
1319

Final decision analytic
protocol (DAP) to
guide the assessment
of image guided
radiation therapy for
cancer treatment
delivery

February 2013

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MSAC and PASC

The Medical Services Advisory Committee (MSAC) is an independent expert committee appointed by the Minister for Health and Ageing (the Minister) to strengthen the role of evidence in health financing decisions in Australia. MSAC advises the Minister on the evidence relating to the safety, effectiveness, and cost-effectiveness of new and existing medical technologies and procedures and under what circumstances public funding should be supported.

The Protocol Advisory Sub-Committee (PASC) is a standing sub-committee of MSAC. Its primary objective is the determination of protocols to guide clinical and economic assessments of medical interventions proposed for public funding.

Purpose of this document

This protocol has been finalised following consultation and will provide the basis for the assessment of the intervention.

The protocol guiding the assessment of the health intervention has been developed using the widely accepted "PICO" approach. The PICO approach involves a clear articulation of the following aspects of the research question that the assessment is intended to answer:

- P**atients – specification of the characteristics of the patients in whom the intervention is to be considered for use
- I**ntervention – specification of the proposed intervention and how it is delivered
- C**omparator – specification of the therapy most likely to be replaced by the proposed intervention
- O**utcomes – specification of the health outcomes and the healthcare resources likely to be affected by the introduction of the proposed intervention

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Purpose of application

A proposal for an application requesting MBS listing of image guided radiation therapy (IGRT) for cancer treatment delivery was received from the Trans Tasman Radiation Oncology Group (TROG) by the Department of Health and Ageing in August 2011. As a result of the completion of the Assessment of New Radiation Oncology Treatments and Technologies (ANROTAT) project being undertaken by TROG, the Faculty of Radiation Oncology of the Royal Australian and New Zealand College of Radiologists has now taken responsibility for sponsoring this application

IGRT is a procedure which can occur prior to, during and/or at the completion of a radiotherapy treatment session to ensure accuracy of radiation therapy treatment delivery. A form of IGRT is currently reimbursed through the MBS (as detailed below).

This application however relates to more advanced systems which allow high-quality medical images to be processed in the treatment room before and/or during treatment in real time. The review and assessment of the images enables trained staff to make adjustment to the patient or machine positional parameters, ensuring the radiation is more accurately and precisely focussed on the tumour target. The currently listed items do not cover the range and scope of the proposed new service. In these, images would be reviewed after the patient has completed treatment on a given day, and any actions required applied on the subsequent day.

The NHMRC Clinical Trials Centre (University of Sydney), as part of its contract with the Department of Health and Ageing, drafted this decision analytical protocol to guide the assessment of the safety, effectiveness and cost-effectiveness of IGRT in order to inform MSAC's decision-making regarding public funding of the more advanced technique being proposed.

Background

Current arrangements for public reimbursement of radiotherapy

Funding for radiotherapy is provided through numerous avenues including:

- The Federal government.
 - The Federal government funds radiotherapy services for private patients (including non-admitted patients treated at public facilities under rights of private practice arrangements) across Australia through the Medicare Benefits Schedule (MBS). A co-payment may be required from the patient or private health insurance organisation (or both) as part of this service delivery funding model.
 - Radiation Oncology Health Program Grants (ROHPGs). ROHPGs cover the capital costs of approved radiotherapy equipment. Public and private institutions may be eligible for receipt of ROHPGs, however payments are only made for services that also attract a Medicare benefit.
 - MBS and ROHPG payments represent the vast majority of funding for radiotherapy services.

- State and territory governments.
 - This funding covers the provision of public outpatient and eligible inpatient radiotherapy services within each state or territory. Specific funding models vary between jurisdictions, however services are funded from state or territories budgets.

Radiotherapy delivered as either external beam radiotherapy (EBRT) or brachytherapy is reimbursed through the MBS along with the simulation, dosimetry and verification steps involved in the planning and delivery of such treatment. IGRT is adjunctive to EBRT. EBRT can be delivered using a number of techniques, including three dimensional conformal radiotherapy (3DCRT).

MBS funding for 3DCRT is currently facilitated through the following generic MBS item numbers:

Simulation: 15550 and 15553.

Dosimetry: 15556, 15559 and 15562.

Treatment: 15215, 15230, 15245 and 15260 (lung)
 15218, 15233, 15248 and 15263 (prostate)
 15221, 15236, 15251 and 15266 (breast)
 15224, 15239, 15254 and 15269 (other)

New MBS item numbers associated with IGRT are not being sought through this application for simulation, dosimetry or treatment.

Verification: MBS items numbers 15700, 15705 and 15710 (Tables 1-3).

New MBS item numbers associated with IGRT are being sought through this application for verification.

Table 1: Current MBS item descriptor for the single projection planar imaging verification item

Category3– Therapeutic procedures	
MBS 15700	<p>RADIATION ONCOLOGY TREATMENT VERIFICATION - single projection (with single or double exposures) - when prescribed and reviewed by a radiation oncologist and not associated with item 15705 or 15710 - each attendance at which treatment is verified (ie maximum one per attendance).</p> <p>Fee: \$45.95 Benefit: 75% = \$34.50 85% = \$39.10</p>

Table 2: Current MBS item descriptor for the multiple projection planar imaging verification item

Category 3 – Therapeutic procedures
<p>MBS 15705</p> <p>RADIATION ONCOLOGY TREATMENT VERIFICATION - multiple projection acquisition when prescribed and reviewed by a radiation oncologist and not associated with item 15700 or 15710 - each attendance at which treatment involving three or more fields is verified (ie maximum one per attendance).</p> <p>Fee: \$76.60 Benefit: 75% = \$57.45 85% = \$65.15</p>

Table 3: Current MBS item descriptor for the volumetric acquisition verification item

Category 3 – Therapeutic procedures
<p>MBS 15710</p> <p>RADIATION ONCOLOGY TREATMENT VERIFICATION - volumetric acquisition, when prescribed and reviewed by a radiation oncologist and not associated with item 15700 or 15705 - each attendance at which treatment involving three fields or more is verified (ie maximum one per attendance).</p> <p>Fee: \$76.60 Benefit: 75% = \$57.45 85% = \$65.15</p>

There were 99,185 claims for item 15700 in the year June 2010 to June 2011. The corresponding figures for 15705 and 15710 during the same time period were 229,833 and 43,342 respectively. ¹

The newer IGRT protocols proposed in this application are not currently specifically reimbursed under the MBS. It is known however that many radiotherapy centres already provide this service and claim for this against the existing MBS items above.

Regulatory status

A total of seven medical devices that could be used in conjunction with the proposed new service were provided by the applicants as example listings in their submission. The relevant TGA numbers, name and GMDN (Global Medical Device Nomenclature) listing are shown in table 4 below. This application for IGRT and any resultant MBS item number is not limited to the list of medical devices provided. Medical advice obtained during the development of this protocol indicates that a range of other vendors and/or equipment may also have products in relation to the service. It is considered that 64% of Linacs currently in use in Australia are capable of online correction (RANZCR 2011).

¹ Accessed from https://www.medicareaustralia.gov.au/statistics/mbs_item.shtml on 6 February 2013.

Intervention

Description of the medical condition

Cancer is a range of diseases where abnormal cells grow rapidly and can spread uncontrolled throughout the body. These cancerous cells can invade and destroy surrounding tissue and spread (metastasise) to distant parts of the body. An estimated 114, 000 new cases of cancer were diagnosed in Australia in 2010 and the Cancer Council Australia estimates that 1 in 2 Australians will be diagnosed with cancer by the age of 85. Cancer is now the leading cause of death in Australia, and although mainly affecting the older population, is a leading cause of premature death. Many patients live for a number of years with a diagnosis of cancer, potentially requiring ongoing intervention to support quality of life.

Other non-malignant lesions are also appropriately treated with radiation therapy, such as benign intracranial tumours and extracranial lesions.

Over 50% of patients with cancer will benefit from treatment programs that have radiation therapy as a component with or without other treatment modalities. The treatment can be part of a curative program or to help ease the symptoms of more advanced disease. For curative treatments particularly, higher radiation doses are more likely to achieve control, but can only be safely delivered if the exact location of the target within the body can be determined.

External beam radiation therapy (EBRT) is the most widely used type of radiation therapy. The radiation is delivered by high-energy photons that come from a machine called a linear accelerator (or linac, for short). The radiation is usually given daily over several weeks and delivered as an outpatient in a radiotherapy department. Three-dimensional conformal radiation therapy (3DCRT) is a form of EBRT that uses tumour imaging scans and computers to very precisely map its location in three dimensions. The radiation beams are matched to the shape of the tumour and delivered from several directions. By aiming the radiation more precisely, it may be possible to reduce radiation damage to normal tissues and increase the radiation dose to the cancer. Intensity modulated radiation therapy (IMRT) is a newer more advanced form of EBRT. As with 3DCRT, computer programs are used to precisely map the tumour in three dimensions. In addition to delivering beams from several directions, the intensity (strength) of the beams can be adjusted. This gives even more control over the conformity and heterogeneity of the dose, decreasing the radiation reaching sensitive normal tissues while delivering higher doses to the tumour.

It is proposed by the applicant (and described later in this document) that the newer IGRT technology would be available under MBS arrangements only for patients whose treatment technique is classified as either 3DCRT or IMRT. These treatments are more likely to be curative in intent and are likely to specify tighter treatment margins that maximise doses and reduce other organ toxicity. IMRT is not currently specifically MBS funded, although an application for funding is being considered at the same time as this application.

Product	ARTG Listing Number	Listing Name	GMDN Description	Name of Manufacturer	Sponsor of the medical device
Linear Accelerator	111760	Elekta Pty Ltd -Accelerator system, linear	Accelerator system, linear	Elekta Limited	Elekta Pty Ltd
Simulator	119995	Varian Medical Systems Australasia Pty Ltd -Simulator, radiation therapy	Simulator, radiation therapy	Varian Medical Systems Inc	Varian Medical Systems Australasia Pty Ltd
Record & Verify system	180498	Elekta Pty Ltd -Information system software, application program, patient record	Information system software, application program, patient record	Impac Medical Systems Inc	Elekta Pty Ltd
Planning system	119983	Varian Medical Systems Australasia Pty Ltd -Radiation therapy treatment planning system	Radiation therapy treatment planning system	Varian Medical Systems Inc	Varian Medical Systems Australasia Pty Ltd
Imaging Device	165040	Elekta Pty Ltd -Digital imager, radiation therapy	Digital imager, radiation therapy	Elekta Limited	Elekta Pty Ltd
Immobilisation	180456	Elekta Pty Ltd -Patient positioning device, diagnostic imaging/radiotherapy, moulding system, vacuum	Patient positioning device, diagnostic imaging/radiotherapy, moulding system, vacuum	Medical Intelligence Medizintechnik GmbH	Elekta Pty Ltd
Other	165041	Elekta Pty Ltd -Collimator, accelerator system, motorized, automatic aperture control	Collimator, accelerator system, motorized, automatic aperture control	Elekta Limited	Elekta Pty Ltd
Medical device system	155887	Emergo Asia Pacific Pty Ltd T/a Emergo Australia - Accelerator system, linear	Accelerator system, linear	Accuray Inc	Emergo Australia

Table 4: Medical devices that can be used in association with proposed service (not exhaustive)

Description of current MBS approved items for IGRT

Patients undergoing radiotherapy treatment usually have some form of imaging performed both during the planning stages and again during the delivery of treatment. This is to improve the accuracy of treatment delivery and minimise the risk of toxicity to surrounding organs. Images derived at the planning stages are used to determine the clinical target volumes (CTV) which in turn determine the planning target volumes (PTV) after appropriate expansion margins are applied. They are used as reference images for the subsequent images produced during the treatment stages.

Under the currently funded MBS items (15700, 15705 and 15710), information processing would not be possible at the time the patient is on the treatment table (x-ray films need to be developed or digital images reconstructed away from the treatment area) and image quality is often not suitable for interpretation and actions to proceed. Single images are reviewed after the patient has completed treatment for the day and any actions apply to the next day when assumptions from the previous day may not apply.

The listings above are described as treatment verification items. They are defined as a quality assurance procedure designed to facilitate accurate and reproducible delivery of the radiotherapy/brachytherapy to the prescribed site(s) or region(s) of the body as defined in the treatment prescription and/or associated dose plan(s) and which utilises the capture and assessment of appropriate images using:

- x-rays (this includes portal imaging, either megavoltage or kilovoltage, using a linear accelerator);
- computed tomography; or
- ultrasound, where the ultrasound equipment is capable of producing images in at least three dimensions (uni-dimensional ultrasound is not covered); together with a record of the assessment(s) and any correction(s) of significant treatment delivery inaccuracies detected.

Item 15700 covers the acquisition of images in one plane and incorporates both single or double exposure. The item may be itemised once only per attendance for treatment, irrespective of the number of treatment sites verified at that attendance.

Item 15705 (multiple projections) applies where images in more than one plane are taken, for example orthogonal views to confirm the iso-centre. It can be itemised only where verification is undertaken of treatments involving three or more fields. It can be itemised where single projections are acquired for multiple sites, e.g. multiple metastases for palliative patients. Item 15705 can be itemized only once per attendance for treatment, irrespective of the number of treatment sites verified at that attendance.

15710 applies to volumetric verification imaging using acquisition by computed tomography. It can be itemised only where verification is undertaken of treatments involving three or more fields and only once per attendance for treatment, irrespective of the number of treatment sites verified at that attendance.

Items 15700, 15705 and 15710:

- may not be claimed together for the same attendance at which treatment is rendered;
- must only be itemised when the verification procedure has been prescribed in the treatment plan and the image has been reviewed by a radiation oncologist.

Description and delivery of proposed new intervention

The newer IGRT processes proposed in this application involve multi-plane image sets or volumetric data sets being obtained at the planning stages and again during treatment delivery. Analysis, interpretation and treatment alignment can be adjusted during treatment and in accordance with narrower margins where appropriate. Review and assessment of the images enables trained staff (using specialised software) to make adjustments to the patient or machine positional parameters ensuring the radiation is precisely focussed on the target area (the tumour). This maximises the prescribed and delivered dose to the target and minimises the radiation to normal tissues close to the target and provides the opportunity to gain maximum tumour control and decrease possible side effects associated with the treatment.

This manipulation is the key difference from what is contained within the current descriptors. The applicant has indicated that many radiation therapy departments within Australia already have implemented these IGRT processes and are claiming through existing generic MBS items. For other centres, there would be a change in capital equipment that includes the hardware and software for these imaging techniques. The applicant indicates that increasingly linear accelerators are being manufactured that incorporate the facilities to undertake IGRT as a standard configuration. Currently the only imaging devices that are eligible for ROHPG funding are electronic portal imaging devices, which are now standard features of linacs. Other imaging devices used for IGRT, such as on-board kilovoltage imaging equipment and cone beam CT equipment, are not currently eligible for ROHPG funding. At its December 2012 meeting, PASC agreed that the issue of ROHPG funding for imaging devices not currently funded under the scheme was not part of this DAP and that these would probably emerge as part of the proposed Radiation Oncology MBS Review.

There are also broader IGRT processes necessarily related to the newer treatments described in the application and which are not covered within the existing verification item descriptors. These include:

- Determination of treatment planning margins and volumes (the size of the radiation fields)
- Documentation and presentation of results at a technical multi-disciplinary forum
- Re-planning based on IGRT information as required
- Analysis of trends and observations determining if there are positional variations
- Research and quality improvement initiatives to improve patient care and technical implementation of radiation treatments which are based on random or systematic events.

Prerequisites

A multi-disciplinary range of radiation oncology professionals are a pre-requisite for the safe and effective utilisation of the proposed new items. These include radiation oncologists, radiation therapists, medical physicists and engineers (Potters et al. 2010) . The application states that these

health service staff would continue to work under the direction and supervision of the radiation oncologist who holds the relevant Medicare provider numbers. Medical advice during the development of this protocol indicates that the majority of technologies currently in use in Australia have the ability to enable IGRT to be undertaken although it will require increased multidisciplinary staff time and increased consideration of hardware, network and storage requirement for digital images.

Centres would need to develop well documented, validated and rigorous clinical algorithms/protocols which permit suitably qualified, trained and credentialed radiation therapy staff to undertake the interpretation and adjustment steps required in IGRT, under medical supervision and review. All data (images and information) are also reviewed by the radiation oncologist – but after treatment due to workflow and logistical considerations.

Other staff involved in the process includes medical physicists who analyse results and data on a broader or population scale. Radiation engineers also assist in ensuring the equipment is performing optimally to ensure image guidance is articulated into the general radiotherapy workflow.

The original applicants (TROG) concurrently submitted an application to the Department of Health and Ageing for the listing of IMRT on the MBS, and this is to be assessed separately. IMRT delivers a non-uniform flux of radiation within each beam of radiation resulting in the ability to dose-sculpt around complex contours where target volumes are immediately adjacent to complex anatomical structures of normal tissue. This makes accuracy of delivery of the treatment paramount. It is with IGRT that IMRT can be most confidently delivered. Examples of such tumour sites are head and neck tumours (especially nasopharyngeal cancers), EBRT dose-escalated prostate cancer, and prostate cancer patients who require radiation therapy after radical prostatectomy (adjuvant or salvage radiotherapy). IMRT requires IGRT to ensure millimetre precision in the placement of the radiation beams.

Medical advice during the development of this protocol indicates that while the benefits of IMRT are less relevant without daily online IGRT, the two techniques have advantages to patients in their own rights and that they should be assessed independently. PASC agreed at their August 2012 meeting that these should be assessed separately. The applicant has stated in submissions that they believe that the additional imaging items proposed should however reflect a practice in which images acquired prior to treatment (with the patient in the treatment position) are reviewed and patient position corrected prior to treatment.

Co-administered and associated interventions

Simulation and dosimetry are integral parts of the planning of an EBRT course of treatment. A range of MBS items are listed in this regard (15500 to 15562; 18 items).

The delivery of EBRT (3D3DCRT) is currently listed on the MBS and a wide range of items are available depending on a number of factors. These include as examples whether a single or dual photon energy linear accelerator is used, the tumour site of treatment delivery and the number of fields of radiation therapy. Table 5 shows the listings for one field as well as fees payable for additional radiation fields (up to five) for a number of treatment sites on a dual photon energy linear accelerator – separate items are for lung (15245 and 15260), prostate (15248 and 15263), breast (15251 and 15266) and other cancers not covered by tumour sites above (15254 and 15269).

Table 5: MBS item descriptors for radiotherapy treatment

One field fee

Category 3 – Therapeutic procedures
<p>MBS 15245, 15248, 15251, 15254</p> <p>RADIATION ONCOLOGY TREATMENT, using a dual photon energy linear accelerator with a minimum higher energy of at least 10MV photons, with electron facilities - each attendance at which treatment is given - 1 field - treatment delivered to primary site [specific indication listed here]</p> <p>Fee: \$59.65 Benefit: 75% = \$44.75 85% = \$50.75</p>

Additional fee payable per field in excess of one

Category 3 – Therapeutic procedures
<p>MBS 15260, 15263 or 15266, 15269</p> <p>RADIATION ONCOLOGY TREATMENT, using a dual photon energy linear accelerator with a minimum higher energy of at least 10MV photons, with electron facilities - each attendance at which treatment is given - 2 or more fields up to a maximum of 5 additional fields (rotational therapy being 3 fields) - treatment delivered to primary site [specific indication listed here]</p> <p>Fee: The fee for item [relating to one field above] plus for each field in excess of 1, an amount of \$37.95</p>

The insertion of fiducial markers may be required in some cases in order to support the proposed IGRT process. The prostate gland, for example, is difficult to image and is mobile. The implantation of radio-opaque gold seeds into the prostate is designed to provide fiducial or fixed reference points during a course of radiotherapy with the aim of delivering radiotherapy more accurately and efficiently. Fiducial marker implantation for this purpose is MBS interim funded (MBS item 37217) and is shown in table 6 below. These are usually inserted under ultrasound guidance prior to the commencement of therapy, and this ultrasound procedure and associated professional attendance is also co-claimed at the same time where relevant (MBS items 55603 and 104). The use of fiducial markers has become standard practice in the radiotherapy treatment of prostate cancer in Australia irrespective of the type of IGRT employed. Their use in other disease sites is currently limited, although considered to be increasing.

Table 6: MBS item descriptor for fiducial markers

Category 3 – Therapeutic procedures
<p>MBS 37217</p> <p>Prostate, implantation of gold fiducial markers into the prostate gland or prostate surgical bed (multiple services rule) (Anaes.) Fee: \$138.30 Benefit: 75% = \$103.75 85% = \$117.60</p>
Category 5 – Diagnostic imaging services
<p>MBS 55603</p> <p>PROSTATE, bladder base and urethra, transrectal ultrasound scan of, where performed: (a) personally by a medical practitioner who undertook the assessment referred to in (c) using a transducer probe or probes that:</p> <p>(i) have a nominal frequency of 7 to 7.5 megahertz or a nominal frequency range which includes frequencies of 7 to 7.5 megahertz; and (ii) can obtain both axial and sagittal scans in 2 planes at right angles; and (b) following a digital rectal examination of the prostate by that medical practitioner; and (c) on a patient who has been assessed by a specialist in urology, radiation oncology or medical oncology or a consultant physician in medical oncology who has: (i) examined the patient in the 60 days prior to the scan; and (ii) recommended the scan for the management of the patient's current prostatic disease (R) Fee: \$109.10 Benefit: 75% = \$81.85 85% = \$92.75</p>
Category 1 - PROFESSIONAL ATTENDANCES
<p>MBS 104 SPECIALIST, REFERRED CONSULTATION - SURGERY OR HOSPITAL</p> <p>(Professional attendance at consulting rooms or hospital by a specialist in the practice of his or her specialty where the patient is referred to him or her) INITIAL attendance in a single course of treatment, not being a service to which ophthalmology items 106, 109 or obstetric item 16401 apply. Fee: \$85.55 Benefit: 75% = \$64.20 85% = \$72.75</p>

Listing proposed and options for MSAC consideration

Proposed MBS listing

In the Consultation DAP four separate MBS items were proposed for IGRT: two for planar imaging (one item for first image acquisition and one item for recurrent images) and two for volumetric imaging (as per planar imaging). Each of the four items had a different fee. These differences were driven by the following assumptions:

- additional time is required by the radiation therapists for planning and QA in the pre-service component of the first image of a set and therefore should attract a higher fee
- Volumetric imaging requires additional time in both image acquisition and interpretation than planar imaging and should therefore be reimbursed accordingly.

Following consultation, PASC agreed at its December 2012 meeting that there should be two items: one for planar imaging and one for volumetric imaging however both items would have the same fee. PSAC commented that the additional costs associated with the first image per set should be absorbed by the planning item billed for radiotherapy treatment. PSAC also noted that having the same fee would ensure that there was no incentive to undertaken a particular type of imaging if it was not warranted clinically. It was also agreed that that only one item can be billed per fraction similar to the existing arrangements for offline verification items which may not be claimed together for the same attendance at which treatment is rendered. Tables 7 and 8 below outline the proposed items for planar and volumetric IGRT. The fee for the proposed IGRT items still needs to be determined however as stated above the applicant initially provided a range of fees for both planar and volumetric imaging and it would be anticipated that the costings underpinning these fees would be used to generate a single fee for the purpose of this evaluation.

PSAC also consulted on whether separate items should be created for offline and online verification. Medical advice obtained during the development of this protocol indicated that not all patients whose treatment is classified as 3DCRT would benefit from online IGRT. The applicant states that it is on a case by case assessment of 3DCRT plans that consideration of whether IGRT should be applied are made. There is the potential that online imaging could be used (and claimed through MBS arrangements) unnecessarily in some treatment sessions. The applicant states that in the future, it is expected that all patients treated with high dose radiotherapy with complex planning will use "online" planar and volumetric IGRT instead of the current MBS verification items.

PSAC agreed at is December 2012 meeting that there should be separate items for offline and verification and online verification, as such the existing items will be retained for less complex planning and treatment, although the use of these items will reduce over time. The fees and descriptors however may need to be modified to be consistent with future item descriptors. As noted earlier in this DAP, PSAC anticipated that the boundaries and definitions around IGRT would probably emerge as part of the Radiation Oncology Review.

Table 7: Proposed MBS item descriptor for planar image guided radiation therapy

Category 3 – Therapeutic procedures GROUP T2 – Radiation Oncology SUB GROUP 7 – RADIATION ONCOLOGY TREATMENT VERIFICATION
MBS [item number] Planar Image Guided Radiation Therapy The use of at least two (2) planar image views/projections to facilitate a 3 Dimensional adjustment to radiation treatment field positioning, where the following conditions are met: <ol style="list-style-type: none"> 1. Treatment technique is classified as either 3DCRT or IMRT; 2. Margins applied to volumes (CTV/PTV) are tailored or reduced to minimise treatment related exposure of healthy/normal tissues; 3. Decisions using acquired images are based on action protocols and are enacted immediately prior to and during treatment delivery by qualified and trained staff considering complex competing factors and using software driven modelling programs; 4. Image decisions and actions are documented in the patient’s record; 5. The radiation oncologist is responsible for prescribing the process and reviewing the results and relevant images and specifying action protocols as required; 6. Where required, re-planning is required when the treatment adjustments are inadequate to satisfy treatment protocol requirements; and 7. Imaging infrastructure (hardware and software) is linked to the treatment unit and networked to an image database enabling both online and offline reviews. 8. Not to be used in conjunction with MBS item XXXX and used only once per fraction. <p>Fee: to be determined</p>

Table 8: Proposed MBS item descriptor for volumetric guided radiation therapy (online)

Category 3 – Therapeutic procedures GROUP T2 – Radiation Oncology SUB GROUP 7 – RADIATION ONCOLOGY TREATMENT VERIFICATION
MBS [item number] Volumetric Image Guided Radiation Therapy The use of a 3 Dimensional Computed Tomography (Helical/Cone Beam) Image Data Set to facilitate a 3 Dimensional adjustment to radiation treatment field positioning where the following conditions are met: <ol style="list-style-type: none"> 1. Treatment technique is classified as either 3DCRT or IMRT; 2. Margins applied to volumes (CTV/PTV) are tailored or reduced to minimise treatment related exposure of healthy/normal tissues; 3. Decisions using acquired images are based on action protocols and are enacted immediately prior to and during treatment delivery by qualified and trained staff considering complex competing factors and using software driven modelling programs; 4. Image decisions and actions are documented in the patient’s record; 5. The radiation oncologist is responsible for prescribing the process and reviewing the results and relevant images and specifying action protocols as required; 6. Where required, re-planning is required when the treatment adjustments are inadequate to satisfy treatment protocol requirements; and 7. Imaging infrastructure (hardware and software) is linked to the treatment unit and networked to an image database enabling both online and offline reviews. 8. Not to be used in conjunction with MBS item XXXX and used only once per fraction. <p>Fee: to be determined</p>

Estimates of usage

MBS items 15550 and 15553 relate to simulation episodes for 3D3DCRT conformal radiotherapy and items 15556, 15559 and 15562 (inclusive) relate to planning of these. In the year July 2011 to June 2012, there were 30,651 claims for simulation and 29,322 for planning. This may provide some estimate of the total proportion of radiotherapy patients for whom MBS claims for the newer IGRT protocols might be made. Medical advice during the development of this protocol indicates that not all patients whose treatment is 3DCRT would require daily IGRT however and that estimates of future use may need to be based on tumour sites and the relative role of 3DCRT and IMRT in their treatment.

Estimates of potential relative usage of the new items were provided in the application. Amongst the proposed planar and volumetric items, it was estimated that approximately 60% of the eligible patients would be treated using planar IGRT, 25% would be treated using volumetric IGRT and 15% of patients would be treated using a combination of planar and volumetric IGRT.

Despite any restrictions on its initial proposed use, the applicant stated that it would be expected that the vast majority of patients for whom a course of radiotherapy was indicated would benefit from "online" IGRT and that five years after implementation the newer IGRT processes would become the standard of care. Imaging technology will continue to improve enabling a more efficient management process. At the very least, it is stated, any patient having a three-dimensional or IMRT plan will have the accuracy of their treatment enhanced by IGRT.

Each patient would be expected to undergo an imaging procedure during each treatment session. This is in contrast to the existing verification items where imaging is performed less frequently. With the potential introduction of IGRT there would be an overall increase in the number of imaging procedures performed throughout a course of radiation therapy.

The proportion of patients undergoing planar versus volumetric IGRT is also expected to change over time. With technological improvements, usage of the volumetric aspect will increase as clinicians are able to use those images in more ways than are possible with planar images.

Clinical place for proposed intervention

A simplified clinical algorithm for the imaging pathways is shown in figure 1 below.

The algorithm highlights the major differences between post-treatment verification (the comparator) and IGRT using planar or volumetric imaging. As a result of determining position with certainty prior to treatment with IGRT, tighter margins are prescribed during planning and acted on during delivery. Imaging is also usually performed daily prior to treatment with IGRT. With offline verification imaging however, imaging is typically performed daily during the first week and once weekly for the remainder of the course.

Clinical claim

Potential benefits of proposed technology

The major potential benefit of the technology is that the dose of radiation being delivered to the target tumour can be maximised while minimising the unintended dose that is delivered to the surrounding tissues. IGRT can assist in the detailed planning, dosimetric calculation, quality assurance of the plan and in optimising the delivery. The use of the process would provide superior tumour control and surrounding tissue protection.

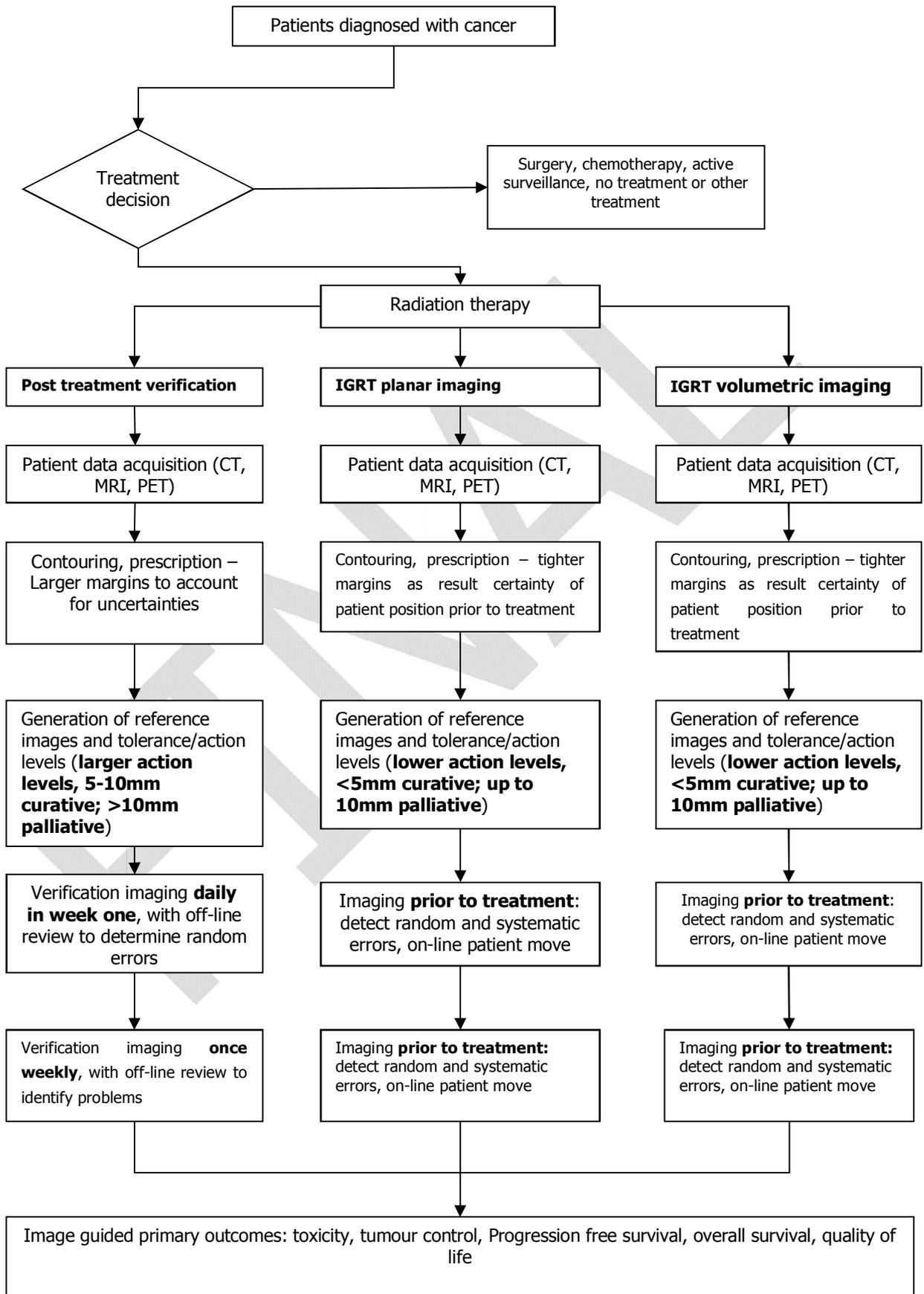
It is stated that there is a large body of evidence available to support the value of radiation dose escalation in achieving improved cancer cure rates including in prostate cancer. In this cancer, rectal tolerance is exceeded if more than 70Gy is delivered to more than 25% of rectal volume. As a result of the toxicity arising from the significant margin, the dose deliverable to the tumour is limited. IGRT allows dose escalation where this is demonstrably superior (e.g. prostate cancer).

PASC noted that the assessment of this technology may find that direct comparative trials between IGRT (older systems) and IGRT (newer systems) in relation to direct clinical outcomes are not available. The benefits arising from more accurately delivered radiation therapy may have to be linked with direct clinical outcome evidence from comparative radiotherapy strategies (e.g. dose escalation, toxicity reduction).

In addition to its effect on cancer control and cure rates, there are other benefits for the technology cited in the application. In the acute or treatment phase, there would be a potential reduction in toxicity and side effects experienced by patients including a reduction in the number of cases requiring acute care and medical intervention during or immediately after treatment. In the 3-6 month period after treatment, there would be a potential reduction in such toxicities as strictures, fractures, scar tissue formation together with less reliance on medications such as pain control and steroids and improved quality of life.

Increased frequency of imaging with additional radiation exposure as a result of these is a potential disadvantage of IGRT. It is stated in the application that the small incremental radiation dose provided from these is taken into account during the planning stages of the treatment, although medical advice indicates that this is difficult to model in practice.

Figure 1: Clinical algorithm



Comparator

The comparator on which the assessment of IGRT as a new option will be based is the currently listed treatment verification items, i.e. portal imaging with offline post-treatment assessment.

It would be expected that the appropriate type of economic evaluation in this assessment, using table 11 as a guide, would be a cost-utility analysis. It is claimed that the treatments that are guided by the new technology provide superior effectiveness and safety over those guided by the comparator. Issues of relative safety of the increased frequency range of images being obtained may also have to be considered.

Table 11: Classification of an intervention for determination of economic evaluation to be presented

		Comparative effectiveness versus comparator				
		Superior		Non-inferior	Inferior	
Comparative safety versus comparator	Superior	CEA/CUA		CEA/CUA	Net clinical benefit	CEA/CUA
					Neutral benefit	CEA/CUA*
					Net harms	None^
	Non-inferior	CEA/CUA		CEA/CUA*	None^	
	Inferior	Net clinical benefit	CEA/CUA	None^	None^	
		Neutral benefit	CEA/CUA*			
Net harms		None^				

Abbreviations: CEA = cost-effectiveness analysis; CUA = cost-utility analysis

* May be reduced to cost-minimisation analysis. Cost-minimisation analysis should only be presented when the proposed service has been indisputably demonstrated to be no worse than its main comparator(s) in terms of both effectiveness and safety, so the difference between the service and the appropriate comparator can be reduced to a comparison of costs. In most cases, there will be some uncertainty around such a conclusion. Therefore, when an assessment concludes that an intervention was no worse than a comparator, an assessment of the uncertainty around this conclusion should be provided by presentation of cost-effectiveness and/or cost-utility analyses.

^ No economic evaluation needs to be presented; MSAC is unlikely to recommend government subsidy of this intervention

The applicant has already outlined a proposal for an economic model that will be used in the assessment. Health states associated with the downstream consequences of radiotherapy treatment will be incorporated into a Markov model, which is depicted in figure 2, page 25. These health states will be the same irrespective of whether the proposed new technology or the comparator is used to guide the treatment. Different rates of transition between the states are however expected, and these will inform the costs and effectiveness. Health states listed include:

- acute toxicity (graded)
- late toxicity
- free of disease and symptoms
- local recurrence (with or without late toxicity)
- progression – distant metastases
- cancer death
- other death

Consideration of the capital costs and health resources

Regardless of the economic structure the review will need to outline additional capital costs in respect to the proposed adoption of IGRT in the health system. This will include purchase of additional equipment for planning and delivery of IGRT as well as the staff required to undertake IGRT (which may require a different skill mix)) and the proposed impact for the ROHPG Scheme.

The table below outlines the list of health resources identified by the applicant relevant to this review.

Table 12 List of resources to be considered in the economic analysis (not exhaustive)

	Provider of resource	Setting in which resource is provided	Proportion of patients receiving resource	Number of units of resource per relevant time horizon per patient receiving resource	Disaggregated unit cost					
					MBS	Safety nets*	Other govt budget	Private health insurer	Patient	Total cost
Resources provided to identify eligible population										
Specialist Consultation	Specialist	Outpatient								
- Resource 2, etc										
Resources provided to deliver proposed intervention (IGRT)										
- Image Management	Radiation Oncologist	Outpatient								
- IGRT procedure	Radiation Therapist	Outpatient								
- Image review	Radiation Oncologist	Outpatient								
- Quality control	Medical Physicist									
Resources provided following proposed intervention (IGRT)										
- Consultation	Specialist	Outpatient								
- Management of disease recurrence	Specialist	Outpatient								
- Management of treatment related morbidities	Specialist	Outpatient								
Resources provided to deliver comparator (offline imaging)										
- Resource 1	nil									
- Resource 2, etc										
Resources provided in association with comparator 1 (offline imaging as above) (e.g. pre-treatments, co-administered interventions, resources used to monitor or in follow-up, resources used in management of adverse events, resources used for treatment of down-stream conditions)										
- Resource 1										
- Resource 2, etc										

Outcomes and health care resources affected by introduction of proposed intervention

This assessment will consider the following outcomes:

Effectiveness of the newer procedure:

Accuracy

Tumour margins applicable

Safety of the procedure

Any adverse events arising from the use of the procedure, or more frequent use of IGRT including radiation exposure.

Therapeutic impact

Alteration of tumour margins

Reduction in treatment toxicity and short term toxicity

Facilitation of EBRT dose escalation

Health outcomes

Treatment related morbidity

Quality of life

Progression free survival

Overall survival

It was noted by the PAC at its December 2012 meeting that the outcomes should stress and identify the methods that will be used to overcome systematic error where imaging identifies that the treatment has not be delivered correctly.

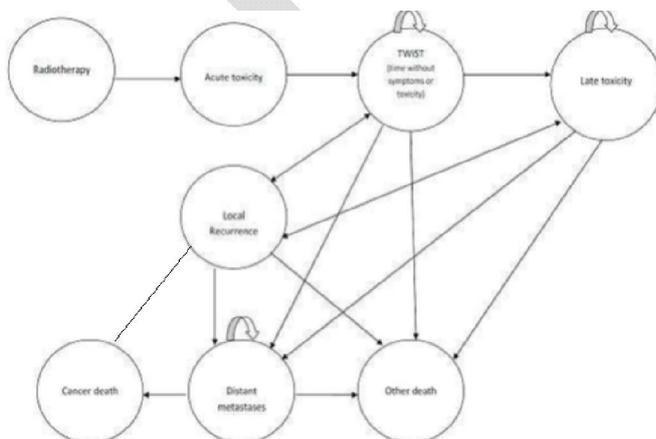
Proposed structure of economic evaluation (decision-analytic)

Table 12: Summary of extended PICO to define research question that assessment will investigate

Patients	Intervention	Comparator	Outcomes to be assessed	Resources to be considered
Patients undergoing external beam radiotherapy that is classified as either 3DCRT or IMRT	Use of pre-treatment (or online) image guided radiation therapy with planar or volumetric imaging techniques	Use of portal (offline) imaging	<p>Procedure effectiveness Accuracy Tumour margins applied</p> <p>Safety Any adverse events arising from procedure including additional radiation exposure from frequent imaging</p> <p>Therapeutic impact Alteration of tumour margins Reduction in treatment toxicity and short term toxicity EBRT dose escalation</p> <p>Clinical Morbidity Quality of life Progression free survival Overall survival</p>	<p>Resources associated with treatment:</p> <p>Simulation</p> <ul style="list-style-type: none"> • Dosimetry • Quality assurance • Target verification • Treatment • Verification <p>Resources for ongoing patient monitoring post-treatment.</p> <p>Resources for treating acute and long-term toxicities of radiation treatment.</p> <p>Resources for further treatment and management of the progression of cancer</p>

Primary question for public funding: What is the safety, effectiveness and cost-effectiveness of the use of online image guided radiotherapy compared with radiotherapy using offline portal imaging?

Figure 2 – Proposed structure of Markov model



References

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PRELIMINARY