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SYSTEMS-LEVEL QUALITY IMPROVEMENT

Surgical Block Scheduling Controlled by a Machine: Reality or Science Fiction?

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Dear Editor, we recently read with great interest a paper by *Zhao* et al. published in your journal entitled "A Machine Learning Approach to Predicting Case Duration for Robot-Assisted Surgery" [1]. It is an interesting study concerning the novel application of emerging technology; machine learning has been brilliantly used to predict case duration in robotic surgery.

As also pointed out by the Authors, proper management of the surgical unit assumes a significant role in optimizing resources [1]. Accurate surgical scheduling is crucial as it limits the waste of resources when cases end prematurely, as well as the disorganization generated and the possible need for additional staff when prolongation occurs. For an optimal planning, collaboration between surgeons and anesthesiologists is essential, for example to estimate the duration of anesthetic induction and recovery time. At our center, both teams meet every week to discuss the planning for the following week. However, in our experience even this type of organization appears to lead to inaccuracies. We would therefore like to apply the methodology described by *Zhao* et al. at our hospital for non-robotic-assisted abdominal and urological surgery. However, the variety of anesthetic techniques employed means that more variables will have to be considered. It might be said that similar cases often demand similar anesthetic maneuvers, yet this is not always the rule. Fragile and/or polypathological patients frequently require more invasive monitoring. *Wu* et al., emphasizing the importance of estimating procedural duration to improve operating room productivity, carried out a two-step analytical approach to evaluate factors influencing the time for induction [2]. The American Society of Anesthesiologists physical status ≥ III, bronchoscope use, arterial, central venous and epidural catheterization all emerged as elements of prolongation [2].

When planning a surgical unit, another important aspect to consider is the need for the post-anesthesia care unit (PACU). Owing to PACU congestion, patients often need to remain for a longer time in the operating room, which can slow down the established program. To overcome these problems, *Fairley* et al. have created an excellent learning model that can optimize surgical block scheduling and minimize maximum PACU occupation [3]. Compared to the traditional system, this model was able to reduce the PACU load by cutting down on delays without decreasing operating room use [3].

Might we therefore conclude that a surgical unit ought to be controlled by a machine? We believe this to be far from the truth, and that the role of professionals in surgical planning will never be definitively supplanted. Thanks to the implementation of powerful algorithms, machine learning seem to be able to provide more precise answers, and to integrate numerous extremely complex components. In addition, as suggested by the Authors, with the increase of available data this new technology can *learn* and thereby improve its performance [1]. However, there are problems that these systems cannot treat with the same accuracy, such as when implementing new devices or for surgical interventions that are not usually performed at the center. Although the model described by *Fairley* et al. appears to reduce PACU load even in the presence of events of uncertain duration, in some cases direct intervention might be required. To make the system more flexible, and to improve adaptability in those cases where insufficient data are available, operators should therefore have the possibility to directly interact with the machine. Furthermore, organizational problems often arise during emergencies; will the program be able to continue, and which interventions will need to be postponed? Planning variation caused by emergencies and urgencies should permit changes with construction of new reorganizational proposals in a short time.

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In conclusion, we believe that this new technology should be considered as a potent tool, not only for clinical but also for organizational purposes. The role of practitioners during conception, design, and implementation is essential to reap the full benefits. However, further studies to confirm the feasibility and effectiveness of these models for surgical block planning and organization are needed.

Compliance with ethical standards

Conflict of interest Author Valentina Bellini declares that she has no conflict of interest.

Author Umberto Maestroni declares that he has no conflict of interest.

Author Elena Bignami declares that she has no conflict of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

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