Envisioning AI-Guided Immersive Tumor Boards: A Transdisciplinary Work-in-Progress on Clinical Collaboration in the Metaverse

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Aims: Tumor boards are central to interdisciplinary oncology, but both physical and video-based formats face growing limitations. Physical meetings restrict access and spatial flexibility; video formats reduce engagement and embodied communication. As AI-derived insights increase complexity, traditional boards risk overloading clinicians [1]. Early immersive systems (e.g., Robb et al. [2]) show promise but remain conceptual and rarely integrate AI in clinical workflows. Although the Metaverse offers spatial freedom, its role in medical AI collaboration remains underdefined [3]. Figure 1 contrasts physical, virtual, and Metaverse tumor board formats, highlighting the unique potential of immersive environments for AI-supported clinical collaboration.

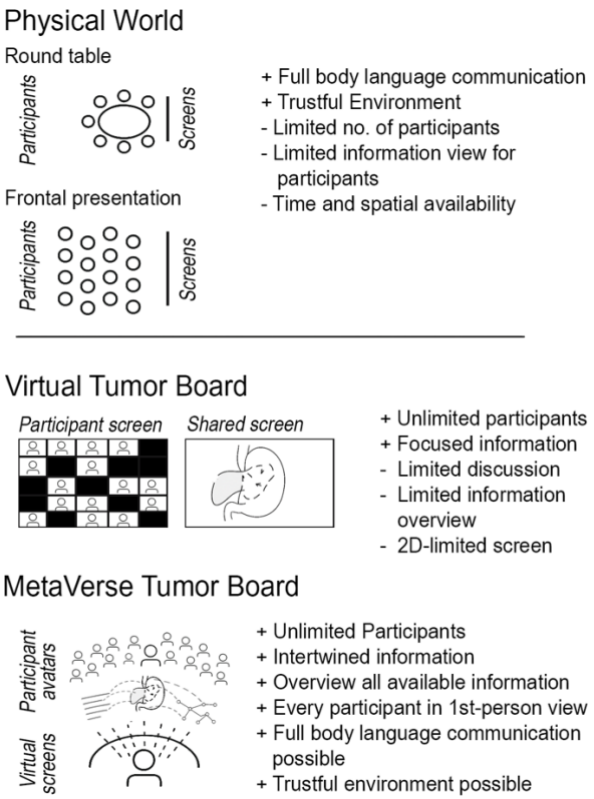

Fig. 1 Conceptual comparison of physical, virtual, and Metaverse tumor boards, contrasting spatial layout, interactivity, and information access.

Materials and Methods: This work-in-progress applies a multi-phase, mixed-methods design (Figure 2):
(1) Retrospective review of two years of field notes from ~40 in-person head and neck tumor boards at a German university hospital (pre-COVID) [4];
(2) Reflexive thematic analysis with double coding of up to 51 publicly available ~1-hour US-organized virtual tumor board recordings (e.g., MSKCC, cf. [5]);
(3) Ongoing ethnographic observation of weekly virtual molecular tumor boards (gastrointestinal oncology); and
(4) Development of an international, expert informed online survey (modified Delphi approach) involving clinicians, AI experts, XR designers, and architects from Germany/EU, the US, and Japan.

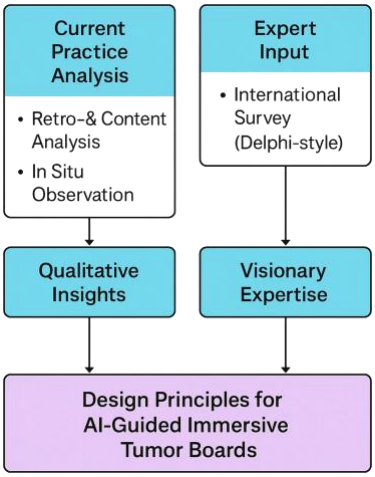

Fig. 2 Methodology practice analysis and expert input inform design principles for AI-supported immersive tumor boards.

Preliminary Results: We identified key limitations in current tumor boards: fragmented attention, information overload, limited individual patient data access, and limited interpretability of AI output. Based on these

findings, we developed an initial concept (Figure 3) for an immersive, AI-supported board with avatar-based interaction, explainable decision graphs, spatially anchored multimodal data, and personal control panels. The envisioned system integrates radiological images, structured records, and clinical notes to support real-time, AI-assisted interpretation within an XR environment.

Conclusions: This study lays the groundwork for reimagining tumor boards as AI-augmented, interaction-rich spatial systems. Our transdisciplinary approach provides an early foundation for design guidelines, prototyping, and future integration into collaborative oncology workflows.

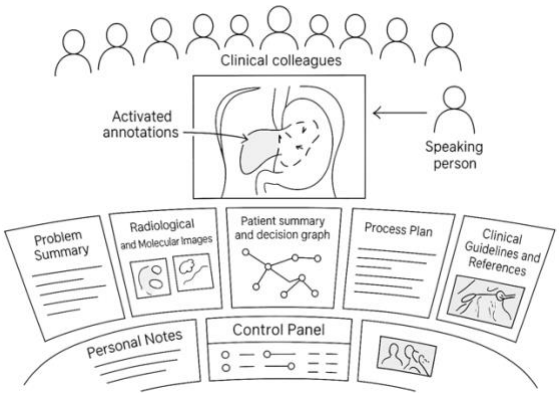

Fig. 3 System sketch: avatars meet around AI-augmented data displays showing imaging, decisions, and clinical context in an extended reality workspace.

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References:

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