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Response to: "Rise of the machines": human factors and training for robotic-assisted surgery

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We thank Kerray and Yule for their Editorial on our evaluation of a training program developed specifically for Versius, a next-generation system for robot-assisted minimal access surgery (MAS).[1] We have found the points raised, particularly those pertaining to validity frameworks and human factors, to be constructive, providing valuable guidance for future studies evaluating the effectiveness of trainings in the surgical setting.

The program we described is intended to provide surgeons with practical experience operating the system in a simulated environment and is not focused on a specific surgical specialty or procedure.[2] As such, the aim of the study was to monitor performance using the system as surgeons became more familiar and practiced using the system over the course of the program. The use of Global Evaluative Assessment of Robotic Skills (GEARS) scoring provided a validated means of quantifying performance across a range of tasks to allow comparison between surgeon subgroups and timepoints.[3] The proficiency levels were determined from the literature only to help contextualize GEARS scores, not to ascertain operating proficiency for individual surgeons using the system.

The features of the device noted in the study publication provide specific examples of how aspects of the design may help remove some of the barriers to uptake of MAS by minimizing the limitations often associated with conventional MAS instruments. Increasing uptake of MAS by incorporating robotic assistance to help improve patient outcomes compared with open surgery was the fundamental driver behind the device's conception and development; the advantages of MAS over open surgery are numerous and well established, yet MAS utilization has been lower than anticipated hitherto across several common procedures.[4] Cooper *et al* also note that lack of specific training and exposure to MAS techniques may be partly attributable to the low uptake.[4] We anticipate that purpose-designed training programs such as this one will play an important role in realizing the vast potential of robotic systems as the field evolves.

While implementation of Kirkpatrick's validity framework could have informed the study design to help better address criteria within levels 1 and 3, level 4, assessing the impact of the training on surgical outcomes and safety, was not within the scope of this study as this is only possible in the clinical setting.[5] Ongoing systematic collection of clinical effectiveness and safety data into a purpose designed registry will facilitate longer-term monitoring and large-scale analyses of outcomes, in line with IDEAL-D recommendations.[6]

As noted by Kerray and Yule,[1] surgeons with experience using other robotic systems may require more training to adjust to a new platform compared with surgeons with no prior robotics experience. As this surgical system is unique, a transference study is planned to investigate how training needs may differ and how the program could be tailored according to the level of prior experience in performing robot-assisted surgery. As also suggested in the Editorial,[1] human factors, such as leadership and teamwork, including surgeon–team communication, are currently being integrated into the program to ensure the training encompasses all aspects of robot-assisted surgery required for optimal performance. This process is ongoing, and human factors must be tailored to this device specifically given its novel architecture.

Given the lack of validated training programs to support the implementation of robotic systems in surgery, we thank Kerray and Yule for their helpful recommendations for future evaluations.

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