

## ASSOCIATION OF VA SURGEONS

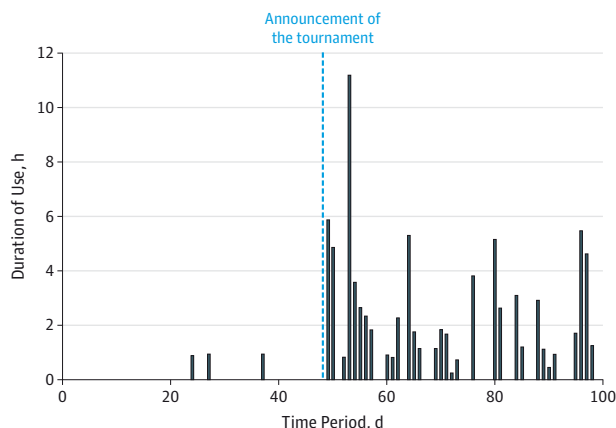
### The Use of Gamification to Boost Residents' Engagement in Simulation Training

Interval deliberate practice of surgical skills is required for surgical residents to develop and maintain their technical skills. Even 2 weeks without practice on a minimally invasive surgical simulator can lead to a substantial decline in skills.<sup>1</sup> In spite of the value of interval simulation training, incentivizing residents to engage regularly in simulation training can be a challenge for many institutions. Can gamification (the introduction of game mechanics to engage users, including but not limited to competition and leaderboards)<sup>2</sup> boost residents' engagement in simulation training? Although game-based learning is cited as an emerging technology likely to have a large impact on education in the next 2 to 3 years,<sup>3</sup> little research has been conducted to demonstrate its efficacy for health professional training.<sup>4</sup> We investigated whether the introduction of competitive game mechanics into simulator education among residents could significantly boost the use and cost-effectiveness of the da Vinci Skills Simulator (Intuitive Surgical Inc).

**Methods** | Our study was conducted over 14 weeks from January to May 2012 at the Veterans Affairs (VA) Boston Healthcare System in West Roxbury, Massachusetts. All urology and general surgery residents at Boston University (13.8 km [8.6 miles] away) and Brigham and Women's Hospital in Boston, Massachusetts (11.5 km [7.2 miles] away), were eligible to participate. During weeks 1 through 7, residents were invited to use the simulator. A single elimination tournament was then announced via e-mail at the end of week 7. The 16 residents with the highest aggregate scores on 9 exercises on the simulator during weeks 8 through 14 would qualify. Leaderboards were posted via e-mail every 1 to 2 weeks. Tournament prizes ranged from \$50 to an iPad (Apple Inc) for the winner. Over all 14 weeks, a \$30 travel reimbursement was given to residents not on a VA rotation for each trip to use the simulator. The tournament compared ring-walk simulator and dry-laboratory performance among qualifying residents. Cost estimates include the price of the simulator (\$85 000 amortized over 5 years), travel reimbursements, and prizes but not the salary expenses of a simulation coordinator.

**Results** | Of 141 eligible residents, 22 (16%) used the simulator over the 14 weeks of our study (6 of 11 urology residents at Brigham and Women's Hospital [55%], 5 of 8 urology residents at Boston University [63%], 4 of 68 general surgery residents at Brigham and Women's Hospital [6%], and 7 of 54 general surgery residents at Boston University [13%]). Use varied widely by specialty: 11 of 19 urology residents (58%) and 11 of 122 general surgery residents (9%) used the simulator. During weeks 1 through 7, 3 residents used the simulator for 4 sessions, 28 exercises, and 2.7 hours (**Figure**). During weeks 8 through 14, 21 residents used the simulator for 70 sessions, 1632 exercises, and 83.9 hours. Residents, sessions, exercises, and use duration increased by 7-fold, 17-fold, 58-fold, and 32-fold, respectively. After the announcement of the tournament, the estimated cost per hour of simulator use decreased 12-fold from \$864 to \$74. In the tournament, qualifying ranks and scores correlated with simulator ring-walk scores ( $P < .01$

Figure. Use of the da Vinci Surgical Simulator Before and After the Announcement of the Tournament



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for both), but none of these 3 metrics correlated significantly with dry-laboratory ring-walk scores.

**Discussion** | The introduction of game mechanics into simulator education significantly boosted the use of our da Vinci Skills Simulator, especially among urology residents. The discrepancy in use by specialty is likely due in part to the importance attributed to robotic surgical training by urology residents given the relatively high frequency of robotic surgical cases in their field. By increasing the use of the simulator, gamification substantially reduced the estimated cost per hour of simulator use. Given the great expense of many simulation systems, cost is an important outcome measure that, to date, has only been reported in approximately 6% of simulation-based medical education research studies.<sup>5</sup> Further work is needed to determine if the boost generated by the tournament can be replicated longitudinally and in the absence of monetary prizes.

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## INNOVATION IN SAFETY: SAFETY IN INNOVATION

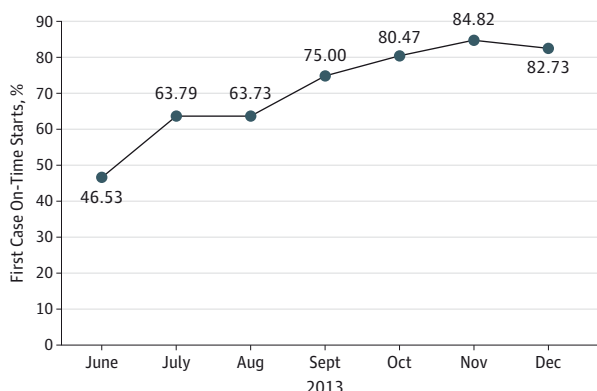
### The Automated Operating Room: A Team Approach to Patient Safety and Communication

For decades, high-risk industries have relied on safety checklists to limit the adverse consequences of human error.<sup>1</sup> The checklist model has only recently been adapted in the surgical field after the World Health Organization launched the “Safe Surgery Saves Lives” campaign in 2006.<sup>2,3</sup> Various studies<sup>4,5</sup> have shown that the use of checklists reduces death rates and perioperative complication rates, and their use also improves teamwork and communication, potentially contributing to improved patient outcomes. On the other hand, a recent study<sup>6</sup> from Canada showed that this tool did not reduce mortality rates or the numbers of complications, emergency department visits, and readmissions. While the use of a checklist remains a standard of care, the priority has shifted to patient safety, compliance with mandates, efficiency, and the monitoring of outcomes. These parameters are much harder to quantify.

The Veterans Health Administration's initiative to improve operating room safety and efficiency has motivated the Bruce W. Carter Department of Veterans Affairs (VA) Medical Center of the Miami VA Healthcare System to investigate a technology-enabled solution to automate safety checklists, integrate patient data, and track staff compliance with safety measures. Before the automated system, the Miami VA Healthcare System was only capable of auditing 5% of cases for checklist compliance, which is insufficient to ensure proper utilization, standardization, and accountability.

**Methods** | In June 2013, an automated workflow system (AWS; OR-Dashboard [LiveData]) was implemented at the Miami VA Healthcare System to provide a common display of perioperative data elements, viewable to every member of the surgical team. The goal was to enhance surgical team

**Figure. Percentage of First Case On-Time Starts by Month Since Implementation of the Automated Workflow System**



communication during the checklist process and throughout each case. Monthly reports were generated to analyze nationally reported metrics and to assess staff compliance with the checklists. Eight months after implementation, 46 surgical team members, including physicians, residents, nurses, certified registered nurse anesthetists, and surgical technicians, completed a survey about their experience with the AWS pertaining to patient safety, “timeout” efficiency, compliance, and team communication. Anonymous responses were collected using a 5-point Likert scale.

**Results** | One month after the implementation of the AWS, checklist compliance reached 89% for “preprocedure,” 95% for timeout, and 82% for “debrief.” The remainder of compliance was achieved using the conventional method for a total of 100%. Six months after implementation, compliance with the AWS timeout was 99%.

During the first 6 months of the AWS, first case on-time starts improved from 47% to 85%. The median timeout duration improved from 71 to 58 seconds over this same time period (Figure). Survey results show that 93% of nurses “strongly agree” or “agree” that the AWS enhances surgical team engagement, improves patient safety, and provides opportunities to prevent errors; 86% of nurses strongly agree or agree that the AWS improves the operative team's communication compared with traditional checklist methods; more than 74% of physicians strongly agree or agree that the AWS improves surgical team engagement, improves patient safety, and improves compliance with Surgical Care Improvement Project documentation; and 100% of nurses and 79% of physicians strongly agree or agree that the AWS is user friendly (Table).

**Discussion** | The AWS provides a consistent, reliable, and user-friendly method for completing the surgical safety checklist and for improving operative team engagement in the process. Since implementation of the AWS at our facility, first case on-time starts have improved by 40%, and automated safety checklist compliance with timeout has improved by 4%. Cases with less than 100% compliance were reviewed, and deficiencies were attributed to, among other things, the staff learning