and reliability of outcome measurements.

Methods

Search strategy: MEDLINE, EMBASE, PreMEDLINE, Current Contents, the Cochrane Library (issue 2, 2005), scholar.google.com, metaRegister of Controlled Trials, National Research Register (UK), and NHS Centre for Research and Dissemination (UK) were last searched in April 2005. PsycINFO, CINAHL, Science Citation Index were searched on March 25, 2003. Additional

articles were identified through the reference sections of the studies retrieved.

Study selection: The review included RCTs assessing any training technique of surgical simulation and any other methods of surgical training, or no surgical training. Included articles must have contained information on at least one of the following outcomes: measures of surgical task performance, whether objective or subjective, and measures of satisfaction with training techniques.

Data collection and analysis: Data were extracted by one researcher using standardized data extraction tables developed *a priori* and checked by a second researcher. It was not appropriate to pool results across studies since outcomes were not comparable. Relative risks for dichotomous outcome measures or weighted mean differences, for continuous outcome measures with 95% confidence intervals were calculated for some outcomes in RCTs where it would aid in interpreting the results.

Further research/reviews required

Further research must be done in the context of training to particular performance standards. Ideally, studies should be multicenter trials with standardized approaches, and with sufficient participants. The skills evaluated should be part of a standard surgical skills training course, not stand-alone technical skills. Once efficacy has been determined economic analyses could be attempted.