

Predicting Survival in Head and Neck Cancer: The Protective Role of BMI and the Impact of Evolving Soft Tissue Volumes During Radiotherapy



Erika Jank¹, Chulmin Bang², Jesus Juarez², Eulanca Liu², Sharon Qi^{1,2}, Robert Chin², Ricky Savjani^{1,2}
UCLA Physics & Biology in Medicine Graduate Program¹, UCLA Department of Radiation Oncology²

INTRODUCTION

- Head and neck cancer (HNC) patients undergoing radiation therapy often experience toxicities triggering weight loss
- Severe weight loss can cause treatment interruptions, compromising disease control and survival
- Known association between **lower pretreatment BMI** and **worse survival outcomes**

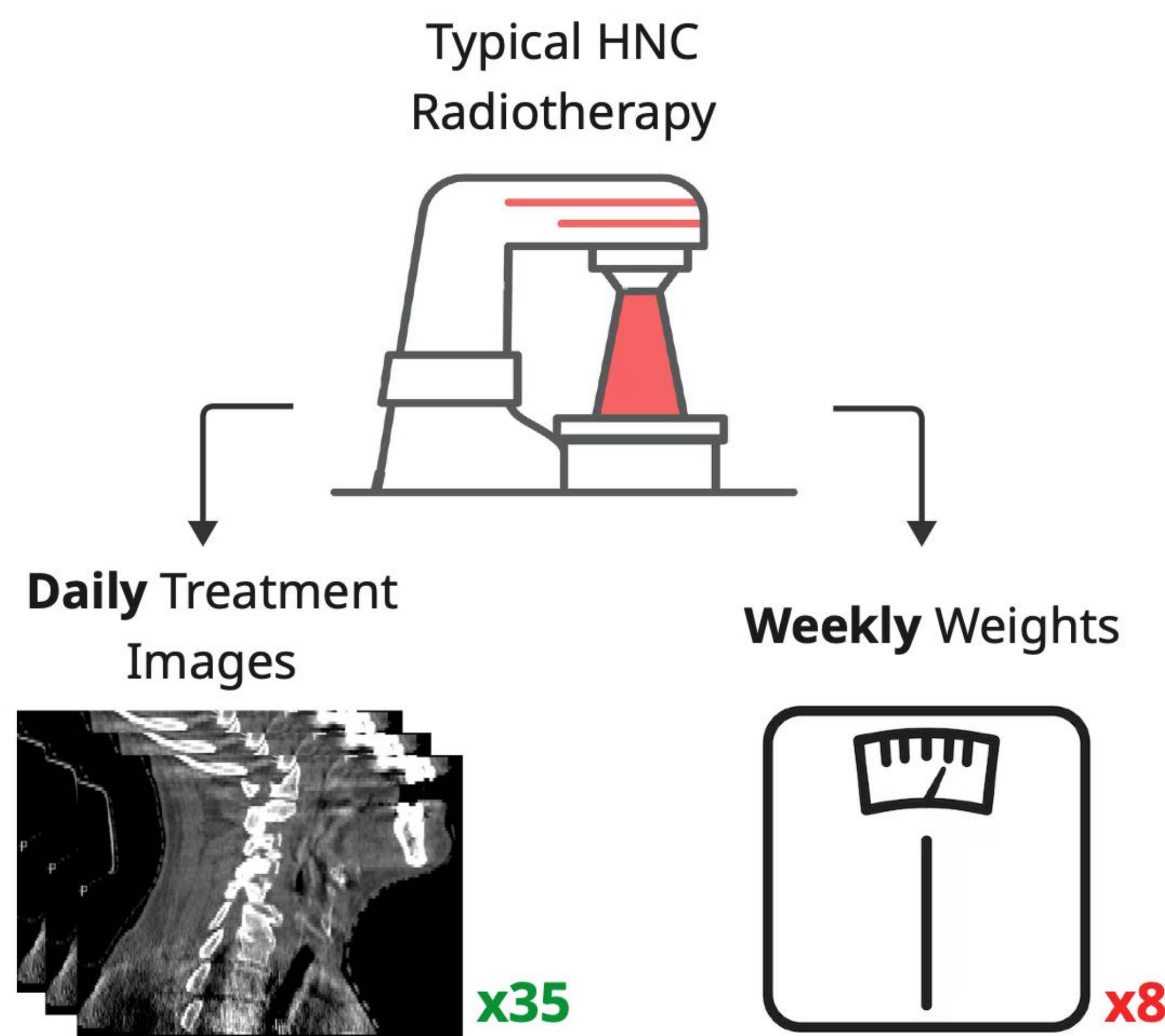


FIGURE 1

Standard tracking of nutritional status relies on weekly weight and body mass index (BMI) measures

Daily cone beam CT (CBCT) is routinely obtained prior to each fraction of radiotherapy

AIM

- Characterize role of baseline BMI on survival in HNC patients undergoing radiation therapy (RT)
- Leverage daily treatment imaging for the longitudinal quantification of soft tissue volumes during RT
- Investigate the association between BMI and volumetric body composition changes with survival outcomes in HNC patients

REFERENCES

1. Wasserthal, J., Breit, H. C., Meyer, M. T., Pradella, M., Hinck, D., Sauter, A. W., Heye, T., Boll, D. T., Cyriac, J., Yang, S., Bach, M., & Segeroth, M. (2023). TotalSegmentator: Robust segmentation of 104 anatomic structures in CT images. *Radiology: Artificial Intelligence*, 5(5), e230024. <https://doi.org/10.1148/ryai.230024>

2. Ye, Z., Saraf, A., Ravipati, Y., Hoebbers, F., Catalano, P. J., Zha, Y., Zapaishchykova, A., Likitlersuang, J., Guthrie, C., Tishler, R. B., Schoenfeld, J. D., Margalit, D. N., Haddad, R. I., Mak, R. H., Naser, M. A., Wahid, K. A., Sahlsten, J., Jaskari, J., Kaski, K. K., ... Kann, B. H. (2023). Development and validation of an automated image-based deep learning platform for sarcopenia assessment in head and neck cancer. *JAMA Network Open*, 6(8), e2328280. <https://doi.org/10.1001/jamanetworkopen.2023.28280>

3. Naser, M. A., Wahid, K. A., Grossberg, A. J., Olson, B., Jain, R., El-Habashy, D., Dede, C., Salama, V., Abobakr, M., Mohamed, A. S. R., He, R., Jaskari, J., Sahlsten, J., Kaski, K., & Fuller, C. D. (2022). Deep learning auto-segmentation of cervical skeletal muscle for sarcopenia analysis in patients with head and neck cancer. *Frontiers in Oncology*, 12, 930432. <https://doi.org/10.3389/fonc.2022.930432>

4. Ma, S. J., Khan, M., Chatterjee, U., Santhosh, S., Hashmi, M., Gill, J., Yu, B., Iovoli, A., Farrugia, M., Wooten, K., Gupta, V., McSpadden, R., Yu, H., Kuriakose, M. A., Markiewicz, M. R., Al-Afif, A., Hicks, W. L., Jr., Seshadri, M., Ray, A. D., ... Singh, A. K. (2023). Association of body mass index with outcomes among patients with head and neck cancer treated with chemoradiotherapy. *JAMA Network Open*, 6(6), e2320513. <https://doi.org/10.1001/jamanetworkopen.2023.20513>

CONTACT

Poster presented by Erika Jank. Please reach out with any questions or comments: ejank@mednet.ucla.edu

METHODS

- Retrospective cohort study on HNC patients treated with definitive-intent RT between 2014-2024 at UCLA
- Clinical electronic health records and imaging data acquired and processed
- Pretreatment BMI and other clinical covariates examined for correlation with overall survival
- CT Simulation and daily CBCT images were automatically contoured using **TotalSegmentator**¹
- Skeletal muscle, subcutaneous fat, and intermuscular fat soft tissue volumes extracted and tracked throughout RT

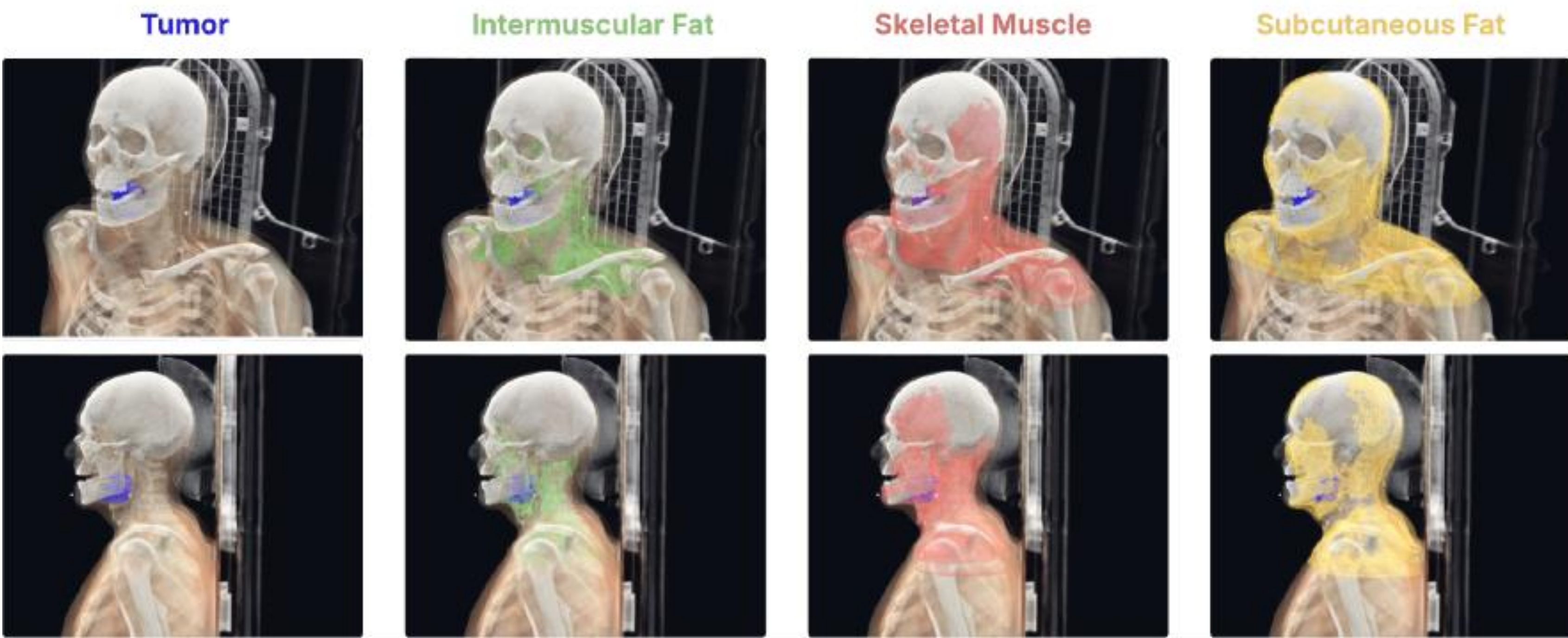


FIGURE 2

Cinematic rendering of soft tissue and target volume on CT Simulation scan

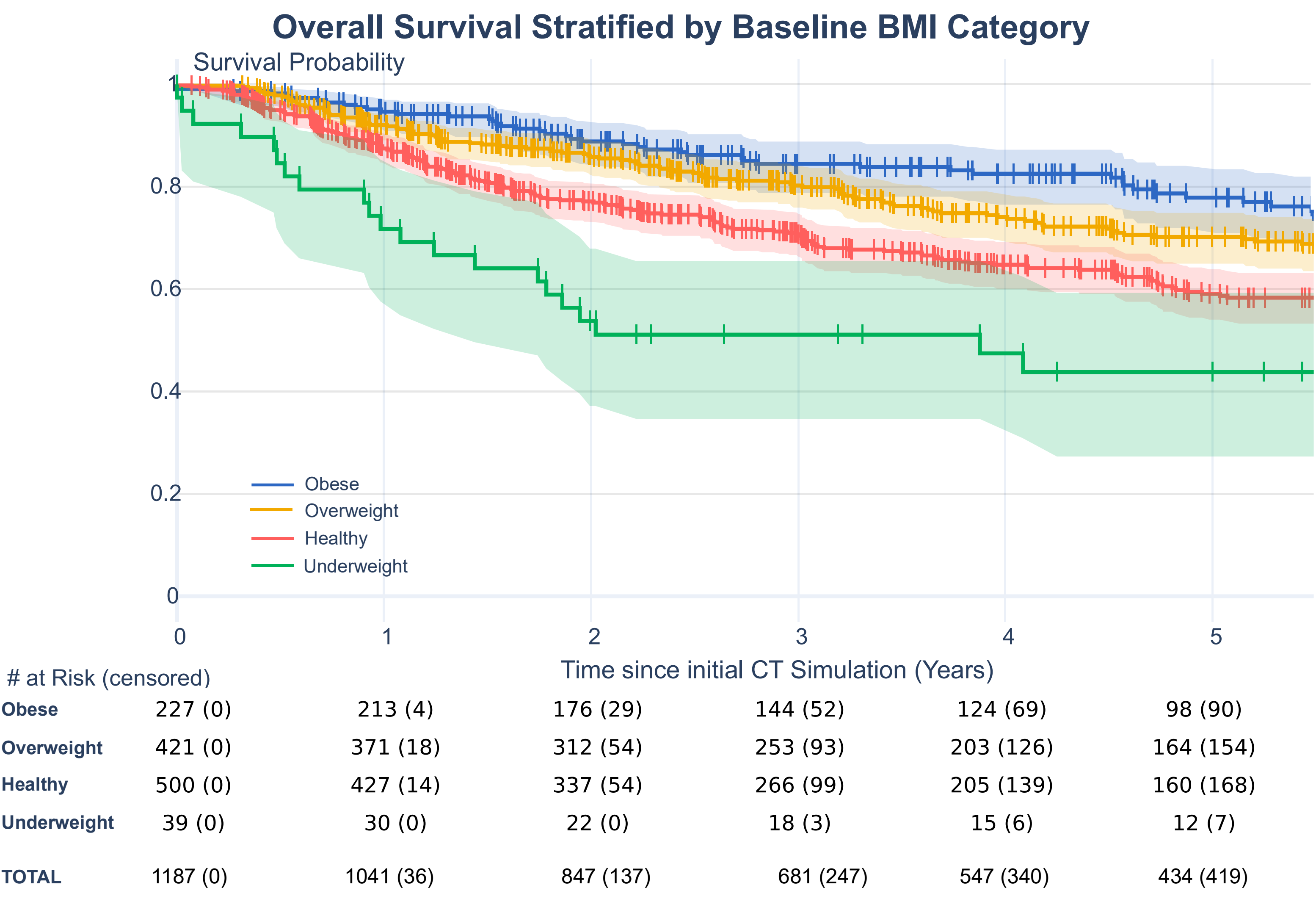
RESULTS

- Baseline BMI was a significant independent predictor of survival in multivariate analysis, in addition to other clinical and demographic covariates
- Poorest outcomes: Underweight patients (Median survival: 4.1 years [1.4-9.7], 5-year survival rate: 43.8% [27.3-59.2])
- Best outcomes: Obese patients (Median survival: 10.9 years [9.5-NR], 5-year survival rate 78.7% [71.9-84.1])

FIGURE 3

Kaplan-Meier curves illustrate survival probability for patients stratified by BMI at treatment initiation (N=1,187)

Shaded areas represent 95% confidence intervals



CONCLUSIONS

Higher BMI categories evaluated at the start of treatment serves as a protective indication for survival outcomes

Daily CBCT imaging can be repropoed to quantify and detect changes in soft tissue volume throughout radiotherapy

Integrating longitudinal, volumetric analysis with static determinants could enable more robust risk stratification, supporting proactive nutritional intervention for HNC patients

Percent Change in Tissue Volumes and BMI over Treatment

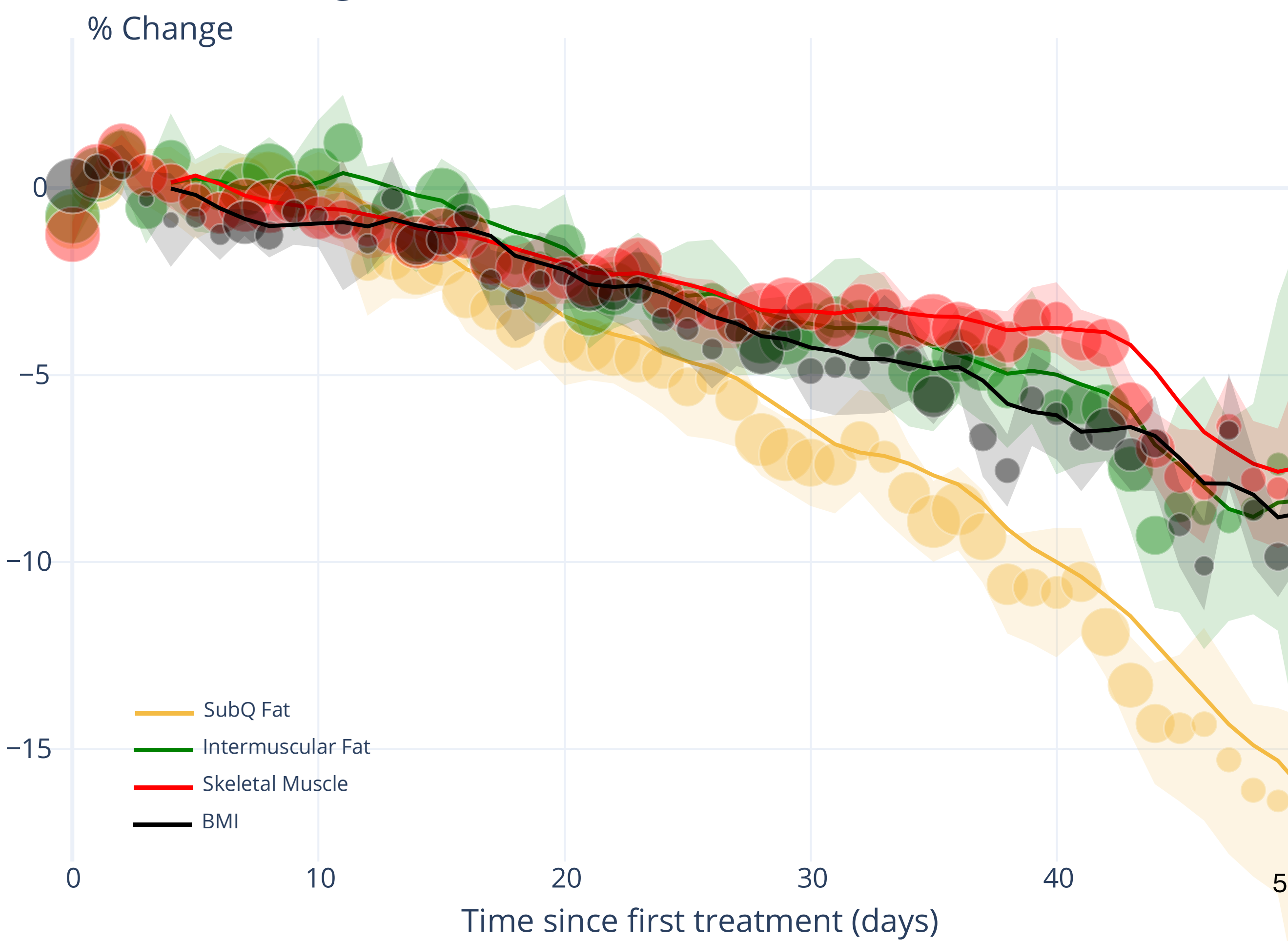


FIGURE 4

Percent change in tissue volumes and BMI (N=631) with trendlines shown as a 5-point rolling average

Shaded areas represent 95% confidence intervals

Dot size reflects quantity of patient data averaged for each point

- Average BMI decreased by 8.4% at Day 50 after the start of RT
- Changes in skeletal muscle and intermuscular fat tracked closely with BMI fluctuations throughout treatment
- Subcutaneous fat showed the most pronounced reduction, decreasing by -18.2% by Day 50

FUTURE DIRECTIONS

Determine the effect of specific tissue loss during treatment on overall survival trends

Correlate trends in weight loss and soft tissue with other clinical outcomes such as progression-free survival and various toxicities

Create clinical dashboards to actively track the nutritional status of HNC patients receiving radiotherapy