robustness and effectiveness. This framework was used to assess a series of safety-related incidents in our clinic related to one selected, relatively common, challenge in our clinic.

**Results:** Final care path included 160 steps. Twelve incidents (involving 0.3% of patients) occurring during a defined time related to patient site setup notes, that could have led to site setup errors (“top event”), were analyzed in depth. Human errors contributing to these incidents were then labeled as threats to site setup fidelity. Five incidents were related to the threat of conflicting bladder information (bladder full vs. empty), 3 related to iso-center shift differences between documentation in the site setup note compared to elsewhere, 3 related to missing a site setup note entirely, and 1 related to the site setup note not followed at patient setup. Table presents a representative example of controls and their type including their effectiveness to prevent these threats.

**Conclusion:** BTA provided valuable insight into the identity and efficiency of the controls within our department to protect against errors related to a representative “top event” (e.g. site setup errors). This analysis has helped us realize that we need to improve the robustness and effectiveness of many of our controls and strategically implement audits into our QA management program to help ensure patient safety.

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**3435**

**Initial Experience with Introducing National Swedish Guidelines for CT- and MRI-based Delineation of Organs at Risk in Radiotherapy: The STRONG Project**

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**Purpose/Objective(s):** A fundamental problem in radiotherapy (RT) is the definition of organs at risk (OARs). Opinions about which volumes to delineate diverge across different studies, countries, and continents. The purpose of this study is to present our experience in engaging the Swedish radiation oncology (RO) community in deriving national consensus guidelines for OAR volumes, the so called STRONG (corresponding acronym in English: STRONG).

**Materials/Methods:** This project started in 2016 and builds on previous standardization initiatives in RO which resulted in Sweden becoming the first and only country in the world to adopt the same national naming convention at all RO departments1. A multi-step plan was devised, with strong focus on identifying and approaching key decision makers for project approval purposes. Applications for funding and ethical approval were submitted to relevant authorities and a network with participation from all 17 RT departments was built incrementally. A survey directed to all RT-departments across Sweden identified frequently used OARs. A first comment round to test logistics in collecting votes by RO experts on one proposed guideline was initiated in December 2018 (male pelvis/rectal contours according to RTOG and ESTRO/ACROB2). By 2019, RO residents in training are recruited to create guidelines as part of a compulsory learning objective during their clinical rotation, Nyholm et al. RO 2016: 119(2):334. 3Gay et al. IJROBP 2012:83(3):e353-62 and Salembier et al. RO 2018:127(1):49-61

**Results:** Most clinically active RO/RT professionals and relevant authorities in Sweden are aware of the ongoing work. Ethical approval and funding (50kEuro/55kUSD for 2018-2020) have been granted. Of 65 surveyed OARs, 16/10/13 entries were reported as “always”/“sometimes”/“never” by a majority of departments (≥9/17). The first comment round was successful with a majority vote in favor of the proposed guideline (10/17 departments by February 19, 2019).

**Conclusion:** Main challenges during the start-up period have concerned reaching out to all parties of interest in a timely manner and motivate funding agencies to support the work. Future work will investigate contour variability before and after implementation of national guidelines, potential impact on treatment decision and toxicity. Discussions on how to use the guidelines for automatic contouring or integrating them in RO educational tools such as eContour3 are also ongoing. The major strengths of this project are previous national standardization RO/RT initiatives in Sweden, a well-functioning multi-professional network with participation from all 17 RT-departments, and a scalable methodological approach including educational aspects. Gillespie et al. IJROBP 2017;98(3):547

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**3436**

**Effectiveness of a Standardized Intracavitary HDR Brachytherapy Emergency Training Protocol**

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**Purpose/Objective(s):** The US NRC requires annual training for high dose rate (HDR) brachytherapy emergencies for authorized users. Previous training at our institution involved verbal instruction by the afterloader vendor, followed by a brief hands-on skills session. Based on perceived knowledge gaps and uncertainty in how to respond to HDR “stuck source” emergencies by staff, we developed and evaluated a new HDR emergency training protocol (HDR-ETP).

**Materials/Methods:** Standardized HDR “stuck source” emergency procedures were developed based on recommendations from the afterloader vendor, modified to reflect clinical practicalities. Detailed action lists for three different HDR staff were developed. An HDR-ETP was then created, consisting of an instructional video, demonstrating use of emergency procedures for various scenarios, and a hands-on HDR emergency simulation. Protocol training commenced with HDR staff watching the short instructional video. Then, a hands-on HDR emergency drill was completed in a team setting, consisting of a physician, a physicist and a radiation therapist. Trained observers evaluated staff on their performance during the simulation and gave direct feedback to each participant. Both before and after completing the HDR-ETP, staff completed a survey to evaluate their knowledge of HDR emergency procedures (using multiple choice questions) and assess their comfort level performing these tasks (using a 5 point Likert scale).

**Results:** A total of 18 staff members participated in the new HDR-ETP. Prior to initiation of training, 22% of participants strongly agreed with the statements “I am familiar with the procedures to follow during an HDR emergency” and “I feel confident in performing my role during an HDR emergency”. After training, 93% and 87% of participants strongly agreed with the above statements, respectively. The average score for knowledge-based questions was 83% (range 60-100%) prior to training. After training, the average score improved to 90% (range 80-100%). Despite high pre-test scores, 44% (8/18) participants made one or more errors during the hands-on simulation. Simulation errors included failure to engage source-retract interlocks, failure to perform a survey for radioactivity at the end of the simulation and general process errors. After training completion, all participants either somewhat or strongly
agreed to the statements “I found the video training useful” and “I found the hands-on practice useful”.

**Conclusion:** A standardized HDR-ETP was developed that included an instructional video and a hands-on drill for brachytherapy staff. Our HDR-ETP resulted in improved familiarity and confidence with emergency procedures. Despite good pre-test knowledge and the instructional video, multiple participants made errors during the hands-on simulation, highlighting the necessity of simulated emergency events.

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### 3437

**Using Automatic Plan Consistency Check (APCC) to Reduce Errors in Treatment Plans**

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#### Purpose/Objective(s):** The Radiation Oncology Incident Learning System (RO-ILS) reported that 33% of reported events occur during the processes of treatment planning and pre-treatment review/verification. The purpose of this study is to report our experience using an automatic plan consistency check (APCC) program to reduce errors in the process of treatment planning.

#### Materials/Methods:** The APCC program was developed, via scripting in our treatment planning system, to automatically check for the most common treatment planning errors encountered in our department. This program was used before preparing plan documents with generation of a document to indicate completion of the consistency check. Planning parameter errors arriving on the treatment machines (not caught during physics check) were reported by therapists through our institutional Workflow Enhancement (WE) system. We compared the total number of planning parameter errors before and after implementing APCC. We manually assign the severity of these errors into five categories: serious (S), near miss with safety net (NM), clinical interruption (CLI), minor impediment (MI), and book-keeping (BK). S is defined as potential patient harm if not caught (e.g. mismatched isocenters among all beams), NM as potential patient harm but caught by a safety net in the process (e.g. incorrect shifts caught by portal images), CLI as an event that could stop the clinical process until cleared (e.g. ambiguous gantry angle for VMAT beams), MI as a minor disruption that does not stop the clinical process (e.g. missing SSD), and BK as a mislabeling in the plan (e.g. beam labels not following institution standards).

#### Results:** A total of 253 planning parameter error forms were submitted between the years of 2013 and 2018, containing 272 separate issues. A drastic reduction of plan errors for the S and NM categories was observed, from 8 in 2013 and 14 in 2014 (before APCC) to 3 in 2015 (after APCC), and remains low (<5), through 2018. Total reported plan errors dropped by 24.1% from 2014 to 2015 and further dropped by 59.1% from 2015 to 2016. This APCC requires continuous adaptation as clinical workflow changes. For example, in 2017, 5 of 6 treatment machines were replaced with new models requiring changes in the planning processes, which resulted in an increase in total plan errors from 18 in 2016 to 46 in 2017 with most being classified as CI or MI, but reduced to 33 in 2018. In 2019, we developed a new solution in the plan consistency check program to further reduce the error rate.

#### Conclusion:** By reporting incidents involving incorrect chart parameters we can identify underlying causes and successfully reduce the number and severity of incidents on a year by year basis through improvements in clinical workflow.

### Abstract 3438: Table 1

<table>
<thead>
<tr>
<th>Number of Cases</th>
<th>Dose difference</th>
<th>Dose Point</th>
<th>Dice Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>BrainStem</td>
<td>−0.4±2.2</td>
<td>D0.05cc [Gy]</td>
<td>0.83±0.05</td>
</tr>
<tr>
<td>SpinalCord</td>
<td>−0.9±1.7</td>
<td>D0.05cc [Gy]</td>
<td>0.79±0.09</td>
</tr>
<tr>
<td>Eyes</td>
<td>−1.4±5.1</td>
<td>D0.05cc [Gy]</td>
<td>0.89±0.05</td>
</tr>
<tr>
<td>Lenses</td>
<td>0.3±0.7</td>
<td>D0.05cc [Gy]</td>
<td>0.68±0.12</td>
</tr>
<tr>
<td>OpticChiasm</td>
<td>−8.1±10.5</td>
<td>D0.05cc [Gy]</td>
<td>0.48±0.14</td>
</tr>
<tr>
<td>OpticNerves</td>
<td>−1.7±8.7</td>
<td>D0.05cc [Gy]</td>
<td>0.64±0.10</td>
</tr>
<tr>
<td>OralCavity</td>
<td>4.2±6.8</td>
<td>Mean [Gy]</td>
<td>0.77±0.12</td>
</tr>
<tr>
<td>Mandible</td>
<td>0.7±1.2</td>
<td>D0.05cc [Gy]</td>
<td>0.88±0.04</td>
</tr>
<tr>
<td>Parotids</td>
<td>1.7±3.1</td>
<td>Mean [Gy]</td>
<td>0.84±0.05</td>
</tr>
<tr>
<td>LarynxGSL</td>
<td>0.6±5.1</td>
<td>Mean [Gy]</td>
<td>0.65±0.18</td>
</tr>
<tr>
<td>TMJoints</td>
<td>1.4±7.6</td>
<td>D0.05cc [Gy]</td>
<td>0.68±0.17</td>
</tr>
<tr>
<td>TemporalLobes</td>
<td>0.7±1.5</td>
<td>D0.05cc [Gy]</td>
<td>0.78±0.09</td>
</tr>
</tbody>
</table>

**Purpose/Objective(s):** This study aims to create a convolutional neural network (CNN)–based autosegmentation models using digital data submitted to NRG-HN001 and assess the viability of using model-based autosegmentations for contour quality assurance (QA) for a multicenter clinical trial.

**Materials/Methods:** We analyzed digital radiotherapy data for 320 patients enrolled in NRG-HN001. 280 sets of CT and RT structures were reviewed and chosen based on published atlas and were used for CNN model training. We used cascaded atrous convolution and spatial pyramid pooling model to augment the model performance. Autosegmentation models were trained for the brainstem, spinal cord, optic nerves, optic chiasm, mandible, oral cavity, parotids, larynxGSL, TM joints, and temporal lobes. We used 20 patients for model validation. The Dice similarity coefficient was evaluated to compare the autosegmented and submitted contours. Other 20 cases were used to test the contour QA process. Based on the submitted and autosegmented contours, dose volume histograms were extracted. Then, protocol-required or recommended dosimetric points were evaluated for each organ at risk (OAR) to assess the impact of contour variation on dosimetry. Furthermore, we identified the dosimetric quality score variation between submitted contours and autosegmented contours.

**Results:** The table lists Dice coefficients from the validation process and the dosimetric discrepancy between submitted and autosegmented structures. In some cases, OAR exhibited marked differences in doses when autosegmented contours were used to plan QA. Furthermore, the table lists the number of cases with adequate dose discrepancy that changed the case from per-protocol to variation acceptable or variation unacceptable.

**Conclusion:** We trained CNN models for HN001 patients OAR autosegmentation. The relative high Dice coefficients indicate the high accuracy of the autocontour. Low Dice of LarynxGSL is caused by variations in

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