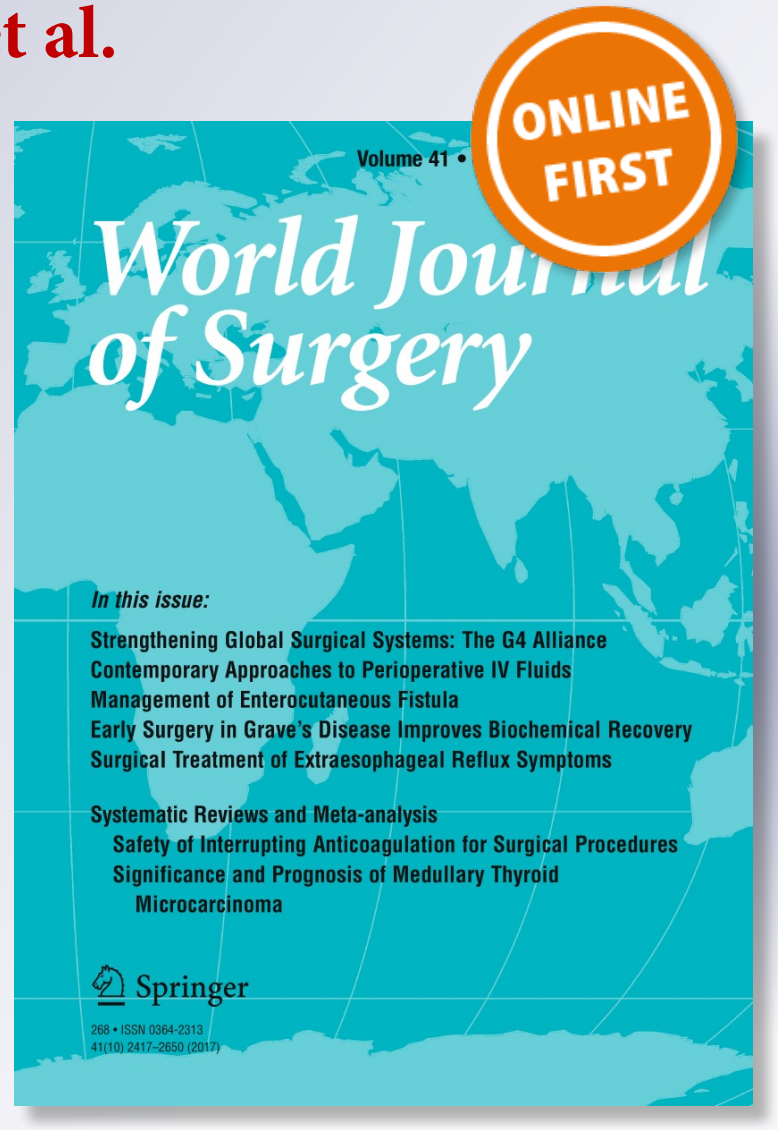
Trauma Leagues—A Novel Option to Attract Medical Students to a Surgical Career

Romeo Lages Simões, Alcir Escocia Dorigatti, Henrique José Virgili Silveira, Thiago Rodrigues Araujo Calderan, Sandro Rizoli, et al.

World Journal of Surgery
Official Journal of the International Society of Surgery/Société Internationale de Chirurgie

ISSN 0364-2313

World J Surg
DOI 10.1007/s00268-017-4190-5



Springer

World J Surg
DOI 10.1007/s00268-017-4190-5

ORIGINAL SCIENTIFIC REPORT

Trauma Leagues—A Novel Option to Attract Medical Students to a Surgical Career

Romeo Lages Simões[1] · Alcir Escocia Dorigatti[2] · Henrique José Virgili Silveira[3] · Thiago Rodrigues Araujo Calderan[3] · Sandro Rizoli[3,4] · Gustavo Pereira Fraga[3]

Abstract

Background In Brazil, most medical schools do not offer trauma surgery in their undergraduate curriculum. The Trauma Leagues arose in Brazil as an important promoter of trauma education and stimulated activities related to surgical skills and practices. In recent decades, studies have demonstrated that the number of surgical residency applicants has decreased worldwide. Strategies to motivate medical students to choose surgery are needed.

Objective To evaluate the impact of participation in the Unicamp Trauma League (UTL) during a 20-year period in the choice for a surgical career.

Methods The study included 276 students in a Brazilian university hospital who were part of the Trauma League. Research of records in universities and medical societies about the specialties chosen during residency were evaluated. A Likert questionnaire was sent to participants to evaluate the impact of participating in the Trauma League in the student's professional career.

Results The questionnaire was answered by 76% of the participants. Of those, 38.4% chose general surgery. About 55.1% did not know what medical career to choose when joined the league. Participation in the league had an influence on specialty choice in 79.1% of the students. Of those choosing surgery, 93.2% believed that participating in the league had positively influenced their career choice. Overall, 93.1% believed that participating in the league provided knowledge and information that the medical school curriculum was not able to provide.

Conclusion Participation in Trauma League has been an effective strategy to encourage medical students to choose a career in general surgery in Campinas, Brazil.

Introduction

Trauma is a global public health problem. Approximately 5 million people die every year as a result of trauma, 10% of all deaths [1]. Despite its major impact, trauma remains a neglected disease with most countries allocating meager resources for trauma prevention or education [2]. Currently, over 2400 medical schools, plus numerous post-secondary nursing and other health educational institutions exist in the world, graduating about 1 million new doctors, nurses, midwives and health professionals every year [3]. While the primary objective of most medical schools is to train physicians capable of dealing with major diseases,

✉ Romeo Lages Simões
romeolagessimoes@gmail.com

[1] School of Medical Sciences, University of Campinas (Unicamp), Rua Alexander Fleming, 181. Cidade Universitária "Prof. Zeferino Vaz" Barão Geraldo, Campinas, SP CEP 13.083-970, Brazil

[2] Department of Surgery, School of Medical Sciences, University of Campinas (Unicamp), Campinas, Brazil

[3] Division of Trauma Surgery, School of Medical Sciences, University of Campinas (Unicamp), Campinas, Brazil

[4] Surgery and Critical Care Medicine, University of Toronto, Toronto, Canada

Published online: 14 September 2017

many graduate without any training or exposure to trauma or injury prevention. It has been proposed that surgeons should become more active in improving medical schools' curricula and advocate the obligatory training in trauma and injury prevention as the basic requirement for all medical students. Trauma should be taught throughout medical training, from medical school to residency training, particularly in surgery [2, 3].

General and trauma surgery are specialties in crises. Many surgical societies have recently developed programs to attract medical students [4, 5]. Despite these efforts, in recent decades, the number of surgical residency applicants has decreased steadily across the world. While in 1981, general surgery was the first choice for residency training 12.1% of all graduating medical students in the USA; over the following years, the number of candidates decreased to less than half of that [6–9]. In 2002, only 5.8% of all American medical students chose general surgery as a career [6]. In Brazil in 2003, approximately 15% of the medical students chose general surgery for postgraduate residency program but in 2013 no more than 6.6% of the Brazilians MDs declared being surgeons [10, 11]. In Brazil, general surgery is only the 4th specialty in number of practitioners [11]. As in the USA, this number has steadily declined recently [12–14]. Thus, strategies to motivate medical students to a career in general surgery are urgently needed worldwide.

In the early 1990′s in Brazil, clusters of medical students interested in increasing their exposure to certain medical disciplines started to emerge and organize under the name of Academic Leagues [15, 16]. Leagues first appeared in a few major academic centers such as the University of Campinas, where the first League was created in 1992.

Trauma Leagues consist of groups of medical students that voluntarily congregate under the supervision of a surgeon, often with an academic career and respectable academic credentials. The stated goals of the Trauma Leagues are to: (1) increase the members' knowledge in trauma, surgery, and emergency care; (2) offer the students the opportunity to participate in emergency room, operating room, and trauma resuscitation care; (3) offer the student the opportunity to participate in research and other academic activities of the Trauma Programs; (4) offer the opportunity to observe all the daily activities of practicing surgeons (apprenticeship); (5) participate and organize trauma meetings, as example the Brazilian Congress of Trauma Leagues (CoLT); and (6) develop and work in injury-prevention projects.

Over 100 Trauma Leagues have been created in Brazil since 1992 and many of their members have opted for a career in general surgery. We hypothesize that participation in Trauma Leagues leads to increased interest in postgraduate residency training in general surgery and thus a valid education that may help shaping future surgical careers.

Methods

The present study is a cross-sectional descriptive-analytical study that evaluated the frequency of School of Medical Sciences from University of Campinas (Unicamp) graduates who specialized in general surgery over the 20 years, analyzing the influence of the UTL in determining the choice for the specialization in general surgery among the graduates.

The study was approved by the Unicamp Institutional Research Board under the number 938576.

Between 1995 and 2014, Unicamp graduated 2011 academics as physicians. These data, in particular, were collected through the Medical Residency Committee of Unicamp. An e-mail was sent to the past residents to identify the doctors who did general surgery residency

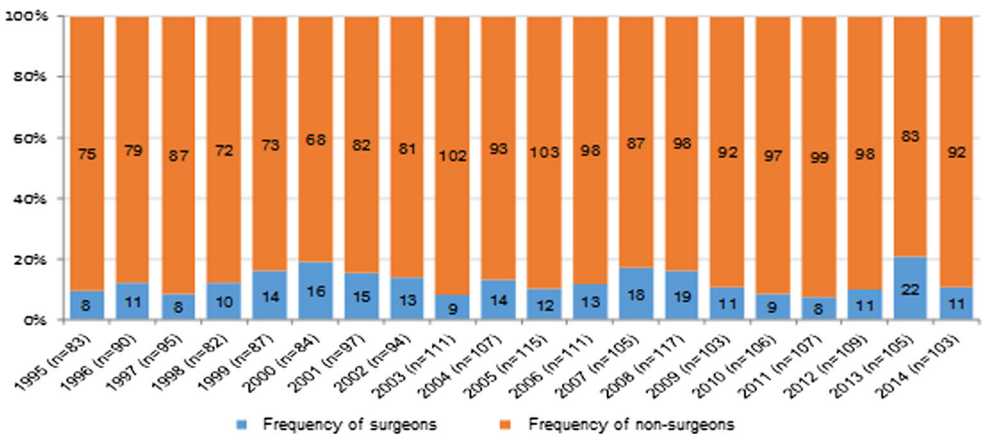


Fig. 1 Frequency (absolute number) and percentage of surgeons and non-surgeons per year, from 1995 to 2014

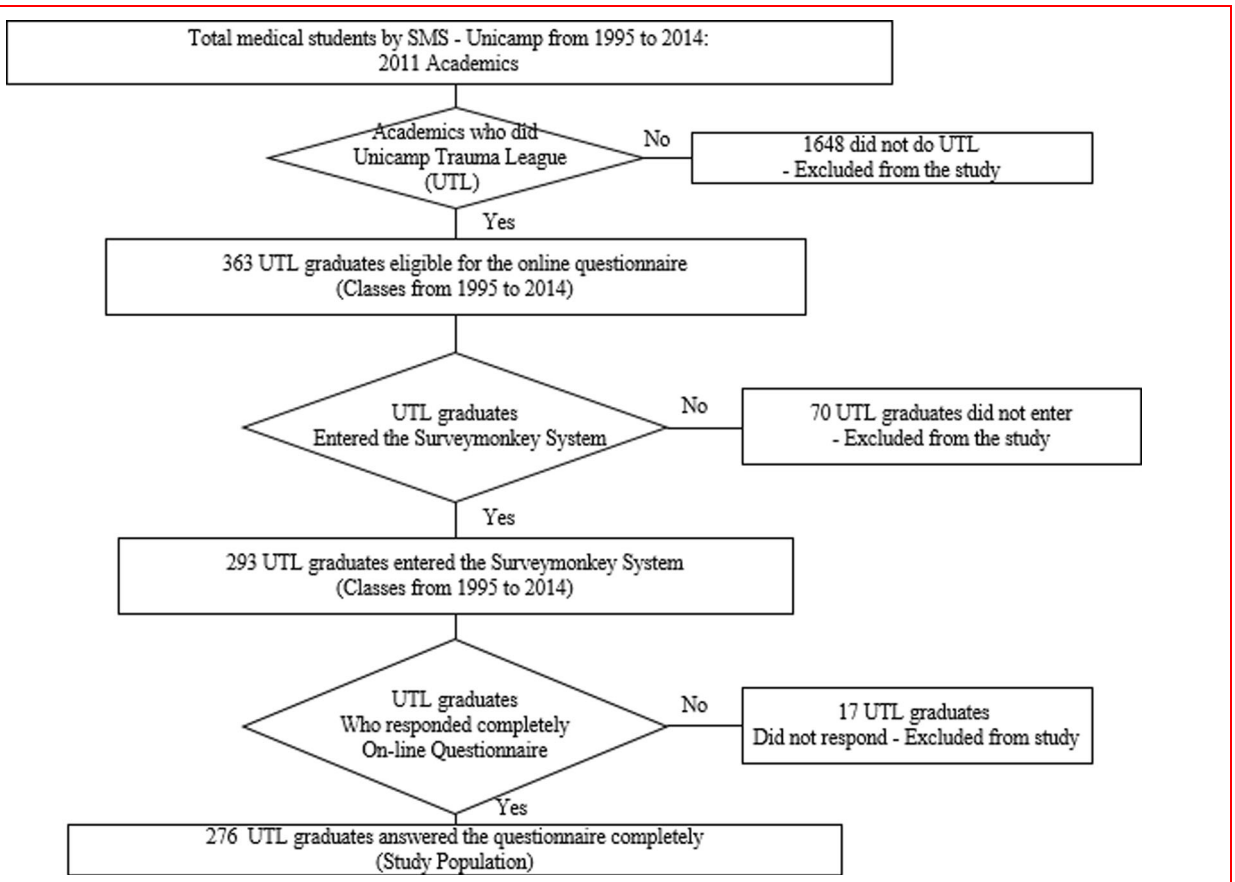


Fig. 2 Flowchart of the Trauma League graduates who make up the study sample

Table 1 Comparison of NUTL and UTL among those who chose general surgery

League	Surgery		
	No	Yes	Total
N-UTL[a]	1527	121	1648
	86.8%	48.0%	
UTL[b]	232	131	363
	13.2%	52.0%	
Total	1759	252	2011

[a] Non-Unicamp Trauma League

[b] Unicamp Trauma League

regardless of whether they did it at Unicamp or at another service.

The next step of the study was to identify UTL graduates, by Trauma League records that were stored in a database, and assign a code to keep the identity confidential. An e-mail was sent to the study where it had the link to the online questionnaire page at Surveymonkey® electronic system. In the first question of the questionnaire, authorization was requested to use the data of the participants, guaranteeing the confidentiality of the identification of the same. If the participant agreed the questionnaire proceeded, and in case of disagreement of the participation, the questionnaire was automatically finalized without prejudice to both the participant and the research.

The questionnaire contained questions concerning: age; gender; specialty choice for residency; whether they were entertaining a surgical career prior to joining the UTL; and the influence that UTL had in their career choice. The influence of UTL on the choice of surgical specialty (general surgery as a prerequisite) and other specialties was also evaluated. The results were analyzed using the SAS System for Windows (Statistical Analysis System) version 9.4. Exploratory data analysis was performed through summary measures (mean, standard deviation, minimum, median, maximum, frequency, and percentage). The correlation between the variables was evaluated through the Chi Square test. The level of statistical significance considered in the analysis was 5% ($p < 0.05$).

Table 2 Frequency and percentage of UTLs regarding the choice of specialty before joining the league between surgeons and non-surgeons

Choice of specialty before League	Surgery residency		
	No	Yes	Total
No	121	28	149
	73.3%	27.2%	
Yes	44	75	119
	26.7%	72.8%	
Total	165	103	268

Table 3 Frequency and percentage of UTLs regarding the influence of the alloy by the choice of its specialty

Influence of the league on the choice of specialty	Frequency	Percentage
Indifferent	20	7.5
Did not influence	36	13.4
Influenced	212	79.1
Total	268	100

Table 4 Comparison of the influence of UTL on choice by specialty between surgeons and non-surgeons

Influence of the league on the choice of specialty	Surgery residency		
	No	Yes	Total
Indifferent	17	3	20
	10.3%	3%	
Did not influence	24	12	36
	14.5%	11.6%	
Influenced	124	88	212
	75.2%	85.4%	
Total	165	103	268

Results

Of the 2011 Medical Doctors (MD) graduated between 1995 and 2014 by the University of Campinas, 252 (12.5%) completed postgraduate residency. The number of MDs completing a residency in general surgery varied from 7.5% to 21% across the years, as shown in Fig. 1.

Through the records of the Trauma League, 363 medical students from Unicamp who regularly attended the league's activities were identified as UTL graduates. Of these, 293 UTL graduates entered the Surveymonkey® to answer the questionnaire.

Seventeen people were excluded from the sample because they abandoned the questionnaire, which made the interpretation of the data unfeasible. About 276 UTL graduates answered the questionnaire, considering the study population. The study sample design can be visualized in the flowchart shown in Fig. 2.

Table 1 shows the comparison between the NUTL group and UTL among those who did general surgery. In the NUTL group, the frequency of surgeons is 7.34% (121/1648), while in the UTL group the frequency is 36.1% (131/363), which suggests that those who underwent to UTL chose surgery as a specialty five times more frequently than those who did not undergo UTL. However, when we compared the frequency of surgeons in the UTL group 36.1% (131/363) with the frequency of surgeons among all physicians graduated in Unicamp 12.5%, (252/2011) we have represented approximately three times more demand for this specialty in the UTL group when compared to the frequency of all MDs graduated in Unicamp who underwent general surgery, which also evidenced statistical significance in the results found ($p < 0{,}0001$).

Among the 363 UTL graduates eligible to respond to the Surveymonkey®, 276 (76%) answered the questionnaire, of which 139 (50.4%) were male. The mean age of the graduates was 35.6 years ± 4.98, with a median of 36 years. The average years of participation of graduates at UTL was 2.6 years ± 0.99, with a median of 2 years.

Two hundred and sixty-eight (97.1%) had medical residency among 276 UTL.

Of those that answered the survey and have specialization, it was found that among the UTLs the most frequently performed medical specialties were general surgery (38,4%), followed by the medical clinic/infectology (10.8%), gynecology and obstetrics (9%), radiology/image (7.1%), orthopedics (5.2%), otorhinolaryngology (4.8%), ophthalmology (4.1%), neurosurgery (1.9%), psychiatry (1.9%), and others (16.8%).

Among the 268 UTL admitted to a postgraduate residency program, 149 (55.6%) had not considered a surgical career before joining the UTL.

These 268 UTL graduates were distributed in two groups, one group of those who had undergone surgery and another group of non-surgeons. It was shown that 72.8% of surgeons knew the specialty they wanted to follow before joining the league. In contrast, only 26.7% of non-surgeons knew the specialty they intended to follow before joining the league ($p < 0.0001$) (Table 2).

Asked about UTL's influence in the choice of medical residency as a specialty, it was observed that 212 (79.1%) said that the league exerted influence in the choice of specialty (Table 3).

Again, these 268 UTL graduates were distributed in two groups, one group of surgeons and another group of non-

surgeons. In the group of surgeons, it was shown that 85.4% were influenced by the Trauma League, as in the non-surgeons group they were influenced in 75.1% (Table 4).

Of those choosing surgery, 96 (93.2%) believed that participating in the league had positively influenced their career choice.

One hundred and eighty-two graduates (66%) had some scientific production, of which 66 (36.3%) said that the production was linked to the Trauma League.

Discussion

The Trauma Leagues in Brazil attract many medical students to their activities, providing students with teaching, research, and practical activities. In addition, a recent study showed that students who attended the academic league activities have significant greater knowledge of trauma compared to non-members [17]. Thus, it was observed in Brazil the capacity of the Trauma Leagues to bring the students to their actions could be a way to attract new general surgeons.

In recent years, numerous studies have demonstrated a concerning drop in the interest of medical school graduates in postgraduate residency training in general surgery. Despite its importance and job opportunities, 10% of the general surgery residency program spots remain unfulfilled in the USA every year. The formation of general surgeons faces a worldwide crisis [18–21]. Other countries, from Canada to Brazil, face the same problem since in the last 15 years, and in 2008, the number of candidates was only 4.7% [22, 23]. Other countries such as Japan, Nigeria, Switzerland, as well as countless other Western countries undergo the same process of fall in the number of medical students who seek the specialization in general surgery [24–30]. In this study, it was observed that the frequency of physicians who graduated and opted for the residence of general surgery at major university in Brazil in the period studied was 12.5%, corroborating the estimated global prevalence of 12 to 15%.

However, it was observed that in the group of UTL graduates this frequency by choice of surgical career increased to 36.1% in the same period, showing that the Trauma League has an impact factor to determine the choice for the surgical career, with statistical significance ($p < 0.0001$).

To understand the reasons for the decline in demand for specialty in general surgery, several surveys investigated the motivations to choose and do not choose general surgery by medical students. The most cited factors that affect choosing general surgery are as follows: no control over one's time, inadequate family time, insufficient leisure time, income is not adequate for the level of commitment and the amount of work, immediate effect of intervention in general surgery, area of expertise is too narrow, differential skills underemphasized, limited interaction with other physicians, and intellectual growth is limited [31–35].

Controllable lifestyle, associated with the capacity to have regular and predictable hours, was by 83% of men and 63% of woman as a factor in not choosing general surgery and one of the most important factors considered in the choosing of the specialty [32, 33, 36–38]. Medical students frequently perceive surgeons as lacking adequate leisure time, regular work schedule, control over their work day, and limitations over stress [31–33].

The activities promoted by the Trauma Leagues in Brazil are done in an extracurricular way and form part of an overall parallel curriculum. The parallel curriculum has become a routine among medical students in Brazil, as it offers opportunities to learn the theory of certain subjects and to practice practical activities to improve their medical education [39–41]. The Trauma Leagues are genuinely *"made in Brazil"* [42].

It is very important to explain the reasons why of the 2011 medical graduates at Unicamp, only 363 did the UTL. Each year, through a selective process (tests and interviews), a maximum of 20 students per year are chosen to ensure the smooth operation of the extracurricular activities. Thus, it would be very difficult to ensure proper functioning of the Trauma League with all students of the School of Medical Sciences. So this is one of the reasons why 1648 students did not make the Trauma League. This justifies the fact that we did not send the questionnaire to all doctors graduated in medicine at Unicamp.

A Trauma League is an opportunity for a medical student to get in touch earlier with the job of a surgeon and the surgical environment. Studies have observed that early exposure to positive role models and early involvement of students in mentored externship and exposure to positive role models is essential in affecting medical students to opt for surgery [31, 43–45]. This study observed that more than half of the students who chose general surgery at University of Campinas were members of the Trauma League, several times more than the national rate.

In this study, another interesting fact to be shown is that among the 268 UTL who answered the questionnaire, 55.6% said they had not considered the general surgery career before joining the Trauma League. However, when these students were distributed in two groups of surgeons and non-surgeons, it became evident that for 73% of the group of surgeons they already knew they wanted to do the general surgery specialty. This fact may suggest that in the group of surgeons they already knew the specialty they wanted to do before joining the Trauma League, and when

they participated in UTL, the activities promoted by the Trauma League confirmed their intention to become surgeons. Some studies emphasize that the Trauma League can lead to reflections, and a self-analysis on the aspects of their personalities that may influence the choice of specialty, as well as the lifestyle that will follow professionally, but at the time of decision by choice is exclusive to each of the students [46, 47]. We must remember that 79.1% of the students confirmed that participation in the league had importance in the choice.

Another factor influencing the students' opting for surgery might be the moment in their career trajectory that join the league. A study has observed that 14% of medical students have made their specialty choice before entering medical school, and an additional 41–45% of students make their specialty choice before their third year of medical school, period that students join the League [18]. Another information that corroborates is that about 50% of medical students who choose general surgery as a career and do not change their minds make this choice by the end of the second year of school, before any clinical experiences in surgery [40]. Other positive character of a Trauma League that can influence the choice of general surgery is the proximity between professors and medical students in the activities of the League. The exposure to mentors makes medical students to become more interested in choosing general surgery as a specialty as well as contact with the residents can also play an important role in the choice for surgery [34, 48–52]. The activities in operating room are other very interesting activities in a Trauma League and can positively influence in the choice for general surgery, since operative experiences during a medical student's clerkship may affect positively the interest in surgery [53, 54].

However, it is very important to note that not everyone who made the UTL chose to do general surgery residency, since 232 students who made the UTL opted for other specialties such as medical clinic, obstetrical gynecology, and radiology, among others. This demonstrates that the activities of the Trauma League make medical students think about what they actually intend to do as medical specialists [46].

Unfortunately, in Brazil, trauma teaching is viewed as an option by most medical schools, when in fact it should not be viewed as optional. Until the initial first 3 years of medical graduation, there are few medical schools that teach practical skills and promote internships that train emergency and emergency care skills.

Recently, there was an update of the National Curricular Guidelines for Medicine courses in Brazil, to improve the training of the medical students [55]. The model of medical training in Brazil is different from other countries. However, new training models should emphasize early contact with patients [56]. In our opinion, trauma training should be mandatory and start early.

Based on our experience of more than 20 years with the Unicamp Trauma League, we believe that the key role of the Trauma League in this context is to be an alternative, complementary instrument, provided it is adequately supervised by committed teachers, exposure to research and other trauma-related activities. The UTL performs important functions both in academic contexts and in society as they carry out prevention activities, such as the P.A.R.T.Y. (Prevent Alcohol and Risk-Related Trauma in Youth); Yellow May; Saving Lives; and simulations of care for mass casualty incidents organized annually, which reverts to education and quality service for the whole society [57, 58].

Another important contribution made by the Trauma League is that it offers medical students the possibility of increasing scientific production by medical students, regardless of their specialty, which can contribute to the better training of medical students. Thus, the Trauma Leagues must continue to stimulate their students in scientific production [17].

The Trauma League provides students the opportunity to learn about trauma and have more experience in practical skills, becoming more prepared to take care of trauma patients. To conclude, in our experience in Campinas, Brazil, participation in Trauma League has been an effective strategy to encourage medical students to choose general surgery as a career, since the number of surgeons was five times more in the UTL group when compared to the NUTL group, and approximately three times more when compared to the frequency of all MDs graduating in Unicamp who underwent general surgery in the period in which it was studied.

Acknowledgements The authors of the study would like to thank all the Trauma League graduates from the University of Campinas (Unicamp) who answered the online questionnaire, which made the study possible, and the past students Thiago Messias Zago and Maria Carvalho Silveira Alves for their support in the study.

Compliance with ethical standards

Conflict of interest The authors report no conflict of interest. The authors alone are responsible for the content and writing of this article.

Ethical approval The present study was approved by the Unicamp Institutional Research Board under the number 938576.

References

1. World Health Organization (WHO) (2014) Injuries. World Health Organization, Geneva

2. Birolini D (2008) Trauma: a social and medical challenge. J Am Coll Surg 207(1):1–6
3. Frenk J, Chen L, Bhutta ZA et al (2010) Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. Lancet 376(9756):1923–1958
4. Committee to Develop the Reorganized Specialty of Trauma, Surgical Critical Care, and Emergency Surgery (2005) Acute care surgery: trauma, critical care, and emergency surgery. J Trauma 58(3):614–616
5. Green SM (2009) Trauma surgery: discipline in crisis. Ann Emerg Med 53(2):198–207
6. Newton DA, Grayson MS (2003) Trends in career choice by US medical school graduates. JAMA 290(9):1179–1182
7. Ziegler MM (2004) Pediatric surgical training: an historic perspective, a formula for change. J Pediatr Surg 39(8):1159–1172
8. Andriole DA, Klingensmith ME, Jeffe DB (2006) Who are our future surgeons? Characteristics of medical student graduates planning surgical careers: analysis of the 1997 to 2004 Association of American Medical Colleges' Graduation Questionnaire National Database. J Am Coll Surg 203:177–185
9. Bland KI, Isaacs G (2002) Contemporary trends in students selections of medical specialties: the potential impact on general surgery. Arch Surg 137:259–267
10. Carneiro MB, Gouveia VV, Souza E (2005) Conselho Federal de Medicina. The doctor and its work: results of the Southeastern region and its states. Brasília: Conselho Federal de Medicina. Available at: http://www.portalmedico.org.br/include/biblioteca_virtual/medico_e_seu_trabalho/regiao_sudeste/Sudeste.PDF (in Portuguese)
11. Scheffer M, Cassenote AJS, Biancarelli A (2013) Medical demography in Brazil - Volume 2: Scenarios and distribution indicators . São Paulo: Conselho Regional de Medicina do Estado de São Paulo. Conselho Federal de Medicina. Avaible at: http://www.flip3d.com.br/web/pub/cfm/index10/?numero=8 (in Portuguese)
12. Jesus LE (2008) Teach surgery: how and for whom? Rev Col Bras Cir 35(1):136–140
13. Cockerham WT, Cofer JB, Biderman MD et al (2004) Is there declining interest in general surgery training? Curr Surg 61 (2):231–235
14. Marschall JG, Karimuddin AA (2003) Decline in popularity of general surgery as a career choice in North America: review of postgraduate residency training selection in Canada, 1996–2001. World J Surg 27(3):249–252. doi:10.1007/s00268-002-6642-8
15. Filho PTH, Villas-Bôas PJF, Corrêa FG et al (2010) Regulation of student leagues: the experience at the Botucatu School of Medicine. Rev Bras Educ Med 34(1):160–167
16. Taquette SR, Costa-Macedo LM, Alvarenga FBF (2003) The alternative medical school curriculum: a reality in physician training at the State University of Rio de Janeiro, Brazil. Rev Bras Educ Med 27(3):171–176
17. Simões RL, Bermudes FAM, Andrade HS et al (2014) Trauma leagues: an alternative way to teach trauma surgery to medical students. Rev Col Bras Cir 41(4):297–302
18. Markert RJ (1983) Change in specialty choice during medical school. J Fam Pract 17(2):295–300
19. Debas HT (2002) Surgery: a noble profession in a changing world. Ann Surg 236(3):263–269
20. Kelly E, Rogers SO Jr (2012) Graduate medical education in trauma/critical care and acute care surgery. Defining goals for a new workforce. Surg Clin N Am 92:1055–1064
21. Fischer FA (2007) The impending disappearance of general surgeon. JAMA 298:2191–2193
22. Li JZ, Chan SCY, Au M et al (2014) Review of a medical student-run surgery lecture series and skills lab curriculum. Can J Surg 57(3):152–154
23. Canadian Residency Matching Service. R-1 statistics (2008). [Website]. [Access in 12/10/2016]. Available at: http://www.carms.ca/assets/upload/pdfs/2008R1_MatchResults/10Discipline%20of%20Canadian%20Applicants_en.pdf
24. Ito Y (2008) Surgical education and postgraduate training in Japan. World J Surg 32(10):2134–2137. doi:10.1007/s00268-008-9638-1
25. Makama JG, Ameh EA (2010) Does general surgery clerkship make a future career in surgery more appealing to medical students? Afr Health Sci 10(3):292–296
26. Cochran A, Judy L, Paukert JL et al (2003) Does a general surgery clerkship influence student perception of surgeons and surgical careers. Surgery 134:153–157
27. Polk HC Jr (1999) The declining interest in surgical careers: The primary mirage, and concern about contemporary undergraduate surgical education. Am J Surg 178:177–179
28. Incorvaia NA, Ringley CD, Boysen DA (2005) Factors influencing surgical career decisions. Curr Surg 62(4):429–435
29. Mayer KL, Perez RV, Ho HS (2001) Factors affecting choice of surgical residency training program. J Surg Res 98(2):71–75
30. Kaderli R, Buser C, Stefenelli U et al (2011) Student's interest in becoming a general surgeon before and after a surgical clerkship in German-speaking Switzerland. Swiss Med Wkly 14(141): w13246
31. Gelfand DV, Podnos YD, Wilson SE et al (2002) Choosing general surgery: insights into career choices of current medical students. Arch Surg 137(8):941–945
32. Scott IM, Matejcek AN, Gowans MC et al (2008) Choosing a career in surgery: factors that influence Canadian medical students' interest in pursuing a surgical career. Can J Surg 51 (5):371–377
33. Clinite KL, DeZee KJ, Durning SJ et al (2014) Lifestyle factors and primary care specialty selection: comparing 2012–2013 graduating and matriculating medical students´thoughts on specialty lifestyle. Acad Med 89(11):1483–1489
34. Musunuru S, Lewis B, Rikkers LF et al (2007) Effective surgical residents strongly influence medical students to pursue surgical careers. J Am Coll Surg 204:164–167
35. Hadzikadic L, Burke PA, Esposito TJ et al (2010) Surgical residents perceptions of trauma surgery as a specialty. Arch Surg 145(5):445–450
36. Wendel TM, Godellas CV, Prinz RA (2003) Are there gender differences in choosing a surgical career? Surgery 134(4):591–596
37. Schwartz RW, Haley JV, Williams C et al (1990) The controllable lifestyle factor and students' attitudes about specialty selection. Acad Med 65(3):207–210
38. Dorsey ER, Jarjoura D, Rutecki GW (2003) Influence of controllable lifestyle on recent trends in specialty choice by US medical students. JAMA 290(9):1173–1178
39. Tavares AP, Ferreira RA, França EB et al (2007) The "Parallel Curriculum" of the medical students of the Federal University of Minas Gerais. Rev Bras Educ Med 31(3):254–265
40. Tavares CHF, Maia JA, Muniz MCH et al (2007) The "Parallel Curriculum" of third-year medical students of the Federal University of Alagoas. Rev Bras Educ Med 31(3):245–253
41. Nascimento DT, Dias MA, de Mota RS et al (2008) Evaluation of extracurricular internships in the adult's intensive care units. Rev Bras Ter Intensiva 20(4):355–361
42. Fraga GP, Collet-Silva FS, Souza HP (2013) More surgeons, less trauma. Rev Col Bras Cir 40(4):267–268
43. Erzurum VZ, Obermeyer RJ, Fecher A et al (2000) What influences medical students' choice of surgical careers. Surgery 128 (2):253–256

44. Marshall DC, Salciccioli JD, Walton SJ et al (2015) Medical Student experience in surgery influences their career choices: a systematic review of the literature. J Surg Educ 72(3):438–445
45. Al-Heeit KNM, Nassar AK, Decorby K et al (2012) The effect of general surgery clerkship rotation on the attitude of medical students towards general surgery as a future career. J Surg Educ 69(4):544–549
46. Corsi PR, Fernandes EL, Intelizano PM et al (2014) Factors that influence the student´s choice of medical specialty. Rev Bras Educ Med 38(2):213–220
47. Pianosi K, Bethune C, Hurley KF (2016) Medical student career choice: a quantitative study of fourth-year medical students at Memorial University, Newfoundland. CMAJ Open 4(2):147–152
48. Zeldow PB, Devens M, Daugherty SR (1990) Do person-oriented medical students choose person-oriented specialties? Do technology-oriented medical students avoid person-oriented specialties? Acad Med 65(9 Suppl):S45–S46
49. Healy NA, Cantillon P, Malone C et al (2012) Role models and mentors in surgery. Am J Surg 204(2):256–261
50. Frei E, Stamm M, Buddeberg-Fischer B (2010) Mentoring programs for medical students—a review of the Pubmed literature 2000–2008. BMC Med Educ 10:32
51. McCord JH, McDonald R, Sippel RS et al (2009) Surgical career choices: the vital impact of mentoring. J Surg Res 155(1):136–141
52. Thakur A, Fedorka P, Ko C et al (2001) Impact of mentor guidance in surgical career selection. J Pediatr Surg 36(12):1802–1804
53. Chen H, Hardacre JM, Martin C et al (2001) Do medical school surgical rotations influence subspecialty choice? J Surg Res 97 (2):172–178
54. Kahn SA, Goldman M, Daul M et al (2011) The burn surgeon: an endangered species. Can exposure in medical school increase interest in burn surgery? J Burn Care Res 32(1):39–45
55. Fraga GP, Pereira Junior GA, Fontes CER (2014) A situação do ensino de urgência e emergência nos cursos de graduação medicina no Brasil e as recomendações para a matriz curricular. In: Lampert JB, Bicudo AM, orgs 10 anos das Diretrizes Curriculares Nacionais dos Cursos de Graduação em medicina. Associação Brasileira de Educação Médica, Rio de Janeiro, pp 41–56
56. Dezee KJ, Artino AR, Elnicki DM et al (2012) Medical education in the United States of America. Med Teach 34:521–525
57. Dorigatti AE, Jimenez LS, Redondano BR (2014) Importance of multidiciplinary trauma prevention program for youth. Rev Col Bras Cir 41(4):245–250
58. Simões RL, Neto CD, Maciel GSB et al (2012) Prehospital care to the trauma victims with multiple simulated. Rev Col Bras Cir 39(3):230–237