Cancer is the leading cause of premature death in Canada. Based on 2015 estimates about 2 out of 5 Canadians are expected to develop cancer during their lifetimes and the number of new cancer cases in Canada is expected to rise about 40% in the next 15 years [1]. Analyzing the effectiveness of current treatment methods, investigating ways to speed them up, and developing new methods for cancer treatment is therefore very important.

Gynecological (GYN) Interstitial High-Dose-Rate (HDR) Brachytherapy is the newest Brachytherapy program at Odette Cancer Centre. Patients are treated in either 3 or 4 fractions with a single HDR implant or 2 implants 1 week apart. It is not currently clear if daily plan adaptation is needed. We investigate if daily plan adaptation is needed (i.e. if re-planning at every fraction would provide a dosimetric benefit) for GYN interstitial HDR patients. If daily plan adaptation is needed/beneficial then we investigate some methods we can use to reduce contouring time which is the current key bottleneck.

**METHOD**

To do this study we developed a DICOM data mining framework for the automated analysis of HDR brachytherapy treatment plans. This framework has different DICOM data inputs, currently, the Oncentra treatment planning system, and MIM Vista. The data is organized in the framework and different analysis modules were developed to analyze the data.

To assess the need of daily adaptation we looked at the dose impact of the Day 1 plan made based on the Day 1 CT (P1_CT1), the Day 1 plan projected onto Day 2 CT (P1_CT2), and the Day 2 plan based on Day 2 CT (P2_CT2). The possible techniques to reduce contouring time investigated were the reduction of contour volumes based on dosimetric sensitivity and contour propagation using deformable image registration (DIR). The organ at risk (OAR) we focused on in this study was the rectum.

**RESULTS**

To determine if daily re-planning is necessary we looked at the D2CC (the 2cm³ that receives the most dose) of the rectum and the D90 (dose delivered to 90% of the volume) of the target volume. To see the dosimetric impact of contour uncertainties associated with DIR-contours we looked at the D2cc ratio between the manual D2cc and the DIR D2cc.

### Investigation #1: Reduction of contour volumes based on dosimetric sensitivity

In HDR, rectal planning metrics (D2cc) do not require full OAR recontouring at each fraction. To identify an OAR region (“partial OAR volume”) proximal to the target volume (HRCTV) that produces accurate D2cc values for replanning purposes partial OAR volumes were constructed by an OAR intersected with HRCTV expansion. The HRCTV expansions studied were 0.5, 0.75, 1, 1.25, 1.5, 1.75 and 2cm.

1.5 cm HRCTV/GTV Expansion

**RESULTS (continued)**

### Investigation #2: Contour Propagation using MIM Deformable Image-Registration (DIR)

Using Deformable Image Registration (DIR), Day 1 OAR contours can be propagated onto the Day 2 image set. To see how DIR-generated contours compare with manual contours the DICE correlation coefficient [2] was used.

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**REFERENCES**
