



Succeeding in Continuing Trauma Education During a Pandemic

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Abstract

Background Corona virus disease 2019 (Covid-19) impacted continuing medical education programs such as the Advanced Trauma Life Support (ATLS) course. Modifications made to medical training like teleconferencing could affect students' learning success. We sought to evaluate the effects of the American College of Surgeons modifications on success rates in passing the ATLS course.

Methods This study evaluated 28 ATLS 10th edition courses educating 898 students at our region before and after Covid-19 modifications. Traditional two-day courses were performed in-person while modified courses were conducted with a one-day teleconference followed by a second in-person practical day. We compared the characteristics and course pass rates between the traditional and modified ATLS courses.

Results Modified ATLS courses had significantly lower pass rates (81.0%; 95% confidence interval = [74.8–87.3]) compared to traditional ATLS courses (94.3%; [92.2–96.3]).

Conclusions Modifications to the ATLS course are associated with lower student pass. This is possibly due to ineffective knowledge consolidation. Better modifications to the course are required such as use of electronic learning tools with modification to course schedule or returning to the traditional course but with the use of Covid-19 vaccines and other protective measures. These suggestions should be considered and evaluated further by ATLS program leaders.

Introduction

The Coronavirus Disease 2019 (Covid-19) pandemic has impacted continuing medical education (CME), such as the Advanced Trauma Life Support (ATLS) program [1, 2].

Adaptations of medical training to the pandemic include use of the flipped classroom model, online practice questions and teleconferencing [3]. Such electronic learning tools are useful alternatives to traditional learning [4, 5], yet they do not replace hands on practical skill training. These changes could affect students' learning in medical education programs such as the ATLS [6].

ATLS is an international standard of care in trauma and the ATLS Course is a great educational achievement of the American College of Surgeons. The course includes didactic lectures, interactive case discussions, practical skill stations and a certifying exam. To adapt to the Covid-19 pandemic, the American College of Surgeons have courageously allowed for ATLS course modifications with appropriate guidelines to continue global trauma care

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education [2]. These encouraged the use of teleconferencing and online learning tools to minimize student gatherings. Some ATLS instructing centers have shown safe ways to conduct the traditional in-person part of the ATLS course in face of the pandemic [7] and even increased knowledge gain using online learning tools for the didactic portion alone [8]. Such modifications to surgical training are known to have advantages and disadvantages, yet they require careful examination of their effects on CME success [9].

The significance of the suggested modifications to the ATLS course has yet to have been examined on a large number of participants. We therefore sought to evaluate the effect of the modifications to the ATLS course structure on its student success rate in passing the course.

Material and methods

Subjects

We performed a pre–post intervention analysis retrospectively evaluating all the ATLS courses conducted in our region since its latest 10th edition released in January 2018. All ATLS courses in our region are directed at a single certified ATLS instructing center which allows for uniformities in course structures. The Covid-19 ATLS course modifications were published and taken into effect by our instructing center in May 2020. Our pre-intervention group included all the ATLS 10th edition courses performed before its modification and the post-intervention group included all modified courses performed since May 2020. The study was exempt from ethics review by an institutional review committee.

Demographics

Students in our region's ATLS courses have varying surgical and emergency medicine specialty backgrounds as they are all required to complete an ATLS course at least once during their postgraduate training and surgical residency. Each course is comprised of students from various hospital trauma center levels as course participation is allocated appropriately by the scientific council of our region's medical association. These allow for homogeneity in factors contributing to each course's student success rate as previous studies showed it is influenced by trainee age, primary language and region of medical schooling, trauma and emergency medicine background as well as previous exposure to trauma cases [10–13].

Terms and measures

The post-intervention group's traditional ATLS course prior to its modification was designed as a two-day in-person course for 32 students and a student to instructor ratio of 4:1. On each day of the course, students would first have a theoretical part followed by a practical part. The theoretical part included didactic lectures and interactive cases with lecturers, while the practical part included skill stations with ATLS instructors.

The post-intervention group's modified ATLS course was structured as a two-part three-day course for 32 students. A first theoretical part was conducted on the first day with a teleconference and a second practical part was conducted in-person on the second and third days. The teleconference on the first day included the didactic lectures and interactive case discussions. Teaching was divided among three lecturers delivering the course to all of the 32 students listening. The practical in-person part of the course had the students divided into two groups of 16 participants for the second and third days of the course. Each group was structured to have a student to instructor ratio of 4:1.

A week prior to both the traditional and modified ATLS courses students received electronic copies of the ATLS 10th edition textbooks and a pretest to prepare them for the course. In order to pass both the traditional and modified ATLS courses successfully and receive ATLS provider certification, students were required to attend all the parts of the course and pass a certifying exam in the end. The exam is comprised of skill assessments by course instructors and a multiple-choice question test. Passing the course was determined appropriately to the exam in accordance with the ATLS 10th edition faculty manual.

Data collection

Our ATLS instruction center tracks course participants and student's course test results. We collected into an Excel spreadsheet data on each course's number of students who passed the course on their first attempt, the course's size, each student's surgical residency type and the number of instructors that participated in teaching. We did not collect data about the student's satisfaction of the course and their pretest results. The data were divided into the pre-intervention and post-intervention groups (traditional and modified ATLS courses, accordingly) according to their start dates.

Statistical analysis

We calculated the passing rates of each course by dividing the number of students who passed by the total number of

students. We then calculated the mean pass rates, ranges and standard deviations (\pm SD) for the pre-intervention and post-intervention groups. Mean pass rates were considered as dependent numeric variables while course types (traditional or modified ATLS course) were independent categorical variables. Analysis for the difference in mean pass rates between the two types of courses was done using an independent samples *t* test. *p* value < 0.05 was considered statistically significant and 95% confidence intervals [95% CI] were calculated. To control for potential confounders, we performed a multiple regression analysis and a sensitivity analysis. Data were analyzed using Microsoft Excel 2019 and IBM® SPSS® Statistics for Windows, version 19.0.

Results

A total of 28 ATLS 10th edition courses were evaluated. These included 898 students of which 790 passed the course on their first attempt with a mean pass rate of $88.0\% \pm 10.4\%$. Most of the students were from a gynecology residency program (26.3%), followed by general surgery (11.8%), orthopedic surgery (11.4%), anesthesia (11.2%), emergency medicine (10.4%) and then other surgical specialties. There were a mean number of 31.80 ± 1.76 students and 7.39 ± 1.50 instructors per course comprising a mean student to instructor ratio of 4.34:1. There were 15 traditional courses and 13 modified courses, the main differences of which are described in Table 1.

The mean number of general surgery residents per course was significantly lower ($p = 0.008$) in the modified course (1.85 ± 2.03) than the traditional course (4.13 ± 2.13). There were more gynecology (8.54 ± 3.82 vs. 5.87 ± 2.90 , $p = 0.046$) and otorhinolaryngology (1.92 ± 1.32 vs. 0.93 ± 0.96 , $p = 0.030$) residents in each modified course and less ophthalmology (0.31 ± 0.63 vs. 1.53 ± 1.92 , $p = 0.032$) residents. The mean number of emergency medicine residents per course was not significantly different ($p = 0.780$) and neither were other surgical specialties ($p > 0.05$). The differences in specialty ratios and their pass rates are further described in Table 2.

The main analysis exhibited a significant difference (Fig. 1) in mean pass rates between the traditional (94.2% [92.2–96.3]) and modified (81.0% [74.8–87.3]) ATLS courses ($t_{14,203} = 3.922$, $p < 0.001$). The mean pass rate in the modified ATLS course is 13.2% [6.0–24.4] lower than the traditional ATLS course.

A multiple regression analysis was run to test whether the significant differences in residency programs between the course types affected the passing rates. The number of general surgery, gynecology, otorhinolaryngology and ophthalmology students moderately predicted course pass rates with a weak correlation, $F(4, 23) = 3.026$ ($p = 0.038$), $R^2 = 0.345$. Of these, being from a gynecology residency program was the only factor significantly impacting passing rates with an odds ratio (OR) of 0.24 ($p = 0.023$). The OR for the other residency programs was 1.36 ($p = 0.736$) for general surgery, 0.24 ($p = 0.409$) for otorhinolaryngology and 1.29 ($p = 0.844$) for ophthalmology.

Following the results of our multiple regression analysis, we performed a sensitivity analysis by excluding gynecology students and comparing the mean pass rates again. The new mean pass rate in the traditional ATLS course was $94.6\% \pm 6.2$ and $84.2\% \pm 11.5$ in the modified ATLS course ($p = 0.009$). This implies that the difference in mean pass rates between the two course types is independent of the gynecology specialty type.

Discussion

The results demonstrate that the modifications made to the ATLS course are associated with lower student success rates in passing the course. There were three main changes to the course. The first was the use of teleconferencing instead of face-to-face lectures and discussions. The second was the formation of smaller student groups practicing skills. The third was separating the theoretical and practical parts between two days rather than practicing the theoretical material on the same day.

These findings suggest that the ATLS course should be further modified to ensure quality continued medical education in face of the Covid-19 pandemic. It is possible that

Table 1 Characteristics of the traditional and modified ATLS courses

Course type	Traditional course (<i>n</i> = 15)			Modified course (<i>n</i> = 13)			<i>p</i>
	M	(SD)	(min–max)	M	(SD)	(min–max)	
Students (N)	31.80	(1.70)	[28–36]	32.38	(1.94)	[30–35]	0.403
Instructors (N)	6.87	(1.25)	[4–9]	7.92	(1.66)	[5–10]	0.066
Students passed (N)	30.00	(2.60)	[26–36]	26.15	(3.23)	[20–30]	0.002
Course pass rate (%)	94.23	(4.09)	[86.67–100]	81.05	(11.50)	[60.61–100]	0.001

Table 2 Medical specialties approaching the ATLS courses

Specialty	Traditional course (<i>N</i> = 477)	Modified course (<i>N</i> = 421)	<i>p</i>	Mean pass rate
Gynecology	23.6%	33.6%	0.046	84.9%
General surgery	15.2%	9.5%	0.008	89.5%
Anesthesia	12.6%	10.9%	0.156	87.8%
Orthopedic surgery	11.2%	12.6%	0.375	88.0%
Emergency medicine	7.8%	14.1%	0.780	92.1%
Oral and maxillofacial surgery	6.6%	5.2%	0.495	87.8%
Ophthalmology	5.5%	2.3%	0.032	96.3%
Critical care medicine	3.7%	2.9%	0.362	95.7%
Urology	3.5%	4.3%	0.878	88.9%
Otorhinolaryngology	3.2%	8.1%	0.030	92.3%
Plastic reconstructive surgery	2.9%	4.0%	0.701	91.7%
Neurosurgery	2.6%	0.9%	0.626	83.3%
Vascular surgery	1.4%	0.0%	N/A	100.0%
Cardio-thoracic surgery	0.3%	1.4%	N/A	100.0%

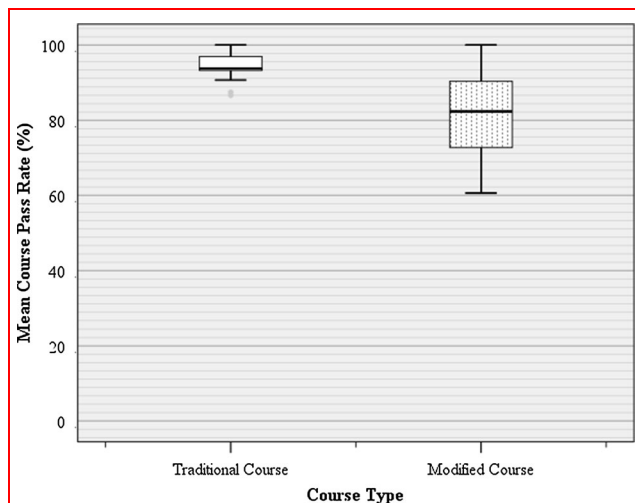


Fig. 1 ATLS Course Student's Pass Rates. ATLS Course student's mean test pass rates before and after course modifications. ATLS, Advanced Trauma Life Support; Traditional Course, ATLS Courses before implementation of modifications; Modified Course, ATLS Courses with modifications. Figure created with IBM® SPSS® Statistics for Windows, version 19.0

the reason for the lower success rates is due to the separation between the theoretical and practical parts of the course rather than the use of virtual teaching. This is supported by evidence that teleconferencing and telementoring is an effective model for teaching in surgical education and ATLS [5, 14]. Also, the student to instructor ratios were similar in the traditional and modified ATLS courses so the smaller group sizes are unlikely to have affected instruction quality. It is also possible that success rates were lower due to students not paying attention to lectures delivered in a teleconference due to diversions.

The Covid-19 pandemic increased demands on health-care resources. This could have prevented surgeons of different specialties from approaching the course. The types of medical specialties are known to have an effect on ATLS course performance [10–13]. Therefore, changes in the types and ratios of the different surgical residencies participating in the two courses could have negatively impacted the scores. However, our analysis found that these changes only weakly explained the course passing rates. Furthermore, the adjustment for these potential confounders did not significantly affect our main finding of a difference in students' success rates between the two courses.

Consolidation of knowledge and memory is better when it is learned in a distributive rather than a massed manner [15]. The distribution of the theoretical and practical parts of the traditional ATLS course over two consecutive days could be better than their massed learning over separate days in the modified ATLS course. Furthermore, knowledge is consolidated by rehearsal [16] which is possible in the traditional course as students put into practice what they learned in the same day.

The modified ATLS course requires better modification to improve student success. A promising remedy to its weaknesses is active learning using electronic tools such as the mATLS application, which has been shown to have better results than the traditional course alone [8]. Perhaps conducting a two and half day course that includes two days of interactive teleconferencing and practical skill video demonstrations, followed by a third half day of in-person evaluation and examination. This would require greater emphasis on practical skills performance during the

in-person evaluation to ensure student's understanding of the skills.

Still, our findings urge to return to the traditional course structure as the modified course pushes patients, albeit simulated, further away from the ATLS provider. A few suggestions may include: (1) returning to the traditional course structure but with a limited number of students, larger classrooms or outdoor classrooms. This has already been suggested to be safe for the traditional course [7]; (2) limiting course participation to only Covid-19 vaccinated students and instructors with or without a negative Covid-19 test. This is supported by ongoing research that points to the success of Covid-19 vaccines and booster doses among medical personnel in preventing infections [17, 18]; (3) conducting the practical skill stations in full personal protective equipment, both to prevent potential infections and to practice trauma skills simulating real cases during the pandemic. This is especially important for practical skill education as trauma victims will not be forgiving to the effects of Covid-19 on ATLS providers' skills [6].

Our study is limited by its retrospective design. We did not adjust the success rates for factors known to affect them as we assumed our courses groups to be homogenic in these regards and did not collect these data. We also did not perform an analysis for differences in the results of the two practical day groups of the modified course. It is possible that the time between the theoretical part and the practical part affects exam success. Lastly, we did not take into consideration student and instructor satisfaction with the modified course as it now allows for better ease of access for participants.

In conclusion, the modifications to the ATLS course are associated with lower student pass rates on the course. This is possibly due to ineffective knowledge consolidation. Better modifications to the course are required such as use of electronic learning tools with modification to course schedule or returning to the traditional course but with the use of Covid-19 vaccines and other protective measures. These suggestions should be considered and evaluated further by ATLS program leaders.

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