Purpose:
To evaluate the dosimetric impact of heterogeneity corrections on both conventional and volume-optimized high dose rate (HDR) tandem-and-ovoid (T&O) brachytherapy treatment plans.

Methods:
A retrospective study of 8 CT-based T&O plans from 5 different patients with FIGO stage IB2-IIIA cervical cancer was conducted. Each plan featured a titanium Fletcher-Suit-Delclos-style T&O applicator (Varian Medical Systems, Palo Alto, CA). In the original clinical plans, dose was prescribed to Point-A (5.5-6 Gy per fraction). For the purposes of this study, volume-optimized plans were retrospectively created in addition to the original Point-A based clinical plans. In the volume-optimized plans, the clinical target volume (CTV) and organs-at-risk (OAR; rectum, bladder, and sigmoid) were contoured on the CT datasets by a single physician. Dose calculations with and without heterogeneity corrections were then performed for both the conventional Point-A based plans and the volume-optimized plans using Brachyvision v8.9 (Varian) along with Acuros: a heterogeneity correction application available in Brachyvision.

Results:
For the conventional plans, the change in dose to Point-A (left and right) and ICRU 38 defined rectum and bladder points was assessed after applying the heterogeneity correction with Acuros. It was found that the dose to the ICRU bladder decreased the most (-2.2±0.9%) while ICRU rectum (-1.7±0.8%), Point-A right (-1.1±0.4%), and Point-A left (-1.0±0.3%) also showed decreases. For the volume-optimized plans, dose-volume-histogram (DVH) parameters (D90 of CTV and D2cc of rectum, bladder, and sigmoid) were evaluated before and after applying the heterogeneity correction with Acuros. It was found that D90 of the CTV decreased by -1.9±0.7% and D2cc decreased by -2.6±1.4%, -1.0±0.4%, and -2.0±0.6% for the rectum, bladder and sigmoid, respectively.

Conclusions:
Heterogeneity corrections on T&O brachytherapy plans were found to have only a small dosimetric impact over TG-43 based dose calculations for both conventional Point-A and 3D imaging based volume-optimization plans.