



Orthopaedic trauma residency programs: Perspectives from different countries across the world[☆]

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ABSTRACT

The ability to manage the myriad of musculoskeletal conditions successfully requires multiple years of training. Access to and completion of orthopaedic surgical training entails an often grueling, highly regulated path to certification to practice. Although the world is more connected than ever, the question is whether the local certification criteria for medical specialists leads to a generic residency program and a similar training in all countries. This report from eight nations on five continents details the distinctive features of that training, including the number of positions available, the examinations required, the gender distribution of residents, and available possibilities once the residence period is complete. This analysis shows a wide variation in the orthopaedic trauma training program worldwide, with emphasis on different skills per country.

Introduction

The complexity of musculoskeletal pathologies, including traumatic, degenerative, developmental and oncologic problems requires years of training to become proficient. In most countries and regions, medicine in general and orthopaedic practice specifically is highly regulated, requiring extensive training and serial examinations to obtain certification to practice. Armed with the validation of such certification surgeons are best prepared to ensure their patients' quality of care.

Although the world is more connected than ever, and people migrate across the globe, recognition of specific training, i.e. as an orthopaedic (trauma) surgeon, is still not obvious. As there is no global regulatory organization or even a common framework, the question is how residency programs vary around the world. It is well-known that the job

market varies from country to country (& even within countries) with important salary, teaching, and academic differences. One similarity is a unique, often coveted, job opportunity once the training is finished. This report aims to analyze the residency program for orthopaedic (trauma) training, with input from eight nations from five continents to summarize the background and outcomes (Table 1). This information was collected during the yearly assembly of the Osteosynthesis and Trauma Care Foundation (OTC) in Madrid, June 15th, 2023. No Central American country has an OTC chapter running, so to increase the representativeness of training differences worldwide, a member of the Honduran Traumatology Society was invited to participate in this review. All participant were interviewed on the requirements to enter the residency program, the length of the program, working hours (both regular and shifts), salary, sex equity, duration of the training program, mandatory

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Table 1

Summary of the characteristics of orthopedic surgery and traumatology residency programs in 8 countries.

Region/Country	Spain	Germany	U.S.A.	South Africa	Brazil	Japan	Hong Kong, China	Honduras
ACCESS	Annual national admission exam (M.I.R.)	School leaving examination	Medical school grades, USMLE, Research, Job & volunteer experiences	Primary examination	Regional or specific exams	Japanese medical exam.	Graduate from medical school and complete internship	Annual admission exam
ACCREDITED HOSPITALS	150	No data available	218 accredited residency programs	14 Tertiary Hospitals	220	Junior residency: 1.024 Senior (orthopaedic) residency: 207	16 orthopaedic units accredited for training	2
RESIDENTS YEAR	280	No data available	899	215	1.100		10–30 orthopaedic residents recruited every year	4–6
RATIO (Male: Female)	1,8:3	No data available	8:2	8,3:1,7	10:2	9,5:0,5	4:1	20:1
YEARS MEDICINE SCHOOL / RESIDENCE	6 / 5	6 / 6	4 (undergrad college). 4 (med school). 5 (residency). 1 (fellowship).	6 years medical school 5 years residency	6 (medicine school) / 3 (residence) / 1 or 2 (fellow)	Japanese medical board exam after 6years of medical college. Obtain medical license and start junior residency program. 2years junior residency. 4 years senior residency (orthopaedic surgery)	Complete medical school (e.g., MBChB 6-year Curriculum at CUHK) and 1 year internship. Orthopaedic training starts with at least 2 years basic surgical training, followed by at least 4 years of higher orthopaedic training.	7 years + 6 months to 1 year of mandatory social service. 3 years residency.
HOURS WEEK	37	40	<80.	56	60	40	60–70	90–100
DAYS ON CALL MONTH	5–7	4–6	7–8	6–8	4 – 8	4 – 8	4–6	7
RESPONSIBILITIES	Depends on the hospital. Usually, first year of external rotations and emergency room.	Not completely specified. 6 months E&A, 6 months ICU	PGY1-Ward, asst in surg; PGY-2 ED; PGY-5 manage svc, most complex surgeries.	Trauma Unit 24 months. ICU 3 months. Elective ortho 35 months.	1st year: Emergency, unit care. 2nd year: Emergency, unit care, trauma surgery. 3rd year: Orthopaedic surgery, pediatric orthopaedic.	Clinical cases, conservative and operative treatment, conference presentation, writing a paper.	Ward round, out-patient clinic, hospital meeting, operations, etc.	Prepare clinical session. Rounds. Medical admission. Assist in OR. Outpatient care. orthopaedic ward: wound cleaning/ dressing, tractions, change of cast or immobilizations. 2 days a week: osteosynthesis material removal (pins, situation screws, dynamizations).
FIRST TRAUMA SURGERY	Implant removal of osteosynthesis or femoral intramedullary nailing.	Not specified	PGY2 Do ankles, inter trochanteric fracture.	Wash-out and external fixator application, ORIF with plates and IM nails.	2nd year	Nailing of trochanteric fracture.	As early as first year resident under supervision	Wash-out and external fixator application.
TOTAL SURGERIES	Not a minimum.	At least 295.	1.000–3.000, aim for 2.000.	Not specified.	1.300 (assistant), 500 (main surgeon).	Minimum 160 surgeries (80 main surgeon).	Fulfil the Index Operation Requirements in various subspecialties	1.100 per year.
EXAMS	No.	1 final exam.	USMLE, OITE each Year,	Primary. Intermediate. Final.	Minimum 5 exams / year.	Evaluation of the residency and orthopaedic	3 parts of MHKICSB exam, and exit	2 exams per year.

(continued on next page)

courses, and job opportunities.

Residency programs in Spain

After graduating medical school, which takes six years, junior doctors must take an exam called the "MIR" (Médico Interno Residente) to enter residency [1]. This exam consists of 225 multiple-choice questions. The final mark is made up of 90% of this exam, and 10% of the degree mark obtained in medical school. The exam is given once annually. In 2022, 8503 residency positions across all specialties were offered for 12,251 applicants. There is a maximum quota for foreigners of 4% of the positions available.

Looking at orthopaedic surgery training specifically, there are 150 hospitals in Spain which accept residents for the five year orthopaedic residency [2]. Approximately 280 orthopaedic surgery residents begin their training each year. Last year, of starting residents, there was a female to male ratio of 1.8/3.

The typical workday schedule (excluding on-call) is from 8 a.m to 3 p.m. Additionally, residents are typically on-call five to seven, 24-hour shifts per month. Residents have the day off after being on call.

First year residents rotate on a variety of other services (e.g. General Surgery, Vascular Surgery, Plastic Surgery) and there is limited autonomy. Significant time is spent in the emergency room as well. The second year of residency includes rotations in traumatology in which the

resident learns to perform basic trauma surgeries like more straightforward ankle and hip fractures (including cephalomedullary nails for intertrochanteric femur fractures) and removals of hardware. In the following years, residents are involved with and perform increasingly complex trauma surgeries.

There is no minimum number of total surgeries or specific surgeries a resident needs to perform to graduate, and as such the number varies by the hospital. Similarly, there is no annual exam taken during residency. There are, however, quarterly evaluations done based on performance in each rotation.

It is feasible to pursue a Ph.D. during residency training. This typically takes two to three years. That said, there is no national accreditation for subspecialty fellowship training.

While salaries can vary, in Madrid, a basic salary is about 1.288€. This increases 130€ approximately every year. On-call, one earns 11–18€ per hour on weekdays and 13–21€ per hour on weekends. The Spanish Big Mac Index is 4,58€. The unemployment rate in Orthopaedics is quite low at 2,1%, compared to 13% overall unemployment rate in Spain. One gets 22 days of paid time off for holidays as well as four personal days.

The two main gaps of the residency in Spain include the lack of homogeneity between training programs and the absence of official accreditation of subspecialties with national recognized fellows.

Table 1 (continued)

Region/Country	Spain	Germany	U.S.A.	South Africa	Brazil	Japan	Hong Kong, China	Honduras
			ABOS Board Certification.			board exam Orthopaedic board exam: 2022: 599 Applicants, 530 Passed (88.4%).	examination (HKCOS-RCSEd Joint specialty Fellowship Exam)	
PHD	Possible, not mandatory.	Possible, not mandatory.	No pathway for PhD during residency.	Possible, not mandatory.	No pathway for PhD during residency. After the residency.	PhD course (4years) at graduate university.	Not mandatory	Not possible.
FELLOW	No certified orthopaedic trauma fellow program.	Possible, not mandatory.	Optional, but 90% pursue.	Possible, not mandatory.		No certified orthopaedic trauma fellow program.	Subspecialty development and training usually after fellowship	No certified orthopaedic trauma fellow program.
OFF DAYS	26	30	28	22	30	25	25	30
SALARY	1.200–1.700 €/month (days on-call not included).	5.000–6.000 €/month	60.000–80.000 € per year	3.000–3.500 €/month	800 €/month	30.000–40.000 € per year	8.400 – 17.000 €/month	911€/month
JOB	Unemployment rate: 2,1%.	No current unemployment.	Many opportunities, only the truly unemployable not employed.	No current unemployment.	Many opportunities It depends (region, city, subspecialty).	Many hospitals are associated with university hospitals.	Usually already working at a unit and become resident specialist	No current unemployment.
OTC COURSES	Basic osteosynthesis skills course. Advanced course with cadaveric dissection. OTC TV Online	Possible, not mandatory	Available to approx. 100 residents/year	Possible, not mandatory	few	3 standard courses and one advance course per year	Complete a fracture fixation course e.g., AADO course	No OTC courses
GAPS	Training not homogeneous. No accreditation of sub-specialties. No national recognized fellows.	Practical training Research possibilities in non-university hospitals	Rare, requires individual review and dire need	basic principles and intermediate courses with saw bone and cadaver workshops.	Pediatric orthopaedic and trauma	Need more educational courses including cadaveric training	Post fellowship training for advanced trauma, revision, etc	Work load reduces studying time. More trauma = less orthopedics. Lack of specialized training: - arthroscopy - joint replacement

Residency programs in Germany

After having passed the examination required to finish an undergraduate degree, students then may proceed on to a medical university, which takes a minimum of six years to complete. After 3 examinations taken during medical school, one is eligible to start residency training in the field of one's interest.

The structure and specifics of the residency training are not completely predetermined at the national level. The training can either be achieved at an university hospital or an accredited teaching hospital. Further, a set curriculum for surgical training does not currently exist, so the residency experience is dependent on and varies with the given conditions of each particular teaching hospital [3].

Although there is no set curriculum, there are some regulations. It is mandatory that every orthopaedic resident spends at least six months in the Emergency Department and six months in the intensive care unit. Further, the medical association of Germany does require residents to log their operative cases (also non-operative cases?). In order to gain certification, residents must demonstrate, using the logbook, that they have performed at least 295 surgeries done independently in different areas [4].

The minimum time to achieve the specialization in orthopaedic surgery is six years, though this could take longer, depending on the number of surgeries the resident is allowed to perform in his teaching hospital. After that, there is a final examination that is required to become a certified orthopaedic surgeon. The type of the first trauma related surgery is not specified and depends on your personal development and the empathy of the responsible teacher.

Residents typically work 40 h per week and are on call four to six times per month. Due to the Working Time Act residents get the day off after having been on call duty. Residents get 30 days of vacation per year [5]. Resident salaries are typically between €5,000–6,000 per month depending on the year of residency. Residents obtain additional for being on call.

Besides the medical doctors (MD) degree, the PhD is possible but not mandatory. A fellowship is likewise possible but has to be organized by the resident. After reaching the specialists level, a job is almost guaranteed as Germany is in need of doctors in general and specialists in particular.

The downside of the current system is a lack of practical training. Also the possibility of scientific research in non-university hospitals could be improved.

Residency programs in U.S.A

In the United States, orthopaedic surgery is extremely competitive. Medical students must maintain high grades to obtain an orthopaedic surgery residency spot. Competitive candidates have had multiple research, work and volunteer experiences. Test scores (United States Medical Licensing Examination or USMLE) of successful applicants are consistently among the highest among all specialties.

Orthopaedic surgical training is also highly regulated. The United States Medical Licensing Examination (USMLE) is a three-step process. Orthopaedic surgery residents take the Orthopaedic In-Training Exam or OITE each November. The OITE offers both the individual and the program an indication of progress. Recent linking of the OITE and the American Board of Orthopaedic Surgery (ABOS) test make it predictive of success on certification boards. Board certification requires passing a seven-hour written examination just after graduating residency and an oral examination two years later. Initial board certification is valid for 10 years. Significant continuing medical education and further testing is required to maintain certification.

There are currently 218 accredited orthopaedic surgery residency programs in the US, with approximately 900 positions per year. The number of positions is regulated by the Residency Review Committee (RRC) of the Accreditation Council for Graduate Medical Education

(ACGME). Currently over 90% of residents pursue one year subspecialty fellowship training [6]. There are approximately 97 accredited orthopaedic trauma fellowship spots at 64 different sites, with all but a few associated with university hospital systems.

Orthopaedic surgery remains the least gender diverse medical specialty in the US. In 2022 approximately 7.4% of practicing orthopaedic surgeons were women [7]. Recent focused efforts to increase the rate of women applicants, faculty members and leaders in institutions and organizations has shown some measure of success. A recent study showed that the percentage of women residents had risen from 13.5% to 19.2% in the five years between 2017 and 2022 [8]. A similar lack of diversity relative to other underrepresented demographic groups has also been noted and has also become a dedicated focus of many institutions, residency programs and organizations.

Resident responsibilities increase as training progresses. The PGY-1 (post-graduate year 1) or intern typically takes first call for the ward and assists in surgery. The PGY-2 commonly takes primary call to the Emergency Department on trauma rotations but also assists or performs (under supervision) operative cases like ankle fractures and intertrochanteric femur fractures. PGY-3 and PGY-4 residents gradually transition from junior resident to senior resident with corresponding increasing responsibilities in the operative room and supervising junior residents. The PGY-5 or Chief Resident typically runs the service, manages the residents, determines deployment to cases and when junior residents are done for the day.

On call responsibilities vary widely by program as well as by specific subspecialty rotations. Some rotations may require Q3 or Q4 on call responsibilities, translating to 8–10 calls per month. The number of calls shifts may decrease as residents become more senior. Newer mandated hour restrictions dictate that residents may not work more than 24 h in a shift, must have 10 h off between shifts, must get one day off per week and must not work more than 80 h per week. Residents log their hours on-line and work hour violations are considered serious enough to threaten a residency program's accreditation.

The total number and types of surgeries that any resident may perform during the course of residency varies significantly from program to program. That said, the ACGME recommends 1000–3000 total cases with a goal of 2000 total cases. There are specific benchmark minimum number of cases for specific types of cases [9]. Residency programs may be cited, put on probation or closed if residents do not meet these benchmarks.

Resident salaries vary geographically, due to cost of living, with salaries ranging from \$60,000 to 80,000 per year, increasing as residents become more senior. Attending salaries currently average approximately \$500,000, but also vary significantly geographically with rural areas often needing to attract surgeons with lucrative offers. Additionally, orthopaedic spine surgeons tend to demand higher salaries, which has a significant impact on the overall average.

Residency programs in South Africa

After completing high school, students go directly into a university medical school for a period of 6 years. Following medical school there is a two year internship program in which one rotates through all the major medical disciplines. Following internship one must complete a nationally mandated year of community service in a public institution. The actual job therein may vary based on specific hospital needs.

After completing the community service requirement, young physicians are eligible to apply to a residency program. Due to the extremely competitive nature of orthopaedic residency training, many doctors do one to two years in orthopaedics in a regional hospital, honing their surgery skills even prior to taking the Primary Examination in Orthopaedics required for application to a residency program.

Orthopaedic residency training is five years. Residents are expected to complete 6 months in the Emergency Unit or in General Surgery, as well as three months in the ICU, though this may be done either prior to

or during orthopaedic residency training. Once this is completed, residents are eligible to take the Intermediate Examination. There are national guidelines available in terms of scope of training but only recently are they expected to log their cases on www.logbox.com. After a minimum of 48 months of training residents are eligible to take the exit Final Examination.

Due to the heavy trauma burden in the country, the first procedures residents perform are almost always trauma related, including open fracture debridement, application of external fixators, open reduction and internal fixation (ORIF) with plates and screws and intramedullary nails. Notably, about 50% of trauma surgery is performed by residents after hours.

Officially, resident working hours are 40 h week, though there is commonly 16 h of overtime for a total of 56 h per week. In reality though, at least in the first two years of training, residents may work upwards of 80 h per week. Residents cover call duty 6–8 days per month. The average annual remuneration for residents is 3000€–5000€. Residents get 22 days of vacation per year. Ratio of men to women in residency is 83% M: 17% F [10].

It is possible to do a PhD, but this is not widespread practice. There are currently fewer than 10 orthopaedic PhDs in South Africa, but this is slowly increasing. Post qualification subspecialty fellowships are possible but not mandatory. Local trauma fellowships are available, and these are extremely popular with international surgeons seeking exposure to trauma. Some surgeons go abroad to pursue subspecialty fellowship training in areas other than trauma.

There is job security after residency both in private and public sectors. Jobs in larger urban areas are more popular but scarce, whereas jobs in smaller towns are more abundant but less popular. Surgeons in smaller towns away from university hospitals tend not to get sufficient exposure to courses for continuing professional development.

A smaller number of surgeons emigrate as they are highly sought overseas [11].

Residency programs in Brazil

In Brazil, the Medical Residency Program in Orthopedics is a rigorous process that prepares professionals to excel in the area. With around 165 hospitals accredited by the Brazilian Society of Orthopedics and Traumatology (SBOT). The admission to residencies takes place through regional or specific exams, carefully selecting the best candidates [12].

Each year, after having completed six years of medical school, approximately 1100 physicians begin their orthopaedic residency journey, a period that lasts three years and is marked by dedication and intense learning. However, the high abandonment rate of nearly 20% reveals the challenge that some face along this path. The women/men ratio is 2/10. Subspecialty fellowships add one or two more years of study after residency [13].

Residents typically have a weekly workload of 60 h and an additional four to eight evenings/nights per month. Residents typically have the day off after taking call the previous night. Residents get 30 consecutive days of vacation per year.

Regarding responsibilities, first year residents are responsible for the inpatient unit and emergency room care, while second year residents participate more frequently in adult trauma surgeries, as well as pediatric trauma and other general orthopaedic cases. In the third year, more non-trauma subspecialty orthopaedic surgeries are added to resident responsibilities [14–16].

Surgeries play a key role in learning, and, over the course of residency, residents participate in an average of 1300 surgeries as assistants and perform around 500 surgeries as primary surgeons. The first trauma surgery is usually done in the second year.

Similarly, exams are also an important part of the training process, with a minimum of five exams taken during each year of residency. However, both the PhD degree and trauma fellow are only possible after

completing the residency. At the end of the three-year residency, residents face an extremely demanding test by the SBOT (Brazilian Society of Orthopedics and Traumatology), which includes one paper, a written test with 100 multiple-choice questions, a practical test with 16 clinical cases, 5 skills questions, 4 physical examination questions, 1 ethics question, and 30 anatomy questions [12].

Greater than 50% of the residents from any accredited hospital with a residency program must pass the specialist exam after residency. If 50% do not pass, the program is placed on suspension and if this happens again the following year, the residency may lose its accreditation [17].

Regarding job opportunities, the scenario is promising, but it varies according to the region, city and the subspecialty that the resident has chosen.

In short, the Medical Residency Program in Orthopedics in Brazil is an arduous yet rewarding journey, which prepares professionals to face the challenges of orthopedics with excellence. With the model adopted by SBOT, teaching is not an option for the Services, but a necessity, and for residents, studying is an obligation, whose main objective is to train specialists able to contribute significantly to the health and well-being of the population, assuming fundamental roles in the Brazilian medical society [12].

Residency programs in Japan

To practice orthopaedic in Japan, one begins by completing the required the six-year medical school in Japan or somewhere else before taking the Japanese board examination to obtain a medical license. Graduates who pass this exam can then start what is known as the junior residency program. Junior residency takes two years and involves mandatory rotations in specialties such as internal medicine, emergency medicine, community medicine and other elective subjects. There are 1024 hospitals available for junior residency programs [18,19].

After completing junior residency, candidates apply for senior residency in their chosen specialty. Senior residency in orthopaedic surgery is four years in length. There are 207 programs nationwide in Japan for orthopaedic surgery. As of 2020 there were 17,416 orthopaedic surgery specialists in Japan, with men comprising 16,606 (95%) and women comprising 870 (5%) [20].

Residents typically work hours 40 h per week. The number of days on call per month varies by hospital but averages one to two days per week. Responsibilities during residency include learning how to manage cases both conservatively and operatively, presenting at conferences and producing research publications. The first trauma surgeries for residents are simple fracture surgeries such as nailing intertrochanteric femur fractures. During the orthopaedic residency, a minimum 160 surgeries, with 80 as the primary surgeon is required.

Upon completion of residency, residents are evaluated by the main instructor of each hospital and are required to pass the national orthopaedic board exam to become orthopaedic specialists. In 2022, 599 applicants took the orthopaedic board exam and 530 passed (88.4%).

Admission to a Ph.D. program is possible at select universities and typically takes four years to complete. There are no nationally accredited orthopaedic trauma fellowship programs available after residency, but some hospitals offer their own non-accredited orthopaedic trauma fellowship programs.

In Japan, there are 16 Japanese public holidays. On top of this, residents usually get an additional 20 days of paid holidays, as well as five additional summer holiday days off from work. Resident salary is about 30,000–40,000€ per year. There are many orthopaedic job opportunities, but many hospitals are associated with university hospitals and generally, surgeons belong to university groups.

In JABO/OTC Japan, there are 3 standard courses and one advanced course per year [21].

There need more educational courses including cadaveric training.

Residency programs in Hong Kong, China

In Hong Kong, applicants for orthopaedic residency must first complete the medical school curriculum (e.g., MBChB 6-year Curriculum at The Chinese University of Hong Kong). After medical school there is a one year internship required after which one may apply for and enter orthopaedic training. Once admitted to the orthopaedic training program, residents are required to complete at least two years of basic surgical training and then four years of higher orthopaedic training. There are 16 orthopaedic accredited units that must be completed.

On average, approximately 10–30 orthopaedic residents are recruited every year in Hong Kong. There is a male to female ratio approximately 4:1, with an increasing trend in the number of female orthopaedic surgeons [22]. The working hours may vary between hospitals and rotations, but entails a 5-day work schedule per week and around 4–6 on-call duties per month, for a total of about 60–70 h per week. There are usual public holidays and annual leaves. Salary is approximately €8400–17,000 per month depending on relevant experience and qualification [23].

Residents are responsible for ward rounds and patient care, outpatient clinics, presentations in hospital meeting, and assisting and performing operations under the supervision of a mentoring surgeon. Residents start to perform their first trauma surgery as early as their first year of training under supervision by a senior surgeon when appropriate cases are available. During the later stage of orthopaedic training, they are required to fulfil the Index Operation Requirements in various sub-specialties [24].

Residents need to pass all 3 parts of the Hong Kong Intercollegiate Board of Surgical College Membership (MHKICSBC) Examination within a maximum period of 4 years. There is a selection procedure to be admitted as a Higher Orthopaedic Trainee. The higher orthopaedic training is completed in a minimum of 4 years including satisfactory performance in clinical rotations, meeting training point requirement, satisfactory number of index operation, completion of a research project under supervision, oral presentation at an orthopaedic related conference, publishing an orthopaedic related scientific paper in a HKCOS accredited peer-review journal as first author, passing the fellowship exit examination, and other requirements. Currently, the training program in Hong Kong is also accredited by the Royal College of Surgeons of Edinburgh (RCSEd). Therefore, the exit examination is a conjoint examination, which is The Hong Kong College of Orthopaedic Surgeons (HKCOS) and The Royal College of Surgeons of Edinburgh (RCSEd) Joint specialty Fellowship Examination in Orthopaedic Surgery. Obtaining a PhD during orthopaedic residency is not common in Hong Kong as it is not essential in the training program.

Subspecialty development and training usually starts after obtaining fellowship training. Orthopaedic Rehabilitation has an additional standardized training program and examination. AADO Chapter usually hosts 2 fracture fixation cadaveric workshops every year. More advanced workshops might be planned in future, to further improve the post-fellowship training of advanced trauma including complex pelvic fracture fixation, trauma revision surgeries.

Residency programs in Honduras

In Honduras, one must complete six years of medical school, do a one year internship and subsequently serve six months to one year of mandatory community service [25]. Only once this is done, can one pursue specialized residency training in orthopaedics.

Honduras has only one accredited orthopaedic surgery residency program. To gain access to it, one must take an exam that is given annually. This exam contains approximately 200 questions and candidates are allotted four hours to complete it. In addition to the exam, there is a scored interview. There are commonly 70–80 applicants/year for orthopaedic residency training [26]. Ultimately, four to six candidates are selected to begin to orthopaedic residency per year.

Honduras has a population of 9749,582 habitants. There are 224 registered orthopaedic surgeons, which represents one orthopaedic surgeon for every 35,000 habitants [27]. There are 11 female orthopaedic surgeons, which represents 5% (ratio 19 M:1 F).

In Honduras, a first-year resident's day usually starts at 4:30 a.m., due to the necessary work and responsibilities that have to be performed before 07:00 a.m., when the operative schedule starts. Residents do not leave the hospital until work is finished. On average, each resident works 15–16 h a day during weekdays and 9–12 hrs on weekends. There is an average of 7 days on call a month (about every 4 days), 12 hrs during weekdays and 24 hrs during weekends. There are no days off post call. Residents typically work greater than 90 h per week.

Resident responsibilities vary from year to year, but the first-year resident usually has the greatest work load. First year residents have to daily prepare admissions from the Emergency Department and conduct ward rounds on the in-patients. They are responsible for procedures like dressing changes and minor wound debridement. They apply musculoskeletal traction, casts and splints. They are in charge of medical admissions and discharges. On top of all this, they are also commonly needed in the operating room as first or second assistants.

During the second and third year of residency, work in the orthopaedic ward reduces significantly. They are in charge of presenting new admissions. Activities in the operating room include being first assistant in orthopaedic trauma surgery. They are in charge of surgical debridements and amputations. The first trauma surgery is usually performed during this second year of residency. Third year residents work predominantly in the operating room, where they are in charge of ambulatory trauma surgeries and perform most of the trauma surgeries while on call.

Residents typically do 30–40 surgeries a week or about 100–120 surgeries a month. By the time residents are in their last year, they perform around 1100 surgeries per year.

To successfully complete the residency program there are two exams per year as well as a final investigation thesis. There are no fellowship programs in the country, but many residents pursue fellowship training outside Honduras.

Residents get one month vacation per year. The monthly salary is 911€ per month, which is tax free, as it's considered a scholarship from the government. Upon graduation certified orthopaedic Surgeon Government Salary is 1314€ (1160€ after taxes). This salary is for a schedule of 6 h (Monday-Friday).

The biggest knowledge gap is probably related to the lack of studying time available for residents due to the amount of work that is required of them. Hospital Escuela is the main referral hospital in the country, one that receives trauma patients from all over the country. The sheer volume of trauma and the resources this demands directly reduces the number of elective non-traumatic orthopaedic surgeries (e.g. arthroplasties and sports medicine procedures) that can be performed, effectively limiting specialized training in most sub-specialties of orthopaedics other than trauma [28].

Conclusions

This review provides a narrative overview of resident training programs in different countries across the world. Although the number of countries is rather low, the strength of the study is that developing and developed countries all over the continents are represented. These reports highlight that orthopaedic surgical training is highly regulated per country, but also underlines the differences across countries. Access to the orthopaedic residency program is extremely competitive with test scores of applicants among the highest among all specialties. The analysis of these data shows that orthopaedic residency training varies from three to five years, with responsibilities increasing as training progresses. The total number and types of surgical procedures that residents perform during their residency vary significantly from program to program. Even with recently focused efforts to increase the rate of female

applicants, orthopaedic surgery continues to be among the least gender-diverse medical specialty. The evaluation of residents is an important mechanism to ensure steady progress, improve the quality of care and resolve any eventual problem. Resident salaries vary geographically and increase as residents become more senior. As an advantage, the demand for orthopaedic surgeons remains high worldwide. As a general drawback, the possibility of scientific research in polytrauma and fracture management could be improved.

Declaration of Competing Interest

The other authors and I have no pecuniary or other personal interest, direct or indirect, in any matter that raises or may raise a conflict with this paper.

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We also acknowledge that we shall make another declaration to state any change in any matter contained in this declaration within one month after the change occurs and shall provide further information on the particulars contained in this declaration if so required by Injury.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.injury.2023.111015](https://doi.org/10.1016/j.injury.2023.111015).

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