The Distribution of Subspecialties in Ophthalmology Group Practices

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Movement toward multisubspecialty group practices prompted these investigators to develop a staffing model, based on employee work-time allocation, to guide new group practices or those looking to add to their current practice.

Many competing models of health care delivery are emerging in the new millennium. One model that is gaining popularity is the multisubspecialty group practice because it is an effective way to deliver efficient, high-quality care.[1-4] The synergies provided by such groups are especially important in times of scarce resources. The primary aim of this study is to describe how academic ophthalmology group practices in the United States allocate work time to their various subspecialties. If a common staffing trend is found among a large number of independent practices, it may be useful as a rough, baseline guide for those forming a new practice or expanding a current practice.

Work-time allocation for each subspecialist in a large group practice is challenging due to the rapid advances in medicine and the numerous changes in health care delivery. New reimbursement plans, new screening techniques, innovative equipment, new treatments, the availability of subspecialists for employment, as well as departmental budgetary constraints must be considered. The distribution of work-time allocation in any given practice may not always perfectly reflect the underlying clinical demand but instead may reflect an attempt to meet clinical demands under the numerous constraints of the delivery system. Our pragmatic study primarily focuses on how practices handle the numerous and often conflicting factors that they are confronted with when trying to meet the needs of their patients.

Ophthalmology is particularly well suited to this type of study, given the numerous subspecialty divisions in the field. We chose academic centers because they are independent groups that provide a wide variety of subspecialty care. We examined the Web sites of 40 medical schools for information on the following subspecialties: comprehensive care, retina, glaucoma, cornea, oculoplastics, pediatric ophthalmology, neuro-ophthalmology, and uveitis. Several comprehensive workforce studies have been conducted that estimated the future supply and demand of clinical specialists.[5-11] To our knowledge, we found no studies in the literature that focused on the level of multisubspecialty group practices in ophthalmology.

METHODS

Collection of Data

From a listing of accredited medical schools in the United States, we randomly selected 1 medical school from each of the 45 states and the District of Columbia. We found no listings for medical schools in Alaska, Delaware, Montana, Idaho, and Wyoming; therefore, these states were excluded from our sampling.

We examined the Web sites of these 46 medical schools between June 2, 2009, and July 17, 2009. Each full-time faculty physician profile was evaluated for subspecialty fellowship training, expressed areas of clinical interest, and the provided description of clinical services. We then classified each physician by subspecialty(s). If any of the 46 medical schools' Web sites did not contain sufficient information to make this type of evaluation, we omitted the school from the study. We considered 8 subspecialties: comprehensive ophthalmology, retina/vitreous, cornea/external disease, glaucoma, pediatric ophthalmology, oculoplastics, uveitis, and neuro-ophthalmology. Comprehensive ophthalmology is the broadest clinical area and includes everything from complete eye exams to anterior segment surgery (cataract surgery) and various laser procedures.

Work time that is allocated to an employee is often quantified in units called full-time equivalent employee (FTEE). In this study, 1 FTEE represents a working schedule of 40 hours per week. Any fraction of FTEE can be translated into hours per week. For example, 0.5 FTEE is equivalent to 20 hours of work per week. Actual FTEE data are not presented on the Web sites of the medical schools

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that we studied. In this study, FTEE, hereafter, refers to our estimation of FTEE based on the subspecialist's self-description of training and clinical interests, as well as on department listings of physicians under subspecialty divisions.

Statistical Analysis

All statistical calculations and graphics were performed using R software.[12]

Mean Proportion FTEE for the 8 Subspecialties

We collected subspecialty data on each physician. Since only full-time employees were included in this study, each was given a total score of 1 FTEE. For example, a physician who was listed only under comprehensive care was coded as 1 FTEE for comprehensive, whereas a physician listed under 2 subspecialties, such as comprehensive care and glaucoma, was coded as 0.5 FTEE for comprehensive care and 0.5 FTEE for glaucoma. Once we coded all the physicians for their area (or areas) of subspecialty, we then aggregated the data by medical school. Relative proportions of FTEE for each subspecialty were then calculated for each medical school separately. We then calculated the mean proportion of FTEE for each subspecialty from this data set.

Mean Proportion FTEE by Regional Location

We classified practices by membership in 1 of the following 4 regions of the country: Northeast, Midwest, South, and West, based on the U.S. Census Bureau's partitioning of the United States.[13] The mean proportions of FTEE were calculated for each subspecialty within each region.

Cluster Analysis of the Practices

We performed cluster analysis using the K-means clustering algorithm of Hartigan and Wong.[14] In this study, practices with similar proportions of FTEE for each of the 8 subspecialties were assigned to the same cluster, whereas practices with different proportions of FTEE were assigned to different clusters. A large homogeneous cluster would suggest the existence of a "typical," or average, practice. The mean proportion of FTEE for each subspecialty in this cluster could then be used to describe the work-time allocation of a typical ophthalmology practice. Using Hartigan's rule of thumb, we estimated the number of appropriate clusters to include in the analysis.[15]

Details of Coding

Physicians were assumed to be full-time if the Web site did not report work-time status (full-time vs part-time). Physicians who were explicitly reported as part-time were excluded from this study. The following 5 coding guidelines apply to full-time physicians who were classified under comprehensive care, cornea, glaucoma, oculoplastics, pediatric ophthalmology, and/or uveitis: (1) Physicians listed only under comprehensive care were coded as 1 FTEE; (2) Physicians who were listed under comprehensive care and who had completed a fellowship and listed under the fellowship subspecialty (for example, cornea, glaucoma, pediatric ophthalmology, oculoplastics, or uveitis) were coded with equal weights. Comprehensive care was coded as 0.5 FTEE, and the given subspecialty was coded as 0.5 FTEE; (3) Physicians who listed cataract surgery as a clinical area of interest and who were also listed under a subspecialty other than comprehensive care were coded as 0.5 FTEE for comprehensive care and 0.5 FTEE for the subspecialty. We chose this allocation because cataract surgery is a procedure performed primarily by comprehensive ophthalmologists; (4) Physicians who had completed 2 different fellowships were given equal weights for each subspecialty. For example, a physician with a fellowship in cornea and another in uveitis would be coded as 0.5 FTEE for cornea and 0.5 FTEE for uveitis; (5) Physicians who were listed under 3 areas of clinical care were coded as 1/3 FTEE for each area.

We handled retina and neuro-ophthalmology differently from the other subspecialties. A physician who completed a retina fellowship or was listed under the division of retina was coded as 1 FTEE in retina. Even if the retina specialist was also included under comprehensive or under uveitis, he or she was coded as 1 FTEE retina. A physician who completed a neuro-ophthalmology fellowship or was listed under both neuro-ophthalmology and comprehensive care was coded as 0.2 FTEE for neuro-ophthalmology and 0.8 FTEE for comprehensive care. Physicians who completed 2 fellowships, one of which was in neuro-ophthalmology, or reported clinical care in another subspecialty were also coded as 0.2 FTEE for neuro-ophthalmology and as 0.8 FTEE for the other subspecialty. We made these coding decisions based on our clinical experience and judgment.

Our clinical judgment was also used to allocate the physician to given subspecialties on a case-by-case basis for physicians with unconventional profiles. Physicians who did not have fellowship information provided but were listed under a given subspecialty department or given a subspecialty title were classified under that given department.

RESULTS

Based on the previously described inclusion criteria, we used subspecialty

Continued on page 33

Continued from page 30

data on 726 physicians from 40 medical schools in this study. Ophthalmology departments ranged from 4 to 48 physicians. The average size of a department was about 18. The median size was 15.

Missing Subspecialties

A subspecialty could be missing for 2 reasons: (1) no physicians were listed under that particular subspecialty; or (2) the physicians that were listed under the subspecialty were classified under part-time status. In practices that contained fewer than 8 subspecialties, uveitis and oculoplastics were the subspecialties that were most frequently missing (Table 1).

Of the 40 practices, 22 (55%) did not include uveitis, and 10 (25%) did not include oculoplastics. Conversely, comprehensive was included in all the practices, cornea was absent in only 1 practice, and retina was absent in only 2 practices.

Mean Proportion of FTEE by Subspecialty and Practice Characteristics

Table 2a presents the mean proportion FTEE by subspecialty for all 40 practices (pooled) and for practices classified by region. Corresponding practice characteristics are reported in Table 2b.

Mean Proportion of FTEE by Subspecialty (Pooled Estimates)

Based on proportion FTEE data on the 40 practices, comprehensive has the highest mean proportion FTEE (0.351) followed by retina (0.190). The next largest mean proportions of FTEE are pediatrics, cornea, glaucoma, and oculoplastics, which all have a similar average proportion of FTEE, a value of about 0.100. Neuro-ophthalmology and uveitis have the smallest average proportion of FTEE with values of 0.020 and 0.015, respectively.

Table 1. Number of missing subspecialties (N = 40)[a]

Subspecialty	Practices with missing subspecialties
	Number (%)
Comprehensive care	0 (0.00)
Cornea	1 (0.02)
Retina	2 (0.05)
Glaucoma	4 (0.10)
Pediatric ophthalmology	6 (0.15)
Neuro-ophthalmology	7 (0.18)
Oculoplastics	10 (0.25)
Uveitis	22 (0.55)

[a]Please refer to the Results section for the definition of missing subspecialties used in this study.

Description of 40 Practices by Geographical Region (N = 40)

The geographical distribution of the practices was as follows: 7 practices (17.5%) were from the Northeast; 7 (17.5%) practices from the West; 10 (25%) practices from the Midwest; and 16 (40%) practices from the South. The average number of physicians per practice was similar across the 4 regions, ranging from 16 to 19, and the median number ranged from 12 to 20.

Mean Proportion of FTEE by Subspecialty (Regional Estimates)

The mean proportion FTEE for each subspecialty by region are as follows: The Northeast, the Midwest, the South, and the West are all similar in their ranking of comprehensive and retina. In all 4 regions, comprehensive has the largest proportion of FTEE (ranging from 0.337 FTEE to 0.390 FTEE), followed closely by retina (ranging from 0.18 to 0.19). Uveitis and neuro-ophthalmology were allocated the smallest proportion of FTEE in all 4 regions. Pediatrics, glaucoma, cornea, and oculoplastics all had similar values of about 0.100 FTEE but were ranked differently across the 4 regions.

A polytomous logistic regression analysis using the 4 regions as a response variable and the proportion FTEE of the 8 subspecialties as explanatory variables was not performed due to the small number of practices in each of the 4 regions. Instead, a logistic regression analysis was performed using the East and West regions as a response variable and the proportion FTEE of the 8 subspecialties as explanatory variables. Practices located east of the Mississippi River (N = 24) were classified as eastern practices; all other practices (N = 16) were considered as western practices. The results of the logistic regression analysis (data not shown) suggest that there are no significant differences (at the 0.1 level of significance) in the allocation of subspecialties based on geographic classification as eastern or western states.

Table 2a. Mean proportion of FTEE by subspecialty (N = 40)

Practices[a]	Subspecialty							
	Comp	Retina	Pediatric	Cornea	Glaucoma	Oculo	Neuro	Uveitis
Pooled	0.351	0.190	0.125	0.114	0.108	0.078	0.020	0.015
Regional[b]								
NE	0.385	0.189	0.115	0.108	0.108	0.063	0.017	0.015
MW	0.342	0.197	0.107	0.087	0.111	0.114	0.026	0.015
S	0.347	0.192	0.128	0.134	0.114	0.057	0.019	0.008
W	0.337	0.177	0.151	0.112	0.088	0.087	0.017	0.029

Comp = comprehensive care; FTEE = full-time equivalent employee; MW = Midwest; Neuro = neuro-ophthalmology; NE = Northeast; Oculo = oculoplastics; S = South; W = West.

[a]Pooled refers to all 40 practices.

[b]The 4 regions are based on the U.S. Census Bureau's partitioning of the United States.[14] The Northeast consists of the New England states (CT, ME, MA, NH, RI, VT) and the Middle Atlantic states (NJ, NY, PA). The Midwest consists of the East North Central states (IN, IL, MI, OH, WI) and the West North Central states (IA, KS, MN, MO, NE, ND, SD). The South consists of the South Atlantic states (DE, DC, FL, GA, MD, NC, SC, VA, WV), the East South Central states (AL, KY, MS, TN), and the West South Central states (AR, LA, OK, TX). The West consists of the Mountain states (AZ, CO, ID, NM, MT, NV, UT, WY) and the Pacific states (AK, CA, HI, OR, WA).

Mean Proportion FTEE Using Cluster Analysis

K-means was done on the square roots of the proportion data to account for differences in variables with small counts, that is, primarily uveitis, neuro-ophthalmology and oculoplastics (Table 1). The analysis consisted of 100 random sets of 3 distinct practices. The resulting clusters of practices are reported in Table 3a. Corresponding characteristics of the practices from each cluster are given in Table 3b.

One dominant cluster, consisting of 26 practices, and 2 smaller clusters, composed of 8 practices and 6 practices, are presented. The average number of physicians in the largest practice was 23.4, and the average number of physicians in the clusters composed of 8 and 6 practices was 9.5 and 7, respectively. The members of the large homogeneous cluster composed of 26 practices are considered representative of typical ophthalmology practices in their allocation of FTEE to the 8 subspecialties. This cluster consists primarily of practices with 11 or more physicians. Mean FTEE values for the 8 subspecialties in this cluster are ranked as follows: comprehensive, retina, pediatrics, cornea, glaucoma, oculoplastics, neuro-ophthalmology, and uveitis. Comprehensive had the highest proportion (0.316) closely followed by retina (0.202). The lowest proportions of subspecialists were neuro-ophthalmology (0.025) and uveitis (0.020). The remaining 4 subspecialties, pediatrics, cornea, glaucoma, and oculoplastics had about the same average proportion of FTEE with values of about 0.100.

Of the practices in the largest cluster (17/26), 65% had all the 8 subspecialties represented, and 31% of the practices (8/26) had only 1 subspecialty missing, namely uveitis. Only 1 practice had 2 missing subspecialties, that is, glaucoma and uveitis. This practice was the smallest practice in the cluster with only 8 physicians. The

Table 2b. Characteristics of 40 practices pooled and subclassified by region

Practices[a]	Number of physicians					
	Total	Average	Median	Minimum	Maximum	Total[b]
Pooled	40	18.15	15.0	4	48	726
Regional						
NE	7	19.29	12.0	4	41	135
MW	10	16.10	15.5	6	25	161
S	16	18.56	13.0	6	48	297
W	7	19.00	20.0	6	38	133

MW = Midwest; NE = Northeast; S = South; W = West.

[a]Please refer to the legend of Table 2a (footnotes a and c).

[b]Total number of physicians refers to the total number of full-time physicians studied.

Continued on page 36

Continued from page 34

Table 3a. Mean proportion FTEE per subspecialty by cluster[a]

Cluster[b]	Subspecialty							
	Comp	Retina	Pediatric	Cornea	Glaucoma	Oculo	Neuro	Uveitis
Large (n = 26)	0.316	0.202	0.119	0.108	0.108	0.102	0.025	0.020
Small (n = 8)	0.320	0.151	0.237	0.160	0.108	0.007	0.006	0.010
Smallest (n = 6)	0.539	0.192	0.000	0.076	0.106	0.067	0.019	0.000

Comp = comprehensive care; FTEE = full-time equivalent employee; neuro = neuro-ophthalmology; oculo = oculoplastics; pediatric = pediatric ophthalmology.
[a]The distribution of the mean proportion FTEE values in the large cluster (n = 26) represents the composition of a typical ophthalmology practice in our study.
[b]n = number of practices in a cluster.

remaining 25 practices ranged from 11 to 48 physicians, suggesting that large practices are more likely to have all of the 8 subspecialties represented.

The smallest cluster was composed of 6 practices and did not include any pediatric or uveitis subspecialists in any of its practices. It had the largest average proportion of comprehensive care doctors (0.539) among the 3 clusters. Of the 6 practices, 5 were missing at least 3 subspecialties. The other missing subspecialties included 3 oculoplastic, 2 glaucoma, 2 neuro-ophthalmology, and 1 cornea.

The other small cluster consisting of 8 practices had the lowest average proportion of retina (0.151) and very low average proportions of oculoplastics (0.007), neuro-ophthalmology (0.006), and uveitis (0.010) specialists. This cluster also had the highest average proportion of pediatric subspecialists (0.237). Each practice in this cluster had 1 or more subspecialties missing. Of the 8 practices, 7 in this cluster were missing oculoplastic subspecialists, 7 of 8 practices were missing uveitis subspecialists, and 5 of 8 practices were missing neuro-ophthalmologists. Other subspecialties that were absent in some practices included 2 practices without retina and 1 practice without glaucoma.

The smaller clusters that were found consisted of practices with smaller average sizes, 1 with an average size of 9.5, and the other with an average size of 7 physicians. It seems that smaller practices have different compositions, or distributions, of subspecialties compared with the largest or typical group (Figure 1). In the 6-member cluster, the complete absence of uveitis and pediatrics distinguished this cluster from the others. The high proportion of pediatric and the very low number of oculoplastic, neuro-ophthalmology, and uveitis subspecialists in the 8-member cluster distinguished it from the others. None of the smaller clusters had all 8 subspecialties represented, and most, that is, all but 1, of the practices in the 2 smaller clusters had 3 to 5 subspecialties missing per practice. These findings suggest that small practices are not always able to fill all of the 8 distinct subspecialties. The demographics of the local patient population, for example, the age of the patients and perhaps budgetary constraints, may be factors that cause smaller groups to differ in their distribution of subspecialists.

DISCUSSION

Multispecialty and multisubspecialty group formation may become a more common phenomenon as physicians reorient to the political and economic forces of change in the health care system. The distribution of FTEE of the typical practice

Table 3b. Characteristics of the clusters[a]

Cluster[a]	Number of physicians					Number of practices by region			
	Average	Median	Minimum	Maximum	Total	NE	MW	S	W
Large (n = 26)	23.38	22	8	48	608	4	7	10	5
Small (n = 8)	9.50	8	6	17	76	1	1	5	1
Smallest (n = 6)	7.00	7	4	9	42	2	2	1	1

MW = Midwest; NE = Northeast; S = South; W = West.
[a]n = number of practices in a cluster.

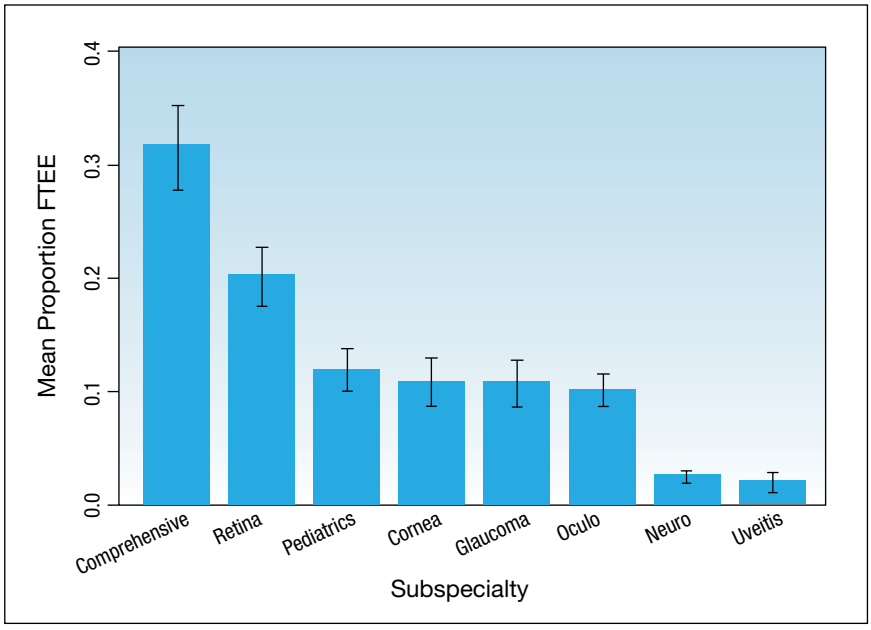

Figure 1. Composition of a typical ophthalmology practice (N = 26). Comp = comprehensive care; FTEE = full-time equivalent employee; neuro = neuro-ophthalmology; oculo = oculoplastics; pediatric = pediatric ophthalmology. Error bars represent 95% confidence intervals for the mean FTEE proportion for each subspecialty.

may serve as a useful model for those who are assembling group practices from scratch or who are expanding current practices. In a recent article in *EyeNet*, Marianne Doran reported, "Disciplines that are intensively focused on patient encounters demand more physician time but are reimbursed significantly less than procedure intensive disciplines."[16] Neuro-ophthalmology, uveitis, and pediatric ophthalmology are among the subspecialties that are experiencing high attrition rates.[16] With complex histories and time-consuming examinations, we are not surprised to find that neuro-ophthalmology and uveitis are represented with such low proportions in our study.

The typical group described in this study may be useful as a rough, baseline guide for academic centers, VA health care centers, and community practices. All 3 treat common eye diseases (cataracts, glaucoma, diabetic retinopathy, macular degeneration). Academic and VA health centers share a research and teaching mission and generally treat sicker populations.[17-19] However, important differences may exist in the proportion of subspecialty eye care provided. The VA generally provides a higher proportion of general eye care (including cataract surgery), and obviously does not treat pediatric patients.[18] VA patients tend to be older and are predominantly male. Community practices are often less involved with tertiary care. The unique characteristics of the patients and the missions of the practices should be accounted for when making staffing decisions.

Another factor that might influence staffing decisions is the financial compensation structure of the practice. Federal facilities offer a fixed salary, whereas private practitioners are usually paid on a strict productivity basis. Academic centers are often a hybrid of the two. Future studies might address the effects of incentives on group composition.

Study Limitation

The limitation of this study is the use of estimated FTEE values since actual values for independent group practices are not publicly available. Our estimation of FTEE was based on the subspecialist's self-description of training and clinical interests, as well as on department listings of physicians under subspecialty divisions. This basis provided us with enough information to obtain a rough estimate of FTEE allocation. The estimated FTEE values were meant to reflect real-world observations, and this involved using our own judgment.

There is no practical way to get a more precise allocation of workload, which would require an evaluation of the diagnostic coding submitted by each physician, categorization of those codes into various subspecialties, and detailed scheduling information, that is, time spent on clinical care, administration, teaching, and research. This quantitative data obviously would not be available on a public Web site.

For the purpose of this study, we considered routine cataracts to be comprehensive care (*please see* Methods). Essentially, all cornea and glaucoma subspecialists perform some cataract surgery. However, subspecialists who specifically listed cataract surgery as a clinical interest or who were listed under the subdivision of cataract surgery on the Web site directory, would certainly attract patients who have a known diagnosis of cataract, whether or not they have comorbidities in glaucoma or cornea. Therefore, we felt it was reasonable to allocate 0.5 FTEE to comprehensive and 0.5 to cornea (or glaucoma) to these subspecialists. In our study

this represents 48 of the total 124 cornea specialists (39%) and 29 of the 106 total glaucoma specialists (27%). However, this allocation may have resulted in an underestimation of FTEE allocation for the cornea and glaucoma specialists who perform cataract surgery exclusively on their cornea or glaucoma patients.

For neuro-ophthalmology, when 2 fellowships or clinical subspecialty interests were listed, the proportion assigned to neuro-ophthalmology was 0.2 FTEE. In our experience, most of the clinical time is spent in the companion field. This may be due to the time required to conduct a clinical examination and low reimbursements.[16] Although we attempted to estimate FTEE as realistically as possible, our methods of coding may have resulted in an underestimation of the proportion of FTEE for this subspecialty, especially in certain tertiary centers where some neuro-ophthalmologists may provide full-time care.

We decided to include only full-time faculty because few Web sites list their part-time physicians. The exclusion of part-time physicians in our study may have resulted in an underestimation of higher paid specialties, such as retina or oculoplastics, or lower reimbursed fields, such as neuro-ophthalmology. If it becomes available, detailed part-time information would be useful for future studies.

The clinical responsibility of a full-time physician may vary enormously based on administrative, research, and teaching responsibilities. These issues would affect the amount of clinical care provided. We have no reason to believe, however, that one subspecialty will be more affected by these factors than another, and the relative proportion of FTEE (which is an average across many practices) should be unaffected.

CONCLUSION

The current health care climate is one of historic change and reorganization. Sensible guidelines are more important than ever. Attempting to define a typical group practice may provide such a guideline. The results of a K-means cluster analysis of 40 academic group practices suggest that the typical, or representative, group practice in ophthalmology may be characterized as being composed of the following proportions of subspecialties, listed from the largest to the smallest: comprehensive (0.316), retina (0.202), pediatrics (0.119), cornea (0.108), glaucoma (0.108), oculoplastics (0.102), neuro-ophthalmology (0.025), and uveitis (0.020). This type of analysis can be conducted for any large group practice in any medical specialty to provide a rough guideline for the allocation of FTEE. The composite allocation can then be fine-tuned to reflect differences in patient population, specialist availability, and the mission of the practice. This type of study may become increasingly important as the health care system evolves and reorganizes. ●

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Author Disclosures

The authors report no actual or potential conflicts of interest with regard to this article.

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