

Reducing treatment table position overrides through basic statistical review and scripting

J. VERVERS¹, Y. XIONG¹, and T. JACOBSON¹

¹ Wake Forest Baptist Medical Center, Winston Salem, NC, USA

INTRODUCTION

- Weekly chart review is done to check many things, including documentation of treatment overrides¹
- Review of overrides should include attempts to determine root causes and analysis of the need for corrections²
- Common treatment table position overrides can cause “alert fatigue”³, which can present a risk of mistaking a serious issue for something more routine⁴

AIM

To reduce the frequency of treatment table position overrides via:

- Statistically-based review of table positions recorded for treatment and associated field tolerances
- Accurate pre-treatment prediction of the intended table height

METHODS

Table position review:

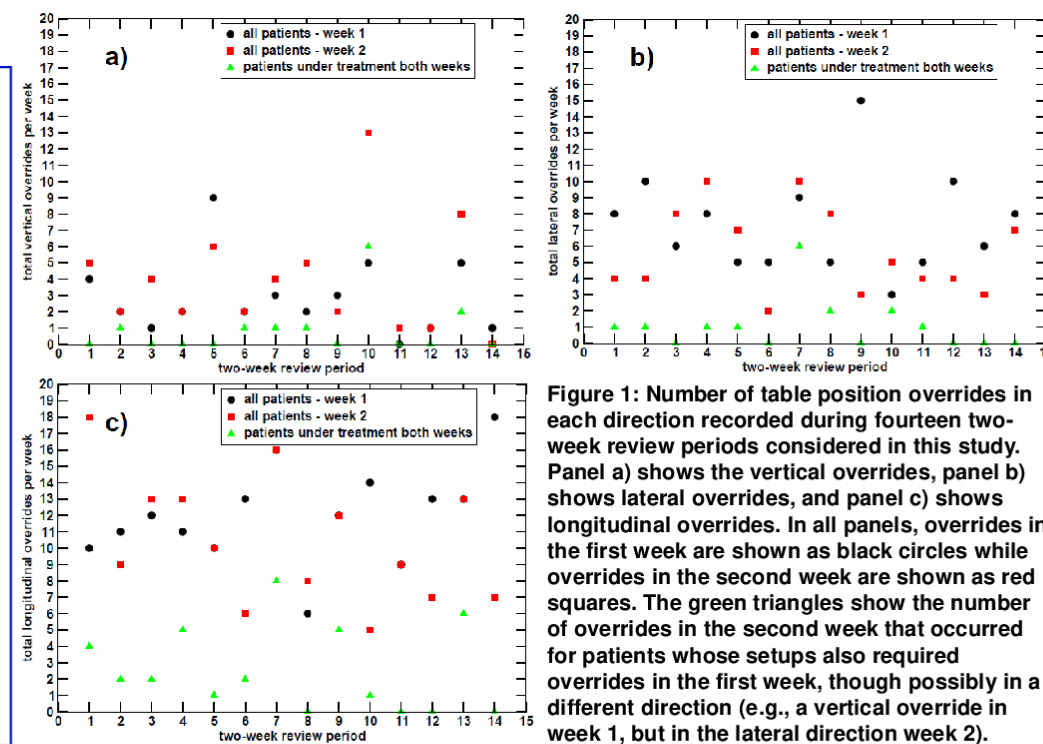
- Create custom reports to query record-and-verify system database for a given patient
 - Compute average and standard deviation of all table positions in each direction (vrt, lat, lng) for all treatments
 - Compare these against nominal positions and tolerances in approved treatment fields
 - Assess if (average \pm 2 std. dev.) recorded table position is contained within the specified tolerance around the nominal position
- Run reports for each patient during weekly chart review
- Tabulate all table overrides in weeks before and after chart review to assess ability to prevent future overrides

Table height prediction:

- Create TPS script using external contour and marked isocenter coordinates to find planned table height
- Validate against direct measurement in TPS
 - Reveals script difficulty with angled breast board and prone positioning (patient below table top)
- Compute difference between planned value and recorded value from first treatment
- Assess differences in context of vertical position tolerances and differences in table accessories

RESULTS

- Table position override results were recorded over 28 weeks (14 two-week periods)
- In that time, 420 table position overrides were noted among the charts reviewed
- Figure 1 shows the number of overrides in each individual direction for each review period
- The fewest table overrides occurred in the vertical direction, likely the most concerning direction
- 192 of these occurred in the second week of each review period (16% fewer than in week 1), though this includes patients who began treatment in the second week
- For patients whose treatments showed a single table override in week 1 of each review period, only 54 treatment fractions showed a table override performed in the second week (72% fewer)
- The majority (57%) of these remaining overrides were in the longitudinal direction, indicating treatments at a different table index than previous



- All accelerators show stable and consistent vertical table calibration, as shown in Figure 2
- Two accelerators use attachments that connect directly to the end of the table while the two other accelerators and both CT simulators use similar attachments that overlay the base table
- Without accounting for these attachment differences, 24% of treatment setups required a vertical override (see Figure 3a)
 - 19% of setups showed differences > 1 cm
 - 7% of setups showed differences > 2 cm
- Correcting for attachment differences reduced these percentages to 18%, 11%, and 0.5%, respectively (see Figure 3b)

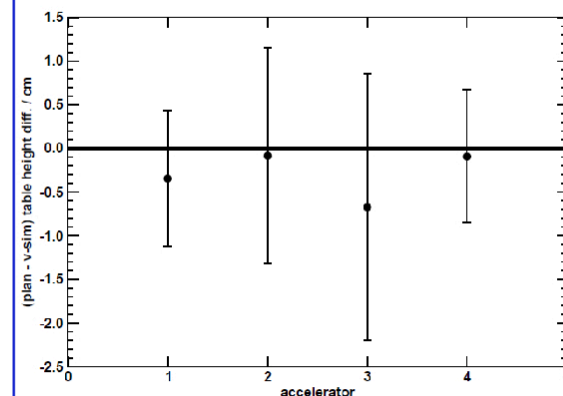


Figure 2: Average differences between the predicted and recorded table height (TH) for the patient treatment courses delivered on four accelerators. Differences for all four accelerators are within one standard deviation of zero, indicating accurate and consistent TH calibration across the four accelerators and two CT simulators used. Error bars displayed represent two standard deviations. A line is drawn at zero difference to help guide the eye.

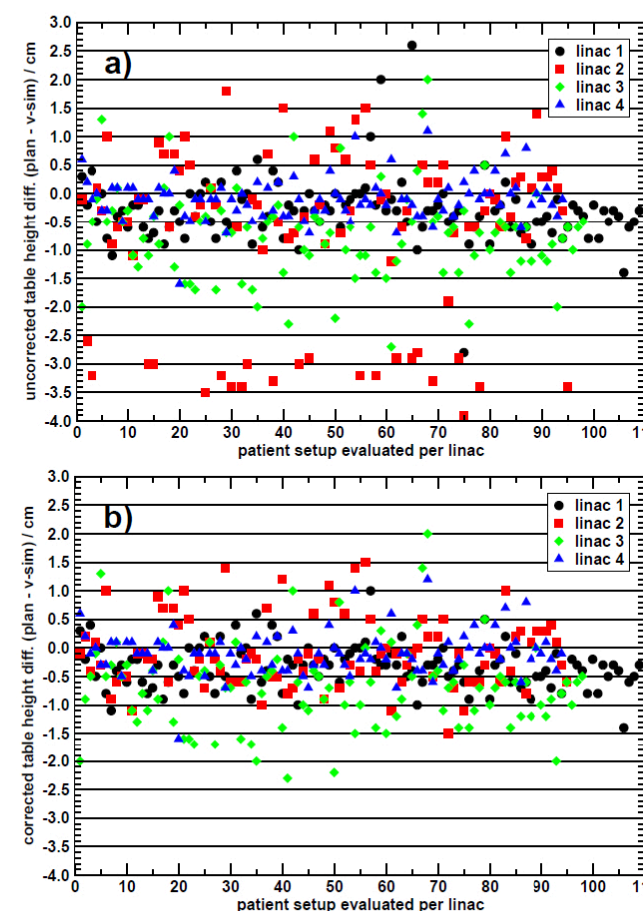


Figure 3: Table height (TH) differences between prediction and measurement for 396 treatment courses delivered on four accelerators. In panel a), deviations between the planned and treatment TH include differences in machine-specific table attachments. Panel b) shows the effect of correcting for these table attachment differences. Horizontal lines are drawn in both panels to help guide the eye.

CONCLUSIONS

- Nominal table position updates as part of weekly chart review is an effective way of reducing overrides
- These updates also help identify positional tolerances in need of review
- Weekly chart reviews cannot overcome overrides at time of first treatment
- Overrides are affected by patients being treated on different accelerators with different treatment tables
- Explicitly accounting for table attachments helps
 - Reduce overrides by improving accuracy of planned table height predictions
 - Inform override reviews when patients switch accelerators
 - Inform chart reviews for patients who do not receive daily imaging
- Acquiring table parameters in verification simulation a day prior to first treatment should help further reduce the need for table overrides
 - This policy has been recently adopted in our department

ACKNOWLEDGEMENTS

The authors thank their colleagues in the Department of Radiation Oncology for useful discussions regarding the investigation and implementation of its findings.

REFERENCES

- Ford E. et al.** Strategies for effective physics plan and chart review in radiation therapy: Report of AAPM Task Group 275. *Med Phys* 2020 (in press)
- Huq M. S. et al.** The report of Task Group 100 of the AAPM: Application of risk analysis methods to radiation therapy quality management. *Med Phys* 2016; 43(7): 4209-4262
- Ancker, J. S. et al.** Effects of workload, work complexity, and repeated alerts on alert fatigue in a clinical decision support system. *BMC Medical Informatics and Decision Making* 2017; 17: 36
- Purdy, J. A. et al.** Medical accelerator safety considerations: Report of AAPM Radiation Therapy Committee Task Group No. 35. *Med Phys* 1993; 20(4); 1261-1275

CONTACT INFORMATION

jversers@wakehealth.edu