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SPECIAL TOPIC

Plastic Surgery Training Worldwide: Part 1. The United States and Europe

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Background: Major differences exist in residency training, and the structure and quality of residency programs differ between different countries and teaching centers. It is of vital importance that a better understanding of the similarities and differences in plastic surgery training be ascertained as a means of initiating constructive discussion and commentary among training programs worldwide. In this study, the authors provide an overview of plastic surgery training in the United States and Europe.
Methods: A survey was sent to select surgeons in 10 European countries that were deemed to be regular contributors to the plastic surgery literature. The questions focused on pathway to plastic surgery residency, length of training, required pretraining experience, training scheme, research opportunities, and examinations during and after plastic surgery residency.
Results: Plastic surgery residency training programs in the United States differ from the various (selected) countries in Europe and are described in detail.
Conclusions: Plastic surgery education is vastly different between the United States and Europe, and even within Europe, training programs remain heterogeneous. Standardization of curricula across the different countries would improve the interaction of different centers and facilitate the exchange of vital information for quality control and future improvements. The unique characteristics of the various training programs potentially provide a basis from which to learn and to gain from one another. *(Plast Reconstr Surg Glob Open 2016;4:e641; doi: 10.1097/GOX.0000000000000627; Published online 17 March 2016.)*

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Although plastic and reconstructive techniques have been described as early as 2500 B.C.,[1] it was only in the twentieth century that modern plastic surgery was formed under the influence of the European pioneers Morestin, Gillies, McIndoe, and Esser.[2,3] Over the next decades, formal plastic surgery training programs were established worldwide. In the United States, plastic surgery training programs have been present since 1937; most European plastic surgery training programs were started many years later.[4]

Because of the important role that plastic surgery plays in modern medical history, and the ever-increasing developments of this field, the proper and complete training of a plastic surgeon is of utmost importance. The aim of this study is to provide an overview of plastic surgery training in the United States

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and Europe. Providing an overview of the 51 countries in Europe is a challenging endeavor. Thus, countries with prominent contributions to this specialty in Europe were analyzed. To our knowledge, no such overview of plastic surgery training programs has been provided to date. It is of vital importance to have an understanding of the similarities and differences in global plastic surgery training, and perhaps this information may generate initial discussion and commentary from plastic surgeons around the world regarding areas of potential progress in trainee education.

METHODS

The available literature regarding plastic surgery training in the United States and the selected European countries was reviewed. A survey was sent to plastic surgeons of participating countries. Participants were selected through local contacts or contacted through the website of European Board of Plastic, Reconstructive and Aesthetic Surgery. The authors contacted the governing bodies of each country and asked for any information regarding training schemes and examinations. Most plastic surgery organizations have websites that provided further information (Table 1). This article rather focuses on basic principles and does not provide statistical analyses of the curriculum between the surveyed countries.

RESULTS

Training in the United States

There are 2 pathways into plastic surgery residency: independent plastic surgery programs (3 year duration) and integrated programs (6 year duration).[5] All integrated programs are now of 6 years duration. The integrated pathway is open to all applicants graduating from medical school and combines 1 to 2 years of prerequisite general surgery training with 4 to 5 years of subsequent plastic surgery training. The independent pathway mandates that an applicant complete formal training program in a surgical specialty (eg, general surgery, neurosurgery, ENT, orthopedics, urology, or maxillofacial surgery), after which one trains in plastic surgery for 3 years. During the plastic surgery training program period, there is an annual plastic surgery in-service examination for all residents, and a trainee is required to perform a minimum of 1150 operations that must cover a variety of areas within plastic surgery.[5,6] There is an 80-hour workweek limit for residents. Currently, there are 67 integrated plastic surgery residency programs approved by the Accreditation Council Graduate Medical Education that offer 148 integrated plastic surgery residency positions.[7] In 2015, there were 206 applicants for the available spots.[8] Passing the American Board of Plastic Surgery examinations is required to become a board-certified plastic surgeon. It is composed of 2 parts: (1) A written examination consisting of 400 multiple-choice questions covering the entire spectrum of plastic surgery. (2) After passing, the candidate has to register for an oral examination and has a 9-month period time to "collect" a minimum of 50 cases. Of these, 5 cases will be selected for the oral examination.[6] According to the American Board of Plastic Surgery, there are currently 6300 board-certified plastic surgeons in active practice.

Table 1. National Plastic Surgery Organization Websites

Country	Organization
United States	The American Board of Plastic Surgery https://www.abplsurg.org/
Norway	Norsk Plastikkirurgisk Forening http://legeforeningen.no/Fagmed/Norsk-plastikkirurgisk-forening/
Sweden	Swensk Plastikkirurgisk Förening http://www.spkf.se/
Germany	Deutsche Gesellschaft der Plastischen, Rekonstruktiven und Ästhetischen Chirurgen http://www.dgpraec.de/
The Netherlands	Nederlandse Vereniging voor Plastische Chirurgie http://www.nvpc.nl
United Kingdom	British Association of Plastic, Reconstructive and Aesthetic Surgeons http://www.baps.co.uk/
France	Société Française de Chirurgie Plastique Reconstructrice et Esthétique http://www.plasticiens.fr/
Spain	Sociedad Española de Cirugia Plastica Reparadora y Estètica http://secpre.org/
Italy	Società Italiana di Chirurgia Plastica Ricostruttiva ed Estetica http://www.sicpre.it/
Austria	Österreichische Gesellschaft für Plastische, Ästhetische und Rekonstruktive Chirurgie http://www.plastischechirurgie.org/
Poland	Polish Society of Plastic, Reconstructive and Aesthetic Surgery http://www.ptchprie.pl/

Training in the United Kingdom

After graduation from medical school, young doctors immediately move into a mandatory 2-year foundation program in clinical practice. After the second year, trainees can apply for 2 years of core surgical training by open application. Core surgical training consists of placement in a variety of surgical specialties each lasting from 4 to 6 months. After spending 2 years in core surgical training, of which a minimum of 6 months is spent in plastic surgery, and obtaining membership from the United Kingdom Royal College of Surgeons, the trainee can apply for plastic surgery training via a highly competitive national selection process.[9,10] Annually, there are approximately 130 to 160 applications for 10 to 20 residency positions. Trainees then proceed to complete 6 years of plastic surgery specialty training (ST3–ST8) and are required to perform a minimum of 2100 procedures over those 6 years of training. As part of their Annual Review of Competence Progression, a minimum of 1 presentation, 1 publication, and 1 audit is required per year. To be eligible for the certificate of completion of training, trainees are also required to pass the intercollegiate specialty examination Fellow of the Royal College of Surgeons (FRCS Plast), which consists of 2 parts.[11] Part I consists of multiple-choice questions, and Part II is composed of 2 days clinical and oral ("viva") examinations. There is a European 48-hour per week work limit for residents. Currently, there are 504 consultant (fulltime) plastic surgeons registered.[12]

Training in the Netherlands

In the Netherlands, recently graduated doctors are usually required to have 2 years of work experience as a "general practitioner" or to obtain a PhD before applying for residency positions in plastic surgery, although this is not mandatory. There are 10 plastic surgery programs in the Netherlands providing 16 plastic surgery spots on an annual basis.[13] Approximately 50 to 70 applicants apply for those residency spots. The plastic surgery training period is 6 years starting with 2 years of mandatory general surgery followed by a core curriculum of 4 years in plastic surgery. All residents are required to keep a (standardized) portfolio and to perform at least 600 procedures. There is a government-controlled weekly working hour limitation of 48 hours. Furthermore, a minimum of 1 presentation and 1 publication are required during residency. Residents are obliged to pass 3 mandatory courses: Microsurgery, Flap Dissections, and Osteosynthesis and Radiation Hygiene courses. The certification process in the Netherlands is under the authority of The Netherlands Society of Plastic Surgery.[13] There are 2 steps to complete the certification process. A written examination: every 6 months, during plastic surgery core training, a teaching day is organized dedicated to a specific topic, followed by an examination of 15 questions. The resident is required to pass at least 6 of the 8 examinations during the 4 years of core training. In the last year of the residency, there is a mandatory oral examination.

Training in Germany

In Germany, one can apply for residency training in plastic surgery immediately after graduation from medical school. Because residency training in plastic surgery is not centralized in Germany, an official number of annually available spots do not exist. Plastic surgeons can get licensed by the regional medical association ("Landesärtzekammer") to provide plastic surgery training to residents. Training licenses can range from 12 to 72 months, depending on the department or surgeon's caseload. Applying for plastic surgery training occurs through application to a specific surgeon eligible to provide plastic surgery training. Currently, 151 plastic surgeons are registered to provide plastic surgery training in Germany. There are approximately 35 "full-time" and 50 "part-time" plastic surgery training departments. Plastic surgery training consists of 2 years of basic surgical training and 4 years of specialized training in plastic surgery. In larger medical centers, chiefs of plastic surgery departments may be certified to provide basic surgical training and the full-length plastic surgery training. At other centers, general surgery department provides the basic surgical training. When one is accepted into plastic surgery residency at a "part-time" plastic surgery training department, the resident is required to "collect" 48 months of plastic surgery training in all different fields of plastic surgery by rotation to different centers. During residency, a resident needs to perform at least 640 procedures to be allowed to apply for the final examination. The training director needs to certify knowledge and stability of surgical performance to be accepted for the final examination. Regular working hours are 42 hours a week with an optional expansion of working hours up to 48 hours a week. After finishing residency training, an oral examination is held by 2 board-certified plastic surgeons and a supervisor organized by each federal country's medical association. There are 1571 board-certified plastic surgeons currently working in Germany.

Training in Norway

After graduation, one is required to do 18 months of mandatory internship in general surgery, internal medicine, and general practice to be granted legal

authorization to practice medicine independently. After this period, one is admissible for residency positions. There are 7 plastic surgery residency programs, but there are no annual spots. For each listed program, there are approximately 20 to 40 applicants. Each position is offered as a job where all qualified doctors can apply. Most positions are initially offered as a 6-month temporary assignment, during which one could be evaluated as a candidate for a full 4-year position when these become available. There are 41 available resident positions nationwide. Plastic surgery residency programs consist of 2 years of general surgery, which can be taken at any time point during the course of specialization, and 4 years of plastic surgery training. There is no fixed endpoint in the plastic surgery training program, and many residents spend a few extra years in training. There are no examinations taken during plastic surgery residency training, and there is no board examination after completion of residency. Residents are required to perform a total of 400 procedures before graduation, and this is not necessarily obtained within the 4 years timeframe. A resident can work for a maximum of 45 hours per week. Performing research is not required during residency. There are approximately 200 plastic surgeons registered in Norway.

Training in Sweden

Plastic surgery residency programs are offered at 8 University Hospitals, but there are no annual spots. Currently, there are 15 plastic surgery residents within the programs and all trainees in different years of their training. When a residency spot opens, approximately 50 to 120 applicants will apply. Plastic surgery residency training has a minimum duration of 6 years. There are a fixed numbers of goals and training objectives to be met before one is eligible to graduate residency. When applying for a plastic surgery residency position, there is a minimum of 18 months of clinical experience required, but most candidates have many years of clinical experience because of its competitiveness. The program itself is divided into 1 year of surgical training in urology, vascular surgery, and general surgery, and 5 years in plastic surgery. Performing research during residency is required. No examinations are required during or after residency. There are 137 plastic surgeons registered in Sweden.

Training in Austria

In Austria, there is a requirement of several publications and a minimum of 2 years of medical experience before starting plastic surgery residency. There are 2 to 3 spots available for plastic surgery residency posts annually. The duration of the training is 6 years in total, where 1 year is spent in general surgery, 6 months in trauma surgery, 3 months in internal medicine, 3 months in pathology, and 4 years in plastic surgery. A plastic surgery resident is required to take a board examination within the 42 months of training to complete their official training. The average workweek is 48 hours. There are currently 180 plastic surgeons in registered in Austria.

Training in Spain

Similar to the United States, students in Spain are required to obtain a bachelor's degree before applying for medical school. Within 1 year after graduating from medical school, all the graduates are required to pass a national examination called Medicao Interno Residente Sistema/Medical Internship system. Organized by the Ministry of Health, students with the highest Medicao Interno Residente Sistema/Medical Internship system results can choose their desired residency first. The residency program for plastic surgery is completely filled within the first 500 students who are eligible to choose first. The Ministry of Health offers 37 plastic surgery residency spots on an annual basis. Plastic surgery residency is 5 years. The first year of residency is divided into 4 blocks of 3 months each in plastic surgery, general surgery, orthopedic surgery, traumatology, and the intensive care unit. The second year is composed of rotations in different specialties peripherally related to plastic surgery, including pathological anatomy, urology, or vascular surgery. The last 3 years of a residency program are focused only on plastic surgery. The required number of procedures is 560 by the end of residency. Residents are restricted to a 69-hour workweek. No examinations are taken during or after residency. Currently, there are 1000 registered plastic surgeons.

Training in Poland

After medical school, one can immediately apply for plastic surgery residency training. There are 12 training programs with a total of 32 spots annually. Duration of plastic surgery residency is 6 years and is divided into 2 years of general surgery training followed by 4 years of plastic surgery training. Plastic surgery training is split into "modules," each covering different aspects of the specialty. After each individual module, an oral examination is taken. To acquire a full license, a minimum of 450 surgeries need to be performed by the resident. Poland has 193 registered plastic surgeons.

Training in France

In France, students need to obtain the highest rank in their final examination, taken during medi-

cal school, to apply for 1 of the 25 to 30 annual residency spots in plastic surgery. There is 1 national program, organized by the French College of Plastic Surgery. Nineteen universities organize the local residency program for plastic surgery. Every city is permitted to enroll 1 or 2 new residents each year. The total duration of residency is 6 years, 2 years of which are spent in general surgery. The resident needs to take a final examination 1 year after completing residency with a combination of oral and written parts. Seven hundred members are registered in la Société Française de Chirurgie Plastique, Reconstructrice et Esthétique (SOFCPRE). The SOFCPRE and the French College of plastic surgeons work together and are responsible for administering the board examinations. Performing research during residency is not required, but it is strongly recommended. There is no set minimum for the number procedures to be performed during residency. The weekly working hours for residents is approximately 60 hours.

Training in Italy

Before graduating medical school, students are required to complete a 3-month internship within the field of their chosen specialty before they can apply for a license to practice medicine. Once obtaining this license, an examination will take place to become qualified for a residency program. For plastic surgery, there are 30 residency programs and 39 plastic surgery spots on an annual basis. Candidates usually have 4 to 5 years of "general practitioner" experience before admission into a plastic surgery residency program. The duration of training is 5 years, of which 1.5 years are spent in general surgery. Weekly working hours average around 36 hours per week. At the end of every year, residents are required to pass an oral examination. By the end of 5 years of training, residents are required to write a thesis. There are 800 registered plastic surgeons currently working in Italy. There are no minimum numbers of procedures that a plastic surgery resident is required to perform during training.

Table 1 shows the national plastic surgery association websites. Table 2 shows the information provided by respondents to questionnaires and from board websites. Table 3 summarizes the overall differences in percentages. A total of 18% (n = 2) of the surveyed countries have no annual residency positions, 18% (n = 2) have <10 annual positions, 18% (n = 2) between 10 and 20 annual positions, 36% (n = 4) from

Table 2. Information Obtained from Questionnaire and Board Websites

Characteristics	United States	Norway	Sweden	Germany	The Netherlands	United Kingdom	France	Spain	Italy	Austria	Poland
Approximate age											
Graduating medical school	26–27	25	25	26	24–25	23–24	24	24	25	25	26
Starting plastic surgery program	28–29	27	27	26	26–29	28	24	25	30	27	26
Plastic surgery residency											
Total programs	67	7	8	35	10	1	19	1	30	30	12
Annual positions	148	—	2–3	—	16	10–20	25–30	37	39	2–3	32
Duration program (y)	6	6	6	6	6	8	6	5	5	6	6
Independent pathway*	3										
Content residency program											
Duration general surgery program (y)	2/0*	2	1	2	2	2	2	1.75	1.5	1	2
Duration plastic surgery program (y)	6/3*	4	5	4	4	6	4	3.25	3.5	4	4
Duty hours (per wk)	80	45	48	48	48	48	60	69	36	48	50
Total plastic surgery operations performed	1150	400	—	640	600	2100	—	560	—	—	450
Research required during residency	No	No	Yes	Yes	Yes	Yes	No	No	Yes	No	No
Examination											
During or after residency	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Registered plastic surgeons											
Plastic surgeons/100,000 inhabitants	1.98	3.87	1.41	1.94	1.71	0.79	1.11	2.09	1.30	2.19	0.50
Total number of plastic surgeons	6300	200	137	1571	289	504	700	1000	800	180	193

*Independent pathway (plastic surgery residency program in the United States).

Table 3. Summary of General Overview in Percentages

Annual residency positions, n (%)	0 (18)	<10 (18)	10–20 (18)	20–40 (36)	>40 (9)
Minimum required plastic surgery operations, n (%)	No set minimum (36)	<500 (18)	500–1000 (27)	>1000 (18)	
Working hour restriction during residency, h (%)	>48 (18)	48–50 (55)	60–70 (18)	>70 (9)	
Total plastic surgery residency, y (%)	5 (18)	6 (72)	8 (9)		
Plastic surgery training, y (%)	4 (55)	5 (18)	6 (9)		
General surgery training, y (%)	2 (55)	<2 (45)			
Conducting research during residency, no/yes (%)	No (55)	Yes (45)			
Examination during or after residency, no/yes (%)	No (27)	Yes (73)			

20 to 40 annual positions, and 9% (n = 1) >40 annual positions. Plastic surgery residency training is 8 years in 9% (n = 1), 6 years in 72% (n = 8), and 5 years in 18% (n = 2). Of these, 55% (n = 6) have 2 years of general surgery training and 45% (n = 5) have less than 2 years of general surgery training. Plastic surgery training in the residency program is 6 years in 9% (n = 1), 5 years in 18% (n = 2), and 4 years in 55% (n = 6) countries. During plastic surgery training, the minimum required operations to be performed by the resident is >1000 in 18% (n = 2), 500 to 1000 in 27% (n = 3), and <500 in 18% (n = 2)

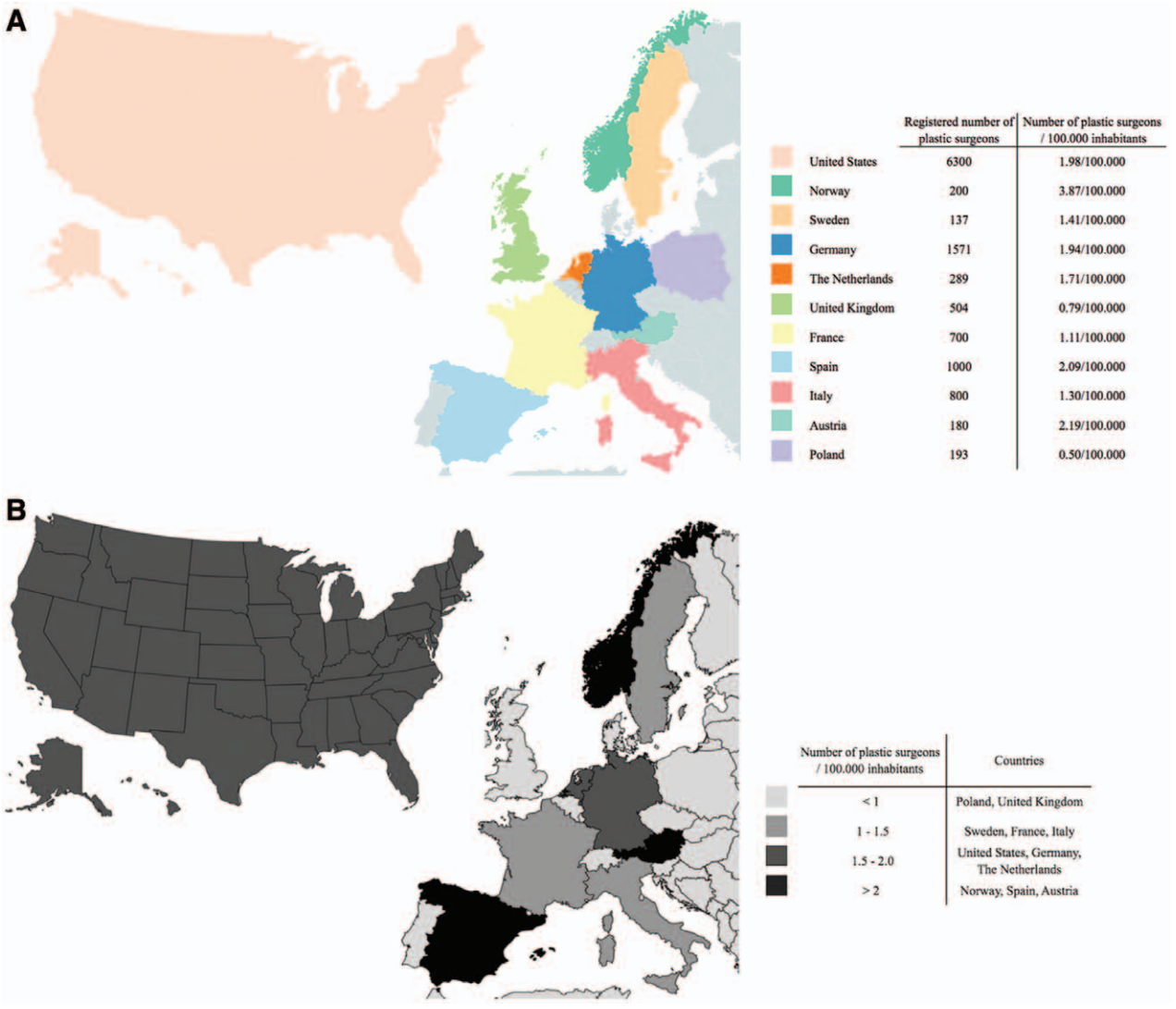

Fig. 1. A, Number of registered plastic surgeons and the number of plastic surgeons per 100,000 inhabitants. B, Density levels of plastic surgeons per country.

and in 36% (n = 4); there are no set minimum required cases that have to be performed. Furthermore, in 45% (n = 7), conducting research is required during residency training. In 73% (n = 8) of the surveyed countries, an examination is taken during or after residency. Finally, working hour restriction is <48 hours in 18% (n = 2), 48 to 50 hours in 55% (n = 6), 60 to 70 hours in 18% (n = 2), and >80 hours in 9% (n = 1) country. Figure 1A shows the number of registered plastic surgeons and the number of plastic surgeons per 100,000 inhabitants. Figure 1B shows the gradation color-coding density levels of plastic surgeons per country. Figure 2 shows the approximate age for graduating medical school and indication of the age for starting plastic surgery training per country. Figure 3 represents plastic surgery residency, including general surgery rotations, and Figure 4 shows the workweek hour regulation of residents.

DISCUSSION

Plastic surgery residency training programs differ in the duration of training, oversight by national accreditation councils, required experience/number of procedures performed, weekly work hours, and board certification process. The quality of surgical training has traditionally been determined by volume of cases and time in training.[14] Current evidence sug-

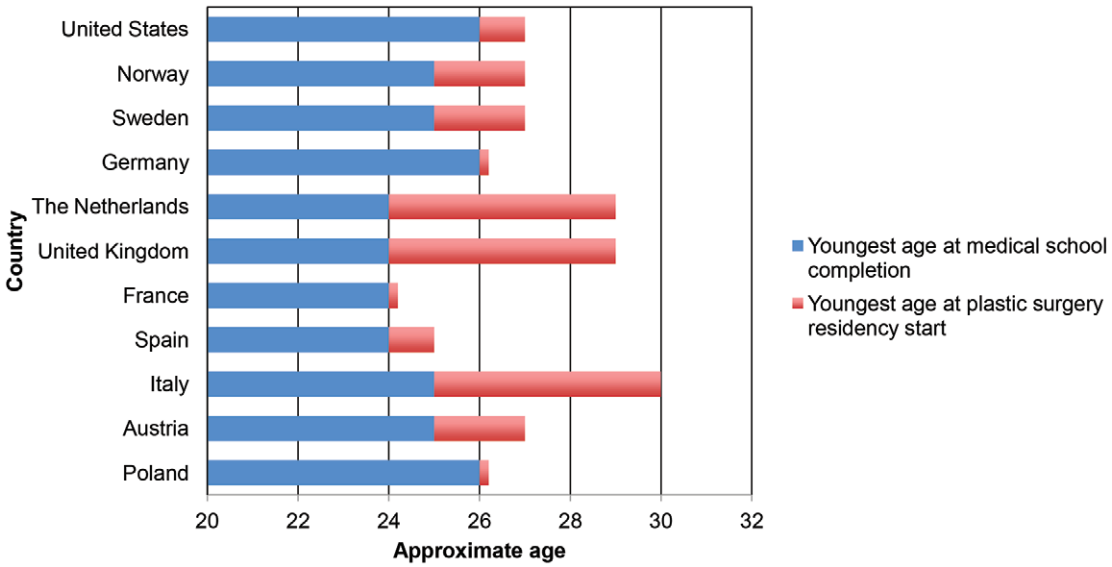

Fig. 2. Approximate age for graduating medical school and an indication of age when starting plastic surgery training.

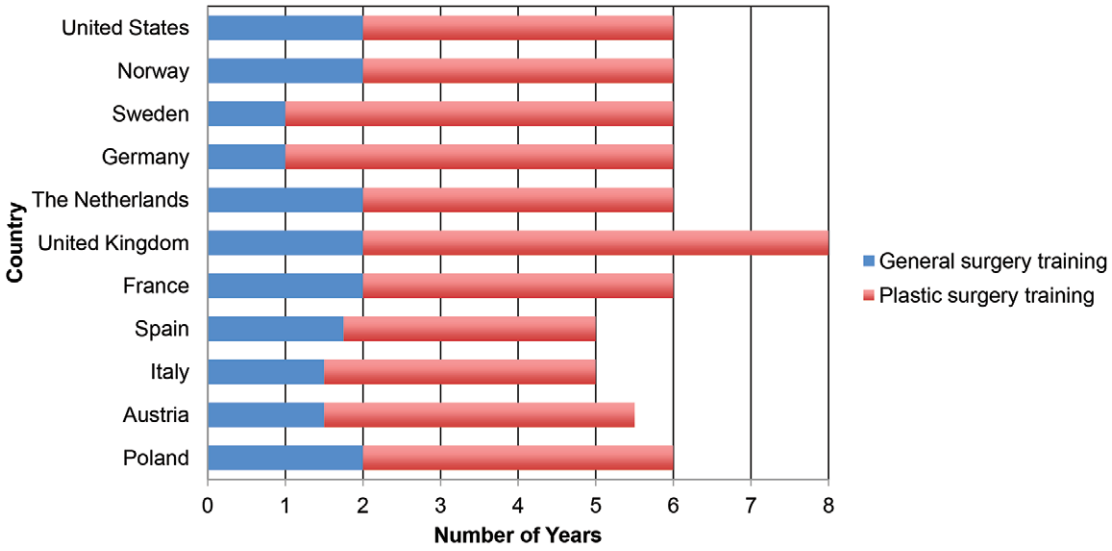

Fig. 3. Duration of plastic surgery training including mandatory general surgery rotation.

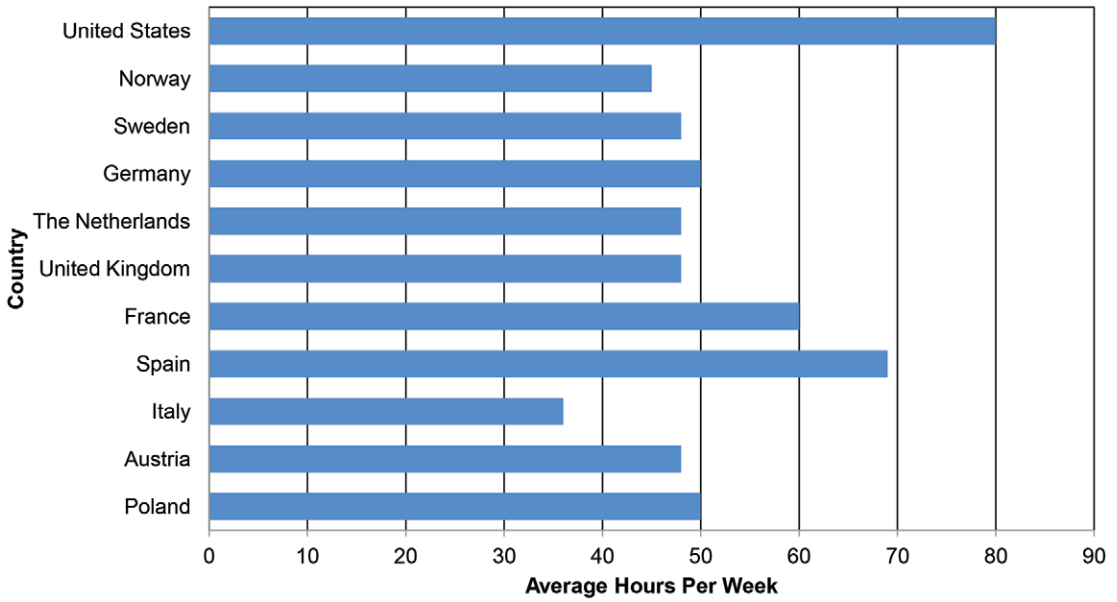

Fig. 4. Workweek hour regulation for plastic surgery residents.

gests that improved patient outcomes can be correlated with increased operative volume.[15] Over the last decade, work hour restrictions have been enforced by law in most Western countries. In the European Union, implementation of the European Working Time Directive has progressively limited the average workweek for medical residents from a maximum of 58 hours in 2004 to 48 hours in 2009.[16] In a similar fashion, the Accreditation Council Graduate Medical Education instituted an 80-hour limited workweek for residents in the United States.[17] To date, there still exists intense debate over the impact of trainee work-hour restrictions, which will further reduce exposure and therefore possibly volume.[18,19] Most surgeons would argue that case volume plays a significant role in surgical training. However, a study by Hopmans et al[20] showed that the reduction in work hours in the Netherlands from 58 to 48 hours did not adversely affected the number of surgical procedures performed nor did it impact the operative experience of surgical residents. One may argue that working hours is therefore not a sole indicator of high-quality training.

Most programs have national governing boards, national standards, and national examinations. A few countries require some kind of research or publication before graduation; many others, however, lack sufficient resources to provide opportunities for independent research activities. A majority of programs use a combination of oral and written examinations to help assess residents' progress. In all countries except Spain, Norway, and Sweden, residents are required to pass examinations to graduate from their programs.

This review has several limitations. First, there was a subjective selection of the countries studied in Europe. With 51 European countries, all training programs could not be included in this study. There may be bias in data collection and variability between centers. Second, the authors did not include several factors in the survey such as graduate medical student, resident debt, postresidency fellowship training, and practice patterns after residency. These factors are of importance to gain a better understanding of the existing differences between countries. Further research is needed to gain clear insight on these topics. In addition, references are limited, as little previous work has described international plastic surgery training.

CONCLUSIONS

Plastic surgery training is notably different between the United States and Europe, and even within Europe, training programs remain heterogeneous. Perhaps standardization of curricula across the different countries would improve the interaction of different centers and facilitate the exchange of vital information for quality control and future progress.

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