

RESEARCH ARTICLE

Subspecialties and Characteristics of Leadership Position in Orthopaedic Surgery

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Abstract

Objectives: The composition of department leadership, notably the Department Chair and Program Director, plays a pivotal role in “Match” decision making and further residency training. This study aims to examine the current landscape of subspecialties and other demographic characteristics of the Department Chairs and Program Directors of orthopaedic surgery residency programs across the United States.

Methods: A list of Department Chairs and Program Directors of all 201 ACGME orthopaedic surgery residency programs was generated from the Orthopaedic Residency Information Network (ORIN) website. Demographic information, years of practice, research productivity (H-Index), and subspecialty for both Chairpersons and Program Directors were gathered. Information was available on 163/201 department chairs and 199/201 program directors.

Results: Among the 163 Department Chairs, Sports (24.5%), Adult Reconstruction (16.6%), and Trauma (13.5%) emerged as the most prevalent subspecialties, while Shoulder and Elbow (5.5%), Pediatrics (3.7%), and General Orthopedics (1.8%) were the least represented. Among the 199 Program Directors, Trauma (22.1%), Sports (17.1%), and Hand and Upper Extremity (14.1%) were the most common, while Shoulder and Elbow (6.0%), Foot and Ankle (5.5%), and General Orthopedics (1.0%) were the least represented. Chairpersons exhibited notably higher mean years of practice, mean H-index, and were more commonly male compared to Program Directors. However, in the multivariable regression model predicting leadership position, only years of practice and H-index were found to be significant predictors.

Conclusion: Sports, trauma, joint reconstruction, and hand were the most common subspecialties among those in positions of leadership explained by their higher prevalence among American-board orthopedic surgeons. Furthermore, H-index and years of practice were both predictors of being a chairperson.

Level of evidence: III

Keywords: Chairperson, Leadership position, Orthopaedics, Program director, Residency, Subspecialty

Introduction

Orthopedic surgery is a surgical specialty that focuses on the surgical care of bones, joints, muscles, tendons, and ligaments, ensuring the maintenance and proper function of the musculoskeletal system.¹ Today, orthopedic surgeons commonly subspecialize into general, sports/shoulder, hand, joint reconstruction, trauma, foot and ankle, pediatrics, spine, and oncology.^{2,3} The duration of most orthopedic residencies is typically five years,

although some may extend to six years or beyond.⁴ After completing residency, over 90% of orthopedic residents opt for fellowship training to develop subspecialty interests and operative skills.⁵ These fellowships typically span one year, with some individuals pursuing multiple fellowships.⁶

In addition to the extensive duration of education, entering the field of orthopedic surgery demands scaling

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the heights of one of the most competitive specialties in the medical field.^{7,8} Every year since the 1950s, medical students are “matched” into their future residencies by the National Resident Matching Program (NRMP), which ensures a fair alignment of applicants' residency preferences with program directors' preferences for candidates.⁹ The Match application cycle comprises of two phases: the first involves submitting applications to the Electronic Residency Application Service (ERAS) to receive interview invitations, while the second phase extends from the interview season to the deadline by which the rank order list must be submitted. In orthopedic surgery, the initial phase relies on objective criteria, such as United States Medical Licensing Examination (USMLE) board exams, Alpha Omega Alpha status (AOA), letters of recommendation, performance on away rotations, and extracurricular activities like research or volunteer involvements, among others. The subsequent phase incorporates subjective factors such as interview performance and interactions with program faculty, residents, and staff.⁶ A critical factor in the “Match” decision making and overall residency training is the makeup of the department's leadership: the department chairs and program directors.^{10,11}

While some studies have investigated the demographics of the orthopedic residency program directors,^{10,12} none have analyzed the subspecialties of both the orthopedic department chairs and program directors of all the orthopedic residency programs.¹¹ Recognizing the significance of leadership in orthopedic surgery programs for navigating the present state of healthcare and future surgeon training,¹¹⁻¹³ we aim to examine the subspecialties of the department chairs and program directors of orthopedic residency programs in the United States.

Materials and Methods

Study design

Two reviewers searched all 201 ACGME orthopaedic surgery residency programs on the Orthopaedic Residency Information Network (ORIN) website (<https://orin.aoassn.org/>) in February 2024 and created a list of all Chairpersons and Program Directors. Residency programs not listed in ORIN were searched for on Google [Figure 1].

Data Collection

The collected data included gender, years of practice, H-Index, US region, and subspecialty. The practicing specialty of each Chairperson and Program Directors was then determined using each residency programs website. Subspecialty was categorized as “Sports”, “Adult Reconstruction”, “Trauma”, “Spine”, “Musculoskeletal Oncology”, “Hand and Upper Extremity”, “Foot and Ankle”, “Shoulder and Elbow”, “Pediatrics”, “General Orthopaedics”. When present, discrepancies between the two reviewers were resolved by a third party.

Statistical methods

Categorical variables were expressed as proportions (percentages), and continuous variables were expressed as means \pm standard deviations. Differences in categorical variables between Chairs and Program directors were assessed using either Fishers-exact tests or Chi-squared tests. The student t-test and ANOVA test were used to assess differences in continuous variables between leadership positions. A logistic multivariable regression predicting the leadership position (chair or program director) was used controlling for subspecialty, gender, years of practice, and H-index. The threshold for statistical significance was set at $p \leq 0.05$. All statistical tests and analyses were performed using SPSS version 25.0 software (SPSS Inc., Chicago, IL, USA).

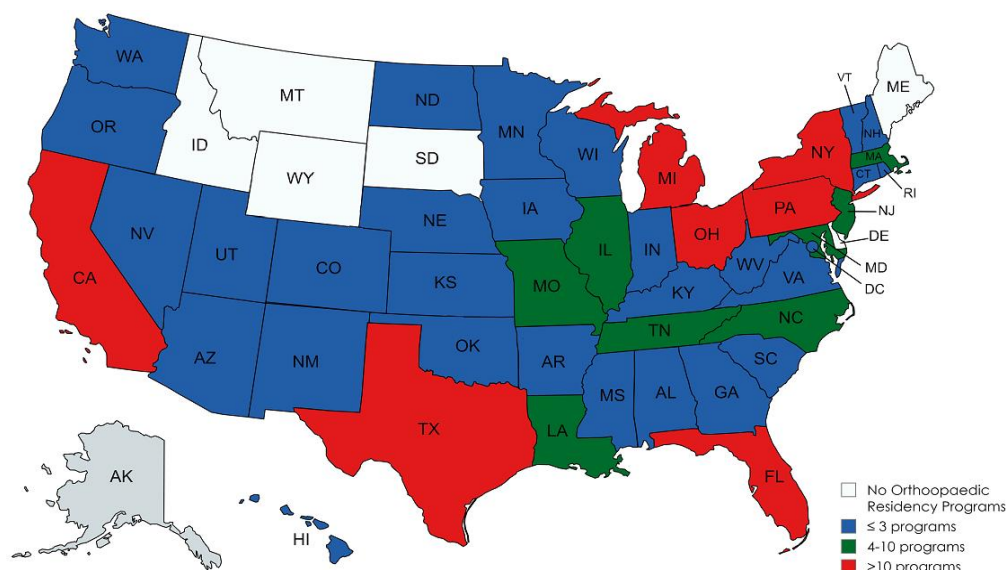


Figure 1. Heatmap of residency programs in the United States

Results

Chairperson Specialty

Of the 201 ACGME accredited orthopaedic residency programs, 163 (81.5%) had a chairperson. The top three most common specialties were Sports (24.5%), Adult Reconstruction (16.6%) and Trauma (13.5%). The three least common specialties were Shoulder and Elbow (5.5%), Pediatrics (3.7%) and General Orthopaedics (1.8%) [Table 1]. The proportion of males to females was higher in all subspecialties with 95.1% of the chair positions being

occupied by males. The mean years in practice for chairpersons was 26.3 ± 8.5 years with the minimum being 22.3 ± 7.0 years in shoulder and elbow specialists and the maximum 30.3 ± 8.8 years for pediatrics. The mean H-index for chairpersons was 27.5 ± 20.9 with the minimum being 20.5 ± 15.7 for Sports and the maximum 34.4 ± 29.6 for spine. The mean H-index for chairpersons did not differ by regions [Figure 2, Table 2]. Eight (4.8%) chairpersons had dual specialty training with the most common second subspecialty being Trauma (50%) [Table 3].

Table 1. Subspecialty of 163 residency program Chair				
Specialty	N, (%)	Males/Females (% of males)	Years of Practice	H-Index
Sports	40 (24.5)	38/2 (95%)	25.9 ± 8.3	20.5 ± 15.7
Adult Reconstruction	27 (16.6)	27/0 (100%)	29.7 ± 8.7	34.2 ± 25
Trauma	22 (13.5)	22/0 (100%)	27.3 ± 8.3	26.6 ± 18.0
Spine	19 (11.7)	19/0 (100%)	26.6 ± 6.1	34.4 ± 29.6
Musculoskeletal Oncology	16 (9.8)	14/2 (88%)	24.9 ± 9.0	25.6 ± 22.2
Hand and Upper Extremity	11 (6.7)	10/1 (91%)	27.2 ± 6.5	26.8 ± 16.1
Foot and Ankle	10 (6.1)	10/0 (100%)	19.9 ± 10.4	27.3 ± 14.5
Shoulder and Elbow	9 (5.5)	8/1 (89%)	22.3 ± 7.0	29.5 ± 20.8
Pediatrics	6 (3.7)	4/2 (67%)	30.3 ± 8.8	33.0 ± 18.6
General Orthopaedics	3 (1.8)	3/0 (100%)	22.7 ± 15.0	NA
Total	163 (100%)	155/8 (95.1%)	26.3 ± 8.5	27.5 ± 20.9

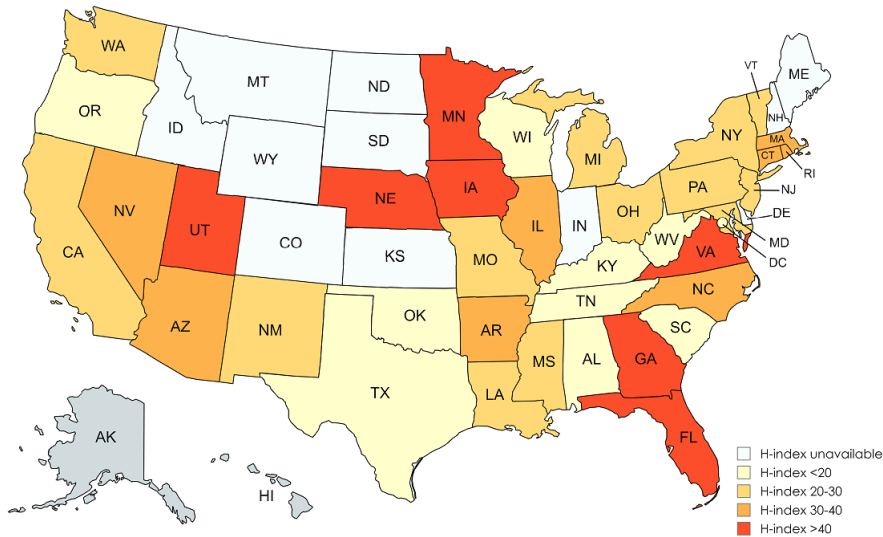


Figure 2.Heatmap of chairperson H-index by state

Table 2. Mean H-index of chairpersons by region		
Region	H-Index	p-value
Northeast	28.4 ± 23.6	0.92
Midwest	28.3 ± 21.0	
South	25.7 ± 17.9	
West	28.4 ± 21.2	

Table 3. Second subspecialty of 8 chairs with dual fellowship training				
Specialty	N, (%)	Males/Females (% of males)	Years of Practice	H-Index
Trauma	4 (50)	4/0 (100%)	31.8 ± 9.3	40.3 ± 16.7
Hand and Upper Extremity	1 (12.5)	1/0 (100%)	37.0	31.0
Pediatric Hand	1 (12.5)	0/1 (0%)	25.0	53.0
Shoulder and Elbow	1 (12.5)	1/0 (100%)	40.0	79.0
Spine	1 (12.5)	1/0 (100%)	36.0	36.0

Program Director Specialty

Of the 201 ACGME accredited orthopaedic residency programs, 199 (99.5%) had a program director. The top three most common specialties were Trauma (22.1%), Sports (17.1%) and Hand and Upper Extremity (14.1%). The three least common specialties were Shoulder and Elbow (6.0%), Foot and Ankle (5.5%) and General Orthopaedics (1.0%) [Table 4]. The proportion of males to females was higher in all subspecialties with 88.4% of the program directors being males. The mean years in practice for

program directors was 17.3 ± 8.1 years with the minimum being 12.9 ± 3.9 years in shoulder and elbow specialists and the maximum 24.0 years for general orthopaedics. The mean H-index for chairpersons was 12.3 ± 12.0 with the minimum being 9.3 ± 7.0 for Pediatrics and the maximum 18.3 ± 6.4 for Shoulder and Elbow. In addition, the mean H-index was highest in the Northeast compared to other US regions [Figure 3, Table 5]. Six (3.0%) Program Directors had dual specialty training with the most common second subspecialty being Trauma (50%) [Table 6].

Table 4. Subspecialty of 199 residency program directors				
Specialty	N, (%)	Males/Females (% of males)	Years of Practice	H-Index
Trauma	44 (22.1)	41/3 (93%)	16.3 ± 8.6	10.8 ± 11.7
Sports	34 (17.1)	33/1 (97%)	20.8 ± 8.2	12.7 ± 9.7
Hand and Upper Extremity	28 (14.1)	23/5 (82%)	17.6 ± 8.3	10.6 ± 5.3
Adult Reconstruction	22 (11.1)	21/1 (96%)	16.9 ± 8.2	16.5 ± 25.0
Spine	18 (9.0)	17/1 (94%)	19.2 ± 7.0	12.3 ± 13.4
Pediatrics	15 (7.5)	8/7 (53%)	14.0 ± 8.7	9.3 ± 7.0
Musculoskeletal Oncology	13 (6.5)	11/2 (85%)	15.8 ± 7.8	13.3 ± 9.2
Shoulder and Elbow	12 (6.0)	10/2 (83%)	12.9 ± 3.9	18.3 ± 6.4
Foot and Ankle	11 (5.5)	10/1 (91%)	18.0 ± 7.8	9.8 ± 4.9
General Orthopaedics	2 (1.0)	2/0 (100%)	24	12
Total	199 (100%)	176/23 (88.4%)	17.3 ± 8.1	12.3 ± 12.0

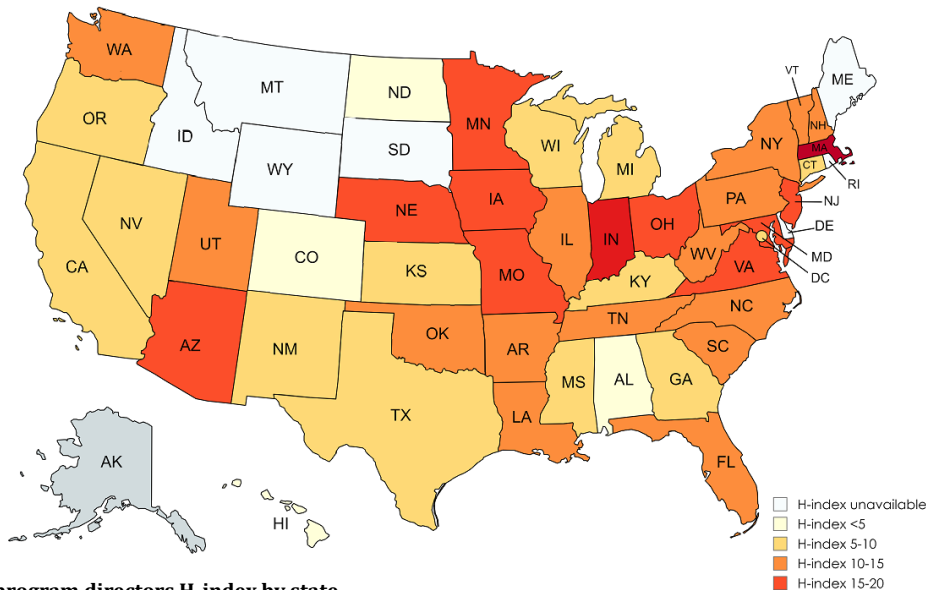


Figure 3. Heatmap of program directors H-index by state

Table 5. Mean H-index of program directors by region

Region	H-Index	p-value
Northeast	15.7 ± 13.3	0.05
Midwest	13.0 ± 16.8	
South	10.3 ± 6.7	
West	9.2 ± 7.3	

Table 6. Second subspecialty of 6 program directors with dual fellowship training

Specialty	N, (%)	Males/Females (% of males)	Years of Practice	H-Index
Trauma	3 (50.0)	3/0 (100%)	14.3 ± 11.0	15.5 ± 3.5
Musculoskeletal Oncology	2 (33.3)	2/0 (100%)	7.0 ± 4.2	7.5 ± 0.7
Pediatrics	1 (16.7)	0/1 (0%)	14.0	11.0

Chairperson vs Program Director

When comparing the characteristics of chairpersons to program directors, gender, years of practice, and H-Index were found to be significantly different. Chairpersons had a higher average years in practice (26.3 ± 8.5 vs 17.3 ± 8.1 , $p < .001$), a higher H-index (27.5 ± 20.9 vs 12.3 ± 12.0 , $p < .001$), and their position was occupied by a higher proportion of males (95.1% vs. 88.4% $p = 0.024$). The

significant difference in years of practice between program directors and chairpersons remained consistent across the different subspecialties except for general orthopaedics [Table 7]. As for H-index, it remained consistent across the different subspecialties except for Shoulder and Elbow. When analyzing the proportion of males across the different subspecialties, the difference was not statistically significant.

Table 7. Comparison of gender, years of practice, and H-index between chairs and program directors

Specialty	Variable	PD	Chair	P-value
Trauma	Number of males (%)	41 (93%)	22 (100%)	0.21
	Years of practice	16.3 ± 8.6	27.3 ± 8.3	<0.001
	H-index	10.8 ± 11.7	26.6 ± 18.0	0.001
Sports	Number of males (%)	33 (97%)	38 (95%)	0.65
	Years of practice	20.8 ± 8.2	25.9 ± 8.3	0.01
	H-index	12.7 ± 9.7	20.5 ± 15.7	0.02
Hand and Upper Extremity	Number of males (%)	23 (82%)	10 (91%)	0.50
	Years of practice	17.6 ± 8.3	27.2 ± 6.5	0.002
	H-index	10.6 ± 5.3	26.8 ± 16.1	0.02
Adult Reconstruction	Number of males (%)	21 (96%)	27 (100%)	0.26
	Years of practice	16.9 ± 8.2	29.7 ± 8.7	<0.001
	H-index	16.5 ± 25.0	34.2 ± 25	0.03
Spine	Number of males (%)	17 (94%)	19 (100%)	0.30
	Years of practice	19.2 ± 7.0	26.6 ± 6.1	0.002
	H-index	12.3 ± 13.4	34.4 ± 29.6	0.007
Pediatrics	Number of males (%)	8 (53%)	4 (67%)	0.58
	Years of practice	14.0 ± 8.7	30.3 ± 8.8	0.001
	H-index	9.3 ± 7.0	33.0 ± 18.6	0.03
Musculoskeletal Oncology	Number of males (%)	11 (85%)	14 (88%)	0.82
	Years of practice	15.8 ± 7.8	24.9 ± 9.0	0.008
	H-index	13.3 ± 9.2	25.6 ± 22.2	0.06
Shoulder and Elbow	Number of males (%)	10 (83%)	8 (89%)	0.72
	Years of practice	12.9 ± 3.9	22.3 ± 7.0	0.001
	H-index	18.3 ± 6.4	29.5 ± 20.8	0.18

Table 7. Continued				
Foot and Ankle	Number of males (%)	10 (91%)	10 (100%)	0.32
	Years of practice	18.0 ± 7.8	19.9 ± 10.4	0.66
	H-index	9.8 ± 4.9	27.3 ± 14.5	0.002
General Orthopaedics	Number of males (%)	2 (100%)	3 (100%)	1.0
	Years of practice	24	22.7 ± 15.0	0.95
	H-index	12	NA	--
Total	Number of males (%)	176 (88.4%)	155 (95.1%)	0.024
	Specialty	-	-	0.046
	Years of practice	17.3 ± 8.1	26.3 ± 8.5	<0.001
	H-index	12.3 ± 12.0	27.5 ± 20.9	<0.001

A regression model predicting the leadership position controlling for specialty, gender, years in practice, and H-index showed that only years in practice ($\beta=0.11$, $p<.001$) and H-

index ($\beta=0.05$, $p<.001$) were statistically significant contributors to the model ($R^2=0.42$) [Table 8].

Table 8. Multivariable logistic regression predicting leadership position types			
Variable	β	P-Value	
Specialty	-0.02	0.64	
Gender	0.34	0.49	
Years of practice	0.11	<0.001	
H-Index	0.05	<0.001	
R2	0.42	--	

Discussion

Examining the subspecialties of leadership positions in orthopedic surgery is important as it may draw attention to the uneven distribution of such positions. Our study revealed that sports, adult reconstruction, and trauma were the most prevalent in chairperson positions, while trauma, sports, and hand surgery were the most common in program director positions. In addition, H-index, years of practice, and the proportion of males were all higher in chairpersons, with both higher H-index and years of practice being predictive of a chairperson position than a program director one.

In the 2018 American Academy of Orthopaedic Surgeons (AAOS) census, sports medicine, joint reconstruction, hand surgery, and trauma were the most common subspecialties among orthopedic surgeons.¹³ In addition, the mean tenure time of both leadership positions is around 8 years which makes the 2018 census the closest to accurately representing the subspecialties of all orthopaedic surgeons at the time of leadership position appointment.^{10,14} The greater number of surgeons in these subspecialties may explain their higher prevalence in leadership positions. This is further reinforced by our results showing that subspecialty was not statistically significant in predicting the leadership position.

Several ways exist to measure research productivity such as the number of publications and/or citations.¹⁵ However, using the H-index could account for both.^{16,17} Our results show that a higher H-index is seen in chairpersons when

compared to program directors, and is an independent predictor of being a chairperson. Research productivity is a major factor associated to academic career success, higher institutional ranking, and a higher chance of promotion.¹⁸⁻²¹ However, one must note that the H-index and years of practice are two correlated factors and were both shown to be higher in chairpersons as well as independent predictors. In fact, Clark et al. reported that it took a mean of 17.9 years from the first year of practice to get elected as a chairperson, whereas another study showed that it took a mean of 10 years from residency completion to get elected as a program director.^{10,14} This could explain why chairpersons had a significantly higher H-index and years of practice.

A higher proportion of males occupied both leadership positions. There is a clear underrepresentation of females in the field of orthopedics, with only 7.4% of practicing orthopedic surgeons being female as of 2022.²² It is anticipated that orthopedic surgery will not achieve equal female representation until 115 years from now.²³ It typically takes on average at least 10 years to attain a leadership position, which explains the male predominance in these positions, especially considering that the number of female practicing surgeons was even less one decade ago. Nevertheless, a significantly higher proportion of females was seen in the program director positions compared to chairpersons. This may suggest that the number of females in leadership positions is improving. However, assessing this

change in chairperson positions may take longer, as it requires more time to attain that position compared to becoming a program director.^{10,14}

Strengths and limitations

This is the most recent cross-sectional study with the most up-to-date data on subspecialties and demographic characteristics of orthopaedic leadership positions. However, one must note that such findings may differ over several years. In addition, not all details could be obtained for each leadership position. Furthermore, the h-index and years in practice collected are current as of the present day, and could not be collected at the time of being assigned the leadership position, which might overestimate the studied parameters.

Conclusion

Sports, joint reconstruction, and Trauma were the most common subspecialties in chairperson while trauma, sports and hand surgery were the most common among the program directors. Furthermore, male proportion, years of practice, and H-index were all higher in chairperson with the last two characteristics being independent predictors of chairperson over program directors. Understanding this quantitative breakdown of subspecialties and related demographics offers insight into the current landscape of orthopedic residency program leadership, facilitating informed decisions for future development and diversity initiatives within the field.

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TP: data collection and data organizing/analysis.
MB: data collection and data organizing/analysis.
PY: data collection and data organizing/analysis.
PB: data collection and data organizing/analysis.
RL: data collection and data organizing/analysis.
MYF: data collection and data organizing/analysis.

MD: Writing original draft.

OC: Writing original draft.

AZK: review and editing

JAA: review and editing

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