*** Title Page**

Subspecialization in Radiology and Radiation Oncology

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Abstract

Practicing radiologists, radiation oncologists, and trainees were surveyed regarding the current state of subspecialization in practice and in training curricula. Our paper presents the results of these surveys, establishes trends compared to previous survey data, and compares the plans of trainees versus current postgraduate practice. Subspecialization is increasing in both radiology and radiation oncology. There remain substantial numbers of practitioners who perform work they deem "general" in nature. The authors also present a method to more accurately measure subspecialization and workload.

Short Running Head: Subspecialization in Radiology and Radiation Oncology

INTRODUCTION

During the last several decades, the complexity of diagnostic and therapeutic radiology has increased dramatically. Fueled by an increasing fund of medical knowledge and technical innovation, what was once a single specialty split into two separate training and certification programs now known as radiology and radiation oncology [1]. The drive toward subspecialization has continued within both areas and what was once on the margin of the profession has moved to the mainstream [2].

As the professional organization representing radiology, radiation oncology, and their related subspecialties, it is critical that the American College of Radiology (ACR) understand trends in subspecialization. These data are important for the support of College membership, for rational recommendations from ACR leadership, to properly allocate ACR resources, and most important, to foster high quality patient care in the context of contemporary medical practice.

With an understanding of these concepts and goals, in January 2008 the chair of the ACR Board of Chancellors, Arl Van Moore, MD, commissioned a study of trends in subspecialization in radiology and radiation oncology. Residents and fellows, as well as postgraduate, professionally active radiologists and radiation oncologists are included.

METHODS AND MATERIALS

The data for this study are the result of a group of surveys conducted from April through October 2008 by ACR Economics and Health Policy staff and independent agencies.

Questions regarding subspecialization were included in a previously planned 2008 survey of radiologists. The ACR provided a random sample of 6,000 postgraduate, professionally active radiologists from their membership records. The term "radiology" used in the remainder of this report is understood to include diagnostic radiology, interventional radiology, and nuclear medicine. A pre-test was conducted to assess the flow and interpretation of the questions. A letter from the ACR president, a practice manager worksheet, and a link to the Web survey was electronically conveyed to radiologists with email addresses (4,893). The remaining radiologists received materials by regular mail (1,029). Interviews were conducted between April 24 and June 13, 2008. Responses were obtained from 1,095 currently practicing radiologists; these physicians were interviewed via a Web survey (575) or Computer Assisted Telephone Interviewing (520). To ensure the confidentiality, the survey was conducted by an outside contractor, *dmrkynetec* [3]. The data set delivered to the ACR was stripped of all individual identifiers. The response rate was 26.8% (1095 completes / (5205 contacted – 911 disconnected or wrong phone number – 189 retired/deceased – 18 not qualified)). The margin of error is approximately +/– 3% at the 95% level.

The data were weighted to be representative of all radiologists in the US. The characteristics of survey respondents do not necessarily match those of the population about which one would like to make inferences—in this case, all postgraduate, professionally active radiologists in the US. Accordingly, as is the custom, weights were constructed to be applied to the survey response data from ACR members so that the data are representative of all US radiologists. Experience has shown that the most important criteria for rendering the survey response pool of ACR members to be representative of all radiologists in the US are age, gender, and Census Division (the nation divided into nine geographic areas). These criteria were used to

create the weights, which were applied to each survey respondent. For example, if there were one-half as many females in the response pool as there are among all US radiologists, the data for each female received a weight of two.

Surveys of radiation oncologists, radiology residents and fellows, and radiation oncology residents and fellows were conducted between July and October 2008. This portion of our data was collected separately from the 2008 survey of radiologists. Email invitations were delivered to potential respondents, asking them to take a short survey using an electronic instrument [4]. The results reported for these three groups are not weighted and, therefore, do not necessarily represent all members these populations.

Information about radiation oncologists was collected via a nonrandom sample, Internet-based survey conducted by the ACR. All ACR members who are practicing radiation oncologists with email addresses were sent email invitations to take the survey. The American Society for Therapeutic Radiation and Oncology (ASTRO) notified its members of the existence of the ACR survey and provided a link to the survey Web site. Responses were obtained from 308 radiation oncologists. The margin of error is approximately +/– 6%.

Information about radiology residents and fellows was collected via a census-like, Internet-based survey. The names and email addresses of all ACR members who were either residents or fellows were drawn from ACR membership files. Those who indicated they did not want to be contacted by email were excluded. The remainder was sent an email invitation with a link to the survey Web site. Responses were obtained from 758 radiology residents and fellows. The margin of error is approximately +/– 4%.

Information about radiation oncology residents and fellows was collected via a census-like, Internet-based survey. The Association of Residents in Radiation Oncology (ARRO) notified its members of the existence of the ACR survey and provided a link to the survey Web site. Responses were obtained from 96 radiation oncology residents and fellows. The margin of error is approximately +/– 10%.

All survey results were analyzed by ACR staff and member volunteers.

TABULATED HIGHLIGHTS OF SURVEY RESULTS

Practice type and location of respondents in practice and interests of those in training

While not the primary focus of our work, data regarding demographic characteristics of respondents is relevant to populations they serve, their ability to aggregate service demand and therefore their ability to subspecialize. In addition, physicians in training were polled regarding their demographic interests in future practice.

Table 1 presents statistics on the distribution of practicing (i.e., postgraduate, professionally active) radiation oncologists and radiologists across several demographic categories in 2008. The mean number of radiation oncologists (full-time and part-time combined) in a practice is about nine and for radiologists it is 23. Slightly over half (55.5%) of radiologists are in private radiology practices, followed by primarily academic (18.2%) and multi-specialty (16.2%). Radiologists are generally located in the main city of metropolitan areas (32.7% large and 26.7% small). Radiation oncologists who responded were more likely affiliated with academic practices in a more urban setting; nearly all (79.9%) practiced in large

metropolitan areas or main cities of small metropolitan areas. About one-quarter of radiologists are employed by a hospital or healthcare system, whereas roughly one-third of radiation oncologists are so employed.

Table 2 presents statistics on the most desirable practice type and practice location among radiology and radiation oncology residents and fellows. Forty-one percent of radiology trainees prefer private, multi-specialty practices. Private, radiology-only practices and academic practices are each preferred by one-quarter of these residents and fellows. The remaining practice types received only very small-scale interest. Large metropolitan areas and main cities of smaller metropolitan areas dominate the most desired practice locations. About 61% of survey respondents expect to complete their residency in 2009 or after.

Of radiation oncologists in training, 38% said their most desired practice type was primarily academic. Another 37% preferred private radiation-oncology only practices. Slightly more than 10% preferred private, multi-specialty practices. No other practice type received more than 5% primary interest. Large metropolitan areas and main cities of small metropolitan areas were, by far, the most preferred practice locations. About three-fourths of radiation oncology residents who took the survey anticipate finishing residency in 2008 or 2009.

Current subspecialization and workload of respondents in practice

The surveys of practicing radiologists and radiation oncologists asked how many times the respondent had changed the main focus of their work, for example, from one specialty to another, or from subspecializing to being a generalist, or vice versa. About one-fourth of

radiologists had changed the main concentration of their work at least once, as shown in Table 3. In contrast, nearly half of radiation oncologists had changed their main focus at least once.

Twenty-four percent of practicing radiologists do not have a main subspecialty. The remainder report being at least somewhat subspecialized. Table 4 shows percentages for main subspecialty as well as the percent of work time in subspecialties. Neuroradiology (17.1%) was the most frequently cited main subspecialty; other subspecialties with double-digit responses were breast imaging/mammography, interventional/vascular radiology, and body imaging/cross-sectional imaging. As shown in the second column of Table 4, respondents also provided information regarding the amount of time they spent working in a particular subspecialty area. For most subspecialties, the distribution of work time for all respondents correlated well with the distribution of subspecialists. The most conspicuous exception pertains to "general radiology," claimed by only 1.5% of respondents as a main subspecialty, but accounting for 18.9% of overall work time. This outlier may be explained by the nearly one-quarter of respondents who indicated they were "not specialized" and could therefore be considered "general radiologists."

Table 5 shows subspecialization and workload among responding radiation oncologists. The survey asked about radiation oncologists' main subspecialty and the proportion of work time in several subspecialty areas. Subspecialization by radiation oncologists can be categorized by body part/organ system and modality. About 70% of radiation oncologists considered their main subspecialty to be in a body part/organ system. Prostate (18.9%), breast (17.7%), and head and neck (17.1%), and were the most prevalent; "other" also received relatively numerous responses (6.9%). Among therapeutic modalities, radiosurgery (12.0%) was the most frequent choice.

Brachytherapy and intensity modulated radiation therapy (IMRT) were the only other modalities that were indicated as a main subspecialty.

In the case of work time spent in subspecialties, an expert panel of survey questionnaire developers believed it best to separate body part/organ system from modality. The questionnaire instructed respondents to provide the percentage of work time such that the total was 100% for body part/organ system and also 100% separately for modality. For body part/organ systems, the percentage of time spent in prostate, breast, head and neck, and lung were all in the range of 14-24%. Among modalities, IMRT and 3-dimensional conformal radiotherapy both averaged in the 32-35% range.

Table 6 shows that over three-fourths (76.6%) of radiologists and nearly as many (69.4%) radiation oncologists are satisfied with the extent of their subspecialization. Among the remaining physicians, those who would like more subspecialization outnumber those who would like less by a 5:1 margin, with a slightly smaller predominance for radiation oncology. Most radiologists cover an absence with a practitioner in the same subspecialty. Radiation oncologists are more likely to substitute generalists or a practitioner from a different subspecialty area.

Less than one-third of radiation oncologists feel pressure to subspecialize, as opposed to half of radiologists. Both groups felt significant motivation to subspecialize based on quality of care and demand from referring physicians. Hospital expectations was mentioned by more than one-third of radiologists but only by 15% of radiation oncologists.

Expanding subspecialization in existing practice

As reflected in Table 7, most radiologists (62.9%) and a minority of radiation oncologists (29.9%) report recent expansion of subspecialization within their practice.

For radiologists, the addition of new members is the almost universal means to augment subspecialization, compared with about 60% of radiation oncologists who report new practice membership. To a similar degree, both radiologists and radiation oncologists undertake additional training, utilize other local practices, or have undergone practice consolidation. By virtue of the digital nature of imaging, three-quarters of radiologists move studies within their group and about one-quarter electronically outsource some studies for second opinions or primary interpretations.

Subspecialty plans of radiation oncologists and radiologists in training

Table 8 lists residents and fellows' plans regarding subspecialization. The differences here between the specialties are striking. Over 90% of radiologist trainees plan on fellowship training while fewer than one in ten radiation oncology residents pursue this pathway. Despite the lack of additional training, many radiation oncology residents (42.7%) still wish to subspecialize. About 67% of radiology trainees wish to work in two or more areas once in practice. About three-quarters of radiology trainees feel moderate or much pressure to subspecialize. Conversely, three-quarters of radiation oncology trainees feel little or none of this stress.

Radiology residents and fellows were asked to indicate the field in which they plan to subspecialize after completion of training. Their responses are shown in Table 9. The top six subspecialties among residents and fellows include the top five main subspecialties of postgraduate radiologists. No single subspecialty garnered more than 23% of choices. Four percent of residents and fellows said they did not plan to subspecialize.

Table 10 illustrates the preferred subspecialty areas of radiation oncology residents and fellows (multiple selections were allowed). Fifty-six percent said they planned to subspecialize in a particular field. (Forty-four percent said they did not plan to subspecialize or it was too early in residency to make a decision.) The most frequently cited subspecialties were radiosurgery (24%) and head and neck (19%). The least frequently mentioned were 3-dimensional conformal radiotherapy (2%) and coronary artery brachytherapy (0%).

We compared the plans of residents and fellows with the main subspecialty of practicing radiologists and the percent of work time in a subspecialty of practicing radiologists. These are presented in Table 11.

The subspecialty preference and practice percentages were adjusted proportionally from those presented in previous tables to add to 100% and facilitate comparisons. The plans of residents and fellows match reasonably well with the main subspecialty of practicing radiologists. Musculoskeletal radiology and abdominal/body/chest/cross-sectional imaging are the main outliers, in that residents and fellows have a greater preference for these specialties compared with the main subspecialty of practicing radiologists. Substantially more time is spent in general radiology by practicing radiologists compared with the preferences of residents and fellows. However, the definition of "general radiology" is not subject to the same degree of

precision and agreement across radiologists as are other subspecialties, perhaps in part because the survey instruments did not define the term “general radiology.”

Using trainees’ preferred subspecialty as a surrogate for “future supply,” the current distribution of subspecialists as “current supply,” and the work time in a particular area as “demand,” we juxtaposed data as shown in Table 12.

As shown in Table 12, for abdominal/body/cross-sectional imaging, cardiac, emergency, and general radiology demand is greater than current supply. In these subspecialties, the market appears to be reacting as expected by showing an increasing future supply of providers. When current supply is greater than demand an economic market model would predict a weakening in future supply relative to current supply. This is the case for interventional/vascular, mammography/women's imaging, neuroradiology, and nuclear medicine. These simple market relationships are not present in the subspecialties of MR Imaging, musculoskeletal, neurointerventional, and pediatrics. In these fields, current supply is greater than demand at the same time there is increased interest in undergoing a fellowship. In the subspecialty of ultrasound, current demand exceeds current supply with no corresponding response in future supply.

Table 13 presents subspecialty comparisons between practicing radiation oncologists and radiation oncology residents and fellows. The subspecialty preference and practice percentages were adjusted proportionally from those presented in previous tables to add to 100%. The greatest excesses of the preference by residents and fellows over the main subspecialty of practicing radiation oncologists is for radiosurgery, IMRT, and lung. The opposite relationship exists for prostate and breast. Comparing residents and fellow’s preferences with practicing

radiation oncologists work time, the largest mismatch is for radiosurgery. At the opposite end of the spectrum, practicing radiation oncologists spend far more work time in 3-dimensional conformal radiotherapy than is preferred by residents and fellows.

We examined the linkage between main subspecialty and work time for the five most frequently cited main subspecialties of the radiology respondents. The results are presented in Table 14. For each of the five most frequently cited main subspecialties, the same subspecialty was the one in which the radiologist spent most of his or her work time. There was considerable variation, however, in the percentage of work time spent in that subspecialty. Slightly more than one-half of work time was spent in neuroradiology and breast imaging/mammography by radiologists with the matching main subspecialty. Those who indicated that MR imaging was their main subspecialty, however, spent only 29% of their work time doing MR imaging. Body imaging/cross-sectional imaging fell between the two extremes, with 40% of work time being spent in body imaging/cross-sectional imaging by those for whom that was their main subspecialty.

For all five of the top main subspecialties, general radiology was the area in which the second most work time was devoted. Similarly, body imaging/cross-sectional imaging was the third most frequently reported work area (with the exception of those who indicated body imaging/cross-sectional imaging was the main subspecialty). Musculoskeletal radiology, abdominal imaging, and ultrasound tended to be cited among the fourth and fifth most frequent subspecialty work areas, even though none of these was among the top five in terms of main subspecialty.

Table 15 shows the distribution by size (i.e., number of radiologists in the practice) of radiologists with various characteristics. Only the main results of interest are highlighted here. With respect to practice type, smaller practices involve mainly radiologists in private, radiology-only groups. Relatively few radiologists are in small academic practices. As practice size increases, the percentage of radiologists in private, radiology-only practices drops while the percentage of radiologists who are in academic practices rises. Larger practices tend to be located in metropolitan areas or main cities of smaller metropolitan areas; smaller practices are in non-metropolitan or rural areas. Radiologists are much more likely to subspecialize if they are in larger practices. Radiologists' work time in general radiology decreases as practice size increases.

The subspecialty results from the 2008 survey of radiologists may be compared with a similar one conducted in 2003 [5]. Table 16 shows the percentage who reported a particular subspecialty in each of the two years, as well as relative percentage changes from the earlier to the later year. Most subspecialties have grown, with musculoskeletal imaging and women's imaging having the largest relative increases. Five subspecialties had no measurable change. The subspecialties of ultrasound and pediatric imaging were the only two for which there was a decrease.

DISCUSSION

Discussion, debates, and disagreements about subspecialization in radiology are as old the specialty. A number of articles have been published regarding the imperatives for subspecialization, while others have argued for importance of general medical practice. [6][7][8].

As the practice of medicine evolves, the demands on individual radiologists, radiation oncologists, and the medical profession as a whole will continue to evolve. As reflected in the survey data, the practice of radiology is in a watershed period. The specialty and its environment vary by size, patient and referring physician expectations, referral patterns, and the some degree geographic constraints. Based on survey results over the long term, there has been a distinct trend towards the practicing of and training for subspecialization. The marketplace continues to make greater demands for subspecialty expertise. Although not measured by our study, demand seems to vary according to credentialing, geography, practice size and hospital location.

Motivations for subspecialization may be categorized as “external” versus “internal.” External factors include demand by referring physicians and hospitals, turf battles, and competition for patients. Internal motivations include personal satisfaction, academic interests, and the desire to have areas of expertise. It is important for radiologists and radiation oncologists to recognize where they are on this spectrum and respond accordingly. Small groups may be pushed beyond their internal capacity to respond and may need to develop referral relationships with larger practices or other centers. The authors’ collective experience indicates that this process, in the absence of external edict or third party, is happening in an organic way. From this standpoint, group size may not be a barrier to offering subspecialty level expertise. Radiologists’

groups continue to transform to facilitate subspecialization by expanding existing members' talents, retraining members, targeted new hires, and electronic image transmission.

The mean number of radiation oncologists in a practice is about nine, compared with 23 for radiologists. This inhibits, to some degree, specialization by radiation oncologists; most members of a group need to remain generalists. For group sizes of 2-3 radiation oncologists, this limitation is important. For intermediate size groups, 4-8, subspecialization may begin to occur, but members will still cover multiple areas (and all deal with palliation, metastatic disease, etc). One radiation oncologist may cover gynecology and breast; another central nervous system (CNS) and lymphoma, etc. The greatest degree of subspecialization in these groups relates to technology, i.e., an individual doing primarily brachytherapy or radiosurgery (utilization of 3-D conformal and IMRT is assumed universal).

Most large groups of radiation oncologists cover multiple facilities, a circumstance that also limits specialization (except for brachytherapy and radiosurgery). In general, large academic practices house radiation oncologists who deal with only one disease site (e.g., lung, CNS, lymphoma, etc.). Radiation oncologists in practice may be more likely to expand their groups with an emphasis on utilizations of new technologies, such as radiosurgery or novel brachytherapy procedures.

A distinction between radiation oncology and radiology is that there are no CAQs or ACGME-accredited fellowships in the former. Even non-ACGME fellowships are uncommon. As a result, fewer than one in ten radiation oncology trainees plan to undertake a fellowship. In contrast, radiology residents and fellows nearly all pursue some type of additional subspecialty training. Many of the pressures radiology trainees experience parallel those of their colleagues in

practice. These residents may also be reacting to the increasing complexity of the field as over three-quarters indicated an independent intent to pursue fellowship.

There is also a new external stress prompting residents to consider additional subspecialty training. In October 2007, the American Board of Radiology (ABR) announced a requirement that each resident declare three subspecialties to be studied during the 4th year of training. These in turn will determine the content of their final certifying examination and their Maintenance of Certification examinations every 10 years thereafter [9]. At this point in time, radiation oncology does not have a similar examination structure.

Academic radiology practices are increasingly being pushed to have specific experts in each of the nine subspecialty areas. As of July 1, 2008, the Accreditation Council for Graduate Medical Education (ACGME) residency review committee (RRC) and New Program Requirements require that there be nine separate subspecialty faculty oversee each of these areas [10].

Private radiology practices are increasingly expecting radiology residents to have completed fellowships in order to provide new expertise for the practice. Radiation oncology also uses new members to supply subspecialty expertise, but not to the same degree.

For trainees in both radiology and radiation oncology, there are occasional imbalances between the expectations of residents and fellows (trainees) and their counterparts in practice. If one uses fellowship training as a proxy for a desired area of subspecialization, a potentially serious mismatch might occur in what subspecialties are desired by trainees and what radiologists actually practice. For instance, as shown in Table 11, for abdominal/body/ chest/cross-sectional added together, there are 23.4% of trainees desiring these subspecialties,

whereas only 17.1% of practicing radiologists currently consider these as their subspecialty. Similarly, 10.5 % of trainees desire MR compared with 7.5% practicing radiologists, 13.1% of trainees desire musculoskeletal (MSK) compared to 6.3% practicing radiologists, and 4.4% of trainees desire pediatric radiology with only 2.7% of practicing radiologists considering that as their subspecialty. Are these apparent differences only a reflection of a marketplace supply and demand, as suggested by the data in Tables 11 and 12? Could these disparities cause incongruities between the needs of the medical market and the skills supplied by upcoming trainees? If the latter is true, some trainees may need to redirect or retrain. Although 79% of radiology residents feel pressure to subspecialize and more than 90% do a fellowship, it is noteworthy that 73.4% do not seek to limit themselves to a single subspecialty.

To be valuable to a practice, residents or fellows must bring new expertise in an area of marketplace demand. Thus, those trained in new areas such as MSK MR imaging might find an advantage in the job market. Ultimately, the job market for new radiologists will determine which fellowships make residents most competitive for new positions.

In many, if not most, practice settings, both radiologists and radiation oncologists should anticipate variety. Despite subspecialty interests, radiation oncologists currently treat across a spectrum of modalities and organ systems. About one-quarter of practicing radiologists do not consider themselves subspecialists. Of those who do consider themselves specialized, only about half of their professional time is spent in their primary subspecialty. Ten to twenty percent of their time is in general radiology and the remainder in other non–primary subspecialty areas. Even if smaller groups can practically and economically outsource their specialty work and call responsibilities electronically, “general radiology”- however it is defined- will probably remain a

viable and necessary part of radiology in the future. It is here that opportunities may exist for larger practices and academic radiology departments to develop beneficial subspecialty referral relationships with smaller practices.

In considering the topic of subspecialization, definitions pose a significant limitation. Our survey suffers from this pitfall, as the details of credentialing for a subspecialty were not specified. In addition, the term "general radiology" or "generalist" may have been perceived as a category of exclusion. Just what is the definition of "general radiology?" Did our respondents infer these words to mean "everything outside of my primary areas of expertise?" The ambiguity and imprecision of these words may well reflect the confusion that we as a profession have regarding the role and future of "general radiology."

The definition of subspecialization is a variable for which we did not control. There is certainly a trend that more recent radiology residents have elected to invest additional training in fellowships for a variety of reasons. While identification for those who continue to practice in the field of their fellowship is better defined, whether or not CAQ certified, those who have either varied their areas of interest and/or graduated to a given field during their course of practice without formal credentialing remain less clear. For instance, many "general radiologists" who do not do interventions nor perform breast imaging may now identify themselves as "cross-sectional imaging" specialists rather than generalists. Does satisfying the Mammography Quality Standards Act (MQSA) requirements for breast imagers certify that one is a specialist? And what of those who have achieved CAQs, but have not practiced their subspecialty?

Another point of confusion is the designation of proportions for subspecialty work. Some responders to our survey may have relied on time as the basis of measuring work, whereas others

may have used effort or RVUs. Further, there is probably significant crossover of studies that can be categorized as falling either within several subspecialties or within general radiology. Instead of objective criteria, or even definitions yet to be determined by arbiters such as a credentialing body, the survey depended on respondents' interpretations and "perceptions" of their work distribution. By their very nature, surveys are victim to the subjective judgment of respondents [11].

While the ideal of specialization can be debated, the practical applications are left to the variety of practices across the country. Practice size is a critical determinant. While larger practices may be better equipped to accommodate the internal or external demands of subspecialization, the critical number of radiologists needed for adequate subspecialty coverage has yet to be determined. For both radiologists and radiation oncologists, personal expectations or those of the institutions in which they practice will determine the degree of subspecialization manifest. These data indicate that a more important contributor for radiologists is the expectation of referring physicians. Unfortunately, these expectations were not measured directly. These demands may vary depending on the time of day; as groups expand and potentially acquire very focused subspecialists, they may also have trouble in staffing on call duties. Practices may have to change traditional compensation models to provide incentives for skill maintenance. The distribution of vacation and continuing education time may be altered to provide time for skill acquisition.

Radiology and radiation oncology practices are also challenged to address the balance of compensation versus productivity. Historically, many groups, at least in private practice, equated time with compensation: those who worked an equivalent number of hours would realize an

equivalent share of the profits of the practice. However, as subspecialization becomes more pervasive, along with the acceptance of the varying lifestyle demands of those in practice, the compensation formulas may need to become more complex. For example, survey data from the Society of Chiefs of Academic Radiology Departments (SCARD) clearly indicate that radiologists who predominantly interpret cross-sectional imaging studies are more productive than those reviewing plain films [12]. Groups that look to RVUs as the basis for compensation will need to consider these inherent productivity differences. Radiation oncology practices may find similar differences based on patient diagnosis, condition, and co-existing disease.

As professional disciplines, radiology and radiation oncology may not want to deem a practitioner who has attended a weekend course, or even a mini-fellowship, as having subspecialty expertise. The categories established by credentialing boards may provide clearer guidelines regarding "credentialing" for those who require Maintenance of Certification. These categories are unlikely to be exhaustive. Should organized radiology and radiation oncology attempt to provide a fair definition of situations in which a non-fellowship trained practitioner might be legitimately termed a subspecialist?

The current state of the "marketplace" and the reaction of practitioners and trainees are important indicators of the current and future trends of radiology and radiation oncology. There are no stronger variables shaping medical practices and organizations than the demands of the marketplace. Currently, horizontal integration including mergers and consolidation seem to be popular in certain markets. Nonetheless, the data suggest that smaller practices and multi-specialty opportunities remain in strong demand by candidates seeking jobs.

The authors acknowledge shortcomings in this survey and work. From its inception in January 2008, data collection extended over a nine-month period. Fortunately, data collection for practicing radiologists dovetailed with a larger and previously planned survey underway by the ACR Economics and Health Policy staff. This portion of the data was carefully selected and controlled, and carries with it the greatest statistical validity.

Radiology and radiation oncology trainees responded in significant numbers to email invitations to a separate poll. Data collection for trainees was occasionally hampered by access to correct electronic contact information. The ACR has an ongoing need to communicate with its membership and to this end, the authors applaud ongoing efforts to maintain close contact with individual members and their practices. Recently the College instituted My Profile and the Practice of Radiology Environment Database (PRED) to better serve the discipline [13].

Practicing radiation oncologists were challenging to contact, in part due to migration of younger practitioners to other professional organizations. The College may be further served by proactive alliances with other professional societies, with an aim to improve communications among constituents with common interests.

As reflected by the data, radiologists, radiation oncologists, and trainees all see quality improvement as an important driver for subspecialization. Credentialing boards and professional organizations, including the ACR, share similar perceptions. Unfortunately, their collective ability to measure marketplace reality is limited. Objective data reflecting the value added to patients and practitioners, much less the work done by a given practitioner or group, is also limited.

Organizational leadership acts, and memberships react, based on personal or limited collective experience rather than more objective and broad measures of service delivery and patient outcome. Does the American College of Radiology have the ability to better measure subspecialization among its membership? Certainly. The College already hosts a robust informatics infrastructure. These facilities are used in conjunction with a variety of registries, such as the National Radiology Data Registry [14]. Voluntary collection of aggregate CPT code submissions by members would be relatively easy by comparison to other ongoing projects, and would leave ACR with objective data regarding practitioners' actual care delivery. Using this information – the actual care delivered – would immediately eliminate the variable of definitions, concepts of work effort, and many of the inaccuracies inherent in data collected through a polling process.

CONCLUSIONS

Subspecialization in the field of radiology is increasing for a majority of respondents, but only a minority of radiation oncologists is so impacted. Both specialties are using similar mechanisms to accommodate this trend. Radiologists identify significantly more stress from referring physicians to subspecialize and in response radiology trainees far outnumber radiation oncologists in their pursuit of fellowship training.

Despite the growth of subspecialty care, generalists remain a substantial portion of practitioners in both fields. A significant amount of subspecialists' time is devoted to work they describe as "general." In addition to studies like this work, ACR has additional opportunities to support its membership and their patients with improved data collection techniques.

ACKNOWLEDGMENTS

The authors wish to thank Jim Moser and Jonathan Sunshine for their excellent work, commentary, and contributions. We wish to thank Christie Ji for assistance with the statistical analysis and tables, and Stephanie Le for coordinating workgroup meetings. We thank all those who replied to the surveys; their responses have provided valuable information for the entire radiology and radiation oncology professions.

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Table 1. Practice type and location of radiation oncologists and radiologists (percent)

Characteristic	Radiation Oncology	Radiology
Number of practitioners		
1	13.0	3.6
2-9	59.4	34.1
10-20	14.6	25.6
21 or more	13.0	36.6
Practice type		
Solo	8.8	3.6
Locum tenens	0.0	1.2
Primarily academic	32.1	18.2
Government	0.6	2.7
Private, multi-specialty, not primarily academic	12.7	16.2
Private radiology, not primarily academic	38.3	55.5
Private radiation oncology and radiology combined, not primarily academic	4.5	N/A
Other	2.9	2.6
Employed by hospital or healthcare system		
Yes	32.8	25.4
No	67.2	74.6
Practice location		
Main city of a large metropolitan area (pop. > 1M)	33.1	32.7
Suburb of a large metropolitan area (pop. > 1M)	20.5	17.2
Main city of a small metropolitan area (pop. 50K-1M)	26.3	26.7
Suburb of a small metropolitan area (pop. 50K-1M)	5.5	7.3
Non-metropolitan or rural (pop. < 50K)	11.4	12.3
Varied locations	3.2	3.8

Source: ACR 2008 survey of postgraduate, professionally active radiation oncologists. ACR 2008 survey of postgraduate, professionally active radiologist ACR members.
Notes: Results for radiation oncologists are not weighted; the percentage for “Solo” is less than the percentage for one radiation oncologist in the practice because several practices with one radiation oncologist were in multi-specialty practices with physicians in other specialties. Results for radiologists are weighted to be representative of all US radiologists. Number of practitioners includes full-time and part-time.

Table

Table 2. Desired practice type and location of radiology residents and fellows (percent)

Characteristic	Radiation Oncology	Radiology
Most desired practice type		
Solo	3.1	2.0
Locum tenens	1.0	0.4
Primarily academic	37.5	26.1
Government	1.0	2.3
Private, multi-specialty, not primarily academic	11.5	40.9
Private radiology, not primarily academic	36.5	25.7
Other	N/A	2.9
Private radiation oncology and radiology combined practice, not primarily academic	5.2	N/A
Most desired practice location		
Main city of a large metro area (pop. > 1M)	45.8	31.2
Suburb of a large metro area (pop. > 1M)	20.8	28.1
Main city of a small metro area (pop. 50K-1M)	24.0	25.3
Suburb of a small metro area (pop. 50K-1M)	6.3	11.6
Non-metro or rural (pop. < 50K)	1.0	4.1
Varied locations	1.0	2.4
Year finished/will finish residency		
2006 or before	2.1	3.6
2007	7.3	13.5
2008	41.7	22.3
2009	34.4	31.3
2010	14.6	21.5
2011 or after	3.1	7.9

Source: ACR 2008 survey of radiation oncology residents and fellows. ACR 2008 survey of radiology residents and fellows who are ACR members.
Notes: Results for radiation oncology are not weighted. Results for radiologists are weighted to be representative of all radiologists in the US.

Table

Table 3. Number of times changed main focus of work (percent)

Characteristic	Radiation Oncology	Radiology
None	52.6%	74.8%
One time	18.7%	14.6%
Two times	14.9%	6.6%
Three times	7.5%	3.6%
Four times or more	6.3%	0.4%

Source: ACR 2008 survey of postgraduate, professionally active radiologist ACR members.
Notes: Results for radiology are weighted to be representative of all radiologists in the US.

Table

Table 4. Radiologists' main subspecialty and work time in subspecialty (percent)

	Main Subspecialty*	Work Time
Abdominal Imaging	3.5%	4.5%
Body Imaging/Cross-sectional Imaging	11.0%	10.3%
Breast Imaging/Mammography	15.8%	11.3%
Cardiac/Cardiovascular Imaging	1.3%	1.4%
Chest (Thoracic) Imaging	2.4%	5.1%
Emergency and Trauma Radiology	1.3%	4.4%
Gastrointestinal Radiology	0.7%	1.5%
General Radiology	1.5%	18.9%
Genitourinary Radiology	0.3%	1.0%
Interventional/Vascular Radiology	15.8%	7.0%
MR Imaging	7.4%	5.9%
Musculoskeletal Radiology	6.2%	4.5%
Neurointerventional Radiology	1.2%	1.0%
Neuroradiology	17.1%	9.0%
Nuclear Medicine/Nuclear Radiology	6.1%	3.9%
Pediatric Radiology	2.7%	2.1%
Ultrasound	2.3%	4.7%
Women's Imaging	3.0%	2.2%
Not involved in any clinical activity	0.2%	0.5%
Other (Thyroid, Nonvascular Intervention, etc.)	0.6%	1.1%

Source: ACR 2008 survey of postgraduate, professionally active radiologist ACR members.
Notes: Results are weighted to be representative of all radiologists in the US.
* 23.8% of all respondents stated they were not subspecialized. Only responses reflecting subspecialization are listed in this table.

Table 5. Radiation oncologists' main subspecialty and percent of work time in subspecialty (percent)

	Main Subspecialty	Work Time
Body Part/Organ System		
Head and neck	17.1%	14.2%
Prostate	18.9%	21.9%
Gynecologic	4.0%	7.3%
Breast	17.7%	23.6%
Lung	3.4%	14.8%
Pediatric	4.6%	2.2%
Other (Thyroid, GI, CNS)	6.9%	16.0%
Modality		
Brachytherapy	9.1%	8.5%
Radiosurgery	12.0%	6.3%
Conventional radiotherapy	0.0%	17.3%
3-dimensional conformal radiotherapy	0.0%	32.0%
Intensity modulated radiation therapy	6.3%	34.6%
Coronary artery brachytherapy	0.0%	0.0%
Other		1.3%

Source: ACR 2008 survey of postgraduate, professionally active radiation oncologists.
Notes: Results are not weighted.

Table 6. Subspecialization satisfaction, cross coverage, and motivations (percent)

	Radiation Oncology	Radiology
Extent of subspecialization in own work compared with desired work		
Would like a lot more subspecialization	4.5	4.9
Would like somewhat more subspecialization	20.5	14.6
About right	69.4	76.6
Would like somewhat less subspecialization	4.9	2.7
Would like a lot less subspecialization	0.7	1.2
Subspecialty coverage in respondent's absence		
A practitioner from a different subspecialty from within practice	19.8	3.3
A practitioner from the same subspecialty from within practice	28.4	64.2
A generalist from within practice	20.9	14.8
A practitioner from a different subspecialty or a generalist from outside practice	3.0	0.8
A practitioner from the same subspecialty from outside practice	1.1	2.0
A practitioner from outside practice, field not known	0.0	0.7
Other	2.6	N/A
Don't subspecialize	24.3	14.1
Practitioner's perception of pressure to subspecialize		
Much pressure	3.0	10.5
Moderate pressure	28.0	39.3
Little or no pressure	69.0	50.2
Main sources of motivation to subspecialize (multiple responses allowed)		
To improve quality of service to patients	71.5	57.7
Demand by referring physicians	39.8	70.8
Demand by hospitals	14.6	34.7
Demand by payers	1.6	13.2
New diagnostic imaging technology	N/A	45.4
Teleradiology	N/A	12.5
Other	13.0	N/A

Source: ACR 2008 survey of postgraduate, professionally active radiation oncologists. ACR 2008 survey of postgraduate, professionally active radiologist ACR members.
Notes: Results for radiation oncologists are not weighted. Results for radiologists are weighted to be representative of all radiologists in the US.

Table

Table 7. Subspecialization expansion of radiation oncologists and radiologists (percent)

	Radiation Oncology	Radiology
Practice has recently increased subspecialization through new members or other means	29.9	62.9
Method of increasing subspecialization (multiple choices allowed)		
Existing practitioners undertook subspecialty training	56.2	64.0
Hired additional practitioners	59.4	95.2
Electronic intrapractice image distribution	N/A	74.7
Electronic extra-practice image distribution (outsourcing)	N/A	24.6
Consolidated with other practices	27.9	29.1
Used other local practices to do some subspecialty work	22.2	24.6
Other	40.0	N/A
Subspecialty training for existing practitioners		
Courses, on-job training, not involving multi-week absences from practice	84.7	76.1
Fellowship or mini-fellowship away from practice	27.7	61.2

Source: ACR 2008 survey of postgraduate, professionally active radiation oncologists. ACR 2008 survey of postgraduate, professionally active radiologist ACR members.
Notes: Results for radiation oncologists are not weighted. Results for radiologists are weighted to be representative of all radiologists in the US.

Table 8. Subspecialty plans and views of radiation oncology and radiology residents and fellows (percent)

	Radiation Oncology	Radiology
Intend to pursue a fellowship	7.3	91.5
Choice of whether to do a fellowship (multiple choices allowed)		
Do not want to, but likely necessary to get a job	6.3	14.1
Always wanted and planned to do a fellowship	6.3	80.1
Compelled to by recent proposed changes to ABR Boards	N/A	8.0
Do not want to, but encouraged by residency program	0	8.9
Plan to subspecialize		
Yes	42.7	89.9
No	26.0	5.9
Too early in residency to know	31.3	4.2
Desired degree of subspecialization to practice		
One area (i.e., modality, organ system)	N/A	26.6
Two or three areas	N/A	52.7
More than three areas	N/A	14.8
Desired percent of clinical work time at most prominent subspecialty	100.0	61.5
Amount of pressure felt to subspecialize		
Much pressure	1.0	27.1
Moderate pressure	22.9	51.9
Little or no pressure	76.0	21.0
Main sources of pressure to subspecialize (multiple mentions allowed)		
Intended or prospective employers	21.9	62.0
Improve quality of service to patients	41.7	60.3
Faculty encouragement	25.0	44.6
New Radiation Oncology technology	30.2	41.5
Referring physicians	2.1	22.3
Hospitals	0.0	13.9
Payers	1.0	9.9
Subspecialization desirability in light of competition from other specialties		
Likely beneficial to profession	47.9	51.7
Subspecialization not necessary, makes no difference	31.3	5.0
Imperative for continuation of the profession	10.4	36.2
Likely to harm the profession	7.3	5.3
Will ultimately result in demise of the medical specialty	3.1	1.8

Source: ACR 2008 survey of radiation oncology residents and fellows. ACR 2008 survey of radiology residents and fellows who are ACR members.
Notes: Results are not weighted.

Table 9. Preferred subspecialty areas of radiology residents and fellows (multiple mentions allowed)

Modality	Percent
Body Imaging	23.0%
Musculoskeletal Imaging	22.5%
Neuroradiology	21.8%
MR Imaging	18.0%
Interventional / Vascular Radiology	16.6%
Breast Imaging / Mammography	14.0%
Abdominal	12.5%
Pediatric Radiology	7.5%
Too early in residency to know	6.4%
Women's Imaging	6.2%
Cardiac/Cardiovascular Imaging	5.8%
General Radiology	5.5%
Chest (Thoracic) Imaging	4.6%
Ultrasound	4.0%
Do not plan to subspecialize	3.8%
Neurointerventional Radiology	3.6%
Emergency and Trauma Radiology	3.0%
Nuclear Medicine	2.9%

Source: ACR 2008 survey of radiology residents and fellows who are ACR members.
Notes: Results are not weighted.

Table 10. Preferred subspecialty areas of radiation oncology residents and fellows (multiple mentions allowed)

Modality	Percent
Do not plan to subspecialize / Too early in residency to know	44.3%
Radiosurgery	23.9%
Head and Neck	19.3%
Intensity modulated radiation therapy (IMRT)	15.9%
Other	13.6%
Prostate	12.5%
Brachytherapy	11.4%
Breast	11.4%
Gynecologic	10.2%
Lung	10.2%
Pediatric	5.7%
3-dimensional conformal radiotherapy	2.3%
Coronary artery brachytherapy	0.0%

Source: ACR 2008 survey of radiation oncology residents and fellows.
Notes: Results are not weighted.

Table 11. Radiologist subspecialization and plans of residents and fellows

Subspecialty	Preferred Subspecialty of Radiology Residents & Fellows (A)	Radiologist Main Subspecialty (B)	Radiologist Subspecialty Work Time (C)	(A) - (B)	(A) - (C)
Abdominal/Body/Chest/Cross-sectional Imaging	23.4%	17.1%	20.7%	6.3%	2.7%
Cardiac/Cardiovascular Imaging	3.4%	1.3%	1.5%	2.1%	1.9%
Emergency and Trauma Radiology	1.7%	1.3%	4.6%	0.4%	-2.9%
General Radiology	3.2%	1.5%	19.6%	1.8%	-16.3%
Interventional/Vascular Radiology	9.7%	16.0%	7.3%	-6.3%	2.4%
Mammography/Breast/ Women's Imaging	11.8%	19.1%	14.0%	-7.3%	-2.2%
MR Imaging	10.5%	7.5%	6.1%	3.0%	4.4%
Musculoskeletal Radiology	13.1%	6.3%	4.7%	6.8%	8.4%
Neurointerventional Radiology	2.1%	1.2%	1.0%	0.9%	1.1%
Neuroradiology	12.7%	17.3%	9.4%	-4.6%	3.3%
Nuclear Medicine/Nuclear Radiology	1.7%	6.2%	4.1%	-4.5%	-2.4%
Pediatric Radiology	4.4%	2.7%	2.2%	1.7%	2.2%
Ultrasound	2.3%	2.3%	4.9%	0.0%	-2.6%

Source: ACR 2008 survey of radiology residents and fellows who are ACR members. ACR 2008 survey of post-training, professionally active radiologists who are ACR members.
Note: Results for radiologists are weighted to be representative of all radiologists in the US. Results for residents and fellows are not weighted. Responses of “no subspecialty” were deleted and the percentages for the named subspecialties rescaled to add to 100%. Some subspecialties are combined that are presented separately in other tables.

Table 12. Radiology subspecialization supply and demand

Subspecialty	Future Supply (A)	Current Supply (B)	Demand (C)	Demand less Current Supply (C – B)	Future Supply less Current Supply (A – B)
Abdominal/Body/Chest/ Cross-sectional Imaging	23.4%	17.1%	20.7%	++	++
Cardiac/Cardiovascular Imaging	3.4%	1.3%	1.5%	+	+
Emergency and Trauma Radiology	1.7%	1.3%	4.6%	++	+
General Radiology	3.2%	1.5%	19.6%	+++++	+
Interventional/Vascular Radiology	9.7%	16.0%	7.3%	- - -	- -
Mammography/Breast/ Women's Imaging	11.8%	19.1%	14.0%	- -	- -
MR Imaging	10.5%	7.5%	6.1%	-	+
Musculoskeletal Radiology	13.1%	6.3%	4.7%	-	+++
Neurointerventional Radiology	2.1%	1.2%	1.0%	-	+
Neuroradiology	12.7%	17.3%	9.4%	- - - -	- -
Nuclear Medicine/Nuclear Radiology	1.7%	6.2%	4.1%	-	- -
Pediatric Radiology	4.4%	2.7%	2.2%	-	+
Ultrasound	2.3%	2.3%	4.9%	+	=

Source: ACR 2008 survey of radiology residents and fellows who are ACR members. ACR 2008 survey of postgraduate, professionally active radiologists who are ACR members.
Note: Results for radiologists are weighted to be representative of all radiologists in the US. Results for residents and fellows are not weighted. Responses of “no subspecialty,” “not involved in any clinical activity,” and “other specialty” were deleted and the percentages for the named subspecialties rescaled to add to 100%. Some subspecialties are combined that are presented separately in other tables.

Table

Table 13. Radiation oncologists subspecialization and plans of residents and fellows

Subspecialty	Preferred Subspecialty of Radiation Oncology Residents & Fellows (A)	Radiation Oncologist Main Subspecialty (B)	Radiation Oncologist Subspecialty Work Time (C)	(A) - (B)	(A) - (C)
Brachytherapy	8.4%	9.1%	4.6%	-0.7%	3.8%
Breast	8.4%	17.7%	13.0%	-9.3%	-4.6%
Coronary artery brachytherapy	0.0%	0.0%	0.0%	0.0%	0.0%
Gynecologic	7.5%	4.0%	4.0%	3.5%	3.5%
Head and Neck	14.1%	17.1%	7.8%	-3.0%	6.3%
Intensity modulated radiation therapy (IMRT)	11.7%	6.3%	18.9%	5.4%	-7.3%
Lung	7.5%	3.4%	8.1%	4.1%	-0.6%
Other	10.0%	6.9%	9.4%	3.1%	0.5%
Pediatric	4.2%	4.6%	1.2%	-0.4%	3.0%
Prostate	9.2%	18.9%	12.0%	-9.7%	-2.8%
Radiosurgery	17.5%	12.0%	3.4%	5.5%	14.1%
3-dimensional conformal radiotherapy	1.7%	0.0%	17.5%	1.7%	-15.8%

Source: ACR 2008 survey of radiation oncology residents and fellows. ACR 2008 survey of postgraduate, professionally active radiation oncologists.
Note: Results are not weighted. Responses of “no subspecialty” were deleted and the percentages for the named subspecialties rescaled to add to 100%. Some subspecialties may be combined that are presented separately in other tables.

Table

Table 14. Five most common main subspecialties and work time spent in subspecialty areas by radiologists

Top Main Subspecialties (Percent indicating as main subspecialty)	Area of Most Work Time (Mean %)	Area of Second Most Work Time (Mean %)	Area of Third Most Work Time (Mean %)	Area of Fourth Most Work Time (Mean %)	Area of Fifth Most Work Time (Mean %)
Neuroradiology (17.1)	Neuroradiology (52.4)	General Radiology (10.6)	Body Imaging/Cross-sectional imaging (6.4)	MR Imaging (4.7)	Musculoskeletal Radiology (3.5)
Interventional/ Vascular Radiology (15.8)	Interventional/ Vascular Radiology (48.7)	General Radiology (20.5)	Body Imaging/Cross-sectional imaging (6.6)	Abdominal Imaging (3.0)	Emergency and Trauma Radiology (2.6)
Breast Imaging/ Mammography (15.8)	Breast Imaging/ Mammography (57.4)	General Radiology (13.9)	Body Imaging/Cross-sectional imaging (6.2)	Ultrasound (3.2)	Women's Imaging (3.2)
Body Imaging/ Cross-sectional imaging (11.0)	Body Imaging (40.0)	General Radiology (10.9)	Ultrasound (6.6)	Musculoskeletal Radiology (5.3)	Neuroradiology (4.9)
MR Imaging (7.4)	MR Imaging (28.9)	General Radiology (19.5)	Body Imaging/Cross-sectional imaging (10.6)	Ultrasound (6.1)	Abdominal Imaging (4.8)

Source: ACR 2008 survey of posttraining, professionally active radiologist ACR members.
Notes: Results are weighted to be representative of all posttraining, professionally active radiologists in the US.

Table 15. Characteristics of radiologists by practice size

	Number of Radiologists in the Practice			
	1	2 – 10	11 – 20	21 or more
Practice Type				
Solo	100.0%	0.0%	0.0%	0.0%
Locum Tenens	0.0	0.7	0.4	0.3
Primarily Academic	0.0	4.0	10.6	36.5
Government	0.0	4.3	3.7	1.0
Private multi-specialty	0.0	16.5	17.9	17.2
Private Radiology	0.0	70.7	65.2	43.4
Other Practice type	0.0	3.8	2.3	1.6
Location				
Main city of large metro area	11.9	18.2	27.9	51.1
Suburb of large metro area	9.2	17.5	20.3	16.4
Main city of smaller metro area	25.7	24.8	40.0	25.0
Suburb of smaller metro area	2.5	11.6	9.8	2.3
Non-metro or rural	43.5	24.7	5.8	2.5
Varied locations	7.2	3.2	2.2	2.7
Region				
Northeast	16.7	19.3	28.0	22.7
Midwest	10.8	19.5	16.1	28.1
South	48.2	38.9	31.8	29.8
West	24.3	22.3	24.1	19.3
Percent who subspecialize	39.3	62.3	81.8	89.1
Percent of work time in General Radiology				
0	23.3	38.3	32.1	52.3
1 – 20	29.8	32.9	40.9	30.5
21 – 40	6.5	6.3	12.5	7.3
41 – 60	5.9	7.4	5.8	3.9
61 – 80	5.5	3.6	4.3	2.0
81 – 100	26.0	11.5	4.5	4.0

Source: 2008 ACR survey of post-training, professionally active radiologist ACR members.
Notes: Results are weighted to be representative of all post-training, professionally active radiologists in the US. Number of radiologists includes full-time and part-time.

Table 16. Main subspecialty of radiologists in 2003 and 2008 (percent)

Subspecialty	Main Subspecialty in 2003	Main Subspecialty in 2008	Relative Difference
Musculoskeletal	≤ 1.0	4.7	370.0
Women's imaging	≤ 1.0	2.3	130.0
Neuroradiology	8.8	13.0	47.7
Magnetic resonance imaging	3.8	5.6	47.4
Chest	1.3	1.8	38.5
Abdominal	2.0	2.7	35.0
Breast	9.4	12.0	27.7
Body	7.3	8.4	15.1
Interventional or vascular	10.8	12.0	11.1
Nuclear medicine or radiology	4.3	4.6	7.0
Cardiac	≤ 1.0	≤ 1.0	0.0
Emergency	≤ 1.0	1.0	0.0
Gastrointestinal	≤ 1.0	≤ 1.0	0.0
Genitourinary	≤ 1.0	≤ 1.0	0.0
Neurointerventional	≤ 1.0	≤ 1.0	0.0
Ultrasound	1.9	1.7	-10.5
Pediatric	2.9	2.0	-31.0
General radiology	NA	1.1	NA

Sources: ACR 2003 survey of radiologists. ACR 2008 survey of postgraduate, professionally active radiologists who are ACR members.
Note: Entries exclude radiologists who indicated they did not have a main subspecialty. 2008 data are weighted to be representative of all radiologists in the US. Rows are arranged in descending order of 2003-2008 difference. For calculating the 2003-2008 difference, values ≤ 1.0% were set to 1.0%. NA = not available.