Paper Title: Utilizing Statistical Process Control Analysis for Calculation-Based Patient-Specific Quality Assurance in Online Adaptive Radiotherapy

Authors: Thunpisit Mundee (Chulabhorn Hospital, Chulabhorn Royal Academy, Thailand); Chirasak Khamfongkhruea (Princess Srisavangavadhana College of Medicine, Chulabhorn Royal Academy, Thailand)

Email: thunpisit.mun@cra.ac.th

Abstract

This study utilized statistical process control analysis to determine the gamma passing rate limits in calculation-based patient-specific quality assurance (PSQA) using Mobius3D. A total of 50 PSQA Mobius3D plans were derived from 168 online adaptive plans and constructed into a control chart, calculating upper control limit (UCL), center line (CL), and lower control limit (LCL) values. The PSQA process quality was further evaluated through the process capability index. The results revealed that the LCL values for the 3%/2mm, 2%/2mm, and 1%/1mm criteria were 91.66, 76.34, and 12.13, respectively. The corresponding C_{pm} values were 1.149, 1.098, and 0.760, while the C_{pml} values were 2.430, 2.297, and 1.612. These findings indicated a high PSQA process quality for the 3%/2mm and 2%/2mm criteria, evidenced by consistent and favorable C_{pm} and C_{pml} values. However, assessing the PSQA process quality for the 1%/1mm criterion raised concerns. The low LCL values suggested potential issues with precision and accuracy in evaluating treatment plans. Additionally, the lack of consistency between the C_{pm} and C_{pml} values further indicated that the 1%/1mm criterion might not be suitable for clinical use with Mobius3D. Considering these results, caution should be exercised when employing the 1%/1mm criterion in the PSQA process. It is essential to prioritize accuracy and reliability to ensure the delivery of high-quality patient-specific treatment plans in radiotherapy. This study offers valuable insights for optimizing the PSQA process with Mobius3D and enhancing patient care and safety.