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## Impact of video game genre on surgical skills development: a feasibility study



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### ABSTRACT

**Background:** The playing of video games (VGs) was previously shown to improve surgical skills. This is the first randomized, controlled study to assess the impact of VG genre on the development of basic surgical skills.

**Materials and methods:** Twenty first-year, surgically inexperienced medical students attended a practical course on surgical knots, suturing, and skin-flap technique. Later, they were randomized into four groups: control and/or nongaming (ContG), first-person-shooter game (ShotG), racing game (RaceG), and surgery game (SurgG). All participants had 3 wk of Nintendo Wii training. Surgical and VG performances were assessed by two independent, blinded surgeons who evaluated basal performance (time 0) and performance after 1 wk (time 1) and 3 wk (time 2) of training.

**Results:** The training time of RaceG was longer than that of ShotG and SurgG ( $P = 0.045$ ). Compared to SurgG and RaceG, VG scores for ShotG improved less between times 0 and 1 ( $P = 0.010$ ) but more between times 1 and 2 ( $P = 0.004$ ). Improvement in mean surgical performance scores versus time differed in each VG group ( $P = 0.011$ ). At time 2, surgical performance scores were significantly higher in ShotG ( $P = 0.002$ ) and SurgG ( $P = 0.022$ ) than in ContG. The surgical performance scores of RaceG were not significantly different from the score achieved by ContG ( $P = 0.279$ ).

**Conclusions:** Different VG genres may differentially impact the development of surgical skills by medical students. More complex games seem to improve performance even if played less. Although further studies are needed, surgery-related VGs with sufficient complexity and playability could be a feasible adjuvant to improving surgical skills.

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## 1. Introduction

Video games (VGs) have become a permanent part of life in many countries. In 2014, over 150 million Americans played video games, and consumers spent over 22 billion US dollars on the industry (E.S.A 2014 official report on sales, demographic, and usage data). Gaming involves the manipulation of three-dimensional objects via a two-dimensional screen and requires, among other skills, manual dexterity. This particular component of the activity has led to intense interest in the relationship between VG playing and surgical skills.

There is ample evidence showing that VG playing improves surgeons' laparoscopic and endoscopic skills [1–12]. Studies that have evaluated the general theoretical basis underlying the cognitive enhancement of demanding motor skills activities resulting from VG usage [3,13] have attributed increases in dexterity, psychomotor abilities, and visual-spatial coordination to fewer errors and less time to perform tasks.

Other studies have demonstrated that VG playing correlates with surgical technique in medical school students [8,12,14] and impacts traditional surgery skills [15], such as knot tying, incision-making, dissection, and suturing, which are the first steps in the individual development of surgical techniques. However, whether the particular VG genre plays a role in initial learning development has yet to be determined in a randomized controlled setting. We systematically investigated the impact of VG genre on the learning curve of basic surgery skills by surgically inexperienced medical students.

## 2. Materials and methods

### 2.1. Background

This study was conducted at the Federal University of Health Sciences of Porto Alegre, Brazil, after approval from the Institutional Ethics Committee. All medical school programs accredited by the Ministry of Education in Brazil are 6 y in length, with students admitted soon after the completion of high school. Therefore, it is highly unlikely that a Brazilian freshmen medical student has any previous surgical experience.

### 2.2. Phase 1

An online questionnaire was sent to all first and second-year medical students of our institution through their official academic e-mails. Senior students were not included because they attend the *Surgical Techniques Course* at this stage of the core curriculum. Demographic data and possible confounders for the study were determined through the questions [5,14,16] (e.g., chopsticks use, musical instrument proficiency, and touch typing). They also assessed past VG experience and specifically queried previous surgical experience, defined as knot tying or suturing knowledge, anatomical dissection, animal research involving surgical techniques, or >4 h of observing surgical procedures. Students were also asked if they would be willing to participate in extensive VG training sessions (at least 3 h per wk [6] for 3 wk duration) and then undergo several performance evaluations.

### 2.3. Stratification and sampling

The students were stratified into low and high VG experience based on whether they had played VGs for an average of at least 10 h per wk [5] over the last year. This cutoff was based on the review of Jalink et al. [2], where studies with positive effects on surgical skills have used 3, 7, or 10 h per wk as benchmark for VG experience. The higher amount of hours was chosen to increase sensitivity. After stratification, the participants were randomly divided into four groups: a control nongaming group and three VG groups, each one with a specific game type in which the participant would be trained during the experimental phase of the study.

The game genre and titles were chosen based on their applicability to the development of specific skills that are important in the surgical setting (fine motor control, visual attention processing, spatial distribution, reaction time, eye–hand coordination, targeting, non-dominant hand emphasis, and two-dimensional depth perception compensation) [9]. They were also chosen taking into account their acceptance and availability on the market.

The Nintendo Wii console (Nintendo Co. Ltd., Tokyo, Japan), and well-known titles within each specific game genre that were playable on it, were chosen over other platforms and games because this system has been used in previous surgical performance studies [6,7,9,11,17] and because its unique controller characteristics (single handheld device, the use of motion-sensing technology via an accelerometer and optical sensor) better simulate the surgical setting [4]. None of the students had previously played the games used in the study.

The experimental groups and game titles were as follows:

1. A nongaming, control group (ContG)
2. A surgery game group (SurgG) that played *Trauma Center: New Blood* (Atlus USA, 2007)
3. A first-person-shooter game group (ShotG) that played *Resident Evil 4* (Capcom, 2005)
4. A racing game group (RaceG) that played *Need For Speed: Carbon* (Electronic Arts, 2006)

### 2.4. Phase 2

Before beginning the experiment, all students attended a practical course on surgical knots, suture techniques, and simple skin-flap exercises. A pig's feet model [18] was used, and training was led by a certified surgeon. Care was taken to ensure that all students were given the same instructions and performed the same amount of training during the course. After the training course (time 0), all students were tested for surgical performance to obtain their basal scores. Students in the VG groups were also tested to obtain basal VG performance data.

Students from the VG groups were provided with a brief overview of the Nintendo Wii operational system and control usage. In addition, each group received explanations on game playing and the goals of the specific game. Five minutes of tutoring were granted before the VG performance test.

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