

Purpose: Inadequate scheduling of RT treatment planning can result in underutilization of resources or, more importantly, in creation of bottlenecks and potentially hazardous situations. In this study we evaluate a method for design of robust and efficient RT planning processes through the use of discrete event simulation (DES) and a novel system for collection of real life planning statistics.

Methods: DES is used to model systems which evolve over time by representation of state variables which change instantaneously at separate points in time. As such, DES is very well suited for modeling of RT operations. In this study, we use commercial DES software (ARENA, Rockwell Automation, Inc.). The software allows detail representation of clinical RT workflows and it also enables inclusion of typical RT resources and constraints. The RT planning model requires data describing the patient arrival process, typical task times, percentage of rework and the resource availability. To facilitate collection of real life data, we designed an electronic white board system which automatically captures relevant clinical statistics. The system requires minimal input by staff and the majority of data is collected through routine clinical activities. This design facilitates high compliance and accuracy of collected data.

Results: The whiteboard system enabled efficient collection and analysis of real life clinical performance data. The Arena model was able to identify failures and delays in planning process and their propagation through the system. The model allowed estimation of the failure probabilities at different stages in the planning process and their impact on the overall system. In addition, the model facilitated investigation of the effects of workflow alteration and patient load on the system performance, and identification of optimal system design schemes.

Conclusions: The proposed method can be used for improvement of safety, quality, and efficiency of RT operations.