

The Role of the Radiation Oncologist in Systemic Therapy - an Australian and New Zealand Perspective

John Leung*

Adelaide Radiotherapy Centre, Adelaide, South Australia, Australia

Abstract

There has been considerable recent interest in radiation oncologists becoming more involved in prescribing systemic therapy. Radiation oncology and medical oncology have been very distinct disciplines with little overlap in Australia and New Zealand. However, the Faculty of Radiation Oncology identified systemic therapy as a priority to be investigated. The subsequent workforce survey in 2010 found that although the majority of radiation oncologists and trainees were not interested in becoming more involved in systemic therapy, there was still considerable interest. This manuscript identifies the key issues to consider if radiation oncologists are contemplating being more involved with systemic therapy.

Keywords: Radiation oncologist; Systemic therapy

Introduction

Radiation Oncology is the medical specialty where ionizing radiation is used as part of cancer treatment to control malignant cells. It is a unique medical discipline because it combines clinical management with an intimate knowledge of the planning, prescription and delivery of radiation therapy. The name radiation oncology denotes a clear distinction from the medical oncology and surgical oncology disciplines.

However, there has been some overlap between radiation oncology and medical oncology because radiation oncologists have been able to prescribe systemic therapy which has been traditionally the domain of medical oncologists.

Definition and use

Systemic therapy is defined as “treatment using substances that travel through the blood stream, reacting and affecting cells all over the body” [1]. It usually refers to chemotherapy, hormonal therapy and biological agents.

The selection, dosing and administration of systemic agents are complex. Modifications of dose and schedule and initiation of supportive care are often necessary because of toxicities, prior treatment, patient comorbidities and individual variability.

In Australia and New Zealand, radiation oncologists in the past prescribed chemotherapy for breast cancers (CMF), gastrointestinal cancers (5-FU) and lung cancers (platinum-based regimens). They have been less involved in lymphomas which haematologists usually manage, paediatric tumours which are managed by paediatric oncologists, gynaecological tumours where the surgeons or medical oncologists have prescribed chemotherapy and head and neck cancers. The prescription of hormones in urological and breast cancers has been prescribed by surgeons, radiation and medical oncologists.

The administration of systemic therapy is now more complex. For example, in breast cancer, CMF (cyclophosphamide, methotrexate and 5-fluorouracil) is now often not the standard regimen prescribed. Regimens such as AC (Adriamycin and cyclophosphamide), TAC (docetaxel, Adriamycin and cyclophosphamide), FEC (5-fluorouracil, epirubicin and cyclophosphamide), trastuzumab and others are used in various combinations. Hormonal therapies with aromatase inhibitors in preference to tamoxifen may also be used.

In lung cancer, chemotherapy is not just administered for combined modality treatment in stage three diseases or for palliation in stage four disease, but can be given as adjuvant treatment for earlier stage disease.

There appears to be a marked decline in radiation oncologists prescribing systemic therapy in Australian and New Zealand. There are no surveys done in comparing prescription of systemic therapy by radiation oncologists now to the past though.

The need for review of current practice

The apparent decline in prescription of systemic therapy by radiation oncologists is counter balanced by the increase in multimodality concurrent chemo/radiotherapy approach to many tumours, an increasing number and possible over supply of radiation oncologists entering the workforce, and the perception that radiation oncologists want to be viewed as clinicians rather than technicians.

The Faculty Board's strategic planning meeting in 2010 identified systemic therapy as an important priority. There are many issues to consider.

Interest in systemic therapy

The first Faculty of Radiation Oncology Survey in 1996 by Stevens et al revealed that many radiation oncologists were interested in systemic therapy because they believed it enhanced their image as clinicians [2]. However, the latest survey by Leung and Vukolova in 2010, showed 57.5% of radiation oncologists believe they should not take a greater role in the delivery of systemic therapy [3]. The majority of trainees at 64.3% also answered in the negative [3]. Some of the main reasons for this were workload issues, trouble keeping up with the required knowledge and interfering with the medical oncologists [3]. Nevertheless, a significant number of radiation oncologists may still

***Corresponding author:** Dr John Leung, Adelaide Radiotherapy Centre, 352 South Terrace, Adelaide, Australia, E-mail: john.leung@adradcentre.com.au

Received May 16, 2012; **Accepted** June 04, 2012; **Published** June 08, 2012

Citation: Leung J (2012) The Role of the Radiation Oncologist in Systemic Therapy - an Australian and New Zealand Perspective. J Nucl Med Radiat Ther S6:006. doi:10.4172/2155-9619.S6-006

Copyright: © 2012 Leung J. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

wish to become involved or more involved in systemic therapy even if this is a minority of college members. Involvement in systemic therapy could also be on a voluntary basis.

The Curriculum

The current radiation oncology curriculum was formulated in 2008 and implemented in 2009 [4]. This is a broad curriculum requiring knowledge of systemic therapy related to radiation oncology. It is beyond the scope of the author to assess whether it is detailed enough for radiation oncologists to practise systemic therapy. It is possible that the curriculum is more than adequate. It may be possible though that sections will need to be revised. It is also unknown whether radiation oncologists require as detailed knowledge as medical oncologists in the specifics of systemic therapy before they can practise. It is interesting to note that even Wiki books lists over 80 chemotherapy and targeted agents that would be useful for a radiation oncologist to know [5].

Training

The current training program does not specify a formal rotation in medical oncology. Some centres ask the radiation oncology registrar to be on-call for both medical and radiation oncology. A formal rotation in medical oncology may be required. This would need to be a specified time of probably at least 6 to 12 months. This could lengthen the training program although it might be possible to fit this into the current five-year training program. It might be possible to make this optional.

Other roles of radiation oncologists

Radiation oncologists have other roles apart from managing the patients. This is clearly enunciated in the new curriculum [4]. It is best summarised by the Can MEDS principles [4]. These principles describe the doctor and radiation oncologist as a medical expert, communicator, collaborator, manager, health advocate, scholar and professional [4].

If radiation oncologists have excessive clinical workload because of their involvement in systemic therapy, they may not have enough time to fulfil these other roles. High clinical workloads precluding radiation oncologists from fulfilling their non clinical roles has been the subject of intense debate recently [6]. However, current workload as measured by new patients per year has substantially decreased from the past and there have been very little complaints about excessive workloads recently [3,6].

It might also be argued the radiation oncologists would be superior in aspects of their Can MEDS roles if they had a greater command and understanding of systemic therapy. For example, a radiation oncologist would be even a better medical expert if he or she knew about systemic therapy in depth. Radiation oncologists might be superior collaborators, communicators and managers if they were coordinating both radiation and systemic treatments. This would all be under the proviso the clinical workloads were acceptable.

Continued professional development

This would be more rigorous as it would have to include aspects of medical oncology as well as radiation oncology. One of the issues mentioned in the 2010 Workforce Survey would be the difficulty for radiation oncologists keeping up with developments in both radiation and medical oncology [3]. Reporting continued professional development has been voluntary until 2011 when mandatory participation has been introduced in Australia. It would be interesting to devise a program incorporating systemic therapy as well as radiation oncology.

Resources

Chemotherapy should be given in a unit or centres where close supervision by an oncologist and chemotherapy nurse specialist is available [7]. There should be an expert pharmacy and 24 hour laboratory support available [7]. Access to emergency care, and information and advice from oncology trained staff 24 hours a day should be available [7].

Radiation oncology practices attached to most hospitals should not have too many problems. However, a standalone facility may not have access to all of the above.

After care of patient

Chemotherapy patients may have complications such as neutropenic sepsis unfamiliar to radiation oncologists who have not dealt with specific chemotherapy side effects. Of course radiation oncologists will be expected to manage these acute side effects. Therefore, workload may become more labour intensive.

Issues with medical oncologists

The prescription of systemic therapy has been traditionally the domain of medical oncologists. It is unknown how medical oncologists would respond to radiation oncologists becoming more involved in prescribing systemic therapy. However, a recent survey of the medical oncology workforce showed a significant shortage of medical oncologists [8]. The national shortage in 2009 was estimated to be between 92 to 157 full-time equivalents [8]. This is projected to rise to 126 to 198 full-time equivalents by 2014 [8].

If there is a significant shortage of medical oncologists, it is possible there might be less resistance to radiation oncologists becoming more involved in prescribing systemic therapy.

The Faculty of Radiation Oncology Survey in 2010 showed there might be a possible excess of radiation oncologists in the near future [3]. The survey indicated 8.8% of the workforce intending to retire in the next five years and 12.5% in 10 years [3]. This translates to approximately 35 to 50 radiation oncologists retiring. However, there are currently at least 20 trainees passing their Part 2 exams every year.

Therefore, a shortage of medical oncologists and an excess of radiation oncologists might be a reasonable justification for radiation oncologists to be more involved in the administration of systemic therapy.

There are certainly some areas of the world such as the United Kingdom and in the Middle East where a shortage of medical oncologists has necessitated radiation oncologists prescribing systemic therapy and in particular chemotherapy [9,10].

Workload and manpower

Perhaps the major issue is workload. There has been a reduction in per year radiation oncology workloads over the last 15 years as measured by new patients per year [2,3,11,12]. This has seen a decrease from an average of 342 new patients per year in 1996 to 275 new patients per year in 2010 [2,3,11,12].

The 2010 survey revealed no complaints about excessive workloads. However, all the previous surveys were dominated by complaints of excessive workload [2,11,12]. If radiation oncologists were to have a greater role in systemic therapy, these workload stresses may return.

Modern radiotherapy practice has also become more complex with

specialised knowledge, detailed planning and evolving technologies making it difficult for most radiation oncologists to keep up with radiation oncology, let alone medical oncology. In fact, there are only 15% of the radiation oncologists who now regard themselves as true generalists [3].

However, as noted above, this is counter balanced by a significant number of new radiation oncologists entering the workforce. The following new centres will be opening in 2011 or soon after: Auckland Radiation Oncology, Auckland, New Zealand; South West Radiation Oncology Service, Bunbury, Western Australia; Central West Radiation Oncology Service, Orange, New South Wales; Lismore Integrated Cancer Care Centre, Lismore, New South Wales; Liz Plummer Cancer Care Centre, Cairns, Queensland; Oceania Oncology, Maroochydore, Queensland; Sunshine Hospital Radiation Therapy Centre, St Albans, Victoria; Regional Cancer Centre, Albury, New South Wales; and, St Georges Cancer Care Centre, Christchurch, New Zealand.

There would thus appear to be many jobs available for newly qualified radiation oncologists. However, these positions would probably be already filled. It should also be noted that with all these new centres opening, it might be difficult opening other new centres in the future.

After hours on call and leave cover

This would potentially be a problem if some radiation oncologists are involved in systemic therapy and others are not involved in the same practice. Those not involved, may not possess the knowledge to deal with patients on systemic therapy. It could still be a problem if most or all radiation oncologists in the same centre were involved with systemic therapy because of subspecialisation.

Subspecialisation

The Workforce Survey showed that 85% of radiation oncologists were subspecialised or had an interest in a specialty area [3]. Radiation oncologists may then choose and limit their involvement in systemic therapy. For example, a radiation oncologist treating prostate cancer could be involved in the systemic therapy. The hormonal therapy given in intermediate or high risk disease has been based on numerous RTOG (Radiation Therapy Oncology Group) and EORTC (European Organisation for Research and Treatment of Cancer) trials [13-15]. The administration of bisphosphonates and strontium-89 is all ready prescribed by a number of radiation oncologists, but medical oncologists and nuclear physicians have also been involved. Taxane drug chemotherapy is possibly the only current area in which radiation oncologists are not involved.

In head and neck cancer, chemotherapy or biological agents are indicated as primary treatment with concurrent radiation therapy for locally advanced disease; induction therapy; post operatively with concurrent radiation therapy; or, for metastatic disease. The common agents used are cisplatin, carboplatin, docetaxel and cetuximab. It would not appear too onerous for a radiation oncologist to know the dosing and scheduling of these agents.

Gastrointestinal cancers such as oesophageal, stomach, and pancreas, rectal and anal cancers often involve chemotherapy with radiation therapy as primary management [16-20]. The major trials are well known as are the systemic agents. Primary colon cancer is the only area where radiation oncologists have little role.

Central nervous system tumours are another area in which radiation oncologists could specialise in. Temozolamide with radiation therapy

is well established treatment for glioblastoma multiforme [21]. BCNU (carmustine) and the PCV (procarbazine, lomustine and vincristine) are other commonly used regimens in the central nervous system.

Breast and lung cancer systemic therapy have already been mentioned.

Paediatric tumour management involves very specialised and complex protocols perhaps best managed by paediatric oncologists.

Name change

It would be certainly justified to consider a name change from radiation oncologist. The United Kingdom uses the name "clinical oncologist". It might be appropriate just to use "oncologist". This might have a beneficial effect on the public who currently perceive the medical oncologist to be the true oncologist. Radiation oncologists are sometimes thought to be only technical specialists. However, the curriculum and the examinations require a broad general knowledge of oncology. It might be argued that radiation oncologists are the true oncologists as they have a reasonable understanding of medical oncology and systemic therapy too. Medical oncologists may not understand radiation oncology as well as radiation oncologists understand medical oncology.

Patient outcomes and benefits

This may be the most important issue taking precedence over everything else. Patient outcomes and benefits are not just measured in overall survival, local control or distant recurrences. The factors such as better coordination of combined modality treatment, patient convenience, minimising delays and starting treatment and overall patient satisfaction are very important.

Oncological management of patients now involves a multidisciplinary approach. This often entails a patient seeing a radiation oncologist, medical oncologist, surgical oncologist, palliative care physicians and even other specialists. In many instances, this can result in fragmentation of services as characterised by multiple appointments, inconvenience for patients, confusion in understanding information, logistical problems in starting treatment, and communication problems between specialists, repetition and conflict of explanations. There are other complexities inherent in seeing doctors from multiple disciplines too. If this approach could be more streamlined with one specialist (i.e. radiation oncologist) coordinating local and systemic therapy, a much more efficient process would be the result. Although there may not be much literature analysing patient satisfaction with a streamlined approach, it is logical to assume that most patients would be satisfied with this.

However, a streamlined approach would work only to a certain degree in some situations because patients may still need to see other specialists.

Medical insurance

This would almost certainly rise as radiation oncologists would be engaged in more therapy. An increased risk of litigation is also possible because there is only one person to sue instead of multiple practitioners. It would not be possible to "share" the blame. Increased workload may increase the risk of errors which may exacerbate the risk of litigation. It is unknown whether insurance premiums would rise to such an extent to make prescribing systemic therapy prohibitive for practitioners.

Hospitals

Apart from radiation oncologists having access to adequate resources and facilities to perform systemic therapy, there may be other issues. Access to beds for systemic therapy complications would be crucial. Currently, there may be a restricted number of beds for radiation patients and this would have to change. It is unknown whether an increased number of beds would be required if both radiation oncologists and medical oncologists share the same wards. Patients in theory are just seeing a different person, so bed numbers may not necessarily rise. However, admitting patients is still a subjective judgment despite the presence of protocols.

Hospital accreditation would need to recognise the radiation oncologists are prescribing systemic therapy as well as radiation therapy.

Health funds

It is unknown what effect of more radiation oncologists prescribing systemic therapy would have on health funds. A current anomaly though is that radiation oncology outpatients cannot claim from their health funds for treatment. Despite intensive efforts to lobby health funds to pay for outpatient radiation therapy, there has been no success. This has resulted in many patients being disadvantaged.

However, if the same practitioner was prescribing outpatient radiation therapy and systemic therapy concurrently, it would not make sense to allow benefits for one form of treatment and not the other.

Faculty of radiation oncology and medical oncology group of Australia

Although radiation and medical oncologists work in close collaboration with one another because of multidisciplinary management of many cancers, closer collaboration and cooperation may be required between the two peak bodies from each respective specialty.

If radiation oncologists were widely to prescribe systemic therapy, it is possible that the Medical Oncology Group of Australia (MOGA) may want to become involved. It is unknown whether they could or would mandate certain requirements before radiation oncologists could prescribe all systemic therapy. It may even be possible that radiation oncologists would be required to join MOGA before prescribing systemic therapy. If this were to occur, the Faculty of Radiation Oncology would not want its' authority undermined.

The Faculty of Radiation Oncology might require medical oncologists to sit on its' board. The Medical Oncology Group of Australia may want radiation oncologists to sit on its' board especially if many radiation oncologists prescribed systemic therapy.

Pharmaceutical companies

These companies would have to deal more often with radiation oncologists. This would result in greater expenditure for them seeing both medical and radiation oncologists. More pharmaceutical representatives may be required. However, this would be counter balanced by a possible increased prescription of their products. The radiation oncologist would have to allocate more time in seeing pharmaceutical representatives, attending sponsored meetings and keeping up with current knowledge.

Government organisations

It is unknown how regional, state and national health services would be affected. However, discussions that might have involved a medical oncologist only in the past would have to be expanded to include a radiation oncologist. It is unknown how funding might be affected. However, if medical oncologists were seeing fewer patients than before, then decreased funding might occur for them as regional funding may be dependent on new cases seen per year.

Ancillary staff

Administrative, nursing and radiation therapy staff in radiation oncology departments would be expected to have a broader knowledge of oncology than what is currently required. Nursing staff will need to be trained in both medical and radiation oncology.

Radiation therapy staff will be required to know the fundamentals of systemic therapy. This might involve a change in their curriculum knowledge. If radiation oncologists were to be burdened with excessive workloads, radiation therapists might become more involved in clinical management. For example, they could see treatment reviews [22-24]. This role has already been examined in the UK, Scotland and Hong Kong [22-24].

Risk of status quo

Radiation therapy has the risk of being viewed as a technical service rather than a consultative specialty. It may end up perceived as an adjunct to surgery and chemotherapy. This could result in radiation oncologists being marginalised and having little influence in decision making of patient care.

Radiation therapy might be viewed as a commodity similar to radiology services where referring physicians request for a service rather than request for the skills of a particular clinician. It is the technical service requested rather than the expertise of a particular clinician.

Advantages of radiation oncologists involved in systemic therapy

- This curriculum is already broad enough to have enough knowledge.
- Enhances image as clinicians.
- Name changed to clinical oncologist or oncologist leading to high profile.
- Renders the profession more attractive as a career choice to medical students and young doctors.
- Forces greater involvement of radiation oncologist in decision making.
- Helps work force issues – shortage of medical oncologists and possible excess of radiation oncologists.
- Role of radiation oncologist – CanMEDS roles may be enhanced provided workload acceptable.
- More cohesive and coordinated management of patients.
- Can be restricted to certain areas such as hormones and commonly used chemotherapy and biological agents.
- Subspecialisation.

- Increased involvement of pharmaceutical companies in radiation therapy
- Radiation therapist could see treatment reviews if workload is excessive which alleviates workload of radiation oncologists and enhances profile of radiation therapist.

Disadvantages of radiation oncologists in systemic therapies

- No great desire at present with majority of radiation oncologists and trainees not interested.
- Workload issue.
- Revision of curriculum may be required.
- Revision of training may be needed.
- Other roles of radiation oncologist difficult to fulfil if clinical workload is excessive.
- Those who do not participate in systemic therapy may feel inferior.
- Interference with medical oncologists.
- Increased resources required.
- Difficult to keep up-to-date with both systemic therapy and radiation oncology.
- After care of systemic side effects leads to some radiation oncologists not having an interest.
- Some radiation oncologists prefer to influence decision at multidisciplinary meeting level only.
- Potential increase in medical insurance premiums.
- Potential tension between peak bodies of radiation oncology and medical oncology.
- After hours on call and leave cover problematic if some radiation oncologists not normally involved with systemic therapy and specialisation in certain areas
- Confusion over funding from health authorities.
- Greater workload on ancillary staff.

Summary

There are a number of issues to consider if radiation oncologists now and in the future are to become more involved in systemic therapy. These include possible changes to the curriculum and training; continued professional development; the role of the radiation oncologist; resource allocation; after care of patients; issue with medical oncologists; workload and manpower issues; after hours and leave cover; subspecialisation; name change; patient outcomes and benefits; medical insurance; impact on hospitals, health funds, pharmaceutical companies, government organisations and the peak bodies of radiation and medical oncology; and, implications on ancillary staff.

Perhaps the most fundamental issue is whether there is a genuine need for radiation oncologists to be involved in systemic therapy. The Faculty survey in 2010 showed the majority of radiation oncologists and trainees were not interested in more involvement [3].

However, only a small part of the survey was devoted to this area. If the topic is to be pursued further a more detailed survey could be

devised specifically focusing on this topic. If there is then genuine interest, the other obstacles could probably be overcome. It should be noted, even if there is a minority of radiation oncologists interested in this area, the issue may need to be explored further. This is especially so if there are reasonable numbers of radiation oncologists interested.

References

1. National Cancer Institute (2011) Dictionary of Cancer Terms.
2. Stevens G, Berry M, Firth I (1999) Faculty of Radiation Oncologists Survey of Work Practices. *Australas Radiol* 43: 233-242.
3. Leung J, Vukolova N; Faculty of Radiation Oncology, RANZCR (2011) Faculty of Radiation Oncology 2010 Workforce Survey. *J Med Imaging Radiat Oncol* 55: 622-632.
4. Radiation Oncology Training Program Curriculum, 2008 1-187.
5. http://en.wikibooks.org/wiki/Radiation_Oncology/Chemotherapy
6. The Royal Australian and New Zealand College of Radiologists (2011) The Faculty of Radiation Oncology (FRO Report on Contemporary Practice): The number of new patients per year 1-18.
7. NHS Executive (1998) Guidance on Commissioning Cancer Services; improving outcomes in lung cancer, the research avenues. Department of Health: London.
8. Koczwara BK, Barton M, Walpole E (2009) The Australian Medical Oncologist Workforce Study 2009.
9. Sambrook RJ, Girling DJ (2001) A national survey of the chemotherapy regimens used to treat small cell lung cancer (SCLC) in the United Kingdom. *Br J Cancer* 84: 1447-1452.
10. El Saghir NS, El-Asmar N, Hajj C, Eid T, Khatib S, et al. (2011) Survey of utilization of multidisciplinary management tumor boards in Arab countries. *Breast* 20: S70-74.
11. Veness M, Rikard-Bell G, Ward J (2003) Australian and New Zealand Radiation Oncology Work Practices in 2000. *Australas Radiol* 47: 146-151.
12. Faculty of Radiation Oncology Workforce Survey (2006) Royal Australian and New Zealand College of Radiologist.
13. Pilepich MV, Winter K, Lawton CA, Krisch RE, Wolkov HB, et al. (2005) Androgen suppression adjuvant to definitive radiotherapy in prostate carcinoma- long term results of phase 3 RTOG 85-31. *Int J Radiat Oncol Biol Phys* 61: 1285-1290.
14. Bolla M, Van Tienhoven G, Warde P, Dubois JB, Mirimanoff RO, et al. (2010) External irradiation with or without long term androgen suppression for prostate cancer with high metastatic risk: 10 year results of an EORTC randomised study. *Lancet Oncol* 11: 1066-1073.
15. Hanks GE, Pajak TF, Porter A, Grignon D, Brereton H, et al. (2003) Phase III trial of long-term adjuvant androgen deprivation after neoadjuvant hormonal cytorreduction and radiotherapy in locally advanced carcinoma of the prostate: the Radiation Therapy Oncology Group Protocol 92-02. *J Clin Oncol* 21: 3972-3978.
16. Herskovic A, Martz K, al-Sarraf M, Leichman L, Brindle J, et al. (1992) Combined chemotherapy and radiotherapy compared with radiotherapy alone in patients with cancer of the oesophagus. *N Engl J Med* 326: 1593-1598.
17. Macdonald JS, Smalley SR, Benedetti J, Hundahl SA, Estes NC, et al. (2001) Chemoradiotherapy after surgery compared with surgery alone for adenocarcinoma of the stomach or gastroesophageal junction. *N Engl J Med* 345: 725-730.
18. Gastrointestinal Tumour Study Group (1988) Treatment of locally unresectable carcinoma of the pancreas: comparison of combined modality therapy (chemotherapy plus radiotherapy) to chemotherapy alone. *J Natl Cancer Inst* 80: 751-757.
19. Sauer R, Becker H, Hohenberger W, Rödel C, Wittekind C, et al. (2004) Preoperative versus postoperative chemoradiotherapy for rectal cancer. *N Engl J Med* 351:1731-1740.
20. The UKCCCR Anal Cancer Trial Working Party (1996) Epidermoid anal cancer: results from the UKCCCR randomised trial of radiotherapy alone versus radiotherapy, 5-fluorouracil, and mitomycin. *UKCCCR Anal Cancer Trial*

- Working Party. UK Co-ordinating Committee on Cancer Research. Lancet 348: 1049-1054.
21. Stupp R, Mason WP, van den Bent MJ, Weller M, Fisher B, et al. (2005) Radiotherapy plus concomitant and adjuvant temozolomide for glioblastoma. N Engl J Med 352: 987-996.
22. McLroy P, McIntyre A, Ross A, Gallagher C, Brown C (2008) Breast radiotherapy: a single centre survey of non-medical weekly patient review. J Radiother Pract 7: 19-29.
23. Ellis T, Ashmore L, Bray D (2006) Multidisciplinary radiographer-led review clinics – an example of implementation. J Radiother Pract 5: 87-95.
24. White P, Lee SWY, Wong SWY, Lee AKW, Cheung DN (2005) Role development for therapeutic radiographers in the public hospitals in Hong Kong. J Radiother Pract 4: 66-77.

This article was originally published in a special issue, [Cancer Radiation Therapy](#) handled by Editor(s). Dr. XinChen, University of Arkansas for Medical Sciences, USA