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Research Article

Survey on the surgical skills of orthopedics and traumatology residents from accredited and nonaccredited institutions in İstanbul

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ABSTRACT

Objective: To investigate whether orthopedic and traumatology residents who are undergoing training achieve competence in surgical techniques after completion of their specialization and to determine whether there are significant differences between the responses of residents from accredited and nonaccredited institutions.

Methods: A total of 131 orthopedics and traumatology residents from nine institutions in the İstanbul province answered the questionnaire during the morning training meeting. In addition to basic demographic data, level of seniority, equipment competence, and theoretical and practical training, the residents were asked about their opinion on what type of surgeries they could perform after their specialization, considering the surgery and follow-up of the case as well as the complications occurring during this period. The residents responded to questions on 46 surgeries under the main headings of trauma, arthroscopy, arthroplasty, spine, pediatric orthopedics, hand surgery, deformity, and bone and soft tissue tumors. In addition to descriptive statistical methods, one-way analysis of variance, Tukey's multiple comparison test, and chi square test were used to evaluate the data. The significance level for the results was set at $p<0.05$.

Results: In total, 131 orthopedics and traumatology residents answered the questionnaire. Furthermore, 53 (40.5%) specialization students were employed at accredited institutions and 78 (59.5%) at nonaccredited institutions. According to the responses, case presentations, article-writing sessions, and in-province meetings held regularly at accredited institutions showed a significant difference compared to non-accredited institutions ($p<0.05$), and the residents at the accredited institutions benefited significantly more from the availability of books and electronic media in gaining theoretical knowledge ($p<0.05$). When the responses of the residents from accredited and nonaccredited institutions regarding 46 different surgeries were compared, a significant difference was found in 17 of them ($p<0.05$). There was a significant difference between the averages of residents' responses on the surgical fields they have interest for ($p<0.05$). It was determined that the residents believed that they could mostly perform surgeries in the fields of trauma, followed by arthroplasty, deformity, arthroscopy, pediatric orthopedics, hand surgery, and spine and tumor surgery. According to their level of seniority, a significant difference was found between the averages of residents' opinions regarding their surgical skill levels ($p=0.02$).

Conclusion: We believe that it would be beneficial for the trainers to take necessary precautions to increase the skill levels of the residents of orthopedic surgery. Accreditation significantly contributes to the standardization of education as well as quality improvement. Further action should be taken to increase the number of accredited clinics.

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The competence of educated people refers to not only having the technical experience required to practice their profession but also having the ethical values and skills necessary to provide good service (1). The Turkish Orthopedics and Traumatology Training Council (TOTEK) visits the applicant clinics for the accreditation of the Orthopedics and Traumatology Specialization program. Visits to such institutions are conducted on a voluntary basis. During these visits, the educational infrastructure and programs of the institution are evaluated, and whether the standard criteria determined by TOTEK are met is assessed. Specialized training programs in the clinics that meet the criteria are accredited, and the assurance of quality is ensured. For clinics that do not meet the criteria, recommendations are made to improve the training activities and the accreditation assessments

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subsequently continue. The validity period of the accreditation is 5 years. This activity is carried out within the framework of the institution visits and accreditation program essentials determined by the Turkish Medical Association-Coordination Committee for the Associations of Specialization (TTB-UDEK) (2).

The aim of this study was to investigate whether the orthopedics and traumatology residents, who are still under training, are competent enough to practice surgical techniques after completion of their specialization, question their thoughts on interventional procedures in the field of orthopedic surgery, and determine if there are significant differences between the responses of the residents at the institutions accredited or nonaccredited by TOTEK.

We believe that by examining the opinions of orthopedic surgical residents who continue with their specialty training and presenting the current situation, this study can provide guidance for training plans and guides that would be subsequently created.

Materials and Methods

A descriptive study was planned in the Istanbul province, and a questionnaire was prepared for this purpose. Before starting this study, approvals were obtained from the Hospital Ethics Committee and Medical Specialization Board.

In 2017, when this study was conducted, there were 250 orthopedics and traumatology residents in Istanbul of a total of 856 residents in Turkey. Two institutions in Istanbul were accredited by TOTEK. The sample size was calculated to be 89 for Istanbul and 117 for Turkey (margin of error: 10%; confidence level: 98%).

A total of 131 orthopedics and traumatology residents from nine institutions that were willing to participate in this study completed the questionnaire. Two of the nine institutions were hospitals that were accredited by TOTEK. The questionnaire was answered during face-to-face interviews with the residents. All the residents who completed this questionnaire were still continuing their specialty training.

In addition to basic demographic data, level of seniority, equipment competence, and theoretical and practical training, the residents were asked about their opinion on what type of surgeries they could perform after their specialization, considering the surgery and follow-up of the case and complications that may occur during this period.

The residents responded to a total of 46 surgical questions under the main headings of trauma, arthroscopy, arthroplasty, spine, pediatric orthopedics, hand surgery, deformity, bone and soft tissue tumors, and feet–ankle.

Statistical analysis

In addition to descriptive statistical methods (mean and standard deviation), one-way analysis of variance, Tukey's multiple comparison test, and chi square tests were conducted to evaluate the data. The significance level for the results was set at $p<0.05$. Data coding and statistical analyses were performed using the Statistical Package for Social Sciences software, version 22.0 (IBM Corp.; Armonk, NY, USA).

Results

A total of 131 orthopedics and traumatology residents who were pursuing their training in the Istanbul province answered the questionnaire. Of the residents, 53 (40.5%) specialization students worked at accredited institutions and 78 (59.5%) worked at nonaccredited institutions. Information regarding residents' seniority is listed in Table 1.

To the question "From where/whom do you most acquire the theoretical knowledge in your field? You may choose/add multiple answers," 71.8% of residents responded "senior resident," 48.1% responded "books," and 45.8% responded "electronic media." A significant difference was detected between the responses

MAIN POINTS

- Accreditation significantly contributes to the standardization of education and increase of quality.
- Residents from accredited institutions believed that they could mostly perform surgeries in the fields of arthroplasty, deformity construction, arthroscopy, hand surgery, and pediatric orthopedics, whereas those from nonaccredited institutions believed that they could mostly perform surgeries in the field of trauma.
- Self-confidence among second-year residents increased.
- Pelvic fracture surgery with external fixator application, which should be performed in emergencies to reduce mortality, can be performed by 48% of fifth-year residents, thus confirming that this surgery should be taken into consideration by trainers during specialty training.
- Surgical training in the fields of deformity, tumor, pediatric orthopedics, and spine is "intermediate–poor."

Table 1. Questionnaire results and resident's responses

Resident information	Number	Ratio (%)
Year of Seniority		
First-year resident	24	18.3
Second-year resident	19	14.5
Third-year resident	27	20.6
Fourth-year resident	36	27.5
Fifth-year resident	25	19.1
Total	131	100
Accreditation status		
Number of residents from accredited institutions	53	40.5
Number of residents from nonaccredited institutions	78	59.5

of residents from accredited and nonaccredited institutions, who answered the question with the responses "books" and "electronic media" (p<0.05) (Table 2).

To the question "Who are the observers and assistants that attend the surgical procedures performed by the residents in your clinic? You may choose multiple answers," 91.6% of residents responded "specialized physician" and 71% responded "senior resident." No significant difference was detected between the responses of the residents from accredited and nonaccredited institutions (p>0.05) (Table 2).

To the question "What regular training activities are held at your clinic that you can participate in? You may choose multiple answers," 62.6% of residents responded "training visits" and 57.2% responded "article-writing sessions." A significant difference was detected between the responses of the residents from accredited and nonaccredited institutions, who answered the question as "article-writing sessions," "case presentations," and "in-province meetings" (shoulder, knee, foot, and ankle meetings) (p<0.05) (Table 2).

To the question "How would you evaluate your specialization period? You may choose/add multiple answers," 96.2% of residents responded "exhausting," 90.8% responded "stressful," and 45.8% responded "improving." No significant difference was detected between the responses of the residents from accredited and nonaccredited institutions (p>0.05) (Table 2).

The residents gave "yes" or "no" answers to the question "What kind of surgery or surgeries do you think you can perform after

Table 2. Questionnaire results and resident's responses

Questionnaire Results, Residents' Opinions Questions	Total (YES) n (%)	Residents from nonaccredited institutions (YES) n (%)	Residents from accredited institutions (YES) n (%)	p
Source of theoretical knowledge				
Senior Resident	94 (71.8)	55 (70.5)	39 (73.6)	0.70
Specialized Physician/Research Assistant	49 (37.4)	25 (32.1)	24 (45.3)	0.12
Chief Resident or Doctor Academic Member	26 (19.8)	18 (23.1)	8 (15.1)	0.26
Lecturer/Academic Member/ Professor/Associate Professor	37 (28.2)	27 (34.6)	10 (18.9)	0.06
Books	63 (48.1)	31 (39.7)	32 (60.4)	0.02
Electronic media	60 (45.8)	29 (37.2)	31 (58.5)	0.02
Seminars/Congresses	35 (26.7)	19 (24.4)	16 (30.2)	0.46
Observers and assistants during surgical procedures				
Senior resident	93 (71)	55 (70.5)	38 (71.7)	0.88
Specialized Physician/Research Assistant	120 (91.6)	71 (91.0)	49 (92.5)	0.77
Chief Resident or Doctor Academic Member	60 (45.8)	37 (47.4)	23 (43.4)	0.65
Lecturer/Academic Member/ Professor/Associate Professor	56 (42.7)	32 (41.0)	24 (45.3)	0.63
Regularly held training activities				
Article-Writing Sessions	75 (57.2)	36 (46.2)	39 (73.6)	0.00
Seminars	54 (41.2)	28 (35.9)	26 (49.1)	0.13
Case Presentations	56 (42.7)	21 (26.9)	35 (66.0)	0.00
Training Visits	82 (62.6)	53 (67.9)	29 (54.7)	0.12
Resident Classes	59 (45)	30 (38.5)	29 (54.7)	0.07
Periodic In-Province Meetings	43 (32.8)	15 (19.2)	28 (52.8)	0.00
Evaluation of the specialization				
Exhausting	126 (96.2)	75 (96.2)	51 (96.2)	0.98
Stressful	119 (90.8)	70 (89.7)	49 (92.5)	0.60
Teaching	54 (41.2)	28 (35.9)	26 (49.1)	0.13
Improving	60 (45.8)	35 (44.9)	25 (47.2)	0.80
Beneficial	46 (35.1)	23 (29.5)	23 (43.4)	0.10
Pleasing	24 (18.3)	14 (17.9)	10 (18.9)	0.89

Table 3. Survey results and residents' responses. "Which surgery/surgeries do you think you will be able to do after your residency? (Please also consider the case, follow-up, and dealing with complications.)"

Questions	First-Year Resident YES N (%)	Second-Year Resident YES N (%)	Third-Year Resident YES N (%)	Fourth-Year Resident YES N (%)	Fifth-Year Resident YES N (%)	TOTAL YES N (%)	Residents from nonaccredited institutions YES N (%)	Residents from accredited institutions (YES) N (%)	p
Arthroplasty									
Primary hip arthroplasty	16 (66.7)	17 (89.5)	21 (77.8)	31 (86.1)	23 (92)	108 (82.4)	60 (76.92)	48 (90.57)	0.04
Primary knee arthroplasty	18 (75)	17 (89.5)	23 (85.2)	33 (91.7)	24 (96)	115 (87.8)	67 (85.90)	48 (90.57)	0.42
Revision hip arthroplasty	5 (20.8)	8 (42.1)	5 (18.5)	8 (22.2)	11 (44)	37 (28.2)	14 (17.95)	23 (43.40)	0.00
Revision knee arthroplasty	7 (29.2)	9 (47.4)	8 (29.6)	10 (27.8)	16 (64)	50 (38.2)	18 (23.08)	32 (60.38)	0.00
Ankle arthroplasty	0 (0)	1 (5.3)	2 (7.4)	0 (0)	1 (4)	4 (3.1)	1 (1.28)	3 (5.66)	0.15
Dysplastic total hip replacement	2 (8.3)	5 (26.3)	7 (25.9)	5 (13.9)	9 (36)	28 (21.4)	8 (10.26)	20 (37.74)	0.00
Shoulder arthroplasty	4 (16.7)	2 (10.5)	5 (18.5)	7 (19.4)	9 (36)	27 (20.6)	13 (16.67)	14 (26.42)	0.18
Trauma									
Compartment syndrome	14 (58.3)	15 (78.9)	24 (88.9)	33 (91.7)	23 (92)	109 (83.2)	66 (84.62)	43 (81.13)	0.60
Around knee fractures (distal femur, tibial plateau)	17 (70.8)	15 (78.9)	23 (85.2)	35 (7.2)	23 (92)	113 (86.3)	68 (87.18)	45 (84.91)	0.71
Around hip fractures (femur neck, Intertrochanteric, subtrochanteric)	17 (70.8)	16 (84.2)	22 (81.5)	31 (86.1)	24 (96)	110 (84)	67 (85.90)	43 (81.13)	0.47
Shoulder area fractures	10 (41.7)	13 (68.4)	20 (74.1)	23 (63.9)	17 (68)	83 (63.4)	53 (67.95)	30 (56.60)	0.19
Lower limb fasciotomy	15 (62.5)	12 (63.2)	24 (88.9)	29 (80.6)	24 (96)	104 (79.4)	65 (83.33)	39 (73.58)	0.00
Pelvis fractures/acetabulum fractures and screw application	6 (25)	3 (15.8)	5 (18.5)	7 (19.4)	5 (20)	26 (19.8)	22 (28.21)	4 (7.55)	0.00
Upper limb fasciotomy	15 (62.5)	12 (63.2)	21 (77.8)	25 (69.4)	23 (92)	96 (73.3)	63 (80.77)	33 (62.26)	0.02
Pelvis fracture with external fixator application	6 (25)	5 (26.3)	11 (40.7)	18 (50)	12 (48)	52 (39.7)	40 (51)	12 (23)	0.00
Malleolus fractures	19 (79.2)	16 (84.2)	26 (96.3)	35 (97.2)	24 (96)	120 (91.6)	72 (92.31)	48 (90.57)	0.72
Lower limb amputations	19 (79.2)	14 (73.7)	24 (88.9)	30 (83.3)	23 (92)	110 (84)	70 (89.74)	40 (75.47)	0.03
Talus and calcaneus fractures	13 (54.2)	11 (57.9)	22 (81.5)	26 (72.2)	22 (88)	94 (71.8)	59 (75.64)	35 (66.04)	0.23
Upper limb amputations	13 (54.2)	11 (57.9)	10 (37)	20 (55.6)	13 (52)	67 (51.1)	45 (57.69)	22 (41.51)	0.07
Comminuted pilon fracture surgery	14 (58.3)	11 (57.9)	17 (63)	18 (50)	17 (68)	77 (58.8)	50 (64)	27 (51)	0.13
Humerus distal intra-articular comminuted fractures	11 (45.8)	11 (57.9)	18 (66.7)	18 (50)	21 (84)	79 (60.3)	48 (62)	31 (58)	0.73
Humerus diaphysis fracture surgery	13 (54.2)	14 (73.7)	21 (77.8)	29 (80.6)	23 (92)	100 (76.3)	59 (75.64)	41 (77.36)	0.82
Deformity									
Adult hip osteotomies	0 (0)	3 (15.8)	3 (11.1)	5 (13.9)	7 (28)	18 (13.7)	7 (8.97)	11 (20.75)	0.05
Osteomyelitis treatment	8 (33.3)	13 (68.4)	12 (44.4)	18 (50)	17 (68)	68 (51.9)	38 (49)	30 (56.60)	0.38

Table 3. Survey results and residents' responses. "Which surgery/surgeries do you think you will be able to do after your residency? (Please also consider the case, follow-up, and dealing with complications.)" (continued)

Questions	First-Year Resident YES N (%)	Second-Year Resident YES N (%)	Third-Year Resident YES N (%)	Fourth-Year Resident YES N (%)	Fifth-Year Resident YES N (%)	TOTAL YES N (%)	Residents from nonaccredited institutions YES N (%)	Residents from accredited institutions (YES) N (%)	p
Deformity correction with İlizarov device	9 (37.5)	7 (36.8)	8 (29.6)	10 (27.8)	8 (32)	18 (32.1)	25 (32.05)	17 (32.08)	1.00
Computer-assisted deformity correction	0 (0)	2 (10.5)	6 (22.2)	5 (13.9)	6 (24)	19 (14.5)	5 (6.41)	14 (26.42)	0.00
Pseudoarthrosis surgery	10 (41.7)	10 (52.6)	12 (44.4)	18 (50)	17 (68)	67 (51.1)	36 (46)	31 (58)	0.17
Arthroscopy									
Arthroscopic knee surgery	15 (62.5)	16 (84.2)	23 (85.2)	33 (91.7)	23 (92)	110 (84)	65 (83.33)	45 (84.91)	0.81
Arthroscopic hip surgery	2 (8.3)	0 (0)	2 (7.4)	0 (0)	0 (0)	4 (3.1)	3 (3.85)	1 (1.89)	0.52
Arthroscopic shoulder surgery	7 (29.2)	4 (21.1)	10 (37)	9 (25)	9 (36)	39 (29.8)	24 (31)	15 (28.30)	0.76
Arthroscopic ankle surgery	1 (4.2)	1 (5.3)	4 (14.8)	9 (25)	7 (28)	22 (16.8)	8 (10.26)	14 (26.42)	0.02
Hand surgery									
Arthroscopic wrist/elbow surgery	1 (4.2)	0 (0)	1 (3.7)	0 (0)	1 (4)	3 (2.3)	1 (1.28)	2 (3.77)	0.35
Vascular and/or nerve suture	2 (8.3)	3 (15.8)	3 (11.1)	4 (11.1)	5 (20)	17 (13)	6 (7.69)	11 (20.75)	0.03
Microscope-assisted hand surgery procedures	2 (8.3)	2 (10.5)	0 (0)	3 (8.3)	3 (12)	10 (7.6)	3 (4)	7 (13)	0.05
Tendon repair	10 (41.7)	7 (36.8)	15 (55.6)	21 (58.3)	16 (64)	69 (52.7)	36 (46.15)	33 (62.26)	0.07
Tendon transfers	6 (25)	5 (26.3)	5 (18.5)	4 (11.1)	7 (28)	27 (20.6)	13 (16.67)	14 (26.42)	0.18
Pediatric orthopedic surgery									
Cerebral palsy multilevel release surgery	2 (8.3)	5 (26.3)	3 (11.1)	7 (19.4)	7 (28)	24 (18.3)	10 (12.82)	14 (26.42)	0.05
Developmental dysplasia of hip surgery	4 (16.7)	6 (31.6)	8 (29.6)	6 (16.7)	9 (36)	33 (25.2)	13 (16.67)	20 (37.74)	0.01
Pediatric humerus supracondylar fractures	13 (54.2)	15 (78.9)	21 (77.8)	28 (77.8)	23 (92)	100 (76.3)	56 (71.79)	44 (83.02)	0.14
Spine									
Spine correction (kyphosis, scoliosis)	2 (8.3)	3 (15.8)	3 (14.8)	4 (11.10)	5 (20.0)	18 (13.7)	8 (10.26)	10 (19)	0.16
Vertebral fractures	4 (16.7)	6 (31.6)	8 (29.6)	12 (33.3)	7 (28)	37 (28.2)	22 (28.21)	15 (28.30)	0.99
Spine surgery with discectomy and osteotomy	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
Cervical spine surgery	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
Tumor surgery									
Malignant bone tumor resection	0 (0)	2 (10.5)	1 (3,7)	1 (2,8)	1 (4)	5 (3.8)	2 (2.56)	3 (5.66)	0.36
Tumor type resection prosthesis application	0 (0)	2 (10.5)	0 (0)	4 (11,1)	0 (0)	6 (4.6)	3 (3.85)	3 (5.66)	0.63
Foot and ankle surgery									
Foot correction surgery	3 (12.5)	7 (36.8)	7 (25.9)	11 (30.6)	9 (36)	37 (28.2)	10 (12.82)	27 (50.94)	0.00

*: Accredited and nonaccredited institutions' residents' responses on surgeries. Chi square test

your specialty training? (Please give your answers considering the surgery, follow-up of the case, and complications that may occur during this period)," taking into account 46 surgeries in the field of orthopedics and traumatology. Regarding the responses given to primary hip arthroplasty, revision hip arthroplasty, revision knee arthroplasty, dysplastic total hip replacement, lower limb fasciotomy, pelvic fractures/acetabulum fractures with screw application, upper limb fasciotomy, pelvic fracture with external fixator application, lower limb amputations, adult hip osteotomies, computer-assisted deformity correction, arthroscopic ankle surgery, vascular and/or nerve suture, microscope-assisted hand surgery procedures, multilevel surgery for cerebral palsy, developmental dysplasia of hip surgery, and foot correction surgery, a significant difference was detected between the responses of the residents from accredited and nonaccredited institutions ($p<0.05$) (Table 3).

A significant difference was found between the averages of the surgical fields (arthroplasty, trauma, etc.) ($p<0.05$). The results showed that the residents believed that they were able to mostly perform the surgeries in the fields of trauma, followed by arthroplasty, deformity, arthroscopy, pediatric orthopedics, hand surgery, spine, and tumor surgery (Table 4).

The residents' opinions regarding their intervention skill levels increased with their level of seniority. According to their level of seniority, a significant difference was found between the averages of the answers ($p=0.02$), and there was a significant difference between the responses of first-year and fifth-year residents ($p=0.01<0.05$) (Table 5).

As shown in Figure 1, some of the surgeries in the field of arthroplasty were responded to with "yes" according to the residents' seniority level.

As shown in Figure 2, some of the surgeries in the field of trauma were responded to with "yes" according to the residents' seniority level.

To the question "Does your clinic offer a 'Resident Training Program' or 'Core Training Curriculum'?" 72.5% of residents responded "yes."

Table 4. Evaluation of the residents' answers regarding 46 surgeries according to the fields of surgery

Fields of Orthopedics and Traumatology	Mean	F value in one-way ANOVA	p value in one-way ANOVA
Arthroplasty	2.82	453.80	0.00
Trauma	10.23		
Deformity	1.63		
Arthroscopy	1.34		
Hand Surgery	0.96		
Pediatric Orthopedic Surgery	1.20		
Spine	0.42		
Tumor Surgery	0.08		

Table 5. Evaluation of the residents' answers regarding 46 surgeries according to the residents' seniority

Level of Seniority	Mean	F value in one-way ANOVA	p value in one-way ANOVA
First-year resident	2.1667	2.953	0.02
Second-year resident	3.1053		
Third-year resident	2.6296		
Fourth-year resident	2.6111		
Fifth-year resident	3.7200		

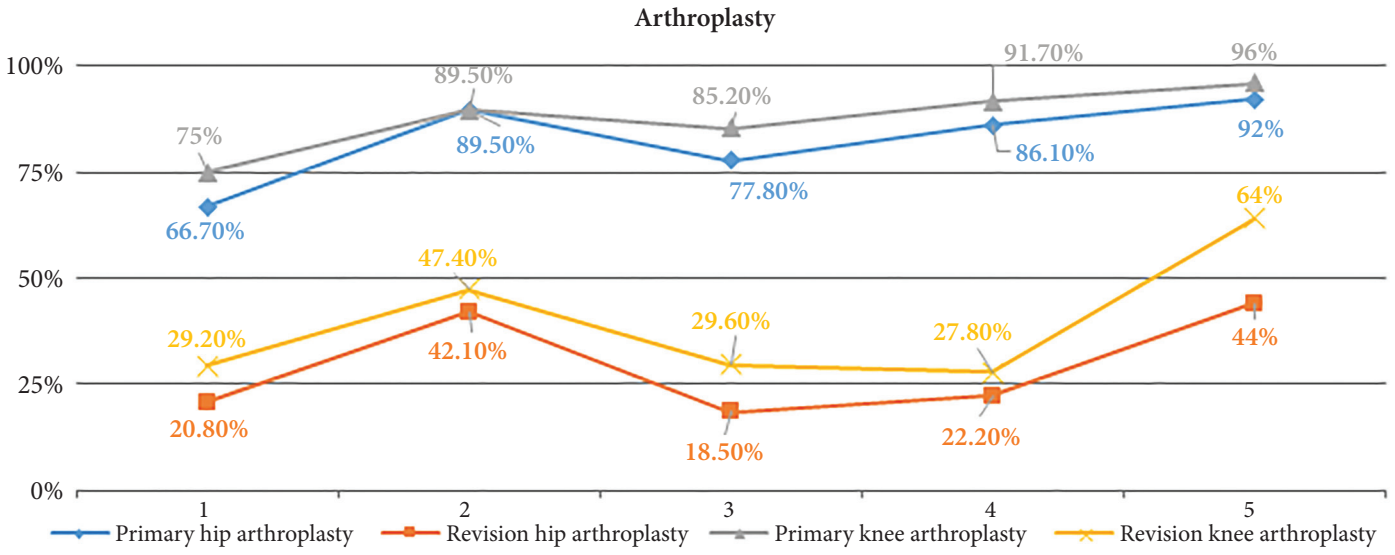

Figure 1. Responses with "yes" to some of the surgeries in the field of arthroplasty according to the residents' seniority level

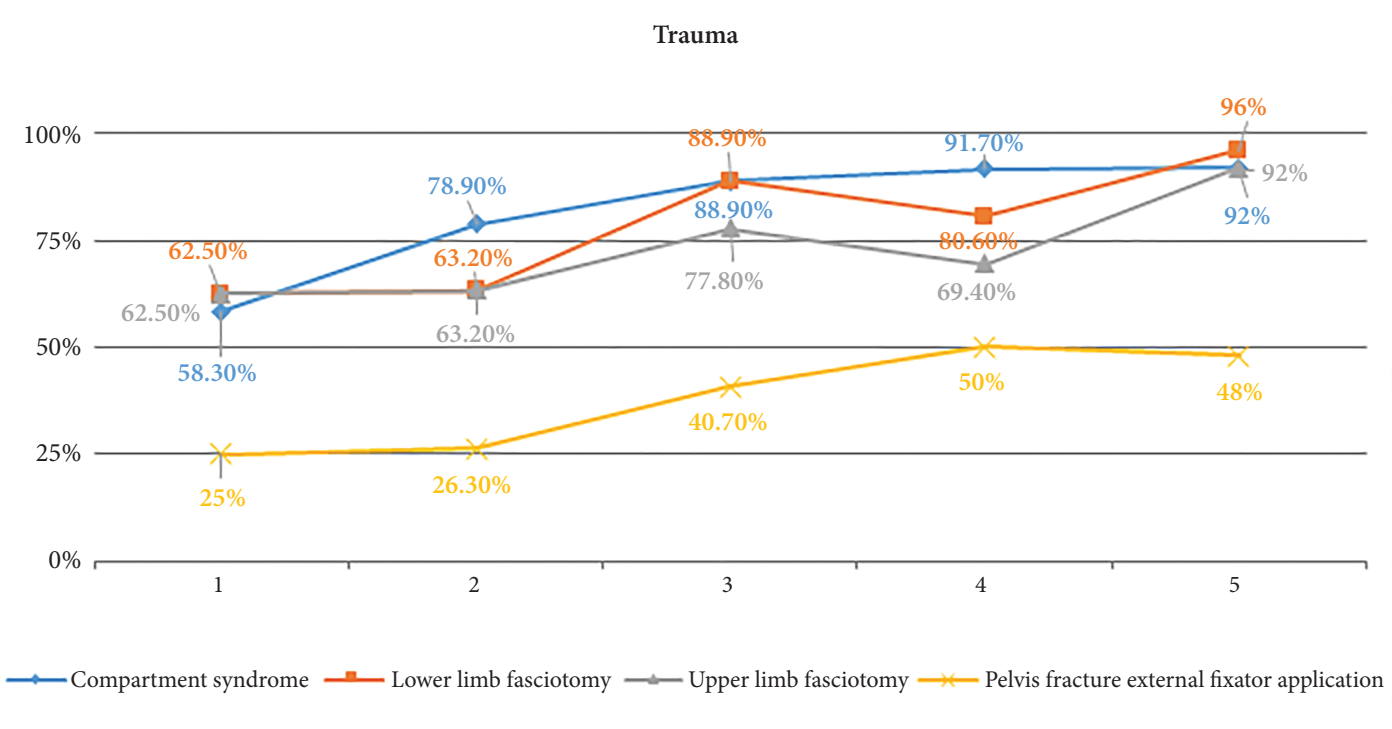

Figure 2. Responses with "yes" to some of the surgeries in the field of trauma according to the residents' seniority level

To the question "Does your clinic keep report cards of the residents?" 79.4% of residents responded "yes." No significant difference was found between the responses of the residents from accredited and nonaccredited institutions ($p>0.05$).

To the question "Mark the work environment characteristics of your institution that you find adequate," 39.7% of residents marked "arthroscopy," 22.1% marked "surgical intensive care unit," 43.5% marked "cutting/drilling burrs," 38.2% marked "lead aprons/collars/goggles/gloves," and 49.6% marked "C-arm fluoroscopy device."

To the question "Have you used an orthopedic surgical simulation system during your residency?" 23.7% of residents responded "yes." To the question "Did you get cadaver training during your residency?" 19.8% of residents responded "yes."

To the question "How would you qualify your working environment?" 42% of residents' responded "mostly based on teamwork," 38.9% responded "based on personal interest," 17.6% responded "competitive/mostly based on individual performance," 25.2% responded "mostly based on cooperation," and 3.1% responded "other." To the question "How would you qualify the management style of the unit you work at?" 69.5% responded "hierarchical," 25.2% responded "authoritarian," 16% responded "desultory," and 2.4% responded "other."

Discussion

In addition to didactic training, preoperative–postoperative patient care, continuously attending surgeries in the operating room, and gaining surgical intervention skills are the main components and objectives of training during the specialization period in orthopedics and traumatology. An inexperienced orthopedics and traumatology specialist with inadequate technical skills may perform inappropriate patient management. On the other hand, it is evident that a physician experienced in surgical intervention can reassure other physicians in the work environment with his/her own confidence as well as his/her success during the performance of critical interventions.

The accreditation system is governed by different principles in the US and Europe. While the accreditation of educational institutions in the US is compulsory, it is carried out on a voluntary basis in Europe and in our country. That is, educational institutions apply to authorized institutions on their own volition and participate in the accreditation process. During the accreditation phase, the educational programs, structure, publications, and studies of the institution; the number of polyclinic visits performed, patients hospitalized, surgeries and interventions, consultations, and emergencies realized in a year; and the presence of a proper registration system are evaluated. Furthermore, the realization of the accreditation process by an independent and external agency/association/commission is important. The fact that the organizations that manage and decide the accreditation process are nongovernmental institutions is important considering the fact that the system should not be subject to possible political pressures and the decisions taken should not change based on daily policies (1). In this study, which included all the accredited institutions in Istanbul, the residents' views were evaluated: it was evident that case presentations, article-writing

sessions, and monthly evening meetings were held significantly more regularly in institutions that were accredited to allow for the participation of residents. In addition, the residents from accredited institutions benefited significantly more from books and electronic media in gaining theoretical knowledge ($p<0.05$).

In the evaluation of the opinions of residents from accredited and nonaccredited institutions with regard to the types of surgeries they could perform after their specialization, the responses of the residents regarding 46 types of surgeries were compared, and a significant difference was detected in 17 of them ($p<0.05$). Among the responses that exhibited a significant difference, it was noted that the residents from accredited institutions believed that they could mostly perform surgeries in the fields of arthroplasty, deformity, arthroscopy, hand surgery, and pediatric orthopedics, whereas those from nonaccredited institutions believed that they could mostly perform surgeries in the field of trauma. In the literature, it is mentioned that accreditation programs have more advantages, but the drawbacks of accreditation programs are also mentioned. The deficiencies of an accreditation program can be identified, and improvements can be achieved via feedback studies and the "identify a problem and fix it" philosophy (3).

According to their level of seniority, a significant difference was found between the averages of the residents' responses regarding their surgical skill levels ($p=0.02$); as expected, there was a significant difference between the first-year and fifth-year residents,($p=0.01<0.05$). However, when the averages of the responses were evaluated according to the level of seniority, self-confidence was found to be higher among second-year residents and lower among third-year residents (Figure 1). In a study evaluating the self-confidence of residents in surgical procedures following their theoretical training, Geoffrion R. et al. found out that self-confidence was significantly higher in intervention residents who had never performed the procedure as well as in first- and second-year intervention residents. There was a positive correlation between self-confidence and satisfaction (4).

We found that the residents believed that they could mostly perform surgeries in the fields of trauma, followed by arthroplasty, deformity, arthroscopy, pediatric orthopedics, hand surgery, spine, and tumor surgery. When all the residents' responses regarding whether they could perform the surgeries were reviewed, a significant difference was found between the averages of the surgical fields ($p=0.00<0.05$). The fact that an orthopaedics and traumatology specialist thinks that "pelvic fracture surgery with external fixator application," which should be performed in emergency situations to reduce mortality, can be performed by 48% of fifth-year residents (Figure 2) confirms the view that this surgery should be taken into consideration by the trainers during specialty training. In addition, the implementation of a structured surgical skills curriculum following specialty training enables the graduates to improve their practical skills during emergency surgery. The curriculum must include skills required for emergency orthopedic care and provide initial training in the basic skills of orthopedic surgery (5).

Recently, skill-based learning opportunities have become widely used in orthopedic surgery. In our study, 23.7% of residents used a simulation system and 19.8% of residents stated that they received cadaver training. Chaer et al. demonstrated that surgical training could be successfully supported by simulation-based training (6). Similarly, studies have shown that simulation-based training for residents in orthopedic surgery successfully accelerated their development in the operating room (7, 8). In surgical skill laboratories, plastic models, simulators, and cadavers can be used to improve the surgical techniques and skills of orthopedics and traumatology specialization students.

In our country, hand surgery is considered a subspecialty. Orthopedics and traumatology, plastic surgery, and general surgery specialists who wish to increase their knowledge and skills on the hand and upper extremities are trained in such programs provided they meet certain conditions; subsequently, they are conferred the title "hand surgery specialists." In this study, most of the residents believed that that they would not be able to perform hand surgeries other than tendon repair following their specialty training. We believe that the number of residents performing surgeries can be increased if rotations are conducted with regard to hand surgeries. Van Heest et al. showed that a combination of internet-based information tests and cadaveric surgical practices could help differentiate between a freshman resident and a senior resident who had performed carpal tunnel surgery (9). Skill-based training may be more useful in the training of orthopedic surgeons compared with a predetermined number of minimum cases (10).

We believe that it will be useful for trainers to take necessary measures because the residents evaluated the theoretical and surgical training in the fields of deformity, tumor, pediatric orthopedics, and spine as "intermediate–poor."

Recording the interventions on resident report cards provides a strategy to monitor the skill levels. Thus, it helps to eliminate the lack of skills by recognizing an insufficient number of interventions performed. In this study, 79.4% of residents stated that their clinic maintained report cards and 72.5% stated that their clinic offered a core training curriculum. At the end of the training period, all the competences in the report card were required to be approved and the fields outside the resident's competence had to be appropriately completed. Because there are no clear rules on which year the competences on the report card should be obtained and evaluated, the program managers and trainers could measure and monitor the competencies based on the level of seniority. Competence should be approved when the level specified in the learning objectives is achieved; otherwise, feedback should be provided to eliminate the deficiencies before giving approval. Training officers are expected to provide their maximum efforts in monitoring the report cards, motivating the residents, and taking measures to remedy deficiencies.

In the present study, 96.2% of orthopedics and traumatology residents qualified their specialization processes as "exhausting" and 90.8% qualified them as "stressful." In a study Goldin et al., evaluation of the quality of life during the surgical internship of medical faculty students showed that there was a decrease in the students' sleep times and that the students were more depressed (11). Several studies have reported that the working conditions in surgical departments are tough. For instance, in Dokuzlar et al.' s study, 89.18% of ear, nose, and throat specialty students evaluated their specialization processes as "exhausting" and 70.27% evaluated them as "stressful" (12).

Orthopedics and traumatology specialty training is a surgical training process. The main approach in surgical training has been defined as a "master–apprentice relationship" by Halsted-Osler in the late 1800s. Although orthopedics and traumatology have been diversified with educational resources such as orthopedic textbooks, articles, internet-based resources, simulations, and skill laboratories, the master–apprentice relationship still forms the core of training, in addition to the experience of treating patients in the operating room and clinical setting (12). To the question "Who are the observers and assistants that attend the surgical procedures?" 120 residents (91.6%) responded "specialized physician," 93 (71%) responded "senior resident," 60 (45.8%) responded "chief resident," and 56 (42.7%) responded "lecturer." In the ranking of contributions in surgical applications, a specialized physician takes the first place, which indicates that the master–apprentice relationship model is continued in the orthopedic surgery training of the surgical branches that require hand skills.

"Senior resident" was the leading response (71%) to the question regarding the source of theoretical knowledge. As a result of obtaining the information from a senior resident by the participants, the residents' level of knowledge and skills are similar to those of senior residents, which reveals that the resident is imparted "convenient" training rather than "sufficient" training. In their study, Huri. et al. stated that the residents' "time spent with the trainer" was insufficient (13).

Besides the responses of "hierarchical" and "authoritarian," it was thought-provoking to note the "desultory" response by 16% of residents (in the third place) to the question regarding the way their unit was managed, despite the department being a surgical one. However, the fact that the work environment was considered to be "mostly based on teamwork" by half of the residents made us interpret the fact that this emphasized work-sharing in the orthopedic surgery teams. Despite the presence of a teamwork-oriented environment, the existence of a hierarchical and authoritarian form of governance was emphasized by many residents.

The adequacy of technical equipment and tools in training clinics is an important component in the development of interventional skills. The absence of some medical devices, such as C-arm fluoroscopy devices, cutting/drilling burr motors, arthroscopes, etc., during orthopedics and traumatology specialty training can render the performance of relevant interventions impossible. The managers of the Orthopedics and Traumatology Program and the Hospital Expenditure Authorities are required to make necessary arrangements to eliminate deficiencies related to infrastructure, devices, and equipment.

According to the Accreditation Council for Graduate Medical Education, orthopedic surgeons are required to examine a total of at least 1000 cases during their specialty training, of which at least 200 should be pediatric orthopedic and at least 10 should be oncologic cases (14). Studies have shown that the number of cases is not the main determinant of the quality of training; rather, the trainers and the type and complexity of cases play a key role in the ability and learning style of the individual during surgical training (10, 15). Skill-based training will become increasingly important in the future of surgical training.

In conclusion, we believe that it would be beneficial for trainers to take necessary precautions to increase the skill levels of the residents of orthopedic surgery. Accreditation significantly contributes to the standardization of education as well as quality improvement. Further measures should be taken to increase the number of accredited clinics.

Ethics Committee Approval: The study protocol was approved by the Institutional Review Board of Metin Sabancı Baltalimanı Bone and Joint Diseases Training and Research Hospital (IRB: 17.07.2017 No:11).

Informed Consent: Informed consent was obtained from all individual participants included in the study.

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