



University of
Salford
MANCHESTER

The role of the GI radiographer: A UK perspective

Nightingale, J and Hogg, P

Title	The role of the GI radiographer: A UK perspective
Authors	Nightingale, J and Hogg, P
Type	Article
URL	This version is available at: http://usir.salford.ac.uk/12543/
Published Date	2007

USIR is a digital collection of the research output of the University of Salford. Where copyright permits, full text material held in the repository is made freely available online and can be read, downloaded and copied for non-commercial private study or research purposes. Please check the manuscript for any further copyright restrictions.

For more information, including our policy and submission procedure, please contact the Repository Team at: usir@salford.ac.uk.

The Role of the GI Radiographer: A United Kingdom Perspective

JULIE NIGHTINGALE, M.Sc.
PETER HOGG, M.Phil.

Context *Since the 1990s radiographers in the United Kingdom have expanded their role in gastrointestinal (GI) radiology, first by performing double-contrast barium enema (DCBE) examinations independently and later by interpreting and reporting the results of these exams.*

Objective *This article will trace the evolution of GI radiographers in the United Kingdom, evaluate their success and explore how the U.K. experience could apply to American radiologist assistants.*

Methods *The authors surveyed the professional literature to determine the historical context in which GI radiographers emerged and assess how their performance on DCBE exams compares with radiologists' performance.*

Results *DCBE exams performed by GI radiographers have been shown to be efficient, cost effective and safe. In addition, GI radiographers have helped reduce waiting and turnaround times for DCBE exams.*

Summary *The success of GI radiographers in the United Kingdom offers assurance that radiologist assistants can benefit American patients, radiologists and radiologic technologists.*

Gastrointestinal (GI) imaging is a flourishing subspecialty of radiology. Air-contrast barium enema examinations, known as double-contrast barium enema (DCBE) exams in the United Kingdom, have long been a mainstay of GI imaging. Today DCBE exams are complemented by, or in some cases replaced by, more complex procedures such as computed tomography (CT), magnetic resonance (MR), ultrasound, nuclear medicine and endoscopy. Although DCBE eventually could be supplanted as the gold standard examination by CT-based techniques, for many patients DCBE remains the initial investigation. There are various reasons for this, including cost, availability and risk factors.

Until quite recently DCBEs were performed by a radiologist with a radiographer assistant. This "master and assistant" relationship was upheld in the United Kingdom for many decades.¹ The traditional role of the radiographer entailed preparing the room, pharmaceuticals and barium; setting exposure factors; and ensuring that images were appropriately captured, developed and prepared for reporting. The traditional role of the radiologist entailed operating the fluoroscopy equipment, positioning the patient, and capturing and reading images. Typically, physical and emotional care was

offered by the radiographer, with the radiologist usually obtaining informed consent from the patient, explaining the procedure and, if appropriate, offering the patient a verbal interpretation of the images.

In the early 1990s several "pioneers" started to perform DCBEs without radiologists present in the examination room, and during the 1990s the number of radiographers doing this increased dramatically.² Radiographers now undertake DCBEs in many hospitals with little or no supervision by a radiologist. It is fair to say that within the United Kingdom the management of DCBE has become the radiographer's domain.

This article examines the current role of radiographers in the United Kingdom who have specialized in gastrointestinal imaging procedures (known as GI radiographers) and explores the historical context of how and why the GI radiographer's role expanded. American radiographers also have started to develop their clinical responsibilities through radiologist assistant programs and may be considering establishing similar GI services.³⁻⁶ The introduction of radiographer-led services can be justified only if the efficacy of these services can be established, and we believe that the insights gained from evaluating these practices in the United Kingdom will benefit American radiologists and radiographers who are involved in GI imaging.

Literature Review

An overview of literature related to the historical development of the GI radiographer role up to the present day is presented, followed by justification for the introduction of radiographer-led DCBE services.

Historical Context

For many years, a chronic shortage of radiologists has existed within the United Kingdom. This human resource problem has been confounded by the expansion of health and medical imaging services coupled with an increase in nonclinical radiologist roles. The implementation of the European Working Time Directive, which reduced the number of hours junior doctors are legally permitted to work, and the introduction of government health targets also affected the shortage of radiologists.⁷⁻⁹ These targets focused on maximum waiting times for consultations with medical staff, appointments for diagnostic procedures, diagnostic report turnaround time and, more recently, total waiting time from initial referral to treatment and discharge. Diagnostic radiology departments were noted as a significant barrier to hospitals achieving these targets, which resulted in financial penalties ultimately being applied.

During the 1990s it became clear that radiologists could not cope with the increasing demands being placed upon them.¹⁰ Not surprisingly, alternative ways of delivering radiology services were sought, and early literature about the capability of radiographers was re-examined.¹¹ In the early 1990s new roles for radiographers started to emerge in a wide range of clinical areas. Such roles were supported by a highly critical national audit of the radiology service,¹² which determined that waiting times for examinations frequently were unacceptably long and radiological reports often were issued too late to influence patient management. The DCBE examination was particularly problematic, mostly because it had extensive patient waiting lists. Given that colorectal carcinoma has a better prognosis when treated at an early stage and any delay in treatment can result in metastasis, the DCBE examination became an area in which advanced competencies for radiographers were rapidly implemented.

In 1981 a Canadian study by Somers et al¹³ suggested that the DCBE was a potential area for role delegation from radiologists to radiographers, as it could be easily described within a written set of instructions (ie, a protocol). However, it was not seriously considered in the United Kingdom until the results of a pilot study for a DCBE training program for radiographers, frequently referred to as the "Leeds Course," were published in

1995.¹⁴ This pilot study was evaluated by comparing radiographers' and trainee radiologists' performances in several aspects of the DCBE examination. The pilot study concluded that delegating performance of DCBEs to radiographers was both safe and effective.¹⁴ The DCBE training course commenced in 1993, and over time proved to be very popular, offering radiology departments a low-cost, fast-track solution to patient waiting lists and radiologist shortages. Subsequent studies demonstrated the efficacy and wide uptake of radiographer-performed DCBE.^{15,16} This added weight to the argument that radiographers could play a much greater part in patient management, as well as providing a springboard for many radiographers to move into more challenging roles.

For many years the Leeds Course continued to be a leading provider of initial DCBE training for radiographers. On completion of this course, some radiographers pursued master's degree courses in their specialist field. The opportunity to study at a higher level provided radiographers with some of the underpinning skills and knowledge necessary to critically evaluate their GI role and therefore improve the radiology service.

It is estimated that more than 1200 U.K. radiographers have been trained to perform DCBEs. The percentage of hospitals where radiographers participate in this role has been estimated between 69%² and 82%,¹⁶ with the majority being nonteaching hospitals and fewer located in London. This could be because teaching hospitals in the capital city have more trainee radiologists and consequently shorter waiting lists for DCBEs. Concern has been expressed regarding the potential effects on radiologist trainees when radiographers perform DCBE examinations because of the suggestion that radiologist trainees will have less access to barium enema training.¹⁵ However, in hospitals where radiographer-performed DCBE is the norm, qualified radiologists tend to delegate the training role to radiographers.

Justification for Radiographer-led DCBE

Radiographers now have performed DCBE examinations in the United Kingdom for more than 10 years. The development and acceptance of this practice has been influenced by research regarding the following aspects of the care pathway:

Service Delivery

Although a wide range of published literature exists regarding radiographer-performed DCBE examinations, surprisingly none has focused on patient acceptability. In practice, however, many unpublished patient surveys

have suggested that patients are happy to be cared for by a radiographer without recourse to a radiologist. Several studies have noted positive service improvements because radiographers have been available to perform a greater number of DCBE sessions than qualified radiologists, thus reducing waiting times.^{15,16} There is also a positive effect on other waiting lists, as radiologists are available for other duties. This is important because the British government has placed significant emphasis on reducing the length of time a patient waits for diagnostic tests and treatment within the publicly funded health care system.^{8,9} The cost effectiveness of radiologist-to-radiographer delegation is also evident in that radiographers' hourly pay rates are significantly lower than radiologists'.¹⁷

Technical Quality and Diagnostic Accuracy

The technical quality of radiographer-performed DCBE examinations has been studied extensively, with much literature reporting a high-quality examination that is indistinguishable from or better than that of radiologists or trainee radiologists.^{13-15,18-20} Technical quality refers to factors such as quality of barium coating of the bowel, density and contrast within the images and adequate demonstration of the appropriate anatomy in double contrast. Closely associated with technical quality is diagnostic accuracy. Several authors have studied accuracy by comparatively assessing histologically proven cancers with DCBE reports. Such studies have noted that radiographer-managed studies compare favorably with radiologist-managed procedures.^{18,21,22}

Radiation Dose

In 1998 Crawley et al²¹ published a comparative study of radiologist- and radiographer-performed DCBEs; this is a particularly interesting study because of the debate that arose within and from it. Crawley et al found that radiation dose to the patient was higher for radiographer-performed DCBEs compared with those performed by radiologists. Increased fluoroscopy times, and therefore radiation doses, can be explained as a byproduct of the radiographer training period. However, there was grave concern that radiation doses were also higher for experienced GI radiographers. Crawley went on to explain that radiographers were required by the radiologists to take more hard-copy images than the radiologists. This requirement was documented formally in a written protocol that radiographers had to follow meticulously. This inequitable practice, which was commonplace in many U.K. hospitals in the 1990s, was difficult to justify. Not surprisingly, it was concluded that a revised protocol

was essential, and in 2002 Crawley and Booth reported that radiographers' doses were as low as the radiologists' doses when following the new protocol.²³ The revised protocol required radiographers to take fewer films than previously, thus creating more consistency between radiologist- and radiographer-performed exams. In addition, digital equipment was introduced, which further reduced radiation dose.

Other published studies have found no difference in fluoroscopy times or DCBE radiation doses for exams performed by radiographers or radiologists¹⁴; however, one study determined them to be statistically significantly lower in radiographer-performed examinations.¹⁹ Much can be done to optimize fluoroscopy techniques, and equipment-related factors have been found to have a major influence on dose.²⁴ For example, the introduction of digital spot images may give only 10% to 20% of the radiation dose of a conventional film-screen combination, and removing the antiscatter grid during fluoroscopy also can lead to a significant dose reduction.²⁴⁻²⁶

The debate on overly prescriptive written protocols highlights one of the problems that many radiographers experience when first undertaking DCBE management. Initially, both radiologists and radiographers felt more comfortable with very clearly demarcated boundaries for practice, as indicated in the protocols. For instance, in the 1990s these protocols often required radiologists to administer smooth-muscle relaxants and antispasmodics, check films prior to allowing the patient to leave the department and routinely rescreen the patient to check for missed pathology. However, as radiologists' and radiographers' confidence increased and radiographers' capability improved, protocols evolved accordingly to permit greater professional latitude for radiographers. This lessened the requirement for radiologist involvement.¹

Complication Rates

The barium enema exam is not without risk, and reassurance that patients have not been affected adversely by radiographer-performed procedures is vital. Several studies with similar methodologies reported that complication rates were similar to the rates for radiologist-performed exams.^{15,16,27} Mortality rates for radiographer-performed DCBE were identified in Culpan and Chapman's 2002 study as 1 in 44 900.²⁷ However, mortality rates were identified as 1 in 69 687 in their 2004 study.²⁸ The only study with a similar methodology on radiologist-performed DCBE noted a mortality rate of 1 in 56 786.²⁹ Although the low mortality rates for radiographer-performed DCBE

examinations are reassuring, concern has been raised regarding the frequency of cardiac complications — 1 in 8000 for radiographers compared with 1 in 46 000 for radiologist-performed DCBE.^{28,29} The discrepancy is suggested to be a result of heightened radiographer awareness of arrhythmias, which frequently go unnoticed and unreported. The authors also discussed the potential anticholinergic effects of routine administration of antispasmodics (ie, Buscopan) by radiographers.²⁸ Many U.K. radiologists do not administer Buscopan routinely, possibly resulting in the lower cardiac complication rates. The authors also pointed out that the use of this drug is prohibited in North America. In spite of the concerns raised, the cardiac complications were generally mild. Such adverse events must be anticipated when radiographers are performing examinations on the whole spectrum of patients, including the very frail and elderly, and a risk assessment should be performed to ensure that patients will not be unduly harmed by any change of practice. Within the United Kingdom's health care system, the risk assessment process is a formal and mandatory prerequisite in such situations.

In summary, performing DCBEs has been shown by the published studies outlined above to be an efficient, cost-effective and safe role for radiographers. This is reflected by the widespread national uptake of radiographer-performed DCBEs.²

Discussion

Early experiences of radiographer-performed DCBEs have been highly encouraging, and in the past few years GI radiographers have developed their clinical role significantly — well beyond that described in the early protocols. It is helpful at this point to consider the possible similarities and differences between the U.K. situation as outlined previously and that emerging within the United States.

The Drivers for Change

This article outlines a number of factors that led to the emergence of the GI radiographer, including the long-standing shortage of radiologists in the United Kingdom, which resulted in long waiting lists for examinations and diagnostic reports. The United States also is beginning to experience similar problems, with a widening gap between the increase in demand for radiology services and the slowly growing supply of radiologists.³ Adding to this problem are limits on hours that residents may work (also imposed on U.K. radiology trainees) and increasing patient expectations regarding

availability and choice of location for services.³

In the United States, work force shortages also are noted for radiologic technologists, with high vacancy rates and an aging work force.^{3,4} May noted that radiologic technologists historically have been limited in their clinical career, with the “best” technologists moving out of clinical practice to advance their careers in education, management and sales.⁴ Until recently, this was the experience in the United Kingdom as well.

Solutions to the Problems

As previously documented, the United Kingdom's solution has been to develop the role of the GI radiographer to take over responsibilities formerly undertaken by radiologists. GI radiographers willingly have accepted greater responsibility for managing DCBE examinations, examining a more complex group of patients and becoming involved in multidisciplinary collaboration, auditing and research.^{18,30}

In a number of hospitals, GI radiographers routinely perform a broad range of studies, including barium swallows and meals, proctograms, T-tube cholangiograms and small bowel examinations.^{31,32} Compared with DCBEs, however, there is limited published evidence of their efficacy. A small number of radiographers also have been trained to perform sigmoidoscopy, colonoscopy and CT colonography examinations. New services have been offered in many hospitals, including radiographer-led videofluoroscopy for speech and language therapy and same-day endoscopy.

Experienced GI radiographers are responsible for fluoroscopy training of radiographers new to the DCBE role, and in some centers GI radiographers are responsible for training trainee radiologists.³³ Many GI radiographers also are involved in formal classroom teaching and associated assessment of GI radiography and radiology students.³³ The proportion of GI radiographers who have been involved in formal research, conference papers and journal publications is still low, but this is expected to change as more radiographers become educated at the master's degree level.

A consequence of the change in roles is that pay and career structures have had to be revised to reflect more adequately the higher levels of responsibility. A GI radiographer who performs DCBE examinations has an elevated position within the structure; one who performs and interprets a wide range of GI examinations has every chance of being at the pinnacle of the career structure.

In the United States the concept of the radiologist assistant (RA) was proposed to address the issues of

radiologist shortages and rising workloads. The first cohort of RAs — radiologist extenders who work under the supervision of a radiologist — recently graduated and is set to change the way radiology is practiced in the United States.⁵ Their scope of practice includes a range of patient management and fluoroscopy procedures and could arguably be considered similar in scope to the United Kingdom's GI radiographer. The RA is an experienced, registered radiologic technologist who has successfully completed an advanced academic program at either the baccalaureate or postbaccalaureate level encompassing both nationally approved curricula and a clinical preceptorship.³ This is not dissimilar to the education of some GI radiographers in the United Kingdom; however, there is no legal or professional requirement for U.K. radiographers to have attended an accredited postgraduate program. Most radiographers attend short, ungraded courses for initial DCBE training, coupled with in-house clinical training. However, to attain the higher levels of the career structure (what are known in the United Kingdom as advanced and consultant practitioner positions), there is an increasing expectation that GI radiographers will have completed relevant studies at the master's degree level.

The Debate Surrounding Image Reporting and Interpretation

GI radiographers usually are involved in image reading, either providing a formal, independent report or a provisional report as part of a double-reporting system.²

DCBE procedures usually are performed with both pulsed and real-time (continuous) fluoroscopy, with images captured as appropriate. This demands considerable operator skill, as the operator not only needs to be able to capture high-quality double-contrast images covering the whole area of interest, but also must react quickly to the appearance of potential pathology, taking additional images as necessary. All GI radiographers must develop advanced pattern-recognition skills so they can identify normal and abnormal anatomy with confidence. This is not straightforward; the DCBE is known for a potentially high level of perceptual error, resulting in up to 30% false-negative findings.³⁴

Not surprisingly, the importance of double reading of DCBE images starts to emerge. Several published studies have demonstrated that multiple or double reading of DCBE images significantly reduces such errors.^{34,35} Therefore, double reading of DCBE examinations is considered the "gold standard." In practice, however, lack of time results in many hospitals only offering single image reading. Because the DCBE examination is

highly operator dependent and is imaged in real time, the person who performs the procedure is in the best position to contribute to the reporting process.³⁶ When this person is the radiographer, it makes sense that he or she should, at the very least, make a written comment on the findings used to inform the definitive report.

Image interpretation and report-writing skills can be developed in GI radiographers, thus enabling them to contribute to double reading.³⁶ GI radiographers with specialized training can read DCBE images to a high standard, although most published studies have involved GI radiographers who underwent in-house reading training.³⁷ Such in-house training can be variable and can lack assessment rigor, creating problems of role transferability between hospitals. To offer a solution to this problem, 4 U.K. universities offer master's level education and training for DCBE image reading. The Society and College of Radiographers, the U.K. radiography professional body, added support to this argument by stating, "Reporting by radiographers is not an option for the future . . . it is a requirement."³⁸

The position regarding reporting by radiologic technologists in the United States is very different than in the United Kingdom. At an early stage during the development of the scope of practice of RAs, decisions were made to exclude image interpretation from their role; thus, RAs will not be able to practice independently of radiologists.^{3,4,6} This could be, in part, a response to financial penalties for radiologists if RAs were to read the images. This is not a factor in the publicly funded U.K. health service, where radiologists' pay remains largely unaffected by their workload. However, it should be reiterated that, arguably, the best-placed person to report on dynamic, real-time images is the one who performs the procedure.³⁶ Even if RAs are prevented from interpreting images and issuing the definitive report, they still could offer an informal opinion to the radiologist, thus following best practice by offering an efficient method of double reading the examination.

Medicolegal Issues

When GI radiographers perform and read DCBE and other fluoroscopy examinations independently, the related medicolegal issues must be considered. In the United Kingdom, each radiographer is responsible for his or her actions and there is no defense for inexperience due to age, junior status or being delegated a role from another profession.³⁹ The patient expects a reasonable standard of care, no matter who performs the examination or who interprets it. Therefore, GI

radiographers must ensure they work within a protocol agreed upon by the supervising radiologist and the employer. Additionally, GI radiographers should have relevant and sufficient medicolegal insurance, gained through membership in the trade union body. In the event of a medicolegal or negligence claim, radiographers must be able to demonstrate that they received appropriate initial and ongoing training for the role and that they worked within agreed-upon protocols and schemes of work. They also must demonstrate continuing competence through a clinical audit of their work.

In the United Kingdom, GI radiographers work within national laws and professional guidelines. The situation in the United States is perhaps more complex, as different states have different views on the scope of practice that is acceptable for radiologic technologists.³ This might limit adoption of the RA role in some areas of the country and could hinder qualified RAs from seeking employment in states other than the one in which they were trained. The RA concept is still in its infancy, and there undoubtedly will need to be a number of important changes if the role is to be used to maximum effect.

Conclusion

Radiographer-performed DCBE examinations now are well established in the United Kingdom, and an expanding evidence base has shown that GI radiographers can perform and read such examinations successfully to an adequate standard. Radiographers can adapt their skills to perform both existing and new techniques, such as CT colonography, that may replace the DCBE in the future. In recognition of their expert clinical abilities, they can be rewarded with elevated status and pay within a new career structure.

The lessons learned from the United Kingdom's experience with GI radiographers have the potential to be transferred to the newly introduced RA role in the United States. As this role takes shape in the near future, radiologists and radiologic technologists should be reassured that the transition of roles from one professional domain to another can be relatively smooth and painless. The RA role has the potential to be of maximum benefit to both professions and, more importantly, to the patients that they serve.

References

1. Furby CEW. The future of the radiographer. *Radiography*. 1994;10:9-10.
2. Price RC, Miller LR, Mellor F. Longitudinal changes in extended roles in radiography. *Radiography*. 2002;8:223-234.
3. Dunnick NR. ACR Intersociety Conference 2003: radiologist assistants and other radiologist extenders. *J Am Coll Radiol*. 2004;1:386-391.
4. May L. The radiologist assistant: a new member of the radiology team. *J Radiol Nurs*. 2005;24(2):31-32.
5. Williams CD, Short R. ACR and ASRT development of the radiologist assistant: concept, roles, and responsibilities. *J Am Coll Radiol*. 2004;1:392-397.
6. Bluth EI, Reid JB. Radiologist assistant certification. *J Am Coll Radiol*. 2004;1:398-401.
7. Council of the European Union. European working time directive. Available at: www.incomesdata.co.uk/information/worktimedirective.htm. Accessed August 5, 2006.
8. Department of Health Web site. HSC 2000/013: referral guidelines for suspected cancer. Available at: www.dh.gov.uk/PublicationsAndStatistics/LettersAndCirculars/HealthServiceCirculars/HealthServiceCircularsArticle/fs/en?CONTENT_ID=4004320&chk=3DRVB0. Accessed June 5, 2006.
9. Department of Health Web site. NHS takes next step in tackling hidden waiting lists. Available at: www.dh.gov.uk/PublicationsAndStatistics/PressReleases/PressReleasesNotices/fs/en?CONTENT_ID=4130626&chk=PdN3zq. Accessed June 5, 2006.
10. Nightingale J, Hogg P. Clinical practice at an advanced level: an introduction. *Radiography*. 2003;9:77-83.
11. Swinburne K. Pattern recognition for radiographers. *Lancet*. 1971;1:589-590.
12. Audit Commission for Local Authorities and the National Health Service in England and Wales. *Improving Your Image: How To Manage Radiology Services More Effectively*. London, England: Audit Commission; 1995.
13. Somers S, Stevenson GW, Laufer I, Gledhill L, Nugent J. Evaluation of double contrast barium enemas performed by radiographic technologists. *J Can Assoc Radiol*. 1981;32(4):227-228.
14. Mannion RA, Bewell J, Langan C, Robertson M, Chapman AH. A barium enema training programme for radiographers: a pilot study. *Clin Radiol*. 1995;50(10):715-719.
15. Bewell J, Chapman AH. Radiographer-performed barium enemas: results of a survey to assess progress. *Radiography*. 1996;2:199-205.
16. McKenzie GA, Mathers S, Graham DT, et al. An investigation into radiographer-performed barium enemas. *Radiography*. 1998;4:17-22.
17. Brown L, Desai S. Cost-effectiveness of barium enemas performed by radiographers. *Clin Radiol*. 2002;57(2):129-131.
18. Law RL, Longstaff AJ, Slack N. A retrospective 5-year study on the accuracy of the barium enema examination performed by radiographers. *Clin Radiol*. 1999;54(2):80-84.
19. Davidson JC, Einstein DM, Baker ME, et al. Feasibility of instructing radiology technologists in the performance of gastrointestinal fluoroscopy. *AJR Am J Roentgenol*. 2000;175(5):1449-1452.

20. Schreiber MH, vanSonnenberg E, Wittich GR. Technical adequacy of fluoroscopic spot films of the gastrointestinal tract: comparison of residents and technologists. *AJR Am J Roentgenol.* 1996;166(4):795-797.
21. Crawley MT, Shine B, Booth A. Radiation dose and diagnosticity of barium enema examinations by radiographers and radiologists: a comparative study. *Br J Radiol.* 1998;71:399-405.
22. Culpan DG, Mitchell AJ, Hughes S, Nutman M, Chapman AH. Double contrast barium enema sensitivity: a comparison of studies by radiographers and radiologists. *Clin Radiol.* 2002;57:604-607.
23. Crawley MT, Booth A. Reducing dose at barium enema: radiographers do it digitally. *Br J Radiol.* 2002;75(896):652-656.
24. Martin CJ, Hunter S. Reduction of patient doses from barium meal and barium enema examinations through changes in equipment factors. *Br J Radiol.* 1994;67(804):1196-1205.
25. Seymour R. Patient dose reduction by audit of grid usage in barium enemas. *Br J Radiol.* 1997;70(833):489-491.
26. Lloyd P, Lowe D, Harty DS, Eyes B. The secondary radiation grid; its effect on fluoroscopic dose-area product during barium enema examinations. *Br J Radiol.* 1998;71:303-306.
27. Culpan DG, Chapman AH. Complications of radiographer performed double contrast barium enema examinations. *Radiography.* 2002;8:91-95.
28. Vora P, Chapman A. Complications from radiographer-performed double contrast barium enemas. *Clin Radiol.* 2004;59:364-368.
29. Blakeborough A, Sheridan MB, Chapman AH. Complications of barium enema examinations: a survey of UK consultant radiologists 1992 to 1994. *Clin Radiol.* 1997;52(2):142-148.
30. O'Connor G, Butler G. Aspects of patient care during barium enema identified as potential factors for audit. *Radiography.* 1999;5:15-22.
31. Law R. The extended role of the radiographer in fluoroscopy. Conference proceedings at: United Kingdom Radiological Congress, May 13-15, 2002.
32. Waugh R. Radiographer performed upper GI studies. Paper presented at: GRSIG National Conference, September 12-13, 2002; Bristol, England.
33. Nightingale J, Hogg P. The gastrointestinal advanced practitioner: an emerging role for the modern radiology service. *Radiography.* 2003;9:151-160.
34. Markus JB, Somers S, O'Malley BP, Stevenson GW. Double-contrast barium enema studies: effect of multiple reading on perception error. *Radiology.* 1990;175:155-156.
35. Leslie A, Virjee JP. Detection of colorectal carcinoma on double contrast barium enema when double reporting is routinely performed: an audit of current practice. *Clin Radiol.* 2002;57:184-187.
36. Halligan S, Marshall M, Taylor S, et al. Observer variation in detection of colorectal neoplasia on barium enema: implications for colorectal cancer screening and training. *Clin Radiol.* 2003;58:948-954.
37. Murphy M, Loughran CF, Birchenough H, et al. A comparison of radiographer and radiologist reports on radiographer conducted barium enemas. *Radiography.* 2002;8:215-221.
38. The College of Radiographers. *Reporting by Radiographers: A Vision Paper.* London, England: The College of Radiographers; 1997.
39. Dimond B. *Legal Aspects of Radiography and Radiology.* London, England: Blackwell Publishers; 2002.

Julie Nightingale, M.Sc., is director of radiography in the school of health care professions at the University of Salford in Greater Manchester, England. Peter Hogg, M.Phil., is a professor of radiography at the University of Salford.

Reprint requests may be sent to the American Society of Radiologic Technologists, Communications Department, 15000 Central Ave. SE, Albuquerque, NM 87123-3909.

©2007 by the American Society of Radiologic Technologists.