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Clinical Implementation and Evaluation of AI-Rad Companion Organs RT for Automated Organ-at-Risk Segmentation Across Multiple CT Radiotherapy Planning Sites

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ABSTRACT

Purpose: To assess the clinical implementation, contour accuracy, and workflow efficiency of a commercially available deep learning auto-contouring system for CT-based radiotherapy planning across multiple anatomical sites.

Methods: AI-Rad Companion Organs RT was implemented as a cloud-hosted solution across two clinical sites. Automated DICOM routing enabled direct import of AI-generated organ-at-risk contours into the treatment planning system. Thirty CT datasets representing head and neck, lung, abdomen, prostate, and breast cases were retrospectively evaluated. Manual contours created by a certified dosimetrist were used as the reference standard. Workflow efficiency was quantified by comparing total contouring time, including segmentation and physician review, between manual and AI-assisted workflows. Contour quality was evaluated using physician qualitative scoring and quantitative metrics, including Dice similarity coefficient and Average Hausdorff Distance.

Results: AI-assisted contouring reduced total contouring time in nearly all cases. Mean time savings were 66% (range: 52–73%) for abdomen, 50% (range: 36–64%) for lung, 58% (range: 45–67%) for head and neck, and 27% (range: 15–41%) for prostate cases. Breast cases demonstrated smaller and more variable efficiency gains, with a mean reduction of 17% (range: -40–42%), influenced by a single outlier. Overall, 89.7% of AI-generated contours were rated as clinically positive results with minor or no edits. Across 324 structures, the mean Dice similarity coefficient was 0.82 and the Average Hausdorff Distance was 2.10 mm. Higher geometric agreement was observed for larger organs, with lower Dice values noted in anatomically complex regions.

Conclusion: AI-Rad Companion Organs RT was successfully integrated into routine clinical workflows and demonstrated substantial reductions in contouring time while maintaining clinically acceptable contour accuracy across multiple anatomical sites. These findings support the clinical utility of AI auto-contouring as a tool to improve segmentation efficiency when used with appropriate clinician oversight.

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INTRODUCTION

Accurate delineation of organs at risk (OARs) on CT data sets is fundamental to modern radiotherapy, as it constrains dose to critical structures and ultimately influences toxicity and tumor control. However, manual contouring remains a labor-intensive and highly operator-dependent process, contributing significantly to geometric uncertainty and workflow bottlenecks [1-3]. Deep learning-based auto-contouring has emerged as a practical strategy to address these demands and improve reproducibility [4-7], relatively few studies have evaluated how a single commercial system performs across multiple CT planning sites in a real-world setting [2, 7]. Consequently, the objective of this study moves beyond pure technical validation to encompass the clinical implementation, workflow integration, and clinical impact of a commercially available deep-learning auto-contouring solution across five distinct anatomic treatment sites.

METHOD AND MATERIALS

Clinical Integration
This study evaluated the clinical implementation of Siemens AI-Rad Companion Organs RT (VA30) within an academic healthcare system. The software was deployed as a centralized, cloud-based solution integrated directly into the existing simulation and treatment planning workflow. Simulation CT images were automatically exported from the CT simulator to a DICOM Hub, which routed the datasets to the AI engine using metadata-based rules. Following segmentation, the CT dataset and RT Structure Set were automatically imported directly into the Treatment Planning System (TPS) database. This eliminated the need for manual DICOM import, enabling a fully automated "no-click" workflow. Data flow is shown in Figure 1. To support this automation, customization was performed collaboratively between physicists and dosimetrists to standardize TG-263 compliant structure names, color conventions, and logic-based templates tied to DICOM metadata.

Study Design & Evaluation Metrics
The study retrospectively evaluated 30 previously treated patients across five anatomical sites (prostate, breast, head and neck, lung, and abdomen), yielding a total of 324 individual contours. We assessed time efficiency by comparing total contouring times including physician review and data transfer between manual and AI-assisted workflows. Contour quality was evaluated using a 4-point qualitative physician scoring scale, where scores of 3 (minor edits required) or 4 (no edits required) were considered clinically positive results. Quantitative geometric agreement was measured using the Dice Similarity Coefficient (DSC) and Average Hausdorff Distance (AHD).

RESULTS

Time Efficiency
AI-assisted contouring improved time efficiency in 29 of the 30 evaluated cases. The abdomen cohort demonstrated the greatest mean time savings at 66%, followed closely by head and neck cases at 58%. Breast cases showed the lowest mean reduction at 17%, though this improved to 28% when excluding a single outlier case that required substantial manual edits, shown in Figure 2.

Qualitative Contour Scoring
Qualitatively, 89.7% of all AI-generated contours were deemed clinically acceptable, shown in Table 1. Head and neck and lung cohorts achieved the highest "no edit" rates at 75.4% and 75.9%, respectively. Conversely, prostate cases had the lowest "no edit" rate at 5.6%, primarily due to the need for minor adjustments around hydrogel spacers, though 75.0% of these contours still scored as clinically acceptable.

Quantitative Contour Comparison
Quantitatively, the AI achieved an average DSC of 0.82 and an AHD of 2.10 mm across all 324 structures, shown in Table 2. Larger volumes like the abdomen and breast exhibited higher DSC values (0.87 and 0.89) but larger AHDs, reflecting that localized surface differences are amplified in larger structures. Smaller, complex structures in the head and neck showed lower DSCs (0.71) due to metric sensitivity to volume, but demonstrated excellent boundary agreement with an AHD of just 1.47 mm.

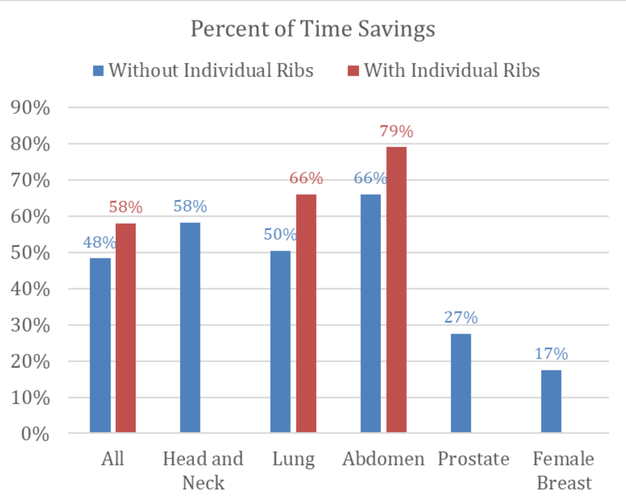

Figure 2. Average percentage time savings for all contours and by anatomical site.

Table 1. Qualitative Scoring Distribution of AI-Generated Contours

Organs RT	All	Head and Neck	Lung	Abdomen	Prostate	Breast
1-Redo	1.3%	0.8%	0.0%	0.0%	0.0%	8.6%
2-Major Edit	9.0%	3.2%	0.0%	10.2%	25.0%	25.7%
3-Minor Edit	28.1%	20.6%	24.1%	27.1%	69.4%	20.0%
4-No Edit	61.6%	75.4%	75.9%	62.7%	5.6%	45.7%
Score 3 or 4	89.7%	96.0%	100.0%	89.8%	75.0%	65.7%

Table 2. Quantitative Geometric Agreement Between AI and Manual Contours

Metric	All	Head and Neck	Lung	Abdomen	Prostate	Breast
Average Dice	0.82	0.71	0.76	0.87	0.82	0.89
Average Hausdorff (mm)	2.10	1.47	2.10	2.81	2.10	2.85

DISCUSSION

The implementation of an automated, cloud-based routing system successfully eliminated manual data handling, significantly freeing up dosimetrist time for other treatment planning tasks. Successful multi-site deployment relied heavily on TG-263 standardization, although current platform limitations regarding selective TPS routing constrained broader network-wide harmonization. The frequent need for minor edits in prostate cases highlighting a training data limitation regarding anatomical modifications like hydrogel spacers, highlighting the critical need for local validation. Furthermore, our findings reinforce that DSC alone is insufficient for evaluating small, complex structures, where AHD better reflects clinically acceptable surface alignment. Despite substantial workload reductions, diligent review by dosimetrists, physicists, and physicians remains mandatory for safe clinical use.

CONCLUSIONS

AI-Rad Companion Organs RT was successfully integrated into routine clinical workflows and demonstrated substantial reductions in importation and contouring time while maintaining clinically acceptable contour accuracy across multiple anatomical sites. These findings strongly support the use of AI-based auto-contouring to improve segmentation efficiency when implemented within a structured, standardized, and carefully monitored clinical framework.

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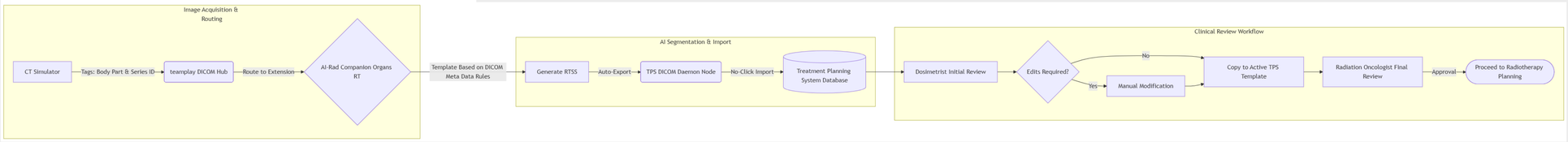

Figure 1. Data flow of "no-click" clinical workflow for AI-assisted contouring.

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