team (strongly agree-64%; agree-36%) and would recommend their care (strongly agree-75%; agree-25%). At PRE-Tx, 94% of the Q5 patients preferred to start RT within a day of CTSim compared to 16% of ConvProcess patients. The preference of ConvProcess patients changed significantly compared to Q5 patients at POST-TX (p < 0.0001); 63% of ConvProcess and 96% of Q5 patients strongly agreed/agreed that given a choice they would prefer to start RT the next day after CTSim. The overall PSS for all patients were not different PRE- and POST-Tx (p = .8) and stress levels did not differ significantly between Q5 and ConvProcess patients (p = .76). For both groups, health was the most common stress. The IIRS for ConvProcess patients was 37.6 (PRE-TX) and 39 (POST-TX), and for Q5 patients was 32 (PRE-TX) and 31.8 (POST-TX); there was no difference in IIRS of ConvProcess and Q5 patients (p = .72). However, subscales of IIRS showed an increase in illness interference with aspects of Physical Recreation and Social relationships for ConvProcess patients compared to Q5 patients (p = .03).

Conclusions: Women undergoing whole breast RT were satisfied with their care and preferred to start RT quickly following their CTSim. Their strongest stressor was health and their stress levels were unchanged at RT completion. Patient involvement and selection of RT timing may impact on their views of how treatment interferes with their lifestyle and social relationships.

182 AGE AFFECTING QUALITY OF LIFE IN RADIATION ONCOLOGY OUTPATIENT CLINIC
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Purpose: Quality of Life (QoL) assessment in cancer clinical trials provides a more accurate evaluation of the well-being of individuals or groups of patients and of the benefits and side-effects that may result from medical intervention. Therefore, our first task in dealing with cancer is to regain some sort of equilibrium which will include mental, physical and spiritual aspect of that individual by addressing these very real issues and creating a support system tailored to our patient and their needs.

Methods and Materials: As part of a Dean’s summer project a survey was undertaken to facilitate a more complete description of the quality of life experience of patients with histological diagnosis of cancer undergoing external beam radiation as an outpatient at Allan Blair Cancer Centre, Regina, Canada. The questionnaires had two major components; depression and global QOL. The depression was measured by the Zung Self-Rating Depression Scale which is a short self-administered survey to quantify the depression status of a patient.

Results: That data indicated that only the variable of age was a significant predictor. A positive relationship was present indicating higher levels of depression when patients received chemotherapy or narcotics. Breast cancer patients rated quality of life, functional well-being significantly higher than lung cancer patients p > 0.05. Breast cancer patients also scored significantly lower on the measure of depression than lung cancer patients p > 0.05.

Conclusions: A significant relationship between the chemotherapy, narcotics use and QOL was found in our study.

For clinicians, this means not only demonstrating that such data are clinically useful but also addressing the effect on clinic work flow, constrained resources for data collection and management, reimbursement for their time and effort in monitoring health related QoL.

183 OPTIMAL EXTERNAL MARKER BLOCK PLACEMENT FOR RESPIRATORY MOTION MANAGEMENT IN BREAST RADIOTherAPY Leigh Conroy1, Alexandra Guebert2, Wendy Smith1
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Purpose: Respiratory motion management is used in breast radiotherapy to reduce dose to cardiac and pulmonary organs at risk or decrease required margins. Variant Real-time Position Management (RPM) is a common tool for gated and Deep Inspiration Breath Hold (DIBH) treatments in breast. The external marker block is typically placed between the xiphoid process and the umbilicus. However, block movement in this location may not be well correlated with the internal chest wall motion. Here, we examine the feasibility of placing the marker block directly on the breast/chest wall to improve the correlation between the target and external marker motion.

Methods and Materials: Three primary concerns are considered: 1) the bolusing effect of placing the marker block in the primary field; 2) amplitude accuracy with block positioning; and 3) correlation between the exterior surface position and internal motion.

1) We determine the bolusing effect of the two-dot, six-dot, and ‘hippo’ (TrueBeam) marker blocks for a 6 MV beam at perpendicular incidence (Gantry 0°) using a Markus ionization chamber. 2) When the marker block is placed on an intact breast, it may tilt in the lateral direction. We investigate the impact of tilt (10° to 50°) on detected motion amplitude of the two-dot and six-dot marker block systems. 3) An in-house edge detection code was used to extract internal chest wall and external surface contours on each frame of weekly during-treatment cine portal images on the medial field from 20 DIBH patients. A population-based correlation study determines the external surface block location that best represents internal chest wall motion.

Results: 1) At perpendicular beam incidence, all three marker blocks doubled the surface dose reading compared to the surface dose with no marker block. This is equivalent to approximately 2.5 mm of bolus. Increasing beam obliquity is expected to increase this bolusing effect. 2) The RPM system overestimated the detected amplitude of the two-dot marker block when the block was tilted laterally: on average by 1 mm at 20°; 2.5 mm at 30°; 5 mm at 40°; and 8 mm at 50°. The detected amplitude when using the six-dot marker block system was unaffected by lateral tilt. 3) Preliminary results using the cine portal image chest wall and surface contours suggest that positioning the marker block at the nipple line best represents central chest wall motion.

Conclusions: Placing the RPM marker block on the breast/chest wall at the nipple line is expected to improve the correlation between the block movement and chest wall motion with a small impact on skin dose. The six-dot marker block system should be used for intact breast, as it is more robust to lateral tilting than the two-dot marker block system. A study of 24 left-sided breast patients using this block placement for DIBH treatments is currently underway at our centre.
quantify the reproducibility of the eye immobilization system CT scans were co-registered using rigid 6D skull registration. With the scans co-registered x, y and z displacement of the lens/optic nerve insertion were measured manually. From these displacements, a 3D vector was calculated.

Results: Thirty-four patients were identified, having been treated from October 2010 to September 2015. Thirty-nine co-registrations were performed using 75 scans (2-3 scans per patient). The mean displacements of lens and optic nerve insertion were 0.1 mm and 0.0 mm — confirming that there was no systemic shift from planning to treatment. The median 3D displacements (absolute value) of lens and nerve insertion were 0.8 and 0.7 mm (SD 0.5 and 0.6 mm). Ninety-eight percent of 3D displacements were below 2 mm (maximum 2.4 mm). Following this analysis, we have not changed our GTV to PTV margin of 2-3 mm as it is also meant to account for uncertainties in planning MRI to CT registration, skull tracking as well as contouring variability.

Conclusions: We have found our stereotactic eye immobilization system to be highly accurate (< 1 mm) and free of systematic error.

185 ROLE OF VOLUMETRIC MODULATED ARC THERAPY WITH FLATTENING FILTER FREE DELIVERY IN LUNG STEREOTACTIC BODY RADIOTHERAPY Hongwei Liu1, Ivo Olivatto1, Harold Lau2, Zoann Nugent2, Rao Khan1
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Purpose: To evaluate the role of volumetric modulated arc therapy (VMAT) combined with flattening filter free (FFF) beam delivery in lung stereotactic body radiotherapy (SBRT).

Methods and Materials: Ninety-eight Stage I lung cancer cases treated with SBRT were included. Retrospectively, single arc, 6 MV VMAT with FFF and flattened filed (FF) beam plans were generated using the identical optimization criteria with Acuros XB dose computation algorithm. Optimization constraints included target dose ratio of 50% prescription isodose volume to target (R50%) and maximal dose at 2 cm from the target (D2cm). Study parameters including the number of monitor units (MUs), mean target dose, conformity number (CN) and heterogeneity index (HI) of the target, R50%, D2cm, and mean dose to normal tissues were determined and compared for the two delivery modes. A paired matched t-test was used to compare the difference. The effect of tumour, patient and treatment mode (FFF versus FF) on the difference of MUs obtained from the two delivery systems was statistically determined using linear regression analyses.

Results: FFF beams required 6.9% (range -3.4 to 15.6%) more MUs and resulted in slightly higher values for mean target dose, R50% and D2cm (all p < 0.0001) compared to FF beams. CN, HI of target and mean dose to the normal body were similar between the two plans. Logistic regression analysis confirmed that VMAT with FFF mode, not the tumour or patient specific parameters, caused the increase in MUs compared to FF beam delivery (p = 0.043).

Conclusions: In lung SBRT, using VMAT with FFF beam required 7% more MUs compared to a VMAT with FF beam plan and provided similar target coverage. The low leakage dose advantage of FFF delivery is offset by the increased number of MU. The only advantage available to the FFF beams is their estimated faster delivery.

186 PROCESS STREAMLINING TO REDUCE RESPIRATORY VARIATION IN VISUALLY MONITORED DEEP INSPIRATION BREATH HOLD RADIATION THERAPY FOR BREAST CANCER PATIENTS Gillian Ecclestone1, Leigh Conroy2, Roseanne Moore2, Tracey Lundstrom2, Karen Long2, Nancy Beauchemin2, Mary Loi1, Colleen Schinkel2
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Purpose: Deep inspiration breath hold (DIBH) is an established technique to reduce heart and lung dose during radiation therapy for left-sided breast cancer. The visually monitored DIBH method (VM-DIBH) is a low-cost technique that employs coincident in-room lasers and skin marks to reproduce the breath hold level (BHL) achieved at CT simulation. The purpose of this study was to quantify inter-fraction BHL variability, and to perform a process review and revision to streamline and improve the current VM-DIBH process at our cancer centre. Specific guidelines, workflows, and tolerances were established to improve daily treatment accuracy, reduce systematic errors and inter-fractional respiratory variability, and mitigate potential breath hold reproducibility issues prior to treatment.

Methods and Materials: BHL measurements were collected for 55 left-sided breast patients at the time of simulation and treatment; to determine population inter-fraction BHL differences. The BHL was determined by measuring the anterior-posterior displacement of the lateral tattoo on the affected side between free breathing and BH. Inter-fractional BHL differences were quantified to establish a baseline for improvement and a BHL tolerance for treatment to reduce the respiratory variation within the VM-DIBH technique. Respiratory reproducibility assessment guidelines to be applied during simulation were developed and validated on a cohort of 12 left-sided breast patients to determine their candidacy for VM-DIBH. This cohort of patients was treated using the new BHL tolerance and was compared to 12 patients treated using the old DIBH process. To assess acceptability of the process change, a 12 question survey was completed by Radiation Therapists prior to and following implementation.

Results: A 3 mm BHL tolerance was chosen for this pilot study as an achievable goal with respiratory coaching based on the population data collected (n = 55). Sixty percent of patients had a BHL variability of ±3 mm with 36% of patients ±3 mm. The mean and standard deviation was 5 mm and 3 mm respectively. Tolerances greater than 3 mm were deemed too large when combined with setup errors. One hundred percent of patients treated with the new DIBH process in place (n = 12) were able to achieve a breath hold within the 3 mm tolerance. The increased respiratory reproducibility achieved with the BHL tolerance yielded decreased setup variation in the motion vectors induced by respiration (longitudinal and vertical directions). When localizing the isocentre on day 1 of treatment, the frequency of required couch shifts decreased by 17% in both the anterior-posterior and superior-inferior directions. The new process was well received based on the radiation therapists surveyed.

Conclusions: The new streamlined DIBH process improved workflows, decreased BHL variability and received positive feedback from staff. Respiratory inter-fractional errors were reduced, which may lead to reduced systematic setup errors.

187 DETERMINING OPTIMAL VOLUMETRIC IMAGE GUIDANCE STRATEGIES FOR BREAST BOOST RADIATION THERAPY Winnie Li, Susanne Lofgren, Grace Lee, Paul Kwan, Robert Dinniswil, Douglas Moseley
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Purpose: Breast boost to the tumour bed following whole breast radiotherapy (RT) in breast-conserving therapy can reduce local recurrence. The aim of this study was to identify appropriate and reliable surrogates to optimize cone beam computed tomography (CBCT) image registration for breast boost patients to reduce inter-user variability.

Methods and Materials: Daily localization CBCT images are acquired and any positional discrepancies corrected prior to three-field conformal breast boost treatment delivery. Under ethics approval, patients receiving breast boost RT between October and December 2014 were included in this retrospective