

A Survey of Breast Imaging Fellowship Programs: Current Status of Curriculum and Training in the United States and Canada

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Purpose: The Society of Breast Imaging and the Education Committee of the ACR Breast Commission conducted a survey of breast imaging fellowship programs to determine the status of fellowship curricula, help identify strengths and potential areas for improvement, and assess the current demand for fellowship programs.

Methods: In 2012, a two-part survey was emailed to breast imaging fellowship directors from 72 fellowship programs.

Results: Of the 66 respondents, a total of 115 positions were identified. There were 90 positions with 9-12 months of breast imaging, and 25 positions with 6 months focused on breast imaging. Approximately two-thirds of programs reported an increase in the number of fellowship applicants, with three-quarters having 3 or more applicants for each position. All programs offered digital mammography, breast MRI, and diagnostic ultrasound services, and nearly all provided experience with interventional procedures. Approximately one-third provided breast screening ultrasound training. More than two-thirds required at least a 1-day rotation with a breast surgeon. Important nonclinical areas of training were not addressed in many programs. Approximately 40% of programs did not offer training related to the practice audit, and one-third of programs did not provide formal training related to quality control.

Conclusions: Breast imaging fellowships are currently in higher demand than in the past. Most fellowship programs provide training in the key imaging modalities and interventional procedures. Potential gaps in training for many programs include the practice audit, quality control procedures, breast positioning, and mammography technical factors.

Key Words: Breast imaging, radiology training, fellowship, radiology education

J Am Coll Radiol 2014;11:894-898. © 2014 Published by Elsevier Inc. on behalf of American College of Radiology

INTRODUCTION

Breast imaging is a dynamic and challenging field in radiology. Since the 1970s, after randomized trials first showed that screening mammography saves lives, radiologists have played a pivotal role in the early detection of breast cancer [1,2]. Breast imagers are invaluable

members of the multidisciplinary health care team, playing a role in the detection, evaluation, and diagnosis of benign and malignant breast disease. The need for individuals trained in this subspecialty area continues to grow as more women enter the screening population and the diversity of breast imaging services increases. In addition, as radiology groups become more subspecialized, many practices seek radiologists who are skilled in breast imaging. Study data suggest that fellowship-trained and experienced breast imagers have improved accuracy [3]. Strong breast health programs attract women patients, who make 80% of health care decisions for families [4]. Therefore, health care plans seek radiology partners with skilled breast imagers.

In the past, recruiting radiology residents into the breast imaging subspecialty was challenging, owing to the perceived high risk of malpractice, high stress, and low reimbursement, and to a higher level of interest in fields

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heavily weighted in CT and MRI techniques [5-8]. However, more recently, the popularity of breast imaging fellowships has increased, possibly in part as a result of advancements in technology, such as image-guided interventional procedures, digital mammography, MRI, and more recently, digital breast tomosynthesis [9].

As the demand for breast imagers has increased, the number of fellowship programs has also increased, from 53 programs in 2000 to 63 in 2008 [5,10]. In the recent past, a breast imaging fellowship graduate was in great demand in the job market owing to the high volume of job vacancies [11,12]. Anecdotal evidence indicates that the combination of having more fellowship-trained specialists and fewer job openings has recently made the job search more competitive.

The Society of Breast Imaging (SBI) and the Education Committee of the ACR Breast Commission conducted a survey of breast imaging fellowship programs, which included programs offering 6-12 months of breast imaging fellowship training. The purpose of the survey was to determine the status of fellowship curricula, which would help identify strengths and potential areas for improvement. The survey also assessed the current demand for fellowship programs and the types of jobs obtained after completion of the programs.

METHODS

In 2012, we conducted a two-part e-mail survey with breast imaging fellowship directors from 72 fellowship programs. These programs were identified via the SBI. The preliminary 5-minute survey covered basic demographic information about the fellowship program. Of the 72 programs, 66 completed this portion of the survey (92% response rate). The second part of the survey included questions on practice volume, fellowship curriculum, and job market issues. This 15-minute survey was completed by 49 programs (68% response rate). Informed consent was waived by the Washington University School of Medicine institutional review board.

The survey tool was designed by several members of the Education Committee of the ACR Breast Imaging Commission and the SBI Education Committee who are also authors of the current paper (DF, DM, MR, BM, LB). One of the authors was a breast imaging fellow at the time of the study (JS).

General Practice Characteristics

Basic demographic questions on practice type and location were included. Questions addressed 2011 practice volumes for a broad range of procedures, including screening and diagnostic mammography, screening and diagnostic ultrasonography, interventional procedures, and breast MRI.

Nature of Training and Curriculum

Fellowship directors were asked specific questions about their programs. These items addressed the number of

trainees, length of training, and amount of hands-on experience with ultrasound, in addition to required and elective rotations. Questions addressed opportunities for formal training on patient positioning, technical settings, quality control procedures, practice audit, research, and conferences. In addition, respondents were asked whether fellows spent time with other breast cancer specialists, such as medical oncologists, radiation oncologists, pathologists, or breast surgeons. There were also questions regarding whether the fellows had academic time, call duties, and opportunities for extra income.

Job Market

Fellowship directors answered a series of questions regarding difficulty in filling fellowship positions and the types of jobs their fellows obtained after training from 2009 to 2011. Questions about the demand for 2013-2014 fellowship positions were also included.

RESULTS

General Practice Characteristics

Of the 66 respondents, 56 (84.8%) programs were associated with an academic practice, 7 with a hybrid academic/private practice, and 3 with a private practice. Twenty-two programs were located in the South, 19 in the Northeast, 14 in the Midwest, 8 in the West, and 3 in Canada. For the 2014-2015 academic year, 90 (78%) fellowship positions were offered with 9-12 months of training. There were 25 (22%) positions at programs that offered 6 months of breast imaging fellowship training. These programs were usually women's imaging programs or combined breast imaging/body imaging fellowships.

The majority of programs had moderate to large mammogram volumes in 2011. Of the 49 respondents, 42 (85.7%) performed more than 10,000 screening mammograms in 1 year. For diagnostic mammograms, 17 programs (34.7%) performed more than 10,000 diagnostic mammograms (Table 1). In 2011, a total of 45 (91.8%) of the respondents utilized full-field digital mammography for 100% of their exams; the remaining 4 (8.2%) practices reported that >75% of their mammograms were digital exams.

The majority of programs did not offer training in screening whole breast ultrasound (32; 65.3%) in 2011. In contrast, diagnostic ultrasound was performed at all sites. Fifteen (30.6%) sites performed >5000 exams annually (Table 1).

In 2011, one of the fellowship programs did not offer interventional breast procedures, which include imaging-guided core biopsies and fine-needle aspirations. Approximately three-quarters of the programs performed ≥ 1000 interventional procedures in 2011 (Table 1).

All of the fellowships offered breast MRI services in 2011. However, the volume of procedures was variable.

Table 1. Fellowship program procedure volumes, 2011, % (n) by annual volume

Screening Mammograms		Screening Ultrasound		Breast MRI	
Not performed	0	Not performed	65.3% (32)	Not performed	0
5000-10,000	14.3% (7)	<500	12.2% (6)	<250	10.2% (5)
10,001-20,000	46.9% (23)	500-1000	6.1% (3)	251-500	20.4% (10)
20,001-30,000	16.3% (8)	1001-5000	10.2% (5)	501-1000	36.7% (18)
>30,000	22.4% (11)	>5000	6.1% (3)	>1000	32.6% (16)
Diagnostic Mammograms		Diagnostic Ultrasound		Interventional Procedures	
Not performed	0	Not performed	0	Not performed	2.0% (1)
1000-5000	18.4% (9)	500-1000	4.1% (2)	251-500	4.1% (2)
5001-10,000	46.9% (23)	1001-2500	30.6% (15)	501-1000	22.4% (11)
10,001-20,000	24.5% (12)	2501-5000	34.7% (17)	1001-2000	46.9% (23)
>20,000	10.2% (5)	>5000	30.6% (15)	>2000	24.5% (12)

Approximately one-third (32.6%) of programs performed > 1000 exams (Table 1). For most practices, the majority of the MRI exams were for diagnostic purposes. Screening MRI comprised <10% of the MRI volume for 3 programs (6.1%); it comprised 11%-25% of MRI volume in 12 (24.5%) programs; it comprised 26%-50% of MRI volume in 19 (38.8%) programs; and it was the majority of the MRI volume in 15 (30.6%) programs.

Nature of Training

From 2009 to 2011, the median number of fellows trained per program was 1.7 individuals per academic year, with a range of 0.5 to 6 trainees per program each academic year. Most programs (55.1%) provided elective time for their fellows outside of breast imaging. The amount of time ranged from less than 1 month to 4 months. The median number of call days per month was 1, but the range was broad: 0 to >10. We did not inquire about the workload associated with call duty or whether call duty was performed onsite or from home.

Academic time was also variable. Fifteen programs (30.6%) did not offer academic time to fellows. Six programs (12.2%) offered <1 day per month; 15 programs (30.6%) offered 1-3 days per month; 13 programs (26.5%) offered ≥ 4 academic days each month. Opportunities for additional pay were common, with 38 programs (61.2%) providing mechanisms for supplemental income after hours.

Curriculum

Attending staff supervision varied. Of the 43 respondents with 12-month programs, 10 sites (23.3%) did not allow fellows to interpret mammograms or perform procedures independently. In 5 programs (1.6%), <3 months of independence was permitted; in 13 programs (30.2%), 3-6 months was allowed; and in 15 programs (34.9%), >6 months was the norm.

Many of the fellowships (77.6%) provided substantial hands-on experience with ultrasound for their fellows. Twenty-eight (57.1%) reported that hands-on scanning was possible in >75% of the fellow's cases. Eight (16.3%) reported this experience in 51%-75% of cases; 3 (6.1%) in

26%-50% of cases; and 10 (20.4%) in <25% of cases. To enhance the breast imaging fellowship experience, some programs required fellows to spend at least 1 day with other specialists in breast health. Thirty-four (69.4%) programs provided time with breast surgery; 28 (57.1%) with breast pathology; 21 (42.9%) with radiation oncology; and 18 (36.7%) with medical oncology.

Fellowship programs also required participation in conferences. Of 49 respondents, 48 (98.1%) required participating in multidisciplinary conferences; 39 (79.6%) required radiology-pathology conferences; 27 (55.1%) required journal club participation; and 18 (36.7%) required Grand Rounds. In addition to clinical responsibilities, 30 programs (61.2%) required research involvement; 42 (85.7%) required fellows to conduct case conferences to teach residents; 11 (22.4%) required oral presentations to either other professionals or the lay community.

Since breast imaging is highly regulated by the FDA, a complete understanding of breast imaging quality issues is essential. Many fellows are expected to lead quality assurance programs in breast imaging in their new jobs. However, 7 programs (14.3%) offered no formal training in mammography positioning and technical settings. Seventeen programs (34.7%) did not provide formal training in quality control tests, and 20 programs (40.8%) provided no training related to the practice audit (Table 2).

Fellowship Applicants and Positions

The 2013-2014 ratios of applicants to fellowship positions were high for most programs. Thirty-six programs (73.5%) had >3 applicants for each position. Eleven programs (16.3%) had 1-3 applicants for each position. Two programs (4.1%) reported more fellowship positions than applicants but did not quantify the exact number of applicants. Two years ago, 20 programs (40.8%) had >3 applicants for each position; 26 (53.1%) had 1-3 applicants for each position; 3 (6.1%) had more positions than applicants.

From 2009 to 2011, a total of 1.7 fellows per academic year were trained. For 2013-2014, the number of funded fellowship positions offered at each program ranged from 1 to 9. The median number of positions was 2. In the 2013-2014 academic year, the majority of programs

Table 2. Quality control training, % (n) by method of training

Mammogram Positioning and Technical Settings		QC Tests		Practice Audit	
No formal training	14.3% (7)	No formal training	34.7% (17)	No formal training	40.8% (20)
At viewbox with attending	85.7% (42)	Time with QC technologist	51.0% (25)	Hands-on	24.5% (12)
Hands-on with technologist	73.5% (36)	Time with physicist	24.5% (12)	Video/slide presentation	8.2% (4)
Video/slide presentation	8.2% (4)	Video/slide presentation	12.2% (6)	Other (mock audit)	34.7% (17)

Note: QC = quality control.

(31; 63.3%) experienced an increase in the number of fellowship applicants, whereas 14 (28.6%) programs had a stable number, and 4 programs (8.2%) reported a decrease.

Compared to 5 years ago, most programs (28; 57.1%) reported that the stress associated with the fellowship application process has not changed significantly. Four programs (8.2%) reported that the process is less stressful, and 17 programs (34.6%) reported that the process is more stressful.

Job Market

Compared to 5 years ago, most programs (29; 59.1%) reported that their fellows had more difficulty obtaining jobs after training. Twelve programs (24.5%) reported no change in difficulty; 4 programs (8.2%) stated that the process was easier; 4 programs (8.2%) did not have fellowship programs 5 years ago. From 2009 to 2011, the respondents trained 267 fellows, with ≥ 6 months dedicated to breast imaging. The programs reported that 82.0% (219) of these fellows accepted jobs in which the majority of their time was dedicated to breast imaging. From 2009 to 2011, the programs reported that 73.8% (197) entered private practice for their first job after fellowship.

DISCUSSION

The number of programs offering breast imaging fellowships has grown from 53 programs in 2000 to 63 programs in 2008 to 72 programs in 2012. Although the number of programs has increased, the number of fellowship positions has remained relatively stable. In 2008, there were 110 positions; in 2012, there were 115 positions, representing a slight decline in the number of positions per program [5,7,10]. In coming years, it will be important to see if this trend continues.

Approximately two-thirds of programs reported an increase in the number of fellowship applicants, and nearly three-quarters had >3 applicants for each position. This increased competition for breast imaging fellowships may be due to several factors. First, recently there was a shortage of breast imagers, resulting in high demand for individuals with training in breast imaging [13]. Anecdotal evidence indicates that this shortage has led to more job openings related to breast imaging than to some other subspecialties. Second, in a study by Mulcahy et al [14], recent fellows predicted that the

demand for all breast imaging fellowships would increase as a result of the new ABR certification process.

The subspecialty's image may be improving. A 2008 survey of residents reported that approximately one-half of residents would not consider a breast imaging fellowship if it were offered. Although far from ideal, these data represent an improvement from 2000 when two-thirds of residents would not consider breast imaging [5,7]. Another 2008 survey of 344 residents at 26 residency programs confirms negative perceptions, which include high stress, low reimbursement, and high malpractice risk [6]. However, the results also acknowledge that residents recognize several positive attributes, including job availability (97% of subjects), flexible work schedule (94%), and few calls or emergencies (93%).

There are published guidelines regarding appropriate breast imaging training for residents and fellows [15]. Breast imaging fellowships should provide deeper training in "bread and butter" breast imaging procedures, as compared to residency training. Fellows should gain ample experience with full-field digital mammography, diagnostic breast ultrasound, breast MRI, and interventional procedures. If a program is not able to provide an adequate volume of interventional procedures, including wire needle localizations, cyst aspirations, as well as stereotactic, ultrasound, and MRI-guided biopsies, then supplemental training at another facility is necessary. In our survey, only 1 program did not offer interventional procedure training. We do not know if these fellows have an opportunity for supplemental training at an outside facility.

In light of the regulatory demands and high level of patient interaction in the field of breast imaging, there are nonimaging areas that are also important for breast imaging fellowship training. These areas include breast positioning, mammography technical factors, medical audit, quality control tests, and patient communication [15]. In this study, the degree of training in these areas was variable. The survey did not address patient communication, but the results do show that there is room for improvement in other areas. Approximately 40% of programs did not offer training related to the practice audit, and one-third of programs did not provide formal training related to quality control.

The current ACR/SBI curriculum recommends observation of pathology, breast surgery, and radiation therapy practices as part of fellowship training. Our results indicate

that many programs do not provide this valuable exposure [15]. Approximately one-third of programs do not offer at least 1 observation day of breast surgery practice; nearly one-half do not provide time with breast pathology; and more than one-half do not provide radiation therapy training exposure. The multidisciplinary nature of breast cancer care requires that breast imagers have a full understanding of the role of all specialists on the health care team.

This study has several limitations. First, we may not have captured all fellowship programs. To address this limitation, we used several sources to identify current programs. We contacted all programs listed by the SBI and asked them to identify other programs we may have omitted. We also sent letters to residency program directors inquiring about breast imaging fellowship programs at their institutions. Second, this study is a cross-sectional study, which offers a snapshot of fellowship programs at a single point in time. A follow-up survey in 5 years may be useful to identify programmatic trends. In addition, we report whether fellows obtained training in a variety of areas. However, this study does not address whether the amount of training in each program was adequate for the fellows as they started to practice breast imaging independently. A survey of recent fellowship graduates would be necessary to obtain this information. Finally, this survey provides information on the stress of the fellowship application process and job-seeking difficulty from the perspective of the fellowship program director. Although valuable information has been obtained on these issues, the fellow's perspective on some of these issues is arguably more important.

Summary

The SBI and the Education Committee of the ACR Breast Commission conducted a survey of breast imaging fellowship programs. According to the results, breast imaging fellowships are currently in higher demand than in the past. All programs provide training in digital mammography, breast MRI, and diagnostic ultrasound. Nearly all provide exposure to interventional breast procedures. Based on the ACR/SBI curriculum, potential gaps in training for many programs include the practice audit, quality control procedures, breast positioning, and mammography technical factors. In addition, fellowship programs should consider at least 1 day of direct observation of breast surgery, breast pathology, and radiation oncology practices.

TAKE-HOME POINTS

- The number of breast imaging fellowship programs increased from 63 in 2008 to 72 in 2012. However, the number of fellowship positions has been relatively stable (110 in 2008 to 115 in 2012).
- Most programs report an increase in the number of fellowship applicants for 2013-2014 positions, compared to 2 years ago.

- All programs provide training in digital mammography, breast MRI, and diagnostic ultrasound. Nearly all provide exposure to interventional breast procedures.
- Based on the ACR/SBI curriculum, potential gaps in training for many programs include the practice audit, quality control procedures, breast positioning, and mammography technical factors. In addition, fellowship programs should consider at least 1 day of direct observation with specialists in other areas of breast health.

ACKNOWLEDGEMENTS

The authors thank Abrey Stilson, Project Coordinator of the SBI, who formatted and distributed the survey.

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