Purpose: Several planning strategies are available for hippocampal-avoidance whole-brain radiotherapy (HA-WBRT) following RTOG protocol 0933, but have yet to be compared on a common set of patient data. In this inter-institutional investigation, we evaluate three modalities likely to be employed by protocol participants: step-and-shoot IMRT, volumetric modulated arc therapy, and helical tomotherapy. A common set of patients is used for comparison, including credentialing and successfully accrued patients.

Methods: Eight patient datasets were selected and de-identified prior to planning. Structures were contoured by physicians per protocol using fused MRI datasets. Three plans were generated for each dataset: Philips Pinnacle 9-field non-coplanar IMRT using protocol recommended beam parameters, Varian's RapidArc using two coplanar arcs, and Accuray's TomoTherapy using a 1cm jaw width. With the goal of meeting the compliance criteria outlined in RTOG 0933 (target coverage and dose limits to the hippocampus and optic structures), three planners independently planned each modality without prior knowledge of the patient's other plans to reduce bias. The three plans for each patient were compared according to the protocol's dosimetric compliance criteria. A homogeneity index was also computed to compare target dose uniformity.

Results: All plans achieved the protocol dose criteria, except for one RapidArc plan with slightly inferior dose to the optic chiasm. TomoTherapy offered superior dose homogeneity for all patients. For the two linac based methods, RapidArc was found to provide dose homogeneity at least as good as, and in most cases superior to, 9-field step-and-shoot IMRT.

Conclusions: Helical TomoTherapy offers superior dose homogeneity for HA-WBRT following RTOG 0933. Compared to step-and-shoot IMRT, volumetric modulated arc techniques, such as RapidArc, can offer improved homogeneity for HA-WBRT and are generally more efficient/expeditious to deliver than the non-coplanar 9-field arrangement recommended by the protocol, which uses 7 separate couch angles.