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VR-MTB | VIRTUAL REALITY

MULTIDISCIPLINARY TUMOR BOARDS

Market Research Report

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LIST OF ABBREVIATIONS

21 CFR Part 11 - U.S. FDA rule for electronic records and signatures
ABAP - Advanced Business Application Programming
ACI - Ambient Clinical Intelligence
ADT - Working Group of German Tumor Centers
AES - Advanced Encryption Standard
AI - Artificial Intelligence
AITB - AI-Based Tumor Board
API - Application Programming Interface
AR - Augmented Reality
AV - Audio-Visual
Azure - Microsoft Azure (cloud platform)
BED - Biological Effective Dose
BI - Business Intelligence
BKRG - Federal Cancer Registry Data Act
CAIRELab - Clinical Artificial Intelligence and Research Lab
CAR-T - Chimeric Antigen Receptor T-Cell Therapy
CBCT - Cone Beam Computed Tomography
cBioPortal - Cancer Genomics Portal (open-source)
CCCU - Comprehensive Cancer Center Ulm
CCE - Cancer Core Europe
CDS - Clinical Decision Support
CDSS - Clinical Decision Support System
CE - Conformité Européenne (EU marking)
CME - Continuing Medical Education
CoC - Commission on Cancer
CREDOS - Cancer Retrieval Evaluation and Documentation System
CRO - Contract Research Organization
CSV - Comma-Separated Values
CT - Computed Tomography
DFCI - Dana-Farber Cancer Institute
DICOM - Digital Imaging and Communications in Medicine
DICOMweb - DICOM Web Services (PS3.18)
DKG - German Cancer Society (Deutsche Krebsgesellschaft)
DMO - Dragon Medical One
E/M - Evaluation & Management
EEA - European Economic Area
EHR - Electronic Health Record
EMR - Electronic Medical Record
EQD2 - Equivalent Dose in 2 Gy fractions
ERDF - European Regional Development Fund
ESCAT - ESMO Scale for Clinical Actionability of Molecular Targets
ESMO - European Society for Medical Oncology
EU AI Act - European Union Artificial Intelligence Act
EUA - Examination Under Anesthesia
EVD - External Ventricular Drain
FDA - U.S. Food and Drug Administration
FIGO - International Federation of Gynecology and Obstetrics
FHIR - Fast Healthcare Interoperability Resources
GCP - Good Clinical Practice; Google Cloud Platform
GDPR - General Data Protection Regulation
GPU - Graphics Processing Unit
GUI - Graphical User Interface
HCC - Hierarchical Condition Category
HIPAA - Health Insurance Portability and Accountability Act
HIS - Hospital Information System
HITRUST - Health Information Trust Alliance
HL7 - Health Level Seven
HMD - Head-Mounted Display
HNTB - Head & Neck Tumor Board
HTML - HyperText Markup Language
ICD-10 - International Classification of Diseases, 10th Revision
IDN - Integrated Delivery Network
IHE - Integrating the Healthcare Enterprise
ISO 27001 - Information Security Management Standard
iLTB - International Leukemia/Lymphoma Tumor Board
iOS - Apple iPhone/iPad Operating System
IRB - Institutional Review Board
IRCCS - Istituto di Ricovero e Cura a Carattere Scientifico
IS-H - SAP Industry Solution - Healthcare
i.s.h.med - Oracle-Cerner clinical information system
ITB - Interdisciplinary Tumor Board
ITV - Internal Target Volume
JSON - JavaScript Object Notation

KIS - Krankenhaus-Informationssystem (Hospital Information System)
 KLAS - KLAS Research
 LACC - Locally Advanced Cervical Cancer
 LIMS - Laboratory Information Management System
 LIS - Laboratory Information System
 LKR - State Cancer Registry
 LMU - Ludwig-Maximilians-Universität (Munich)
 LLM - Large Language Model
 mCODE - Minimal Common Oncology Data Elements
 MCP - Model Context Protocol
 MDM - Medical Document Management
 MDR - Medical Device Regulation (EU)
 MDT - Multidisciplinary Team
 MITK - Medical Imaging Interaction Toolkit
 ML - Machine Learning
 MPI - Master Patient Index
 MR - Mixed Reality; Magnetic Resonance
 MRI - Magnetic Resonance Imaging
 MTB - Multidisciplinary Tumor Board; Molecular Tumor Board
 MTBP - Molecular Tumor Board Portal
 NAACCR - North American Association of Central Cancer Registries
 NAPBC - National Accreditation Program for Breast Centers
 NAPRC - National Accreditation Program for Rectal Cancer
 NCI - National Cancer Institute
 NEN 7510 - Dutch Health Information Security Standard
 NGS - Next-Generation Sequencing
 NLP - Natural Language Processing
 OAR - Organ at Risk
 ODSeasyNet - Asthenis browser-based tumor documentation system
 OIS - Oncology Information System
 OnkoBox - Interface/registry tool family (OnkoZert-verified)
 OR - Operating Room
 ORN - OncoLens Research Network
 P2P - Peer-to-Peer
 PACS - Picture Archiving and Communication System
 PC-VR - Tethered PC-based Virtual Reality
 PET-CT - Positron Emission Tomography-Computed Tomography
 PHI - Protected Health Information
 PIPEDA - Personal Information Protection and Electronic Documents Act
 PoC - Proof of Concept
 PRO - Patient-Reported Outcome; Professional (regulatory-cleared) edition
 QIP - Quality Improvement Program
 QOPI - Quality Oncology Practice Initiative
 QR - Quick Response code
 RAF - Risk Adjustment Factor
 RBAC - Role-Based Access Control
 REST - Representational State Transfer
 ROI - Return on Investment
 RWE - Real-World Evidence
 SaaS - Software as a Service
 SAP DMS - SAP Document Management System
 SAP R/3 - Systems Applications and Products (ERP system)
 SAS VTA - SAS Visual Text Analytics
 SAS Viya - SAS Viya (analytics platform)
 SNOMED CT - Systematized Nomenclature of Medicine-Clinical Terms
 SOAP - Simple Object Access Protocol
 SOC 2 - System and Organization Controls 2
 SR - Structured Report
 SRS - Stereotactic Radiosurgery
 SSO - Single Sign-On
 STL - Stereolithography (3D model file format)
 STT - Speech-to-Text
 SUS - System Usability Scale
 TB - Tumor Board
 TPS - Treatment Planning System
 UTMS - Ulm Trial Management System (study monitor)
 VC - Video Conferencing
 VMB - Virtual Medical Board
 VR - Virtual Reality
 VRMDT - Virtual Reality Multidisciplinary Team (software)
 VTB - Virtual Tumor Board
 VUS - Variant of Uncertain Significance
 WSI - Whole-Slide Image
 XML - Extensible Markup Language
 XR - Extended Reality (AR/VR/MR)

EXECUTIVE SUMMARY

The VR-MTB (Virtual Reality Multidisciplinary Tumor Board) project, led by Deggendorf Institute of Technology - European Campus Rottal-Inn (DIT-ECRI), aims to transform multidisciplinary tumor board (MTB) meetings, which are central to collaborative cancer treatment planning but still constrained by fragmented data sources, limited integrated imaging, and high time pressure. The project is developing an extended reality (XR) and AI-supported platform that consolidates clinical, laboratory, pathology, imaging, and selected patient-generated data (including sensor-based metrics) into a single immersive workspace. Within this environment, oncology teams can collaboratively explore 2D and 3D medical images and patient information in real time, while AI-driven tools automatically transcribe and structure MTB discussions to streamline documentation and integration with hospital information systems.

Supported by the German Federal Ministry for Research, Technology, and Space (BMFTR) with a planned funding volume of around €0.87 million over three years, VR-MTB seeks to enhance diagnostic precision, efficiency, and collaboration in MTBs and, ultimately, to make high-quality cancer care more accessible worldwide.

This market research report, which is part of Work Package 2 (Needs and Requirements Analysis), assesses the competitive landscape and market readiness for a Virtual Reality Multidisciplinary Tumor Board (VR-MTB) solution. It examines 35 products across four key areas: Workflow Solutions, Interoperability Solutions, Imaging and Extended Reality (XR) Solutions, and AI Solutions. The overarching goal is to evaluate the market viability for VR-MTB solutions.

Market Landscape and Scope

The report finds that the broader market for Extended Reality (XR) in healthcare is projected for substantial growth, with forecasts indicating the VR in Healthcare market may reach USD 29.38 B by 2030, reflecting a CAGR of 32.2%. Similarly, the Extended Reality segment in Healthcare is expected to grow from USD 4.04 B in 2025 to USD 18.38 B by 2034, presenting a CAGR of 18.38%. Key drivers include rising healthcare digital spending and the growth of telemedicine.

Key Comparative Insights and Strategic Findings

The detailed analysis across the four segments provides strategic direction for a VR-MTB platform:

1. Workflow and Interoperability Maturity

Established workflow solutions like OncoLens (U.S.-led, 200+ centers) and NAVIFY Tumor Board (Roche, global use) provide commercial, cloud-based platforms that automate agendas, centralize data, and support remote boards. OncoLens reports significant efficiency gains, including a 65% reduction in tumor board preparation time.

A critical finding regarding data integration is that while existing solutions commonly use HL7 and DICOM, specific details regarding FHIR/IHE compatibility are often „**Not disclosed**“. Furthermore, systems focused on German-speaking countries (DACH), such as ONKOSTAR and ULTIMA (embedded in SAP IS-H), prioritize registry-grade documentation (BKRG/ADT) and frequently require on-premises or tightly embedded solutions.

Strategic Implication: The VR-MTB platform to implement a dual-path interoperability strategy, supporting immediate integration via HL7 v2/CSV while preparing for FHIR/IHE compatibility to ease pilot adoption. Crucially, the platform must write back structured outputs aligned with national oncology datasets to fit mandatory certification workflows and consider on-premise or hybrid deployment options.

2. Status of Imaging and XR Solutions

The Imaging & XR segment is dominated by research pilots and proofs-of-concept (PoCs) (e.g., VRMDT, IMHOTEP, TVASurg) focused on immersive 3D image review for surgical planning and collaboration. While commercial products exist, such as the Brainlab Mixed Reality Viewer (CE-labeled, FDA 510(k) cleared, >110 installs), objective clinical outcomes are sparse, and live integration with EHR or PACS is generally limited in these XR prototypes.

Strategic Implication: The VR-MTB solution must differentiate by providing turnkey PACS/EHR connectivity to reduce manual data preparation (a major bottleneck in prototypes like MR-HNTB, which averaged 47 minutes of preparation time vs. 13 minutes conventional). Prioritizing a headset-agnostic UX that supports affordable standalone/MR devices is also recommended.

3. AI Integration for Efficiency

The AI segment features commercially mature speech recognition/ambient scribe tools (e.g., DeepScribe for Oncology, Dragon Medical One, Autoscriber) that automate documentation and integrate with major oncology EHRs (Epic/SmartData, OncoEMR, iKnowMed). DeepScribe cites training on 600,000+ oncology visits and reports up to 75% less after-hours documentation. Additionally, platforms like Azra AI perform upstream AI tasks, such as patient identification (claiming 98% precision) and triage.

Strategic Implication: The VR-MTB platform should embed a proven ambient scribe via API immediately to cut documentation burden during VR sessions. Future roadmap development should focus on utilizing upstream flags and summaries (e.g., from Azra AI) within the VR environment to streamline case triage.

Conclusion

A key strategic recommendation is pursuing an evidence-led rollout. Since many existing XR and AI competitors lack published, peer-reviewed MTB outcomes, generating prospective pilot results on efficiency metrics (e.g., prep time reduction, adherence to guidelines) will be a critical differentiator in the competitive landscape. Partnerships with established workflow and AI providers are recommended, allowing the VR-MTB solution to focus on competing via its immersive user experience combined with integrated analytics.

More Information:

1. VR-MTB on the BMFTR website: <https://www.interaktive-technologien.de/projekte/vr-mtb>
2. VR-MTB on the DIT website: <https://th-deg.de/vr-mtb>

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1. OncoLens



Overview

OncoLens is a cloud-hosted “virtual tumor board” platform that aggregates EHR/EMR, pathology, and imaging data into a browser workspace, automates agendas and slides, and supports real-time collaboration through an integrated web viewer and embedded video (OncoLens, 2025a).

- **Title / Name of the Solution or Study:** OncoLens - AI-Powered Multidisciplinary Tumor Board and Oncology Workflow Platform
- **Country:** United States (with expansion to the Middle East; global growth plans)
- **Development Stage:** Commercial product
- **Timeframe of Study or Deployment:** Initial deployments in 2017; continuous enhancements through 2025
- **Target Clinical Use Case:** Tumor boards; molecular tumor boards; oncology workflow optimization; clinical-trial matching; precision oncology; registry automation; RWE generation; rare-disease identification

Description

OncoLens is an oncology workflow and informatics platform built to streamline MTB preparation, presentation, and follow-up while expanding access to research and precision therapies. Modules cover case preparation, clinical-trial feasibility/accreditation, biomarker testing alerts, molecular treatment planning, accreditation/QI reporting, and analytics. The platform addresses manual data entry, inconsistent documentation, missed trial eligibility, fragmented biomarker tracking, and non-standard decisions by surfacing insights from structured and unstructured data to support timely, guideline-aligned care (OncoLens, 2025a; 2025b).

Key Features, Technology & Functional Approach

- **AI-assisted staging, cohort screening, and documentation** (OncoLens, 2025e; 2023b).
- **Real-time patient identification and alerts** for trials, CAR-T, and key services (OncoLens, 2024a; 2025b).
- **Precision-oncology/biomarker modules** with molecular MTB support (OncoLens & Caris, 2022).
- **Workflow automation** for tumor boards (slides, agendas, follow-ups) (OncoLens, 2025c).
- **Asynchronous collaboration and image sharing** via web workspace and viewer (OncoLens, 2025c; 2025i).
- **Registry and accreditation reporting** (CoC, CME tracking, dashboards) (OncoLens, 2025c; 2025b).
- **Configurable modules** tailored per institution; **Research Network (ORN)** for feasibility/QIP (OncoLens, 2025e; 2025b).
- **Use of XR:** Not used; imaging via secure 2-D web viewer (OncoLens, 2025d).
- **Use of AI:**
 - LLM-enabled extraction from clinical notes and PDFs (OncoLens, 2023b).
 - **Staging extraction accuracy ~80%** (vendor metric) (OncoLens, 2025e).
 - AI-assisted trial matching using EMR and biomarker data; proactive alerts for missed diagnostics/therapies (OncoLens, 2025b; 2024a).
 - Automated registry abstraction and RWE generation (OncoLens, 2025b).
 - **Other technologies:** Browser-based dashboard; embedded video for meetings; automated slide/agenda creation; asynchronous collaboration; biomarker data integration with Caris (OncoLens & Caris, 2022). Integrations with other named labs were not publicly documented at the time of writing.

Supported Tumor Types

- Tumor-agnostic platform supporting solid and hematologic malignancies; includes molecular tumor boards and rare-disease use (OncoLens, 2025b).
- Configurable boards (e.g., breast, lung, GI, GU, neuro-oncology) (OncoLens, 2025c).

Applications in Tumor Board Workflow

- **Before the meeting:** AI-based triage; eligibility screening; automated case files/slides; biomarker-gap prompts; patient ID alerts for trials and advanced therapies (OncoLens, 2025b; 2025c).
- **During the meeting:** Unified dashboard for EHR/EMR, labs, imaging, and pathology; real-time prompts for trial opportunities and pathways; synchronous/asynchronous participation; standardized documentation and CME tracking (OncoLens, 2025b; 2025c).
- **After the meeting:** Accreditation-ready reports (CoC, NAPBC, QOPI); follow-up tracking; analytics dashboards for quality improvement (OncoLens, 2025c; 2025b).

Interoperability & Integration

- **Connected systems:** EHR/EMR (e.g., Epic, Cerner), PACS, LIS, and genomics partners (OncoLens, 2025b; 2025d).
- **Data standards:** FHIR, HL7, JSON for clinical data; DICOM image import (OncoLens, 2025d; 2025c).
- **Cloud vs. on-prem:** Cloud SaaS with secure browser access; SSO supported (OncoLens, 2025d; 2025c).
- **Data capture/entry:** Automated ingestion from structured/unstructured sources; workflow and registry automation; minimal local IT footprint (OncoLens, 2025d; 2025c).

Security & Compliance

- **Compliance:** HIPAA; SOC 2 (vendor claim/badge) (OncoLens, 2021; 2025h).
- **Access controls:** Role-based access; auditability; SSO (OncoLens, 2025c; 2025i).
- **Encryption:** Session and content encryption; secure video and screen-share (OncoLens, 2025i).
- **Data privacy:** Options for de-identification/pseudonymization for QI/RWE projects (OncoLens, 2025b).
- **Accreditation support:** Outputs aligned to CoC, QOPI, NAPBC, NAPRC (OncoLens, 2025c; 2025b).

Implementation Setup

- **Led by:** OncoLens, with hospitals, cancer centers, and life-science partners.
- **Scale:** Vendor-reported: **200+ cancer centers; 3-5M+** patients in network; **~50% of top pharma** engaged via research/QI (OncoLens, 2023a; 2025h). Exact physician counts not publicly disclosed.
- **Requirements:** Cloud-based; browser access; no local installation.
- **Training:** White-glove onboarding and ongoing support (OncoLens, 2025b).

Advantages & Evaluation Outcomes

- **80%** staging extracted from notes (vendor metric) (OncoLens, 2025e).
- **650+ hours** saved in cohort screening (vendor metric) (OncoLens, 2025e).
- **70%** improvement in biomarker testing rates (vendor metric; supported by QIP publications) (OncoLens, 2025e; Heron et al., 2024).
- **65%** reduction in tumor board preparation time (vendor metric) (OncoLens, 2025e).
- **350%** increase in genetic testing at a community center (case study) (OncoLens, 2025g).
- Improved guideline adherence, trial participation, and documentation quality; operational dashboards for oncology service-line performance (OncoLens, 2025b; 2025c).

Challenges & Limitations

- Integration complexity varies with local IT and data sources.
- Subscription pricing may limit adoption in smaller practices.
- No immersive 3-D/XR imaging capabilities (2-D only).
- Current deployments are predominantly U.S.-based; early international expansion (OncoLens, 2024a).

Stakeholder Engagement

- **Stakeholders:** Oncologists, radiologists, pathologists, registrars, nurses, IT teams, pharma, CROs.
- **User engagement/change management:** Continuous clinical feedback; onboarding/training; demos.
- **Research Network (ORN):** Supports trial feasibility and QI participation; potential revenue/insight generation while advancing care (OncoLens, 2025b; 2025e).

Future Directions

Expanded real-time alerts and predictive oncology features (OncoLens, 2024a; 2025b).

Deeper integration with genomics platforms (e.g., Caris) and molecular diagnostics partners (OncoLens & Caris, 2022).

International growth supported by **Cross Border Impact Ventures** (OncoLens, 2024a).

Continued AI tooling for trial matching, QIP scaling, and automated abstraction (OncoLens, 2025a; 2025e).

Broader benchmarking and analytics for value-based care (OncoLens, 2025a).

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12. OncoLens. (2023b). *Rapid Identification of Cancer Patient Cohorts with Generative AI*.
13. OncoLens & Caris Life Sciences. (2022). *A Solution for the Future of Oncology Care (Caris integration; PDF)*.
14. OncoLens. (2025i). *Virtual Tumor Board & Cancer Conference Security (encryption, access)*.
15. OncoLens. (2021). *Fast-Growing Oncology Startup OncoLens Secures \$7.25 Million Series A Funding (HIPAA statement)*.

2. Zlynger



Overview

- **Title:** Zlynger Virtual Tumor Board
- **Vendor / Country:** Zlynger Softworks; Spain (EU), United States (US)
- **Category:** Workflow Solutions
- **Development Stage:** Commercial product
- **Timeframe:** Ongoing deployment; product available
- **Target Clinical Use Case:** MTBs/TBs, oncology case management, remote collaboration; custom medical software solutions (Zlynger, n.d.-a; Zlynger, n.d.-d).

Description

Zlynger's VTB is a web application that centralizes case materials-clinical data, reports, presentations, and images-so MTB participants (e.g., medical oncology, pathology, surgery, radiation oncology) can review and document decisions in one workspace. It supports on-site and remote boards to enable cross-institution collaboration (Zlynger, n.d.-a).

A tumor board (TB) is a multidisciplinary meeting to discuss cancer cases and agree on a treatment plan; Zlynger's platform virtualizes these activities and is positioned for hospitals, reference centers, and research groups, including international collaborations (Zlynger, n.d.-a).

Key Features, Technology & Functional Approach

- **Core capabilities:**
 - Central repository for patient case materials (clinical info, reports, images, slide decks) (Zlynger, n.d.-a).
 - Documented conclusions/decisions per case; support for remote boards (Zlynger, n.d.-a).
- **Collaboration/telemedicine:**
 - Designed for browser access; can integrate with telehealth/video service components offered by Zlynger (Zlynger, n.d.-b).
- **Customization:**
 - Modular/custom solutions for healthcare and research organizations (Zlynger, n.d.-c).
- **XR: Not disclosed.**
- **AI: Not disclosed.**

Supported Tumor Types

- Tumor-agnostic; suitable for solid and hematologic malignancies discussed in MTB settings (Zlynger, n.d.-a).

Applications in Tumor Board Workflow

- **Before:** Aggregate and organize patient data/presentations for case review (Zlynger, n.d.-a).
- **During:** Share presentations and imaging; support real-time multidisciplinary discussion (Zlynger, n.d.-a).
- **After:** Record decisions/treatment plans; retain case discussions for reference (Zlynger, n.d.-a).

Interoperability & Integration

- **Connected systems:** Integration with hospital systems is indicated at a high level; specific EHR/PACS/LIS products not disclosed (Zlynger, n.d.-a; n.d.-c).
- **Data standards: Not disclosed** (no explicit FHIR/HL7/DICOM statements on VTB page).
- **Deployment:** Cloud/web; browser-based access (Zlynger, n.d.-a).
- **Data entry/retrieval:** Vendor emphasizes user-friendly, web-based interfaces (Zlynger, n.d.-d).

Security & Compliance

- **Quality management:** Company states alignment with **ISO 9001:2015** quality/process management (Zlynger, n.d.-e).
- **Security features (vendor statements):** Access control, **SSL encryption**, daily backups (Zlynger, n.d.-d).
- **Regulatory framework (vendor statements):** Meets **HIPAA, GCP, 21 CFR Part 11** requirements (site-wide feature claims); VTB-specific attestations not disclosed (Zlynger, n.d.-d).
- **Consent:** Site forms show two consent checkboxes (privacy vs. marketing). Product-level consent workflows are **Not disclosed** (Zlynger, n.d.-a).

Implementation Setup

Led by: Zlynger Softworks.

Deployment context: Hospitals, clinics, CROs, research groups, international projects (Zlynger, n.d.-a; n.d.-c).

Requirements: Fully web-based; no local installation; multi-device support (Zlynger, n.d.-a; n.d.-d).

Training: Designed for easy adoption; details **Not disclosed** (Zlynger, n.d.-c).

Advantages & Evaluation Outcomes

- **Operational:** Streamlines TB management and participation; clean UI; clear case presentation (Zlynger, n.d.-a; n.d.-d).
- **Scale/limits of evidence:** No peer-reviewed outcomes or quantified efficiency metrics identified for VTB at time of writing (**Not disclosed**).

Challenges & Limitations

- **Integrations:** Specific scenarios, standards, and vendor connectors not detailed (**Not disclosed**) (Zlynger, n.d.-a).
- **Change management:** Training and adoption processes **Not disclosed**.
- **XR/AI:** No native XR or AI features stated (**Not disclosed**).

Stakeholder Engagement

- **Users:** Oncology teams, hospital IT, CROs, researchers (Zlynger, n.d.-a; n.d.-c).
- **Feedback mechanisms: Not disclosed.**

Future Directions

- **Planned upgrades / evaluations:** Not publicly disclosed; no clinical white papers or studies listed for VTB at time of writing (**Not disclosed**).

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3. Zlynger. (n.d.-c). *Custom Software Development for Clinical Research*.
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5. Zlynger. (n.d.-e). *Quality Policy (ISO 9001:2015 alignment)*.

Overview

- **Title:** CANCOM Tumorboard
- **Vendor / Country:** CANCOM SE (Germany)
- **Category:** Workflow Solutions
- **Development Stage:** Commercial product (introduced 2023; first shown at DMEA 2023) (CANCOM, 2023).
- **Positioning:** Hybrid telemedicine platform for tumor conferences using Cisco Webex; vendor describes it as Germany's "first comprehensive" hybrid tumor board with integrated live OR planning and 4K display of diagnostics (CANCOM, 2023; Handelsblatt, 2024).

Description

The CANCOM Tumorboard provides a virtual meeting environment where oncology teams co-review imaging, labs, and reports in high-resolution and document joint decisions. Clinicians can join securely from different locations; diagnostics are prepared and displayed for collective review to streamline case coordination (CANCOM, 2023; Handelsblatt, 2024).

Key Features, Technology & Functional Approach

- **Conference & display**
 - 4K video/audio; multi-content sharing (press materials show up to four streams; Handelsblatt article mentions up to six inputs) (CANCOM, 2023; Handelsblatt, 2024). Note: discrepancy between sources (4 vs. 6). CANCOM NewsroomHandelsblatt
 - Split-screen and fullscreen switching; on-screen annotation (CANCOM, 2023; Handelsblatt, 2024). CANCOM NewsroomHandelsblatt
- **Collaboration & scale**
 - Secure participation via link or CANCOM app; "unlimited" participants noted in press article (Handelsblatt, 2024). Handelsblatt
 - Real-time transcripts and translations for multilingual meetings (CANCOM, 2023). CANCOM Newsroom
- **Workflow actions**
 - Integrated pathway to OR planning from within the board; coupling with "nextOR" cited for AI-assisted scheduling (Handelsblatt, 2024). Handelsblatt
- **Platform basis**
 - Runs on Cisco Webex with CANCOM software for medical data presentation (CANCOM, 2023; Handelsblatt, 2024). CANCOM NewsroomHandelsblatt
- **XR/AI**
 - Native XR: **Not disclosed**.
 - AI: AI-assisted OR scheduling referenced; broader clinical decision support: **Not disclosed** (Handelsblatt, 2024; IT-BUSINESS, 2025). HandelsblattIT-BUSINESS

Supported Tumor Types

- **Tumor-agnostic:** Designed for organ-specific and molecular TBs; vendor materials do not limit to any specific cancer type (Handelsblatt, 2024). Handelsblatt

Applications in Tumor Board Workflow

- **Before:** Case materials from relevant departments are prepared and presented for review; meetings scheduled with calendar integration (Handelsblatt, 2024). Handelsblatt
- **During:** Multi-source 4K display; simultaneous review of scans/labs/reports; live annotation; remote specialists join securely (CANCOM, 2023; Handelsblatt, 2024). CANCOM NewsroomHandelsblatt
- **After:** Decisions documented; initiation of OR planning directly from the meeting when indicated (CANCOM, 2023; Handelsblatt, 2024). CANCOM NewsroomHandelsblatt

Interoperability & Integration

- **Connected systems:** Integration into existing environments including KIS/HIS, PACS, and hospital portals is claimed (Handelsblatt, 2024). Handelsblatt
- **Data standards:** Specific standards (e.g., HL7/FHIR/DICOM) **Not disclosed** in public materials reviewed.
- **Access model:** Web-based participation via browser/app; calendar-based joining (Handelsblatt, 2024). Handelsblatt

Security & Compliance

- **Encryption:** End-to-end encryption stated by vendor (CANCOM, 2023). CANCOM Newsroom
- **Access control:** Restricted to authorized participants (high-level statement; details **Not disclosed**) (Handelsblatt, 2024). Handelsblatt
- **Regulatory stance:** Materials emphasize compliance with country-specific legal and data-protection requirements; explicit product GDPR/MDR attestations **Not disclosed** (Handelsblatt, 2024). Handelsblatt

Implementation Setup

- **Delivery model:** Turnkey setup; CANCOM installs and tunes AV (4K display, camera, microphones) and can operate as a managed service (CANCOM, 2023). CANCOM Newsroom
- **Adoption support:** Live demos (DMEA, Hauptstadtkongress); test installation in Munich for hands-on evaluation (CANCOM, 2023). CANCOM Newsroom
- **Training:** Interface designed to minimize training; specifics **Not disclosed** (Handelsblatt, 2024). Handelsblatt

Advantages & Evaluation Outcomes

- **Operational benefits (vendor/press):** Faster coordination; participation from multiple sites; consolidated case view (CANCOM, 2023; Handelsblatt, 2024). CANCOM NewsroomHandelsblatt
- **External exemplars (not specific to CANCOM):**
 - **Oslo University Hospital (Webex MCS):** time from diagnosis to treatment reportedly reduced from ~7 weeks to ~1 week (Cisco, 2021/2022). Webex Blog+1video.cisco.com
 - **Digital TB studies:** pilot work shows improved preparation time and user satisfaction with digital TB platforms (Krupinski et al., 2018); additional studies report impacts on discussion time and efficiency (Hammer et al., 2021; Hammer, 2020). ResearchGateSpringerLinkPMC
- **CANCOM-specific quantitative outcomes: Not disclosed.**

Challenges & Limitations

- **Infrastructure needs:** Multi-stream 4K conferencing requires robust network and modern AV; may impact smaller sites (inferred from platform design; vendor does not quantify).
- **Integration detail:** Specific interfaces/standards and automation depth **Not disclosed**; custom work may be required.
- **Adoption:** Cultural change and workflow adjustments still required despite familiar UI (Handelsblatt, 2024). Handelsblatt
- **Clinical decision support:** Platform is collaboration-centric; advanced CDS/analytics **Not disclosed**.

Stakeholder Engagement

- **Clinician engagement:** Live demos at DMEA; pilot/test site in Munich; collaboration with hospital stakeholders (CANCOM, 2023). CANCOM Newsroom
- **Industry forums:** Participation noted in German health IT forums/working groups (Handelsblatt, 2024). Handelsblatt

Future Directions

- **Near-term:** Video consultation module; continued Telehealth portfolio build-out (CANCOM, 2023). CANCOM Newsroom
- **AI & planning:** Ongoing AI-enabled scheduling and therapy-planning workflows discussed in trade coverage (IT-BUSINESS, 2025). IT-BUSINESS
- **Ecosystem integrations:** Demonstrated linkage with Getinge Torin for OR planning at DMEA 2025 (CANCOM Austria, 2025). cancom.at

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3. IT-BUSINESS. (2025, Apr 2). *KI meets Krebsforschung*.
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4. Philips IntelliSpace Tumor Board



Overview

- **Title:** Philips IntelliSpace Tumor Board (part of IntelliSpace Precision Medicine/Oncology platform)
- **Region:** EU prioritized; global deployments reported
- **Development Stage:** Commercial product
- **Launch milestones:** Initial modules 2017-2018; **Oncology Pathways powered by Dana-Farber** went live August-September 2019 (Philips, 2019a).
- **Primary Clinical Use:** MTBs; oncology workflow integration; case review and decision support (Philips, n.d.-a; Philips, 2019a)

Description

Philips, in partnership with **DFCI**, integrated Dana-Farber Clinical Pathways into IntelliSpace Oncology to surface therapy and clinical-trial options tailored to patient features (e.g., genomic alterations) (Philips, 2019a). IntelliSpace Tumor Board unifies **radiology, digital pathology** (IntelliSite Pathology Solution), **genomics**, and **EHR** data in a shareable HTML5 workspace for pre-, in-, and post-meeting review, annotation, and documentation (Philips, n.d.-a; Philips, n.d.-b). Pathways content is updated routinely to support standardized, personalized treatment selection; meetings can be conducted remotely via secure web access (Philips, 2019a).

Key Features, Technology & Functional Approach

- **3D & multimodal imaging:** Synchronized multi-modality tumor tracking (MR/CT/MI), volumetric visualization, segmentation; multimedia-enhanced reporting with hyperlinks via IntelliSpace Portal (Philips, 2022a; Philips, 2025a).
- **Dashboards & documentation:** Patient-centric views with structured outputs; embedded annotations and linked evidence (Philips, n.d.-a; Philips, 2019a).
- **Trial matching & analytics:** Recommends trials and therapies based on Dana-Farber pathways and available clinical/genomic data (Philips, 2019a).
- **AI components:** NLP-assisted documentation and pathway/trial matching within the broader IntelliSpace Precision Medicine (ISPM) platform (Philips, 2019a; Philips, 2023a).

- **Collaboration:** Simultaneous multi-user annotation and chat; secure web access for remote participants (Philips, n.d.-a; Philips, 2019a).
- **Unique pathway feature: Regimen-specific consent forms** generated from selected treatment plans (Philips, 2019a; Philips, 2023a).
- **XR:** Not part of standard deployment (**Not disclosed**).

Supported Tumor Types

General (agnostic): Configurable for all tumor entities.

Disease-specific modules: Commonly used for breast, lung, GI, prostate, head & neck, hematologic cancers, and molecular TBs (vendor positioning; product pages do not list a fixed set) (**Not disclosed**) (Philips, n.d.-a).

Applications in Tumor Board Workflow

- **Before the meeting:** Aggregates imaging, pathology, genomics, and EHR; surfaces pathway-based therapy/trial options and supporting literature for review (Philips, 2019a).
- **During the meeting:** Shared dashboard; multi-user annotation/chat; real-time discussion of pathway and trial options (Philips, n.d.-a; Philips, 2019a).
- **After the meeting:** Regimen-specific consent forms and treatment reports; structured outputs back to EHR; tasks/analytics updated (Philips, 2019a; Philips, 2023a).

Interoperability & Integration

- **Connected systems:** PACS, EHR, LIS/LIMS, IntelliSite Pathology; knowledge bases (e.g., guidelines/trials) (Philips, n.d.-a; Philips, n.d.-b).
- **Data standards: DICOM, HL7/FHIR, IHE; REST APIs (OAuth 2.0 authentication mentioned in marketing/technical collateral; detailed spec **Not disclosed** in public product pages)** (Philips, n.d.-a; Philips, 2022b).
- **Deployment options:** Cloud (Philips HealthSuite), hybrid, or on-premises for data-residency constraints (Philips, 2020).
- **Ease of entry/retrieval:** Single login and role-based views; longitudinal retrieval across departments (Philips, n.d.-a).

Security & Compliance

- **Platform security (ISPM/HSDP):** ISO/IEC 27001 and 27018 certifications for the underlying HealthSuite platform; HIPAA security safeguards documented (Philips, 2019b).
- **SOC 2 context:** Philips Remote Services requires ISO 27001 and **SOC 2 Type 2** reporting from hosting providers (Philips, 2023b).
- **Privacy & legal:** Vendor materials reference alignment with **GDPR/HIPAA**; product-specific MDR/ISO 13485 status **Not disclosed** on public ISPM pages (Philips, 2018; Philips, 2019b).
- **Security features:** TLS in transit, encryption at rest, RBAC, audit logging; consent/pseudonymization capabilities for research workflows (Philips, 2019b; Philips, 2023a).

Implementation Setup

- **Leadership:** Philips; collaborations include DFCI; evaluations/pilots reported at European and US sites (Philips, 2019a; ICTHealth, 2017).
- **Deployment scale:** Examples include multi-site MTB use; specific counts vary by market (**Not disclosed** on product pages).
- **Requirements:** Browser-based (e.g., Chrome/Edge); remote access supported; mobile access where enabled (Philips, n.d.-a).
- **Training:** Structured onboarding and super-user model are commonly used in enterprise informatics; product-specific training details **Not disclosed** publicly.

Philips USA, icthealth.org

Advantages & Evaluation Outcomes

- **Operational:** Vendor/press report streamlined prep and more complete data at point of discussion (Philips, n.d.-a; Philips, 2019a).
- **Quantitative examples (non-randomized; context):**
 - **Guideline adherence** improved by ~12% and **prep time reduced** in early pilot reports related to IntelliSpace Oncology deployments (ICTHealth, 2017).
 - **Consent workflow:** pathways generate **regimen-specific consent forms** with curated adverse effects, supporting faster documentation (Philips, 2019a; AJMC/DFCI commentary, 2020).
- **Product-specific peer-reviewed clinical impact: Not disclosed.**

Challenges & Limitations

- **Integration complexity:** Higher effort when hospital stacks are not Philips-centric; mapping non-Philips systems may require project resources (**Not disclosed** quantitatively).
- **Learning curve:** 4-6 weeks for full fluency reported in field experience; formal time-and-motion data **Not disclosed**.
- **Licensing & cost:** Licensing often bundled with other Philips informatics (e.g., PACS), which may raise entry cost for smaller centers (vendor/market reports; **Not disclosed** formally).

Stakeholder Engagement

Users: Oncologists, radiologists, pathologists, nurses, IT, administrators; patient-facing communications via consent/report outputs (Philips, 2019a; Philips, 2023a).

Co-design: User workshops and iterative UI refinements are part of platform evolution (Philips, n.d.-a; ICTHealth, 2017).

Future Directions

- **XR:** Potential future immersive capabilities; not in standard deployment (**Not disclosed**).
- **AI deepening:** Expanded NLP/LLM-assisted documentation and recommendations; adaptive features trained on MTB outcomes (**Not disclosed**).

- **Consent & engagement:** Continued enhancement of patient-facing documentation and portals (Philips, 2023a).
- **Network scale:** Regional/national MTB networks and federated analytics models (**Not disclosed**).

References

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3. Philips. (2019a, Sept 11). Oncology Pathways powered by Dana-Farber is now live. Philips USA
4. Philips. (2019b). IntelliSpace Precision Medicine Security White Paper (ISO 27001/27018; HIPAA safeguards). Philips
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6. Philips. (2022a). IntelliSpace Portal-Instructions for Use (tumor tracking, segmentation, multimedia reporting). Philips Documents
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5. MIM Maestro



Overview

- **Title:** MIM Maestro (MIM Software)
- **Category:** Workflow Solutions
- **Positioning:** Vendor-neutral radiation oncology software to standardize pre-planning workflows and streamline plan preparation; compatible with all TPSs (MIM Software, 2025a). mimsoftware.com
- **XR:** Not disclosed.

Description

MIM Maestro supports radiation therapy planning by centralizing pre-planning tasks: multi-modality image registration, motion analysis, auto-segmentation (via Contour ProtégéAI+), prior dose evaluation, and workflow automation. The goal is consistent, efficient preparation of physician-ready datasets across disease sites (MIM Software, 2025a). mimsoftware.com

Key Features, Technology & Functional Approach

- **Image registration:** Rigid/deformable registration across CT, MR, PET/CT; concurrent multi-study registration with QA and TG-132 reporting (MIM Software, 2025d).
- **4D motion management:** ITV creation, 4D CT binning, motion statistics, MIP generation; workflow-guided steps (MIM Software, 2025b).
- **Automated contouring:** Zero-click AI auto-contouring for OARs/targets via **Contour ProtégéAI+** (MIM Software, 2025c).
- **Reirradiation planning:** Prior dose registration/summation; **BED/EQD2** tools in guided workflows (MIM Software, 2025e).
- **Workflow automation:** **MIM Workflows** and **MIM Assistant** for rule-based automation and data routing (MIM Software, 2025f; 2025g).
- **Remote access:** **MIMcloud** for secure image sharing, storage, and off-site viewing (MIM Software, 2025h). mimsoftware.com

Supported Tumor Types

- **General/agnostic:** Used across thoracic, breast, prostate, head & neck, GI, gynecologic and other sites; product pages highlight modality- and workflow-driven (not tumor-specific) capabilities (MIM Software, 2025a; 2025c).

Applications in Tumor Board Workflow

- **Before the meeting:** Prepare multi-modality registrations, motion assessments, and AI contours to support case review (MIM Software, 2025a; 2025b; 2025c).
- **During/After the meeting:** MTB-specific modules are **Not disclosed**; outputs (images/contours/summaries) can be exported for presentation or downstream TPS use (MIM Software, 2025a). mimsoftware.com

Interoperability & Integration

- **Standards & compatibility:** Vendor-neutral; **DICOM** imaging; compatible with all major **TPSs** (MIM Software, 2025a; 2025d). mimsoftware.com, mimsoftware.com
- **Data movement & automation:** **MIM Assistant** rules and **MIMcloud** routing (MIM Software, 2025g; 2025h).

Security & Compliance

- **MIMcloud security (vendor statement):** PHI encrypted for transfer and storage to support **HIPAA** compliance (MIM Software, 2025h). mimsoftware.com
- **Product-level certifications:** Additional attestations (e.g., SOC 2/ISO 27001 for specific services) **Not disclosed** on product pages.

Implementation Setup

- **Training & support:** Vendor training resources; **Radiation Oncology Automation Workshop** for **MIM Workflows/MIM Assistant** (MIM Software, 2025f; 2025i). mimsoftware.com
- **Scalability:** Deployed across varied settings; remote use supported via **MIMcloud** (MIM Software, 2025h). mimsoftware.com
- **Cloud integration:** Encrypted browser-based access to MIMcloud; DICOM routing via MIMcloud Assistant (MIM Software, 2025h). mimsoftware.com

Advantages & Evaluation Outcomes

- **Operational:** Standardizes pre-planning steps; reduces manual effort via automation and guided workflows (MIM Software, 2025a; 2025f). mimsoftware.com+1
- **Quantitative outcomes:** Product-specific peer-reviewed metrics **Not disclosed** in public pages.

Challenges & Limitations

- **MTB specificity:** No dedicated MTB module disclosed; use is primarily pre-planning (**Not disclosed**).
- **XR:** No VR/AR capabilities disclosed.
- **Evidence:** Independent clinical outcome studies for Maestro-specific gains **Not disclosed**.

Stakeholder Engagement

- **Primary users:** Dosimetrists, medical physicists, radiation oncologists; role-oriented materials provided by vendor (MIM Software, 2025j). mimsoftware.com

Future Directions

- **Roadmap:** **Not disclosed** on public Maestro pages; vendor continues to release updates to AI models and workflows (context: Contour ProtégéAI updates) (MIM Software, 2024). MIM Software

References

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3. MIM Software. (2025c). Contour ProtégéAI+ - Zero-Click Auto-Contouring.
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5. MIM Software. (2025e). MIM Maestro - Treatment Evaluation (Reirradiation).
6. MIM Software. (2025f). Radiation Oncology Automation Workshop: MIM Workflows & MIM Assistant.
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8. MIM Software. (2025h). MIMcloud - Securely Store and Share Medical Images.
9. MIM Software. (2024). Press: FDA clearance of Contour ProtégéAI models.

6. NAVIFY Tumor Board



Overview

- **Title:** NAVIFY Tumor Board (Roche)
- **Region:** Global deployments
- **Development Stage:** Commercial product
- **Primary Clinical Use:** MTBs; oncology workflow coordination; case review and decision support (Roche, n.d.-a; Roche, n.d.-b).

Description

NAVIFY Tumor Board is a cloud solution that aggregates oncology data into a standardized patient dashboard to support MTB preparation, discussion, and documentation (Roche, n.d.-b).

Key Features, Technology & Functional Approach

- **Integrated patient dashboard:** EMR, LIS, PACS, pathology/radiology reports, genomics, and notes in one view (Roche, n.d.-b).
- **Interoperability & data integration services:** Long-term collaboration with Accenture for data integration between hospital systems and NAVIFY (Accenture, 2017).
- **Imaging capabilities:** Medical image viewing integrated with NAVIFY Tumor Board 2.x through collaboration with GE Healthcare (Fierce Biotech, 2019; GE Healthcare, n.d.).
- **CDSS apps:** NAVIFY Clinical Trial Match, Publication Search, and access to guidelines/literature for case-specific evidence (GenomeWeb, 2018; Roche, n.d.-b).
- **AI use:** Documented NLP-assisted documentation and trial-search features within the NAVIFY portfolio (Roche, n.d.-b).
- **XR use:** **Not disclosed** by vendor (**Not disclosed**).

Supported Tumor Types

Tumor-agnostic; configurable for organ-specific and molecular TBs (Roche, n.d.-b).

Applications in Tumor Board Workflow

- **Before meeting:** Automated data aggregation; creation of standardized case views (Roche, n.d.-b).
- **During meeting:** Interactive presentation of imaging and reports; literature/guidelines lookup; trial identification (Roche, n.d.-b; GenomeWeb, 2018).
- **After meeting:** Documentation and analytics to support accreditation/quality programs (Roche, n.d.-b).

Interoperability & Integration

- **Connected systems:** EMR, PACS, LIS; GE viewer integration for DICOM images (Fierce Biotech, 2019; GE Healthcare, n.d.).
- **Data standards:** Use of international standards (e.g., HL7, FHIR, DICOM, IHE) referenced in Roche materials (Roche, 2020a; Roche, 2020b).
- **Deployment:** Secure cloud; web client (Roche, n.d.-b).

Security & Compliance

- HIPAA/GDPR alignment; RBAC; audit logging; encryption; ISO 27001/27017/27018; HITRUST noted in collateral (Roche, 2020a; GE Healthcare, n.d.).

Implementation Setup

Joint configuration with Roche and site IT; workflow mapping, integration, training, and ongoing support (Accenture, 2017; Roche, n.d.-b).

Advantages & Evaluation Outcomes

- Prospective deployment reported a **~30% reduction in preparation time** at Ellis Fischel across multiple TBs (Roche, n.d.-b).
- Enhanced meeting coordination, standardized documentation, and quality reporting (Roche, n.d.-b).

Challenges & Limitations

- Vendor does not publicly detail limitations; site-specific integration and change-management needs are typical in practice (**Not disclosed**).

Stakeholder Engagement

- Multidisciplinary users: oncologists, radiologists, pathologists, nurses, administrators; vendor-supported onboarding and training (Roche, n.d.-b).

Future Directions

- Vendor materials emphasize continued enhancements in analytics/trial matching; no official XR roadmap disclosed (Roche, n.d.-b).
- Note: MR for TBs is being explored in research settings (e.g., **head-and-neck MR TB prototype**, Düsseldorf), but not part of NAVIFY (Karnatz et al., 2024).

References

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3. GE Healthcare. (n.d.). NAVIFY Tumor Board brochure (2.2).
4. GenomeWeb. (2018, September 18). Roche Navify Clinical Trial Match & Publication Search.
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6. Roche. (2020a). NAVIFY-Data privacy & security (FAQ/brief).
7. Roche. (2020b). Personalized healthcare brochure (includes standards references).
8. Roche. (n.d.-a). navify@ Clinical Hub for Tumor Boards (product page).
9. Roche. (n.d.-b). navify@ Clinical Hub for Tumor Boards (marketplace).

7. MTB Smart Virtual Assistant in LACC

Overview

- **Title / Name of the Solution or Study:** Multidisciplinary Tumor Board (MTB) Smart Virtual Assistant in Locally Advanced Cervical Cancer (LACC) - Proof of Concept
- **Country / Organization:** Academic prototype led at IRCCS Policlinico Gemelli (Italy)
- **Development Stage:** Research prototype / Proof of Concept (PoC)
- **Timeframe:** Retrospective cohort 2015-2018; publications/abstracts 2021-2022.
- **Target Clinical Use Case:** MTB triage and decision support for LACC (IB2-IVA) by automating staging from free-text reports and flagging complex cases.

Description

The prototype aggregates patient information from institutional sources and applies NLP to MR, EUA, and PET-CT narrative reports to derive structured features, cluster cases, and predict FIGO stage. It highlights inconsistencies to prioritize complex cases for MTB discussion and offers a dashboard for review.

Key Features, Technology & Functional Approach

- **Core features:**
 - Automated extraction from EHR/data-lake; NLP transforms free text to structured clinical features.
 - ML-based prediction of pre-diagnostic FIGO staging; case clustering; discrepancy highlighting.
 - MTB dashboard for drill-down review.
- **AI use:** NLP + machine-learning classifiers for staging and case prioritization.
- **XR use:** **Not disclosed**; no XR described in sources.
- **Architecture:** Research tool built on institutional data-lake workflows; web-style dashboard shown in study figure.

Supported Tumor Types

- **Scope:** LACC (cervical cancer) only in this PoC.
- **Generalizability:** Authors suggest extendability to other cancers/languages as future work.

Applications in Tumor Board Workflow

- **Before MTB:** Auto-retrieves EHR items (MR, EUA, PET-CT), structures features, clusters cases, predicts staging to triage complex cases.
- **During MTB:** Dashboard supports review and identification of conflicting interpretations to focus discussion.
- **After MTB:** **Not disclosed**.

Interoperability & Integration

- **Connected systems / data:** Institutional EHR and diagnostic report repositories; specific standards (e.g., HL7/FHIR/DICOM)

not disclosed. **Status: Not disclosed.**

- **Data handling:** ETL-style extraction and NLP from a hospital data-lake.

Security & Compliance

- **Regulatory posture:** Research system with ethics oversight at IRCCS Policlinico Gemelli; no medical-device certification reported. **Status: Not disclosed.**

Implementation Setup

- **Led by:** Academic clinical/research team; ethics statement cites IRCCS Policlinico Gemelli approval.
- **Scale:** Retrospective training set n=96 LACC patients; independent validation cohort n=13 reported in abstract.
- **Deployment model / requirements:** Research setting; productization not reported. **Status: Not disclosed.**

Advantages & Evaluation Outcomes

- **Accuracy:** 94% staging accuracy in training set (retrospective).
- **Validation:** 93% accuracy on a 13-patient validation cohort (conference abstract).
- **Operational concept:** Prioritizes complex cases and may reduce information overload for MTB.

Challenges & Limitations

- Single-center, retrospective PoC; limited external validation.
- Cancer-specific (LACC) scope; generalization requires further work.
- Interoperability standards, security controls, and real-time integration not reported. **Status: Not disclosed.**
- No public evidence of commercialization; subsequent literature continues to cite it as a prototype.

Stakeholder Engagement

- Intended for MTB clinicians; also positioned as an educational/knowledge-transfer aid for junior staff.

Future Directions

- Authors propose: expanding training/validation cohorts; extending to other cancers/languages; end-to-end support beyond initial staging.

References

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1. ONKOSTAR- Tumor Documentation System



Description

Title / Product: ONKOSTAR - Tumor Documentation System (IT-Choice Software AG)

Category: Interoperability in MTBs Solutions

- Tumor-agnostic documentation platform used for clinical data capture, MTB support, and cancer-registry reporting in German-speaking countries (IT-Choice, n.d.; MHH, 2025).
- Companion to the hospital HIS/KIS; centralized capture for DKG certification and registry submissions (IT-Choice, n.d.).

Core Functionalities / Analytical Capabilities

- **Flexible documentation & editors** (forms, queries, R-scripts); disease-context fields; treatment-status-driven records (IT-Choice, n.d.).
- **Plausibility & QA checks** (separates registry-relevant errors vs. certification warnings) (IT-Choice, n.d.).
- **MTB support:** Tumor conference module for participants, agenda, and decision logging; CONFYSTAR adds invitations and decision approval (IT-Choice, n.d.; IT-Choice, 2025a).
- **Analytics:** ONKOSTAR 3 integrates **Shiny for R** for interactive analyses (IT-Choice, 2025b).

Interoperability & Integration

- **Registry data exchange:** oBDS-based capture; LKR submission; ONKOSTAR 3 **imports LKR status feedback** to streamline processing (IT-Choice, n.d.; IT-Choice, 2025b).
- **HIS/KIS connectivity:** HL7 import for master/diagnosis/OP data; **HL7 MDM** to send PDFs (incl. tumor-conference decisions) back to KIS; Web-service APIs for CSV/XML I/O (IT-Choice, n.d.).
- **Multi-site use:** Role-based access, multi-tenant setup, and **MPI** for cross-site patient identity (IT-Choice, n.d.).
- FHIR or IHE profile specifics for ONKOSTAR core: **Not disclosed** (cf. national FHIR efforts for oncology data exchange) (Carus et al., 2023).

Security & Compliance (Data Governance and Access Control)

- Operates under **BKRG** with reporting to state registries; sites remain responsible for lawful processing/data governance (Erdmann et al., 2022; MHH, 2025).
- Access control via user groups and permissions; vendor materials describe secure, role-based access; encryption details: **Not disclosed** (IT-Choice, n.d.).

Applications in Tumor Board Workflow (Adoption & Impact / Implementation & Usage)

- **Before MTB:** Case registration, agenda, and automated email invitations via **CONFYSTAR** (IT-Choice, 2025a).
- **During MTB:** Structured presentation; real-time decision recording; decisions later approved and distributed (IT-Choice, n.d.; IT-Choice, 2025a).
- **After MTB:** Follow-up tracking; registry submissions; LKR feedback handled in ONKOSTAR 3 (IT-Choice, 2025b).
- **Adoption examples:**
 - MHH (CCC Hannover): ONKOSTAR in use since **01.01.2018**; KIS integration; XML exports for registries and DKG metrics (MHH, 2025).
 - CCC Karlsruhe: ONKOSTAR in use since **mid-2016**; >20,000 LKR submissions in 2023; 1.5% primary rejection rate (CCC Karlsruhe, 2024).

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2. CREDOS



Description

CREDOS (Cancer Retrieval Evaluation and Documentation System) is CCCU's tumor documentation platform, developed and operated in a SAP R/3 environment using i.s.h.med. It provides structured oncology documentation for care, research, and registry reporting, with a base dataset (diagnosis, course, therapy) aligned to Baden-Württemberg's state registry and ADT standards. Basis documentation has been in routine use since 1 July 2000. (Comprehensive Cancer Center Ulm, 2025).

Core Functionalities / Analytical Capabilities

- **CREDOS-B (Base):** Records core items for malignant diseases per ADT/Baden-Württemberg registry specifications. (Comprehensive Cancer Center Ulm, 2025).
- **CREDOS-S (Specialized modules):** Extends base documentation with center-specific modules (e.g., prostate, colorectal, breast, skin, lung). (Comprehensive Cancer Center Ulm, 2025).

- **Analytical use (via BI layers):** LMU demonstrated a QlikView-based analysis layer on tumor documentation data to support near-real-time dashboards for quality/process control, knowledge discovery, and hypothesis generation; MTB discussion status appears among analyzable fields. (Nasseh et al., 2020).
- **Unknowns:** Native CREDOS analytics beyond external BI layers - **Not disclosed**.

Interoperability & Integration

- **HIS integration:** Implemented within SAP R/3 using i.s.h.med at CCCU, enabling tight workflow embedding in the hospital environment. (Comprehensive Cancer Center Ulm, 2025).
- **Interfaces / registry tooling:** CREDOS lists “Schnittstellen - OnkoBox”; OnkoZert verification exists for OnkoBox disease modules (colorectal, prostate, breast). (Comprehensive Cancer Center Ulm, 2025; OnkoBox, 2025).
- **CCCU ecosystem:** CCCU develops complementary systems alongside CREDOS-ULTIMA (tumor boards) and UTMS (trials)-used across departments and partners. (Comprehensive Cancer Center Ulm, 2025).

Security & Compliance (Data Governance and Access Control)

- **Role-based access:** Clinicians may view all data for a patient when a treatment relationship exists; users can only modify data entered by their own department. (Comprehensive Cancer Center Ulm, 2025).
- **Standards alignment:** Base dataset considers ADT and state cancer-registry requirements. (Comprehensive Cancer Center Ulm, 2025).
- **Unknowns:** Explicit GDPR posture, external security certifications, audit trails - **Not disclosed**.

Applications in Tumor Board Workflow (Adoption and Impact / Implementation and Usage)

- **Adoption footprint:** CREDOS is used in 13 clinics across Germany, including LMU, Mannheim, Leipzig, and the Munich municipal hospitals; CCCU is among the sites. (Comprehensive Cancer Center Ulm, 2025).
- **Implementation history:** Basis documentation live since 2000 at CCCU; specialized modules deployed for organ-specific centers. (Comprehensive Cancer Center Ulm, 2025).
- **MTB use / impact evidence:** At LMU, the CREDOS dataset was used to link documentation with routine data, enabling evaluations where MTB participation signaled positive management impact in pancreatic cancer. (Al Zahmi, 2022).
- **Market dynamics:** Some German locations report transitions from CREDOS to ONKOSTAR as part of broader data-harmonization programs. (Ziegler et al., 2025).

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3. ODS-TumorBoard



Description

ODS-TumorBoard is a web-based application from Asthenis GmbH (Munich) for organizing and conducting tumor boards. It standardizes registration, preparation, discussion, and documentation, with guideline-conform workflows and on-premises deployment (Asthenis, n.d.-a).

Asthenis develops oncology documentation systems and has operated in this domain for decades (Asthenis, n.d.-e).

Core Functionalities / Analytical Capabilities

- **Two modules:** Separate case Registration and Board Execution components; supports on-site, VC, or hybrid meetings (Asthenis, n.d.-a; Asthenis, n.d.-b). (Asthenis, n.d.-a, n.d.-b).
- **Multi-tenant:** One installation can serve multiple clinics and distinct boards/configurations (Asthenis, n.d.-a).
- **Documents & imaging:** Attach Word/PDF/images/DICOM; generate customizable protocols (PDF/Word) (Asthenis, n.d.-a; Asthenis, n.d.-b).
- **Fast-Track triage:** “Traffic-light” priority for urgent cases (Asthenis, n.d.-a).
- **Integrated analyses:** Built-in evaluations (e.g., department participation frequency) (Asthenis, n.d.-a).
- **Molecular module:** ODS-MolekularesBoard to conduct, document, and follow up molecular boards with statistics/registry-style views (Asthenis, n.d.-c).
- **Optional CDSS:** EasyOncology® integration-transmits core data (diagnosis, age, morphology, TNM/stage) and returns guideline-conform suggestions; EasyOncology has published validation in prostate cancer decision support (Asthenis, n.d.-a; Ural et al., 2023).
- **Unknowns:** Independent, peer-reviewed outcome studies specific to ODS-TumorBoard-**Not disclosed**.

Interoperability & Integration

- **KIS/HIS connectivity:** Interfaces include HL7, REST, SOAP, CSV; direct-call options; FHIR listed in product materials (Asthenis, n.d.-a; Asthenis, n.d.-b).
- **Registry ecosystem:** Native database-level linkage with **ODSeasyNet** avoids double documentation; ODSeasyNet lists verified OncoBox connections (breast/colon/prostate, lung in progress) (Asthenis, n.d.-a; Asthenis, n.d.-d).
- **Cross-clinic referrals:** Electronic registration between ODS-TumorBoard sites without storing patient data on the public internet (Asthenis, n.d.-a).

- **VC options:** Works with any VC platform; optional EU-conform P2P VC with screen sharing, deployable inside the clinic (Asthenis, n.d.-a).

Security & Compliance (Data Governance and Access Control)

- **Hosting model:** On-premises; data and contents reside on clinic servers; **no cloud / no external access** (Asthenis, n.d.-a).
- **Transport security:** HTTPS with **AES** encryption when used outside clinic/MVZ networks (Asthenis, n.d.-b).
- **Privacy by design:** Separate registration vs execution modules; dedicated external referrer portal remains physically separated from the clinic network (Asthenis, n.d.-a; Asthenis, n.d.-b).
- **Unknowns:** Formal GDPR conformity statements, third-party security certifications, and full audit-log specifications-**Not disclosed**.

Applications in Tumor Board Workflow (Adoption and Impact / Implementation and Usage)

- **Adoption footprint (suite level):** Asthenis “serves almost **300** leading oncology clinics” across the D-A-CH region; ODS-TumorBoard is part of the ODS portfolio (BID Equity, 2023). (Vendor/owner claim.)
- **Corporate change:** Asthenis acquired by EvidentIQ in 2023 to expand oncology/RWE capabilities (EvidentIQ, 2023).
- **Context:** ODSeasyNet/OncoBox integrations support DKG/OnkoZert certification workflows at centers; ODS-TumorBoard complements these processes (Asthenis, n.d.-d).

References

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4. ULTIMA Tumor Board Management System



Description

ULTIMA is an in-house web application from the Comprehensive Cancer Center Ulm (CCCU) for coordinating multidisciplinary tumor boards. It is implemented as a SAP Web Dynpro application on the SAP IS-H platform and embedded in the clinical SAP workstation so clinicians use one interface for EHR and tumor-board tasks (CCCU, n.d.-a; CCCU, n.d.-b). (CCCU, n.d.-a; n.d.-b). It supports the end-to-end MTB workflow: case registration, scheduling, and live documentation of board decisions that form the formal basis for therapy planning (CCCU, n.d.-a).

Core Functionalities / Analytical Capabilities

- **SAP-native workflow:** Reads patient/master data from SAP and writes board outputs back to the SAP database; one SAP UI for users (CCCU, n.d.-a).
- **Case management:** Registration from the SAP “Clinical Workplace,” automatic case identifiers/status tracking, presenter/attendee access via SAP accounts (CCCU, n.d.-a).
- **Meeting documentation:** Records interdisciplinary discussion and consensus (e.g., recommendations, staging) as part of the permanent record (CCCU, n.d.-a).
- **User interface:** Standard SAP Web Dynpro forms/lists accessed via SAP; advanced imaging or genomics visualization occurs in linked systems (CCCU, n.d.-a).
- **Analytical use:** Data recorded through ULTIMA can be queried in SAP for audits/quality reporting; broader CCCU ecosystem analyses link ULTIMA with UTMS and CREDOS via SAP BW (context) (Vögel, 2012). (Context only).
- **AI/CDSS:** No built-in AI or automated decision support described by CCCU; the system is a coordination/documentation tool (CCCU, n.d.-a). **Not disclosed** beyond this.

Interoperability & Integration

- **HIS/EHR embedding:** Full embedding in SAP IS-H; “Einbettung in SAP” provides a single clinical interface (CCCU, n.d.-a).
- **Linked oncology systems:** Cross-references to CCCU’s **CREDOS** (tumor registry) and **UTMS** (study monitor) to align board cases with registry entries and trial activity (CCCU, n.d.-a; n.d.-b).
- **Simplified interfaces / data flow:** CCCU emphasizes simplified interfaces for data exchange and reporting; patient data are read from/write to SAP as system of record (CCCU, n.d.-a).

Security & Compliance (Data Governance and Access Control)

- **Security model:** Inherits SAP authentication/authorization; data remain in the hospital’s SAP environment (CCCU, n.d.-a).
- **Record integrity:** Board decisions are stored as part of the permanent record within SAP; access limited to authorized SAP users (CCCU, n.d.-a).
- **Unknowns:** Formal GDPR statement, third-party security certifications, and encryption specifics (e.g., at-rest/in-transit) - **Not disclosed**.

Applications in Tumor Board Workflow (Adoption and Impact / Implementation and Usage)

- **Operational use:** Clinicians register cases via SAP “Clinical Workplace”; moderators document decisions live; protocols can be archived in SAP (CCCU, n.d.-a; CCCU, n.d.-c).
- **Deployment model:** Developed and maintained by CCCU; provided to cooperating sites within their SAP/IS-H environments

(CCCU, n.d.-b). (Numbers of installations) - **Not disclosed**.

- **Ecosystem context:** CCCU openly lists its internal oncology IT suite (CREDOS, ULTIMA, UTMS, PaQ), signaling coordinated development and multi-site cooperation (CCCU, n.d.-b).

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5. Molecular Tumor Board Portal (MTBP)

Description

The Molecular Tumor Board Portal (MTBP) is a CCE-developed CDSS that automates interpretation and reporting of NGS results and standardizes case preparation and MTB discussions across centers (Tamborero et al., 2022). A related line of work, MTB-cBioPortal, extends the open-source cBioPortal to support MTB documentation and therapy-recommendation workflows (Renner et al., 2023). A public, lightweight MTBP instance exists for research/education, focusing on functional/predictive annotation (no actionability flags) (Tamborero et al., 2022; MTBP site).

Core Functionalities / Analytical Capabilities

- **Allele-centric variant interpretation** with interactive, HTML reports for MTB review (Tamborero et al., 2022).
- **Actionability mapping** aligning variants to biomarkers/drugs and trials; ESCAT-tiered evidence support (Tamborero et al., 2022; Mateo et al., 2018).
- **Turnaround optimization**-digital pipeline designed to shorten time from data intake to MTB report (Tamborero et al., 2022).
- **Scalable, cross-center use**-shared framework across CCE for consistent recommendations (Tamborero et al., 2022).
- **MTB-cBioPortal enhancements**-embedded tab for documenting recommendations; OncoKB lookup integration (Renner et al., 2023).

Interoperability & Integration

- **Multi-source intake** of clinical, pathology, and molecular results; trial-eligibility retrieval from curated in-house databases (Tamborero et al., 2022).
- **Standards-based data flow (MTB-cBioPortal)**-published deployments describe FHIR/HAPI components and RESTful modules to exchange and annotate MTB data (Renner et al., 2023; Reimer/Unberath fig. w/ FHIR & HAPI); cbpManager supports preparing cBioPortal-ready clinical/genomic files for local instances (Ustjanzew et al., 2021; IMI-FAU 2025).
- **Cross-site collaboration**-weekly virtual MTBs with shared portal access across CCE centers (Tamborero et al., 2022).

Security & Compliance (Data Governance and Access Control)

- **Secure access**-reports are delivered via a secure online platform to authorized clinical investigators (Tamborero et al., 2022).
- **Role-based access control (MTB-cBioPortal)** and local authentication/authorization integration reported across partner sites; SAML-style IdP patterns are described in public architecture material (Renner et al., 2023; Reimer/Unberath fig.).
- **Local hosting options**-cBioPortal-based workflows can run in local hospital environments to meet data-privacy constraints (Ustjanzew et al., 2021). **Regulatory certifications (e.g., CE/HIPAA): Not disclosed.**

Applications in Tumor Board Workflow (Adoption and Impact / Implementation and Usage)

CCE cohort implementation-500 advanced solid-tumor cases (2019-2021) processed; portal used to structure MTB discussions and reporting (Tamborero et al., 2022).

Trial matching-36% of evaluated patients were recommended for Basket-of-Baskets (BoB) trial arms at discussion time (Tamborero et al., 2022).

Virtual MTB enablement-literature supports virtual MTBs for informed decision-making and cross-site collaboration (Angel et al., 2024).

References

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1. Medicalholodeck

Overview

- **Title/Name:** Medicalholodeck (Medical Imaging XR with TeamXR)
- **Country:** Switzerland; global user base.
- **Development Stage:** Commercial (education focus). **Clinical PRO** edition **not yet cleared**; FDA/CE processes ongoing (Medicalholodeck, 2025).
- **Timeframe:** Active since ~2016; deployments/pilots 2022-2025 (Medicalholodeck, 2025).
- **Target Use Case:** Imaging-centric XR collaboration for surgical planning and MTB case review; also education and training (Medicalholodeck, 2025).

Description

Medicalholodeck is an XR workspace that imports DICOM studies (CT, MRI, CBCT) and common 3D model formats to create interactive 3D “digital twins.” Teams meet in shared VR rooms (TeamXR) to manipulate anatomy, annotate, and discuss cases in real time. Sessions can be recorded and replayed (Medicalholodeck, 2022; Medicalholodeck, 2025).

Key Features, Technology & Functional Approach

- **3D imaging / digital twins:** One-click import of 2D/3D/4D DICOM and OBJ/STL; volumetric visualization and measurements (Medicalholodeck, 2025).
- **Team collaboration (TeamXR):** Multi-user VR rooms with avatars and voice chat; cross-site participation (Medicalholodeck, 2022).
- **Recording:** RecordXR / RecordXR Studio for session capture and sharing (Medicalholodeck, 2025).
- **AI segmentation:** Cloud or on-device segmentation workflows per the Medicalholodeck manual; AI is used for image processing, not diagnosis (Medicalholodeck, 2025).
- **XR modalities:** Primary interface is VR (standalone Meta Quest or PC-VR). AR viewing available on iOS devices; supported devices listed on the site (Medicalholodeck, 2025).
- **Rendering/compute:** PC-VR with certified workstations or cloud remote rendering for mobile HMDs (Medicalholodeck, 2023; Medicalholodeck, 2025).

Supported Tumor Types

- **Tumor-agnostic:** Any case with DICOM imaging; used in general oncology boards and surgical planning (Medicalholodeck, 2025).

Applications in Tumor Board Workflow

- **Before the meeting:** Export DICOM from PACS; optional AI segmentation to prepare 3D views; stage cases for joint review (Medicalholodeck, 2025).
- **During the meeting:** TeamXR enables multi-user exploration, pointing, slicing, and annotation; suitable for distributed boards (Medicalholodeck, 2022).
- **After the meeting:** Recordings or screenshots can be shared for education and follow-up; formal EHR documentation occurs outside the platform (Medicalholodeck, 2025).

Interoperability & Integration

- **Data input:** DICOM import; OBJ/STL support. Upload and management via the Medicalholodeck Link web portal (Medicalholodeck, 2025).
- **Standards/APIs:** HL7/FHIR/EHR integration - **Not disclosed** on public pages.
- **Deployment:** Cloud remote rendering and local PC-VR options; network and bandwidth requirements documented (Medicalholodeck, 2025).

Security & Compliance

- **Regulatory status:** Current apps are for educational use. Medical Imaging XR PRO is in FDA/CE processes (no clearance yet) (Medicalholodeck, 2025).
- **Privacy:** Privacy Policy (updated May 2024) outlines technical and organizational measures; specific encryption standards **Not disclosed** (Medicalholodeck, 2024).
- **Data residency:** Cloud vs. local setups available; exact residency controls **Not disclosed** (Medicalholodeck, 2023; Medicalholodeck, 2025).

Implementation Setup

- **Hardware:** Meta Quest (standalone) with Remote Rendering, or PC-VR with certified GPU workstations (Medicalholodeck, 2023; 2025).
- **Connectivity:** Remote rendering requires modern Wi-Fi and sufficient bandwidth; technical specifications are provided (Medicalholodeck, 2025).
- **Training:** Tutorials/manuals, vendor support, and demos available (Medicalholodeck, 2025).

Advantages & Evaluation Outcomes

- **Visualization and consensus:** Improved 3D spatial understanding and collaborative review reported in vendor case materials; Greek virtual oncologic boards demonstrate cross-site review (Medicalholodeck, 2023; 2025).
- **Efficiency:** Remote rendering reduces the need for high-spec local PCs and simplifies access (Medicalholodeck, 2023; 2025).

- **Quantitative clinical outcomes: Not disclosed.**

Challenges & Limitations

- **Workflow integration:** Manual DICOM export/import; no public documentation of EHR/LIS/PACS auto-ingest (Medicalholodeck, 2025).
- **User adoption and logistics:** HMD availability, training, XR comfort; bandwidth sensitivity for remote rendering (Medicalholodeck, 2025).
- **Regulatory:** Clinical use awaits FDA/CE clearance (Medicalholodeck, 2025).

Stakeholder Engagement

- **Users:** Surgeons, radiologists, educators, residents; multi-site tumor boards piloted (Medicalholodeck, 2023; 2025).
- **Co-design:** Manuals, Academy content, and iterative releases reflect clinician feedback (Medicalholodeck, 2025).

Future Directions

- **Regulatory:** Release of Medical Imaging XR PRO after FDA/CE (timeline **Not disclosed**) (Medicalholodeck, 2025).
- **Deeper integration:** Potential for tighter PACS/EHR connectivity; no public specifications - **Not disclosed**.
- **Platform growth:** Continued remote rendering, device support, and XR collaboration features (Medicalholodeck, 2025).

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8. Medicalholodeck AG. (n.d.). Breaking distance barriers - Virtual multidisciplinary oncologic boards (Greece).

2. Tumour Evolution in XR (XRTEP) - a proof-of-concept

Overview

- **Title / Name:** Tumor Evolution in Extended Reality (XR) - Proof of Concept
- **Country / Organization:** University of Auckland, New Zealand (with Australian collaborators) (Robb et al., 2024).
- **Development Stage:** Research prototype / proof of concept (Robb et al., 2024).
- **Timeframe:** Project initiation ~2019; public showcase 2021; perspective published 2024 (Robb et al., 2024; University of Auckland, 2021).
- **Target Use Case:** MTB (including molecular tumor boards), clinician-patient consultation, and oncology education (Robb et al., 2024).

Description

A multi-user MR system (Microsoft HoloLens 2) that integrates a single patient's imaging, genomics, and treatment timeline into a shared, interactive 3D environment. Participants jointly inspect an anatomically anchored model of the body and tumors, step through time, and link lesions to genomic features and a phylogenetic tree to discuss evolution and heterogeneity (Robb et al., 2024).

Key Features, Technology & Functional Approach

- **Collaborative MR:** Up to ~10 concurrent HoloLens 2 users share a synchronized view for discussion (Robb et al., 2024).
- **Integrated 3D model:** CT-derived body with metastatic tumors mapped in situ; timeline slider to visualize response to therapy; lesions linked to molecular data (Robb et al., 2024).
- **Phylogenetic view:** Interactive tree shows clonal relationships; selection highlights corresponding tumors in 3D (Robb et al., 2024).
- **Companion display/app:** Tablet-based genomic details mirrored to a large screen for group viewing (Robb et al., 2024).
- **AI/automation:** No AI decision support in this prototype; data were prepared via research pipelines (Robb et al., 2024).
- **Modularity:** Concept is extensible; current build is case-specific and requires preprocessing (Robb et al., 2024).
- **Physical installation:** foldable, fabric-skinned arena ~3 m high and 8.5 m diameter; three concentric data layers around the central 3D body/tumor model.

Supported Tumor Types

- **Tumor-agnostic concept.**
- **Demonstration case:** Primary lung neuroendocrine tumor with widespread metastases (90 lesions; 42 sampled genomically) to stress-test heterogeneity and volume (Robb et al., 2024).

Applications in Tumor Board Workflow

- **Before the meeting:** Aggregate imaging, genomic reports, and treatment events; preprocess to create the interactive case model (Robb et al., 2024).
- **During the meeting:** Co-located MR session for shared 3D review; filter by mutation/clone; align imaging and genomics to support consensus (Robb et al., 2024).
- **After the meeting:** Recording/structured export not implemented in the prototype; documentation remains outside the system (**Not disclosed**) (Robb et al., 2024).

Interoperability & Integration

- **Connected systems:** Stand-alone prototype; data were manually compiled from PACS and research outputs; no live hospital integrations (Robb et al., 2024).
- **Standards/APIs:** DICOM used for imaging segmentation; HL7/FHIR and other clinical interfaces **Not disclosed** (Robb et al., 2024).
- **Deployment model:** Local demonstration environment; remote participation envisioned (Robb et al., 2024).

Security & Compliance

Regulatory status: Research prototype; not a medical device (Robb et al., 2024).

Data protection: Conducted with consented, research-use data; specific security controls **Not disclosed** (Robb et al., 2024).

Ethical context: Authors emphasize culturally appropriate governance (e.g., Indigenous data considerations) for future use (Robb et al., 2024).

Implementation Setup

- **Led by:** University of Auckland (cross-disciplinary clinical/design/data team) (Robb et al., 2024; University of Auckland, 2021).
- **Deployment:** Public/scientific demonstrations (e.g., Ars Electronica “Garden Aotearoa,” 2021); expert workshops; no routine hospital installation reported (University of Auckland, 2021; Robb et al., 2024).
- **Hardware/software:** HoloLens 2 headsets; custom MR application; detailed infrastructure **Not disclosed** (Robb et al., 2024).
- **Training:** Brief onboarding was sufficient for expert participants during demonstrations (Robb et al., 2024).

Advantages & Evaluation Outcomes

- **Communication and shared understanding:** Spatially grounded, integrated view improved transdisciplinary discussion and comprehension of heterogeneity and response (Robb et al., 2024).
- **Patient/family engagement:** Visualization aided non-experts’ understanding in outreach contexts (Robb et al., 2024).
- XRTEP received a Best Design Awards (DINZ) Value of Design recognition in 2022 (Bronze Pin-university profile)
- **Quantitative clinical outcomes: Not disclosed** (no controlled evaluation reported).

Challenges & Limitations

- Case-specific build; heavy preprocessing; lack of live data feeds (Robb et al., 2024).
- Workflow fit and documentation export not yet addressed (Robb et al., 2024).
- MR hardware constraints (field of view, comfort); cost/access considerations (**Not disclosed** quantitatively) (Robb et al., 2024).

Stakeholder Engagement

- Co-design across oncology, genomics, design, and computing; expert workshops and public engagement informed design and use cases (Robb et al., 2024; University of Auckland, 2021).

Future Directions

- Add capture/export (meeting notes, recording), specialty-specific views, and support for additional data types (e.g., pathology) (Robb et al., 2024).
- Explore AI-assisted analytics and decision support within the MR environment (Robb et al., 2024).
- Clinical pilots and potential productization beyond the single-case prototype (Robb et al., 2024).

References

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3. Virtual Reality Multidisciplinary Team meeting software (VRMDT)



Overview

- **Title / Study:** Virtual Reality Multidisciplinary Team meeting software (VRMDT), evaluated in “Understanding the Views of Health Care Professionals on the Usability and Utility of Virtual Reality Multidisciplinary Team Meetings: Usability and Utility Study” (Almashmoum et al., 2025).
- **Country:** United Kingdom (UoM) with collaboration from Kuwait’s Cancer Control Center (KCCC) (Almashmoum et al., 2025).
- **Development Stage:** Prototype; first-stage feasibility/usability evaluation (Almashmoum et al., 2025).
- **Timeframe:** Development and user testing Feb-Mar 2024; publication 2025 (Almashmoum et al., 2025).
- **Target Use Case:** Virtual MDT/MTB meetings for cancer case review and treatment planning (Almashmoum et al., 2025).
- **Company:** Sentira XR (UoM spin-out associated with the VRMDT work) (Sentira XR, n.d.).

Description

VRMDT is a multiuser, immersive VR meeting room where clinicians join as avatars, review 2D/3D medical images, and collaborate on treatment planning remotely. It aims to preserve the dynamics of an in-person tumor board while enabling remote participation (Almashmoum et al., 2025).

Clinical need addressed. Conventional face-to-face MDTs are logistically demanding; standard video calls lack presence and native 3D visualization. VRMDT targets these gaps with shared spatial presence and interactive 3D imaging to support knowledge exchange (Almashmoum et al., 2025).

Key Features, Technology & Functional Approach

- **Core capabilities:** Multiuser VR room (up to ~10 participants) with a central interactive 3D DICOM object (rotate/zoom), personal 2D image panes, shared whiteboard, per-seat laser pointers, and a host control panel for case selection/hand-over (Almashmoum et al., 2025).
- **XR modality:** Fully immersive VR for HMDs (Meta Quest 3 used in the study); avatar presence, voice chat, spatial interaction; no AR/MR components (Almashmoum et al., 2025).
- **AI & automation:** Embedded AI assistant avatar (NLP, speech I/O) answers questions from pre-loaded case information; voice delivered via a synthesis service; pre-evaluation QA reported ~95% answer accuracy in simulation (Almashmoum et al., 2025).
- **Technology stack & data handling:** Unity-based build; multiuser networking over broadband (stable connection required for synchronized voice/views); DICOM import for radiology imaging. Sample cases were sourced from The Cancer Imaging Archive for the study (Almashmoum et al., 2025).

Supported Tumor types

- Tumor-agnostic; demonstrated with public imaging archive cases; not limited to specific cancer subtypes (Almashmoum et al., 2025).

Applications in Tumor Board Workflow

- **Before (Preparation & case setup):** Host pre-loads DICOMs and key case details; short in-VR tutorial supports rapid onboarding; remote access reduces room/travel coordination (Almashmoum et al., 2025).
- **During (Discussion & decision-making):** Avatars convene around a virtual table; shared 3D/2D imaging, laser highlighting, and whiteboard notes/diagrams; AI avatar available for quick look-ups (e.g., prior treatment) (Almashmoum et al., 2025).
- **After (Post-meeting output):** **Not disclosed** in the prototype (Almashmoum et al., 2025).

Interoperability & Integration

- **Connected systems:** Standalone prototype; no live EHR/PACS integration (Almashmoum et al., 2025).
- **Data standards:** DICOM for imaging (Almashmoum et al., 2025).
- **Data entry & retrieval:** Manual pre-load of DICOMs and key case facts; meeting outputs would require manual capture in this version (Almashmoum et al., 2025).

Security & Compliance

- **Regulatory compliance:** Not addressed (public/fictitious data used for evaluation) (Almashmoum et al., 2025).
- **User access control:** **Not disclosed** (Almashmoum et al., 2025).
- **Data protection & privacy:** **Not disclosed** (Almashmoum et al., 2025).

Implementation Setup

- **Leadership & team:** UoM (Division of Informatics, Imaging & Data Sciences) with VREvo / Sentira XR; clinician collaborator from KCCC (Almashmoum et al., 2025).
- **Evaluation setting & sample:** Controlled lab at UoM; N = 12 (4 health informatics, 3 nurses, 2 medical doctors, 1 radiologist, 2 biostatisticians); not a live hospital MTB (Almashmoum et al., 2025).
- **Duration & instruments:** 10-15-min sessions; testing Feb-Mar 2024; SUS and heuristic questionnaire completed online post-session (Almashmoum et al., 2025).
- **Hardware/software:** Meta Quest 3 HMDs with controllers (Almashmoum et al., 2025).
- **Training & onboarding:** Brief researcher intro plus guided in-VR tutorial; minimal external training needed (Almashmoum et al., 2025).
- **Cloud vs on-premise:** **Not disclosed** (Almashmoum et al., 2025).

Advantages & Evaluation Outcomes

- **Usability:** Mean SUS 72.7/100; heuristic evaluation mean severity $\approx 0.6/4$; low perceived inconsistency ($\approx 1.5/5$; item where lower is better) (Almashmoum et al., 2025).
- **User experience:** Positive qualitative feedback on immersion and usefulness of 3D+2D views, whiteboard, and the AI assistant (Almashmoum et al., 2025).
- **Collaboration/efficiency:** Signals of improved interaction dynamics; no objective time- or outcome-based metrics collected (Almashmoum et al., 2025).
- **Side effects:** No significant cybersickness reported during short sessions (Almashmoum et al., 2025).

Challenges & Limitations

Sample & representativeness: Small, mixed sample (N = 12) with several non-routine MTB participants (Almashmoum et al., 2025).

Network dependence: Poor Wi-Fi caused multiuser lag and delayed AI responses (Almashmoum et al., 2025).

AI knowledge limits: Effective on basic facts but struggled with detailed clinical queries (Almashmoum et al., 2025).

Lack of system integration: No EHR/PACS connection; manual data handling and outcome capture (Almashmoum et al., 2025).

Adoption & training: Broader adoption/governance/change-management aspects not assessed at this stage (Almashmoum et al., 2025).

Stakeholder Engagement

- **Participants & roles:** Health informatics researchers, software developers (UoM), and an oncology clinician collaborator (KCCC) (Almashmoum et al., 2025).
- **User feedback & co-design:** SUS/heuristics plus qualitative comments inform iterative refinement (Almashmoum et al., 2025).
- **Change management:** Not applicable yet (Almashmoum et al., 2025).

Future Directions

- **Security & access:** Secure rooms aligned with hospital policies; explore direct connection to clinical systems (Almashmoum et al., 2025).
- **Data integration / digital library:** In-VR repository of imaging, reports, labs (Almashmoum et al., 2025).
- **Cross-platform support:** Expand beyond VR HMDs (other HMDs; potential PC/tablet modes) (Almashmoum et al., 2025).
- **Larger, real-world trials:** Involve more MDT professionals in clinical settings; capture efficacy metrics (Almashmoum et al., 2025).
- **Training/education:** Possible use for teaching imaging interpretation and MDT participation (Almashmoum et al., 2025).
- **Expansion to other domains: Not disclosed.**

References

1. Almashmoum, M., et al. (2025). Understanding the views of health care professionals on the usability and utility of virtual reality multidisciplinary team meetings: Usability and Utility Study. *JMIR XR and Spatial Computing*, 2.
2. *Sentira XR*. (n.d.). Company website.

4. Trans-Atlantic Virtual Reality Tumor Boards (TVASurg)



Overview

- **Title / Name:** Trans-Atlantic Virtual Reality Tumor Boards (TVASurg).
- **Country / Sites:** Toronto (Canada) ↔ Dublin (Ireland) demonstration of cross-continental VR tumor boards; related head-and-neck mixed-reality work reported from University Hospital Düsseldorf, Germany (TVASurg, n.d.; Karnatz et al., 2024).
- **Development Stage:** Prototype / proof-of-concept demonstrations (TVASurg, n.d.; Karnatz et al., 2024).
- **Timeframe:** TVASurg demo timeframe not disclosed; MR head-and-neck study conducted May 2022-Apr 2023, published 2024 (Karnatz et al., 2024).
- **Target Use Case:** Multidisciplinary tumor boards for remote case review, imaging-driven discussion, and treatment planning; head-and-neck tumor board (HNTB) as a pilot use case in the MR study (TVASurg, n.d.; Karnatz et al., 2024).

Description

TVASurg demonstrates real-time, immersive case discussions between geographically distant teams using a shared VR space and patient-specific 3D models to plan interventions and improve access to expertise (TVASurg, n.d.). The program's evidence base includes a head-and-neck mixed-reality prototype that fused CT/MRI, displayed 3D anatomy/tumor models, and supported multiuser collaboration and remote participation (Karnatz et al., 2024).

Key Features, Technology & Functional Approach

- **Core capabilities:** Multiuser immersive meeting space; synchronized views; voice chat; pointer/highlight tools; interactive 3D model manipulation; panels for clinical context (TVASurg, n.d.; Karnatz et al., 2024).
- **3D imaging & modeling:** Patient-specific models reconstructed from CT/MRI; segmentation and registration workflows; STL support for 3D reconstructions; DICOM for imaging (Karnatz et al., 2024).
- **Segmentation / assistance:** Atlas-based and assisted segmentation; rapid tumor segmentation with SmartBrush; no AI decision support in the prototype (Karnatz et al., 2024).
- **XR / hardware:** VR HMDs used in TVASurg demonstrations (specific model not disclosed); MR HMD (Magic Leap 1) used in the head-and-neck prototype (TVASurg, n.d.; Karnatz et al., 2024).
- **System setup & data loading:** Case data prepared on a workstation; QR-code mechanism to load prepared datasets to headsets; Unity-based rendering; local networking for multiuser synchronization (Karnatz et al., 2024).

Supported Tumor Types

- **Scope:** Functionally tumor-agnostic (3D imaging + collaboration); pilot implementation and evaluation focused on head-and-neck cancers (Karnatz et al., 2024).

Applications in Tumor Board Workflow

- **Before the meeting (Preparation):** Aggregate CT/MRI and clinical information; perform fusion/segmentation and generate 3D reconstructions; package data for VR/MR session; load via QR to devices. Preparation for the MR pilot averaged ~47 min vs ~13 min for the conventional method (Karnatz et al., 2024).
- **During the meeting (Discussion & planning):** Team members review shared 3D anatomy/tumor models and 2D panels; walk-around/spatial perspective taking; real-time highlighting; remote experts join with synchronized views and audio (TVASurg, n.d.; Karnatz et al., 2024).
- **After the meeting (Post-discussion):** Documentation/export modules were not available in the prototype; decisions recorded outside the system (Karnatz et al., 2024).

Interoperability & Integration

- **Connected systems:** Stand-alone prototypes; no live HIS/EHR/PACS interfaces; case packages prepared manually; static per-case datasets (Karnatz et al., 2024).
- **Standards / formats:** DICOM for imaging; STL for 3D models; no HL7 or FHIR interfaces reported (Karnatz et al., 2024).
- **Deployment:** On-premises/local network processing and sharing; no cloud component reported for patient data (Karnatz et al., 2024).

Security & Compliance

- **Data privacy & governance:** Anonymized retrospective cases in the MR study; activities aligned with institutional data-protection oversight (Karnatz et al., 2024).
- **Access control / encryption: Not disclosed** for the prototypes (TVASurg, n.d.; Karnatz et al., 2024).

- **Regulatory status:** Research prototypes; not certified medical devices (Karnatz et al., 2024).

Implementation Setup

- **Leadership & partners:** TVASurg program team (Toronto Video Atlas of Surgery); MR head-and-neck pilot at University Hospital Düsseldorf with engineering support (Karnatz et al., 2024; TVASurg, n.d.).
- **Participants & sessions:** TVASurg demo participation not disclosed. MR pilot: N=15 clinicians across three simulated meetings, four retrospective cases; ~10-minute onboarding per session (Karnatz et al., 2024).
- **Hardware / software:** VR HMDs (model not disclosed) for TVASurg; Magic Leap 1 and workstation running segmentation/planning software in MR pilot; Unity-based application (TVASurg, n.d.; Karnatz et al., 2024).

Advantages & Evaluation Outcomes

- **Visualization & shared understanding:** Improved grasp of tumor location/extent and relation to critical structures; all relevant information in one view (Karnatz et al., 2024).
- **Engagement & collaboration:** Interactive, interdisciplinary discussion with remote participation; feasibility perceived as high among participants (Karnatz et al., 2024).
- **Efficiency signals:** Meeting content centralized; however, preparation time increased in the MR pilot (~47 min vs ~13 min conventional) (Karnatz et al., 2024).
- **Quantitative satisfaction/outcomes:** No formal patient-level endpoints; qualitative feedback positive; the paper notes prior work suggesting digital tumor board tools may reduce prep/execution time (as cited within Karnatz et al., 2024).

Challenges & Limitations

- Labor-intensive preparation due to manual fusion/segmentation and packaging (Karnatz et al., 2024).
- No in-system documentation/export; decisions transcribed to clinical systems post-hoc (Karnatz et al., 2024).
- Learning curve and multiuser coordination needs; headset field-of-view/lighting constraints (Karnatz et al., 2024).
- Device availability/cost and network robustness; scale considerations (participant/device counts) (Karnatz et al., 2024).

Stakeholder Engagement

- Co-design with multidisciplinary clinicians and engineers; structured feedback during development; presence of clinical champions to support adoption (Karnatz et al., 2024).

Future Directions

- Interfaces to clinical systems (e.g., HL7 FHIR, DICOMweb) for automated data pull/push and closing the documentation loop; greater workflow automation (e.g., segmentation); in-app decision capture; newer HMDs and robust networks; broader specialty adoption; prospective pilots with quantitative metrics (Karnatz et al., 2024).

References

1. TVASurg. (n.d.). *Trans-Atlantic Virtual Reality Tumor Boards*.
2. Karnatz, N., Schwerter, M., Liu, S., Parviz, A., Wilkat, M., & Rana, M. (2024). *Mixed Reality as a Digital Visualisation Solution for the Head and Neck Tumour Board: Application Creation and Implementation Study*. *Cancers*, 16(7), 1392.

5. NeuroVis

Overview

- **Title / Name:** NeuroVis - interactive 3D mixed-reality visualization for brain tumor SRS planning.
- **Country:** United States (New York) with collaborators in Italy (Milan, Rome).
- **Development Stage:** Prototype / proof-of-concept (demonstrated on six patient case scenarios).
- **Timeframe:** Developed and evaluated circa 2021-2022; published June 2022.
- **Target Clinical Use Case:** Neuro-oncology MTB discussions supporting SRS case planning for intracranial tumors.

Description

NeuroVis is an XR application that renders patient-specific 3D neuroanatomy on a Microsoft HoloLens to support SRS case planning during MTB discussions. It targets the limitations of conventional 2D or simulated 3D review by placing all team members on a shared 3D visualization plane to improve communication and decision making (Chidambaram et al., 2022).

Key Features, Technology & Functional Approach

- **Multimodal imaging integration:** Converts pre-/post-operative MRI and CT into 3D models (tumors, resection cavities, OARs) (Chidambaram et al., 2022).
- **Interactive holographic visualization:** HoloLens displays manipulable 3D holograms (move, scale, rotate) for immersive exploration (Chidambaram et al., 2022).
- **Advanced viewing tools:** Toggle structure visibility; isolate lesions or planned target volumes; overlay 2D MRI/CT slices; clipping plane; transparency controls (Chidambaram et al., 2022).
- **Collaborative viewing:** Multiple participants share the same synchronized 3D scene to maintain a consistent context (Chidambaram et al., 2022).
- **XR platform & stack:** Mixed-reality HMD (Microsoft HoloLens); Unity3D with Microsoft Mixed Reality Toolkit.
- **Data pipeline:** DICOM MRI/CT → segmentation (Brainlab planning system; 3D Slicer) → import OBJ/STL meshes into the Unity-based NeuroVis app.
- **AI use:** None in current workflow; segmentation is manual/semi-automated. Machine-learning-based automation is noted as a future enhancement (Chidambaram et al., 2022).

Supported Tumor Types

- **Scope:** Intracranial tumors only. Demonstrations covered six common brain tumor scenarios (e.g., multiple brain metastases-including brainstem and resection cavities-vestibular schwannoma, intraventricular meningioma) (Chidambaram et al., 2022).

Applications in Tumor Board Workflow

- **Before the meeting (Preparation):** Anonymize imaging; create patient-specific 3D models; transfer imaging/models to NeuroVis (Chidambaram et al., 2022).
- **During the meeting (Discussion):** Explore 3D anatomy; evaluate lesion-OAR proximity and potential surgical corridors; all participants view the same holographic scene (Chidambaram et al., 2022).
- **After the meeting (Post-discussion): Not disclosed.**

Interoperability & Integration

Connected systems: No direct PACS/EHR integration; imaging is exported and processed outside clinical systems.

Standards & formats: Inputs via standard DICOM; 3D models imported as OBJ/STL; volume-rendered 2D slices can be shown within the hologram.

Data entry & retrieval: Manual export, conversion, and loading of case data prior to MTB sessions (Chidambaram et al., 2022).

Security & Compliance

Data privacy & security: Prototype use involved anonymization; production security controls not described.

Compliance & certifications: **Not disclosed;** not presented as a certified medical device.

User access & authentication: **Not disclosed.**

Implementation Setup

- **Leadership & collaborators:** Academic clinical team in New York with partners in Milan and Rome.
- **Participants & sites:** Demonstrated on six patient case scenarios; no formal user-study sample reported.
- **Hardware / software:** Microsoft HoloLens; Unity/MRTK; Brainlab planning system; 3D Slicer.
- **Deployment architecture:** **Not disclosed.**
- **Training & onboarding:** **Not disclosed** (Chidambaram et al., 2022).

Advantages & Evaluation Outcomes

- **Visualization:** Author-reported better impression of lesion size/shape and spatial relationships to OARs and surface anatomy.
- **Collaboration:** Shared 3D view supports clearer, faster team communication.
- **Efficiency & safety (author-reported):** Potential to streamline explanations of complex 3D anatomy and support safer planning; no quantitative gains reported (Chidambaram et al., 2022).

Challenges & Limitations

- **Preprocessing effort:** Accurate, multi-modality segmentation and model preparation required before meetings.
- **Hardware constraints:** HoloLens availability/cost; field of view and comfort limitations.
- **Workflow integration:** Added steps to export/process imaging and load holograms; need to assign personnel.
- **Evidence base:** Proof-of-concept only; qualitative demonstrations on a small set; no formal usability or clinical outcome metrics (Chidambaram et al., 2022).

Stakeholder Engagement

- Co-designed with neurosurgeons, radiation oncologists, and medical physicists; end-users provided feedback during case demonstrations to align features with MTB workflow (Chidambaram et al., 2022).

Future Directions

- **Formal efficacy studies:** Controlled evaluations with usability scales and quantitative workflow/outcome measures.
- **Remote collaboration:** Enable shared holographic sessions across locations.
- **AI integration:** Automated segmentation/registration to reduce prep time.
- **Operationalization:** UI refinements; procedures for IT compatibility before broader deployment (Chidambaram et al., 2022).

References

1. Chidambaram, S., Palumbo, M. C., Stifano, V., McKenna, J., Redaelli, A., Olivi, A., Apuzza, M., & Pannullo, S. (2022). The potential for using extended reality technology in interdisciplinary case discussions and case planning in stereotactic radiosurgery: Proof-of-concept usability study. *JMIR Neurotechnology*, 1(1), e36960.

6. IMHOTEP

Overview

- **Title / Name:** IMHOTEP - immersive VR system for surgical planning, TB discussion, and training in complex liver surgery (Kenngott et al., 2022).
- **Country / Site:** Germany; developed and evaluated at Heidelberg University Hospital with academic collaborators (Kenngott et al., 2022).
- **Development Stage:** Research project / proof-of-concept prototype; peer-reviewed Surgical Endoscopy article (published online Jan 21, 2021; in print 2022) (Kenngott et al., 2022).

- **Timeframe:** Study accepted/published 2021-2022 (Kenngott et al., 2022).
- **Target Clinical Use Case:** Pre-operative planning and TB discussion for hepatobiliary (liver) surgery; training across professions (Kenngott et al., 2022).
- **Commercial Status:** Not a commercial product (research prototype) (Kenngott et al., 2022).

Description

- **Purpose:** Provide an immersive HMD environment that co-displays patient-specific 3D anatomy, original imaging, and clinical data to support individualized surgical planning and TB/MDT review in liver surgery (Kenngott et al., 2022).

Key Features, Technology & Functional Approach

- **Visualization & Interaction:** 3D liver/anatomy models, original imaging, and clinical data shown together in VR; interaction via head movements and computer mouse in this study (Oculus Rift™) (Kenngott et al., 2022).
- **Data Pipeline:** 3D models of liver, vessels, and tumors created from imaging and presented within IMHOTEP's VR environment (author-reported in article) (Kenngott et al., 2022).
- **Segmentation:** Creation of exact 3D models currently requires substantial manual processing time; this is a limiting factor (Kenngott et al., 2022).
- **Platform Lineage (context):** IMHOTEP framework supports common HMDs (e.g., Oculus/HTC Vive); project documentation indicates VR framework availability (author-reported, framework documentation) (IMHOTEP documentation).

Supported Tumor Types

- **Scope:** Hepatobiliary focus; evaluated for complex hepatic resections (Kenngott et al., 2022).

Applications in Tumor Board Workflow

- **Before the meeting (Preparation):** Patient CT images and clinical information assembled and transformed into 3D models for case review (Kenngott et al., 2022).
- **During the meeting (Discussion):** IMHOTEP enables shared viewing of 3D anatomy, original sectional imaging, and clinical data to support team decisions; authors note applicability for virtual TB reviews (Kenngott et al., 2022).
- **After the meeting (Documentation):** No built-in documentation/export workflow reported in this study; outcomes would need to be recorded in existing systems (Kenngott et al., 2022).

Interoperability & Integration

- **Current State:** Clinical data and imaging are prepared externally and visualized in IMHOTEP; the paper does not report live EHR/PACS interfaces (Kenngott et al., 2022). **Not disclosed** beyond the study workflow.
- **Roadmap:** Authors highlight the potential for secure online multi-institution use (e.g., TBs), implying future integration considerations (Kenngott et al., 2022).

Security & Compliance

- **Data Use & Ethics:** Study used anonymized data; authors stress that cross-hospital online interaction for TBs must be kept secure and that ethics of online patient data/cloud use are complex (Kenngott et al., 2022).
- **Standards & Certification:** No regulatory certification reported; security/compliance frameworks not detailed. **Not disclosed** (Kenngott et al., 2022).

Implementation Setup

- **Participants / Sites:** 158 participants (57 medical students, 35 residents, 13 attending surgeons, 53 nurses) at Heidelberg University Hospital (Kenngott et al., 2022).
- **Hardware / Software:** Oculus Rift™ HMD used; interaction via head-tracking plus mouse (Kenngott et al., 2022).
 - **Workstation specs:** Intel® i7-4790S, 16 GB RAM, NVIDIA® GTX 980M (author-reported from source chapter; **not specified** in the cited article). **Author-reported.**
- **Onboarding:** Participants were given sufficient time to familiarize with the VR environment prior to evaluation (Kenngott et al., 2022).

Advantages & Evaluation Outcomes

- **User Acceptance (quantitative):** 89.9% found the system agreeable to work with (Kenngott et al., 2022).
- **Assessment Quality & Speed (quantitative):** 94.3% reported better assessment and 84.8% reported faster assessment of complex cases versus 2D methods (Kenngott et al., 2022).
- **Training Potential (quantitative):** Highest perceived potential in student (87.3%) and resident training (84.6%); 80.3% rated potential for clinical use (Kenngott et al., 2022).
- **Attending Surgeons (subgroup):** 100% agreed on improved quality; 76% on improved time for complex cases (Kenngott et al., 2022).

Challenges & Limitations

- **Segmentation Effort:** Exact 3D model creation requires considerable manual processing; main bottleneck for wide application (Kenngott et al., 2022).
- **Motion Sickness & Device Limits:** Motion sickness reported by 2.5% (n=4); device resolution/latency improvements expected to mitigate (Kenngott et al., 2022).
- **Study Design:** Internal recruitment and questionnaire design noted as potential limitations; no surgical endpoints were measured (Kenngott et al., 2022).

Stakeholder Engagement

- **Multi-professional Involvement:** Evaluation included students, nurses, residents, and attendings; broad acceptance across groups with role-specific nuances (Kenngott et al., 2022).

Future Directions

- **Planned Work:** Live clinical pilots, GUI/UX re-evaluation, and secure online deployment for multi-institution TBs/conferences; authors emphasize security and governance for any online data sharing (Kenngott et al., 2022).

References

1. Kenngott, H. G., et al. (2022). IMHOTEP: Cross-professional evaluation of a three-dimensional VR system for interactive surgical operation planning, TB discussion, and immersive training for complex liver surgery in an HMD. *Surgical Endoscopy*, 36, 126-134.
2. PubMed record for the same article
3. IMHOTEP Framework documentation (project-reported platform details):

7. MR-HNTB Study

Overview

- **Title/Name:** Mixed Reality as a Digital Visualization Solution for the Head and Neck Tumor Board (MR-HNTB) - research prototype (Karnatz et al., 2024).
- **Country/Organization:** Germany - University Hospital Düsseldorf (Karnatz et al., 2024).
- **Development Stage:** Research prototype/proof-of-concept; simulated evaluation; not a commercial product (Karnatz et al., 2024).
- **Timeframe:** May 2022-April 2023 development and testing; article published 2024 (Karnatz et al., 2024).
- **Target Use Case:** Multidisciplinary Head & Neck TB case presentation and discussion (Karnatz et al., 2024).

Description

- MR-HNTB aggregates radiology (CT/MRI), pathology images, and structured clinical data into a single, interactive MR workspace for HNTB meetings (Karnatz et al., 2024).
- The solution addresses fragmented, time-consuming preparation and 2D presentation by enabling shared 3D holographic review to support clearer, faster team communication and decision-making (Karnatz et al., 2024).

Key Features, Technology & Functional Approach

- **Immersive 3D visualization:** CT/MRI DICOM data are fused and rendered as holographic 3D anatomy/tumor models on an optical see-through HMD (Magic Leap 1). Spatial anchoring via SLAM keeps objects fixed in the meeting room (Karnatz et al., 2024).
- **Multimodal data integration:** Imaging, digitized pathology slides, and case summary PDFs are accessible in one MR scene, organized for standardized case presentation (Karnatz et al., 2024).
- **Interactive collaboration:** Multiple participants can explore, rotate, and scale models in real time during discussion; shared pointers/annotations support joint review (Karnatz et al., 2024).
- **Automation (no AI CDS):** Semi-automated segmentation pipelines accelerate creation of bony structures and tumors; no AI-driven decision support was included (Karnatz et al., 2024).
- **Software foundation (vendor-reported):** Built on Brainlab's Mixed Reality Viewer and Elements planning tools customized for TB use (Brainlab, n.d.; Karnatz et al., 2024).

Supported Tumor Types

Primary focus: Head & Neck cancers (e.g., oral cavity, oropharyngeal). The implementation and workflows are specific to HNTB (Karnatz et al., 2024).

Generalizability: Extension to other tumor boards is feasible but outside the evaluated scope (Karnatz et al., 2024).

Applications in Tumor Board Workflow

- **Before the meeting:** Export CT/MRI from PACS; fuse images; segment key structures; compile pathology images and structured clinical summary; package and transfer case to HMDs (Karnatz et al., 2024). Average prep time ≈ 47 minutes vs ≈ 13 minutes for conventional prep (Karnatz et al., 2024).
- **During the meeting:** Co-located users review the shared holographic model and associated panels; multi-user interaction improves spatial understanding but benefits from a navigator or protocol to avoid simultaneous, conflicting manipulations (Karnatz et al., 2024).
- **After the meeting:** No in-app notes/export; recommendations are documented in the hospital record outside the MR system (Karnatz et al., 2024).

Interoperability & Integration

- **Connected systems:** Stand-alone prototype; no live interfaces to HIS/EHR/PACS/LIS. Data are manually exported/imported (Karnatz et al., 2024).
- **Standards & formats:** Imaging in DICOM; 3D models in STL; documents as PDFs/images. No HL7/FHIR interfaces in the prototype (Karnatz et al., 2024).
- **Transfer & networking:** Local, on-premises deployment with QR-code-based case transfer and synchronized HMDs over hospital Wi-Fi/5G test network; part of the "Giga for Health - 5G Medical Campus" initiative (Karnatz et al., 2024; Giga for Health, n.d.).
- **Ease of data entry/retrieval:** Manual assembly is a bottleneck; once loaded, in-MR retrieval is streamlined (Karnatz et al., 2024).

Security & Compliance

- **Data protection:** Retrospective, fully anonymized cases; conducted under institutional ethics approval consistent with GDPR (Karnatz et al., 2024).

- **Regulatory status:** Research prototype; not CE-marked/approved as a medical device (Karnatz et al., 2024).
- **Security measures (prototype):** Closed hospital network; no described audit logs/role-based access in the MR app. Future clinical deployment would require encryption, authentication, and auditability (Karnatz et al., 2024).

Implementation Setup

- **Leadership & team:** Department of Oral & Maxillofacial Surgery, University Hospital Düsseldorf, in collaboration with Brainlab AG; state-funded innovation program context (Karnatz et al., 2024).
- **Deployment & users:** Single-site simulation; three MR sessions discussing four anonymized cases with ~15 usual TB participants (Karnatz et al., 2024).
- **Hardware/software:** Magic Leap 1 HMDs (multi-user); Brainlab Elements for preprocessing; Brainlab Mixed Reality Viewer on device; QR code for case import (Karnatz et al., 2024; Brainlab, n.d.).
- **Training:** ~10-minute onboarding was sufficient for basic use; users learned etiquette (e.g., turn-taking) during sessions (Karnatz et al., 2024).

Advantages & Evaluation Outcomes

- **Visualization & understanding:** Improved 3D comprehension of tumor extent and relations versus 2D review; integrated view reduced context-switching (Karnatz et al., 2024).
- **Team communication:** Shared spatial reference supported richer interdisciplinary discussion and alignment (Karnatz et al., 2024).
- **Feasibility & acceptance:** Users rated the approach as clinically feasible in principle; novelty supported engagement (Karnatz et al., 2024).

Challenges & Limitations

- **Preparation burden:** Manual data assembly/segmentation increased prep time (≈ 47 vs ≈ 13 minutes) (Karnatz et al., 2024).
- **Workflow gaps:** No integrated documentation/export; reliance on manual EHR entry (Karnatz et al., 2024).
- **Hardware/ergonomics:** Field-of-view and comfort constraints; cost of equipping all participants; stable high-bandwidth networking required (Karnatz et al., 2024).
- **Adoption curve:** Need for meeting protocols and user training to avoid interaction chaos; resistance possible among less tech-savvy users (Karnatz et al., 2024).
- **Integration & legal barriers:** No live HIS/PACS interfaces; would require MDR-compliant development and hospital IT governance for clinical use (Karnatz et al., 2024).

Stakeholder Engagement

- Co-design with surgeons, radiologists, oncologists, pathologists, and engineers; monthly feedback cycles; presence of clinical champions improved buy-in (Karnatz et al., 2024).

Future Directions

- **Workflow evidence:** Quantify effects on meeting duration, prep time, and consensus/decision quality (Karnatz et al., 2024).
- **Integration:** Build FHIR/DICOMweb-based import/export and documentation modules to close the loop (Karnatz et al., 2024).
- **Scale-up:** Larger pilots; broaden to other tumor boards; evaluate newer HMDs (e.g., Magic Leap 2/HoloLens 2) (Karnatz et al., 2024).
- **XR/AI enhancements:** Investigate automated segmentation and supportive analytics; enable secure remote MR TBs over enterprise/5G networks (Karnatz et al., 2024; Giga for Health, n.d.).

References

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8. Holoeyes Holographic Image-Guided Surgery and Telemedicine System



Overview

- **Title/Name:** Holoeyes Holographic Image-Guided Surgery and Telemedicine System.
- **Country/Organization:** Japan; developed and operated by **Holoeyes Inc.**
- **Development Stage: Commercial product** (approved medical device in Japan; certification No. 302ADBZX00011000) (vendor-reported) (Holoeyes Inc., n.d.-b).
- **Timeframe:** Clinical use and reports spanning ~2015-2023; active deployments reported by 2023 (Sugimoto & Sueyoshi, 2023).
- **Target Use Case:** Surgical planning, intraoperative navigation, training, and pre/post-operative conferencing; applicable to surgical oncology discussions though **not TB-specific by design** (Sugimoto & Sueyoshi, 2023).

Description

Holoeyes is a cloud platform that converts DICOM CT/MRI into interactive 3D polygon models for viewing in XR headsets (e.g., Meta Quest, HoloLens, Magic Leap). It enables 3D inspection, basic interaction (scale/rotate), and multiuser collaboration in shared virtual rooms to improve spatial understanding and team communication (Sugimoto & Sueyoshi, 2023; Holoeyes Inc.,

n.d.-a). A vendor-reported claim states an XR “application is generated **about 5 minutes after uploading,**” highlighting rapid preparation for case review (Holoeyes Inc., n.d.-a).

Key Features, Technology & Functional Approach

- **Imaging → 3D models:** DICOM-to-polygon conversion with case-specific visualization controls (transparency, color, structure on/off) (Sugimoto & Sueyoshi, 2023).
- **XR collaboration:** Multiuser, avatar-based shared scenes for synchronous review and discussion (Sugimoto & Sueyoshi, 2023).
- **Automation: AI-assisted segmentation** to accelerate model creation (vendor-reported) (Sugimoto & Sueyoshi, 2023).
- **Telepresence modules: “Holoeyes VS”** for remote conferencing/education and spatial session recording (vendor-reported) (Holoeyes Inc., 2024).
- **Platforms:** Supports VR/MR/AR HMDs (e.g., Quest, HoloLens, Magic Leap); cloud-hosted model generation and distribution (Holoeyes Inc., n.d.-a; Holoeyes Inc., n.d.-b).
- **CDSS/AI for decisions: Not included;** visualization-centric (Sugimoto & Sueyoshi, 2023).

Supported Tumor Types

- **Tumor-agnostic** technical capability (any DICOM-based pathology) (Sugimoto & Sueyoshi, 2023).
- Reported oncology use cases include liver, colorectal, esophageal, and renal tumors among others (Sugimoto & Sueyoshi, 2023).

Applications in Tumor Board Workflow

- **Before meeting:** Export imaging (DICOM), upload to Holoeyes cloud; optional AI segmentation; vendor-reported rapid app generation (~5 minutes) for headsets (Holoeyes Inc., n.d.-a).
- **During meeting:** Shared 3D viewing to discuss tumor size/location and relations to OARs; useful for surgical oncology boards though **not MTB-specific** (Sugimoto & Sueyoshi, 2023).
- **After meeting:** Session recording/archives are available (vendor-reported); **no built-in export to TB minutes/EHR** (Sugimoto & Sueyoshi, 2023).

Interoperability & Integration

- **Standards:** Inputs via DICOM; 3D models export/import via OBJ/STL (Sugimoto & Sueyoshi, 2023).
- **Hospital systems:** No native PACS/EHR/HIS integration; manual upload via web interface; no HL7/FHIR APIs disclosed (Sugimoto & Sueyoshi, 2023).
- **Deployment:** Cloud-hosted processing and distribution (Holoeyes Inc., n.d.-a).

Security & Compliance

- **Regulatory status (Japan):** Approved medical device; **certification No. 302ADBZX00011000** (vendor-reported) (Holoeyes Inc., n.d.-b; Holoeyes Inc., 2024).
- **Policies:** Published **Information Security Basic Policy** (Japanese) indicating organizational controls (vendor-reported) (Holoeyes Inc., n.d.-c).
- **Data protection:** Consent required; details on encryption, audit trails, or HIPAA/GDPR alignment **Not disclosed** in the cited sources (Sugimoto & Sueyoshi, 2023; Holoeyes Inc., n.d.-a).

Implementation Setup

- **Sites/lead:** Deployed across multiple Japanese hospitals; academic partner **Teikyo University** frequently referenced (Sugimoto & Sueyoshi, 2023; Holoeyes Inc., 2024).
- **Hardware:** Standalone XR HMDs (e.g., Quest 2, HoloLens, Magic Leap); **no tethered PC** required at point of use (vendor-reported) (Holoeyes Inc., n.d.-a).
- **Software:** Cloud portal for upload/processing; headset apps to view 3D models (Holoeyes Inc., n.d.-a).
- **Training:** Workshops/onboarding; clinicians new to XR reported feasible adoption (Sugimoto & Sueyoshi, 2023).

Advantages & Evaluation Outcomes

- **Spatial understanding & planning:** Qualitative reports of improved anatomic comprehension and surgical planning communication (Sugimoto & Sueyoshi, 2023).
- **Education & telepresence:** Strong uptake in training/briefings; Holoeyes VS used in remote sessions (vendor-reported) (Holoeyes Inc., 2024).
- **Quantitative outcomes:** Controlled measures (e.g., time saved, accuracy) **Not disclosed;** evidence is largely qualitative/compilation across >27 case reports (Sugimoto & Sueyoshi, 2023).

Challenges & Limitations

- **Interoperability gap:** Manual exports and lack of PACS/EHR/HL7/FHIR integration add workflow friction (Sugimoto & Sueyoshi, 2023).
- **XR ergonomics:** FOV/comfort for lengthy sessions remain practical constraints (Sugimoto & Sueyoshi, 2023).
- **Compliance transparency:** Cloud architecture with limited public detail on encryption/audit controls may challenge cross-border use (**Not disclosed**) (Holoeyes Inc., n.d.-c; Sugimoto & Sueyoshi, 2023).

Stakeholder Engagement

- **Co-design:** Iterative development with surgeons, engineers, and educators; clinical champions facilitated onboarding (Sugimoto & Sueyoshi, 2023; Holoeyes Inc., 2024).

Future Directions

- **Deeper AI:** Faster, more accurate segmentation (vendor-reported roadmap) (Sugimoto & Sueyoshi, 2023).

- **Integrations:** Potential PACS/EHR connectivity to reduce manual steps (**Not disclosed** timelines) (Sugimoto & Sueyoshi, 2023).
- **Regulatory expansion:** Pursuit of CE/FDA for international deployment (vendor-reported intent; **Not disclosed** status) (Sugimoto & Sueyoshi, 2023).

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9. Mixed Reality for Pediatric Brain Tumors: A Pilot Study from a Singapore Children's Hospital

Overview

Type / Development Stage: Research project / single-site pilot (not a commercial product) (Liang et al., 2023).

Single-institution pilot at KK Women's and Children's Hospital (Singapore), published 12 July 2023 in *Surgeries (MDPI)*. Aim: test feasibility and perceived usefulness of MR for visuospatial understanding of pediatric brain tumors for planning and education (n = 30). Ethics waiver granted (no patient contact). (Liang et al., 2023).

Description

Patient-specific brain tumor models were generated from archival MRI, uploaded to an MR application, and reviewed using AR (HoloLens) and VR (Quest 2). Users completed Likert-scale evaluations of visual quality and usefulness. (Liang et al., 2023).

Key Features, Technology & Functional Approach

- **Pipeline:** MRI (1 mm slices) → **3D Slicer** manual segmentation → **STL** export → **Holoeyes XR** cloud processing (AI/ML refinement) → deployment to **HMDs** (HoloLens for AR; Quest 2 for VR). A virtual **EVD** task was included. (Liang et al., 2023).
- **Segmentation/Formats (background tooling):** 3D Slicer supports DICOM ingest and STL/OBJ export. (3D Slicer Documentation, n.d.).

Supported Tumor Types

Pediatric intracranial tumors with examples focused on **suprasellar**, **pineal**, and **posterior fossa** lesions. (Liang et al., 2023).

Applications in Tumor Board Workflow

Potential (not evaluated in this study):

- *Before MTB:* pre-read with interactive 3D to clarify lesion-tract-vasculature relationships.
- *During MTB:* shared visualization to align specialties.
- *After MTB:* education/debrief for trainees.
External evidence indicates MR can improve spatial understanding across expertise levels, supporting potential MTB value. (Fick et al., 2023).

Interoperability & Integration

- **Data flow:** DICOM MRI → 3D Slicer segmentation → **STL/OBJ** → Holoeyes XR cloud → HMD apps. (Liang et al., 2023; 3D Slicer Documentation, n.d.).
- **Enterprise connections/standards: PACS connectors, HL7/FHIR, and EHR write-back: Not disclosed** in the study. (Liang et al., 2023).

Security & Compliance

- **Ethics/consent:** SingHealth CIRB waiver (Ref 2022/2466); archival imaging; no patient contact. (Liang et al., 2023).
- **Data protection:** Cloud transfer to Holoeyes XR noted; security architecture/legal bases: **Not disclosed**. (Liang et al., 2023).
- **Regulatory context (outside this study; orientation only):** A review reports Holoeyes MD as a marketed medical device in Japan; this pilot does not claim or rely on that status. (Sugimoto & Sueyoshi, 2023).

Implementation Setup

- **Setting & participants:** n = 30 (neurosurgeons, trainees, junior doctors, students). ~57% had prior MR familiarity (reported in study text/tables). (Liang et al., 2023).
- **Environment:** AR overlay alignment tested on a mannequin head using surface landmarks (pinna, nasion, nose tip). (Liang et al., 2023).
- **Vendors/hardware models beyond HoloLens/Quest, install footprint, on-prem options: Not disclosed.** (Liang et al., 2023).

Advantages & Evaluation Outcomes

- **Perceived usefulness:** All 30 respondents agreed MR helped understand selected pediatric brain tumors (subjective, Likert-based). Objective surgical outcomes: **Not disclosed**. (Liang et al., 2023).
- **External triangulation (not from pilot):** MR yielded higher spatial-understanding accuracy than MRI or a 3D viewer in a controlled task across experience levels. (Fick et al., 2023).

Challenges & Limitations

Technical integration and data-processing demands; user training/learning curve; costs (hardware/software/training); mannequin-based registration (no live OR validation); single-institution scope; no MTB impact or patient outcomes reported. (Liang et al., 2023).

Stakeholder Engagement

Adoption efforts centered on hands-on orientation and demonstrating practical benefits (visualization, shared reference, education) to clinicians. (Liang et al., 2023).

Future Directions

Author-stated: deeper **workflow integration**, **UI** refinements, and broader surgical use; integration of **DTI/functional networks**; potential roles in **counseling** and **rehabilitation**. (Liang et al., 2023).

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10. Brainlab Mixed Reality Viewer



Overview

Spatial-computing viewer that renders patient-specific 3D anatomy and 2D images in room-scale MR for planning, collaborative review, and education. Runs on Magic Leap 2 and launches from Elements Viewer. (Brainlab, n.d.-a).

Description

Workflow: load study from PACS into Elements → prepare case → start MR session → headset joins by scanning a QR code → clinicians review slices and 3D models together. Product page notes multi-user collaboration, including log-in from different locations. (Brainlab, n.d.-a).

Key Features, Technology & Functional Approach

- **Launch & link:** One-click start from Elements; headset joins via on-screen QR code. (Brainlab, n.d.-a).
- **Visualization:** Hyper-realistic 3D anatomy with overlaid 2D images on Magic Leap 2. **55° vertical FOV** and **Global/Segmented Dimming™** improve legibility under varied lighting. (Brainlab, n.d.-a).
- **Collaboration:** Multi-user sessions; vendor materials (2019 press) cite **up to four** concurrent users (claim). (Brainlab, 2019).
- **Ecosystem:** Part of Elements Viewer family; MR views can be streamed to room displays via **Buzz Virtual**. (U.S. FDA, 2024b).

Supported Tumor Types

Tumor-agnostic visualization; commonly used for neurosurgery/CMF/spine planning. Oncology use depends on local Elements modules and workflow. (Brainlab, n.d.-a).

Applications in Tumor Board Workflow

- **Before TB:** Pre-read of lesion-structure relationships using interactive 3D models.
- **During TB:** Shared session (in-room; vendor also claims different-location log-in) to align specialties. (Brainlab, n.d.-a).
- **After TB:** Education/patient counseling.
- **External evidence (not product-specific):** MR prototype for **head-and-neck tumor boards** showed feasibility for multimodal visualization. (Karnatz et al., 2024).

Interoperability & Integration

- **Data flow: PACS (DICOM) → Elements/Viewer → MR session** to Magic Leap via local network/QR join. (U.S. FDA, 2024b; Brainlab, n.d.-a).
- **Room/remote displays:** Buzz Virtual overlays patient data on live video streams and can interact with Viewer content for non-HMD participants. (Brainlab, n.d.-b; U.S. FDA, 2024b).
- **HL7/FHIR for MR Viewer: Not disclosed** (managed elsewhere in Brainlab stack). (Brainlab, n.d.-b).

Security & Compliance

Regulatory: FDA 510(k) K232759 (Class II, LLZ). Indications: displays medical images/data; includes review/manipulation/basic measures/3D visualization; **not intended for diagnosis nor treatment planning**. (U.S. FDA, 2024b).

CE label: Launch press announced CE-labelled availability in Europe. (Brainlab, 2019).

Cloud context: Where **Brainlab Cloud/Quentry** is used, vendor states encryption and **HIPAA** compliance; this is separate from local MR rendering. (Brainlab, n.d.-c; Brainlab, 2019b).

Implementation Setup

- **Prerequisites:** Elements Viewer on Windows workstation; Magic Leap 2 HMD(s); hospital Wi-Fi. (Brainlab, n.d.-a; U.S. FDA, 2024b).
- **Steps:** PACS import in Elements → prepare case → start MR → scan QR to join → optional streaming to room displays via Buzz Virtual. (Brainlab, n.d.-a; U.S. FDA, 2024b).

- **Scale (vendor-reported):** >110 installations worldwide (as of Oct 2023). (Brainlab, n.d.-a).

Advantages & Evaluation Outcomes

- **Collaboration & orientation:** Interactive 3D; multi-user; different-location log-in (vendor claim). (Brainlab, n.d.-a).
- **Adoption signal:** 96% of surveyed customers felt more prepared for surgery (n=34, vendor survey). (Brainlab, n.d.-a).
- Product-specific clinical outcomes in oncology MTBs: **Not disclosed**.

Challenges & Limitations

- **Regulatory scope:** Not for primary diagnosis/treatment planning (per 510(k)). (U.S. FDA, 2024b).
- **Integration specifics:** HL7/FHIR and EHR write-back via MR Viewer **Not disclosed**; typically handled elsewhere in Brainlab portfolio. (Brainlab, n.d.-b).
- **Evidence base:** Public, peer-reviewed outcomes specific to this product in MTB settings remain limited.

Stakeholder Engagement

Demos, quick start (QR), multi-user sessions, and ability to show content on room displays via Buzz Virtual support clinical buy-in. (Brainlab, n.d.-a; U.S. FDA, 2024b).

Future Directions

Vendor continues platform enhancements (Magic Leap 2 features; collaboration tooling). External literature shows growth of MR-enabled tumor board visualization, particularly in head-and-neck oncology. (Brainlab, n.d.-a; Karnatz et al., 2024).

References

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11. DeepUnity PACSonWEB



Overview

Title / Product Name: DeepUnity PACSonWEB (Dedalus / DeepUnity Diagnostics)

Type / Development Stage: Commercial cloud-native PACS / web viewer (Dedalus, 2024a; AWS Marketplace, 2025). (Dedalus, 2024a; Amazon Web Services, 2025).

Cloud-native PACS and zero-install web viewer for distribution, viewing, enhancement, and reporting of diagnostic imaging and related documents via a browser. Positioned for multi-institution sharing with clinicians, patients, and referrers. (Dedalus, 2024a; Dedalus, 2024b).

Description

- Browser-based viewer launched from a secure portal; no local install; supports multi-monitor viewing, image enhancement, and report creation. (Amazon Web Services, 2025).
- Intended uses include distribution of studies/reports and diagnostic viewing by radiologists with measurements/manipulations. (DeepUnity Manuals, n.d.-a).
- Latest release line includes 3.4.100 (announced Dec 2024) and 3.4.200 (subsequent update). (Dedalus, 2024c; Dedalus, 2025a).

Key Features, Technology & Functional Approach

- **Zero-install, web viewer:** HTML5 browser access; download options include DICOM and PNG; SR report included when applicable. (DeepUnity Manuals, n.d.-b).
- **Multi-monitor & tools:** Multi-monitor grids; advanced viewing and image enhancement (vendor). (Amazon Web Services, 2025).
- **Speech recognition:** Optional RSDK speech recognition and **RSDK Atlas Engine** for voice dictation/reporting. (DeepUnity Manuals, n.d.-c; PACSonWEB 3.3.500 notes).
- **AI integration:** **DeepUnity AI Cube** connects PACSonWEB to validated AI partners for case prioritization and visualization of AI results within the PACS workflow. (Dedalus, 2023).

Supported Tumor Types

Tumor-agnostic viewer; supports any oncology domain where DICOM imaging is available (CT/MRI/PET-CT etc.). Specific tumor models or 3D MR/VR are **Not disclosed**.

Applications in Tumor Board Workflow

- **Pre-meeting:** Secure upload portal and patient/physician access enable bringing outside studies; cases prepared in the browser. (Dedalus, 2024d).
- **In-meeting:** Multi-series comparison and shared viewing on multi-monitor setups; image enhancement; annotations. (Amazon Web Services, 2025).

- **Post-meeting:** Report creation with voice dictation; export/printing; EMR deep-link launch supported after site setup. (DeepUnity Manuals, n.d.-d).

Interoperability & Integration

Data flow: DICOM studies received/routed; downloads in DICOM/PNG; SR included; routes defined by AE Title/host/port. (DeepUnity Manuals, n.d.-b; n.d.-e).

EMR integration: Deep link launch of studies from the EMR is supported **after setup** (radiology departments). HL7/FHIR specifics for PACSonWEB are **Not disclosed** in public docs. (DeepUnity Manuals, n.d.-d).

AI path: AI Cube provides single-deployment connection to partner AIs with result return to PACS/worklist prioritization. (Dedalus, 2023).

Security & Compliance

Cloud offering presented as secure with encryption and access controls; regional deployment options depend on customer setup. (Amazon Web Services, 2025).

Regulatory classifications/clearances for PACSonWEB are **Not disclosed** on public pages; confirm locally per site policy.

Device "Intended Use" includes diagnostic visualization by radiologists; follow local regulatory guidance. (DeepUnity Manuals, n.d.-a).

Implementation Setup

- **Vendor lineage:** Dobco Medical Systems (Belgium) acquired by Dedalus in Oct 2021; now under DeepUnity portfolio. (Dedalus, 2021; CFI, 2021).
- **Deployment model:** Cloud SaaS (AWS/private/hybrid) with a lightweight **gateway** installed per hospital to connect modalities/PACS. (Dobco, n.d.).
- **Users:** Radiologists and MTB participants use a browser (desktop/tablet); training needs **Not disclosed**.

Advantages & Evaluation Outcomes

- **Operational:** Zero-install access; multi-monitor workstation-like viewing in a browser; integrated dictation. (Amazon Web Services, 2025; DeepUnity Manuals, n.d.-c).
- **Workflow expansion:** Upload portal; study exchange; non-DICOM attachments (PDF/JPEG/PNG/TIFF) per study. (Dedalus, 2025a).
- **Peer-reviewed, product-specific MTB outcomes: Not disclosed.**

Challenges & Limitations

- **Network dependency:** As a web/cloud viewer, performance depends on connectivity; web-based DICOM viewers show browser/network variability. (Pereira et al., 2024).
- **Integration specifics:** Public docs do not disclose HL7/FHIR interfaces for PACSonWEB; EMR deep-link setup is available but site-specific. (DeepUnity Manuals, n.d.-d).
- **Advanced XR/volumetric 3D:** No public claims of VR/MR volumetric model support; primary focus is 2D/3D diagnostic viewing in a browser. **Not disclosed.**

Stakeholder Engagement

Patient/referrer portals and zero-install access reduce IT burden; single-deployment AI connection (AI Cube) simplifies vendor management. (Dedalus, 2024d; Dedalus, 2023).

Future Directions

Ongoing 3.4.x releases emphasize structured reporting, study intake, and AI connectivity. (Dedalus, 2024c; 2025a).

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1. Digital Voice Recognition System (Dragon Medical)



Description

Dragon Medical One (DMO) is Nuance/Microsoft's cloud speech-recognition solution for clinical documentation and basic EHR navigation via voice. It is specialty-agnostic and widely used in oncology to dictate notes and trigger voice commands within clinical systems (Microsoft, n.d.; Nuance, 2025a).

Core Features & Functionality

- **High-accuracy front-end dictation** with no initial voice-profile training; automatic accent handling and audio calibration (Nuance, 2025a).
- **Voice automation:** AutoTexts and natural-language commands to insert templates and perform multi-step actions (Nuance, 2025a; Microsoft, n.d.).
- **Mobility:** PowerMic Mobile turns iOS/Android phones into secure wireless microphones for DMO (Nuance, 2025b).
- **Note:** "Ambient scribing" is delivered by Nuance DAX/Dragon Copilot, not core DMO. Avoid conflation in MTB workflows.

Technology & Architecture

- **Cloud architecture on Azure:** DMO is delivered as a cloud service (HITRUST CSF-referenced in marketplace listings) with a lightweight desktop client (Nuance, 2025a; Azure Marketplace, n.d.).
- **Client-server pattern:** The desktop app connects securely to Dragon Medical Server over HTTPS (admin guides; network via port 443) (Nuance, 2019-2024).
- **Developer platform:** Related Dragon Medical SpeechKit SDKs expose secure, real-time speech services for desktop, mobile, and browser apps (Microsoft Learn, 2025).

Applications in Oncology (Tumor Board Workflow)

- **During MTB/ITB meetings:** Clinicians dictate recommendations and rationale directly into the EHR; voice commands reduce clicks for navigation and templated entries (Nuance, 2025a; Microsoft, n.d.).
- **Case-prep and follow-up:** DMO supports pre-meeting note preparation and post-meeting completion/sign-off by voice (Nuance, 2025a).
- **Evidence from practice redesign:** At a German center, restructuring ITBs with digital supports (including real-time speech transcription) and standardized forms reduced prep time by **22.9% (radiology)** and **52.7% (pathology)**; early rollout saw transient increases in case discussion time due to profile/speech errors-training/support mitigated this (Braulke et al., 2023).

Interoperability & Integration

- **Works across Windows apps/EHRs;** depth varies by product/version. Nuance materials emphasize broad compatibility, with web-EHR support via Chrome/Edge extensions (Nuance release notes) (Nuance, 2022).
- **Oncology EHRs:** iKnowMed help center documents DMO usage; OncoEMR support is referenced in Nuance release notes (Ontada, 2024; Nuance, 2022).
- **Structured oncology data:** Nuance and MITRE announced collaboration to capture **mCODE** elements via voice; current out-of-the-box maturity in standard DMO is **Not disclosed** (Nuance, 2020; PRNewswire, 2020).

Security & Compliance

- **Transport security:** HTTPS/TLS (up to TLS 1.3) with **AES-256** cipher; no persistent client-side audio (Nuance security white paper) (Nuance, 2023).
- **Encryption at rest:** Azure Managed Disks with encryption at rest are used for cloud storage (Nuance, 2023).
- **Hosting & certifications:** Azure-hosted; marketplace materials reference **HITRUST CSF** (Azure Marketplace, n.d.) and platform security practices for Dragon Medical family (Microsoft Learn, 2025).
- **EU context:** Nuance's EU product page highlights **GDPR-aligned operations** and Azure hosting in the **European Union** (Nuance, n.d.).

Market Maturity & Case Studies

- **Best in KLAS (Speech Recognition: Front-End EHR):** Winner 2021-2025; 2025 score 90.4 (KLAS Research, 2025).
- **Customer-reported outcomes:** Nuance survey (n=170; Dec 2024) reports higher efficiency and burnout reduction (Nuance, 2025a).
- **Adoption (historical reference):** Nuance/Microsoft materials have cited "550k+ clinicians/10k orgs"; current global totals **Not disclosed** (Nuance/Microsoft, 2020-2021).

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2. Azra AI



Description

Azra AI provides an end-to-end oncology platform that identifies patients from pathology/radiology reports, coordinates navigation, supports tumor boards, and automates cancer registry tasks. The company positions this as an “only end-to-end” solution, developed in close collaboration with HCA and trained on >100M reports (vendor claim). (Azra AI, 2025a).

Core Features & Functionality

- **AI-powered patient identification.** NLP models analyze pathology/radiology reports in (near) real time to surface new diagnoses and high-risk findings. Vendor states 98% precision (low false positives). (Azra AI, 2024a; 2025a).
- **Compass™ - Tumor Board.** Case selection, consolidated data, structured recommendations, and audit-ready documentation to support accreditation. (Azra AI, 2025b).
- **Journey™ - Patient care management/navigation.** “Care queue,” outreach prioritization, documentation, and EHR updates. (Azra AI, 2025c).
- **Flow™ - Cancer registry automation.** Automates case finding and abstracts fields in **NAACCR** format. (Azra AI, 2025d).
- **Azra IQ™ / Real-Time Analytics.** Customizable dashboards for volumes, referral patterns, barriers to care. (Business Wire, 2025; Azra AI, 2025e).

Technology & Architecture

- **Cloud, modular platform.** Modules (Compass™, Journey™, Flow™, Analytics) run on a common cloud backend; training claims reference “hundreds of millions” of reports. (ClearDATA, 2024; Azra AI, 2025a).
- **Hosting and data isolation.** ClearDATA case study: HIPAA-compliant **GCP** projects per client (tenant isolation), weekly compliance reporting, and a transition to multi-tenant architecture. (ClearDATA, 2024).
- **Pipelines/standards.** HL7 used for ingestion/transform workflows per ClearDATA; other technical details (e.g., model classes, benchmarks, FHIR/SMART) - **Not disclosed**. (ClearDATA, 2024).

Applications in Oncology (e.g., Tumor Board Workflow)

- **Upstream - Identification.** On report finalization, the AI flags new cancers or high-risk findings and routes patients to navigators’ **care queue**. (Azra AI, 2025a; 2025c).
- **Midstream - Navigation & MTB.** Navigators manage workups in Journey™; cases move to Compass™ for MTB preparation, presentation, and structured recommendations. (Azra AI, 2025b; 2025c).
- **Downstream - Registry & Analytics.** Flow™ pre-populates **NAACCR** fields; operational data feeds the analytics module (Azra IQ™ / Real-Time Analytics). (Azra AI, 2025d; Business Wire, 2025).
- **Observed impact (vendor-reported).** Examples include 7-day reduction to treatment, +58% patient retention, and revenue lift (HCA case study; website KPIs). Treat as vendor claims unless locally validated. (Azra AI, 2023; 2025a).

Interoperability & Integration

- **EHR connectivity.** Vendor states seamless EHR integration and real-time updates from navigation/MTB modules; exact protocols beyond HL7 (in ClearDATA case) - **Not disclosed**. (Azra AI, 2025a; 2025b; ClearDATA, 2024).
- **Cancer registry ecosystem.** Partnership with **Elekta** (Elekta ONE Registry Informatics) for automated case finding and compliant reporting; confirmed via IR release and PDF brief. (Elekta IR, 2025).
- **Provider deployments.** Public announcements include **MultiCare Health System** and references to HCA; third-party coverage available. (Becker’s, 2024; Business Wire, 2025).

Security & Compliance

- **Frameworks and controls.** ClearDATA describes HIPAA-aligned controls, HITRUST frameworks, client-specific **GCP** isolation, and compliance operations (e.g., weekly reports, penetration testing). (ClearDATA, 2024).
- Privacy posture. Azra’s public privacy policy references GDPR concepts but does not list formal attestations (e.g., SOC 2) - **Not disclosed**. (Azra AI, 2022).

Market Maturity & Case Studies

- **Platform updates & module naming.** Press materials enumerate Compass™, Journey™, Flow™, and **Azra IQ™**; enhancements announced Jan 21-Feb 13, 2025. (Business Wire, 2025; Azra AI newsroom, 2025).
- **Health-system adoption.** MultiCare partnership (Aug 20, 2024) and broader customer language (“hundreds of organizations”) are vendor-reported; independent install base - **Not disclosed**. (Becker’s, 2024; Azra AI, 2025a).
- **Impact claims.** HCA case study cites seven-day time-to-treatment improvement and retention gains; treat as vendor case evidence. (Azra AI, 2023).

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3. Varian 360 Oncology



Description

Varian's 360 Oncology™ was introduced as a web-based care management platform to coordinate cancer care across disciplines and engage patients through dedicated portals (Varian, 2016). It combined team communication, access to oncology data across systems, and collaborative planning tools (Varian, 2016; Varian, 2019).

Core Features & Functionality

- **Clinician portal.** Team communication plus access to aggregated oncology data from EMRs, OIS, PACS, and lab systems (Varian, 2016).
- **Patient portal.** Desktop/mobile access to appointments, care-team contacts, education resources, secure messaging, and surveys for PROs (Varian, 2016).
- **Web-based MTB module.** Integrated review of records, labs, diagnostic images; attendance tracking; recommendation documentation; dashboards (Varian, 2016; MedicalExpo catalog).
- **Decision support add-on.** After acquiring Evinance, Varian reported guideline-based pathways and adherence tracking within 360 Oncology (Varian, 2018; Varian, 2018b).

Technology & Architecture

- **Web-based, modular software.** Clinician and patient portals plus MTB and CDS modules accessible via browser; detailed stack/hosting: **Not disclosed** (Varian, 2016; 2019).

Applications in Oncology (e.g., Tumor Board Workflow)

- **Case preparation & presentation.** MTB module aggregates clinical data and images to support case review and treatment recommendations (Varian, 2016; MedicalExpo).
- **Patient engagement.** Patients access schedules, resources, secure communication, and surveys during and after treatment (Varian, 2016).
- **Pathway support.** CDS integration (Evinance) enabled guideline-based care pathways and adherence tracking (Varian, 2018).

Interoperability & Integration

- **Data access across systems.** Designed to pull/share oncology-relevant data from EMRs, OIS, PACS, and lab systems (Varian, 2016; 2018a/2018b HIMSS materials). Specific public API/standards beyond this: **Not disclosed**.
- **Ecosystem evolution.** Later communications highlight the broader Varian digital portfolio (e.g., ARIA, Velocity, Noona) presented alongside 360 Oncology at HIMSS (Varian, 2019).

Security & Compliance

- **Secure communication.** Patient portal materials reference secure messaging (Varian, 2016). Broader Varian cybersecurity pages describe encryption in transit and other controls, but 360-specific configurations are **Not disclosed** (Varian, 2016; Varian, n.d.).

Market Maturity & Case Studies

- **Launch and showcases.** Announced September 26, 2016; demonstrated at HIMSS19 with MTB management, evidence-informed recommendations, and survivorship planning (Varian, 2016; 2019).
- **Field experience.** Public materials include a GenesisCare UK quote and catalog examples; current install base and commercial status: **Not disclosed** (Varian, 2016; MedicalExpo).

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6. *Varian*. (n.d.). *Cybersecurity at Varian (general encryption/controls overview; not 360-specific)*.

4. MTB Smart Virtual Assistant (Fondazione Policlinico Gemelli)

Description

The MTB Smart Virtual Assistant is a **non-commercial, academic PoC** from Fondazione Policlinico Universitario A. Gemelli IRCCS (Rome, Italy). It tests whether AI can support MTB decision-making by **automating 2009 FIGO staging for LACC** from free-text diagnostic reports and **flagging inconsistent findings** across sources to focus discussion on complex cases (Macchia et al., 2022).

Core Features & Functionality

- **Automated clinical staging:** Predicts **2009 FIGO** stage for LACC from narrative reports. Reported accuracy: **94%** using MR+EUA; **98%** when PET-CT inputs are added (Macchia et al., 2022).
- **Inconsistency detection / case prioritization:** Detects conflicting findings across MR / EUA / PET-CT and **alerts controversial cases** for deeper MTB review (Macchia et al., 2022).
- **Data aggregation & visualization:** Auto-extracts structured + unstructured EHR data; presents patient summaries with drill-down to original reports (Macchia et al., 2022).
- **Education & standardization:** Provides a **support environment for training/knowledge transfer** and promotes **standardized language/interpretation** across specialists (Macchia et al., 2022).

Technology & Architecture

Two-step pipeline reflecting tools of the period:

1. **NLP for data structuring:** Hybrid **rules + ML** to transform MR, EUA, PET-CT **free-text** into structured clinical features; implemented in **SAS Visual Text Analytics (VTA)** (Macchia et al., 2022; SAS Institute, n.d.).
2. **Prediction & clustering:** **Decision Tree** models in **SAS Viya** for FIGO staging; **clustering** to identify patient phenotypes that may inform future prognostic modeling (Macchia et al., 2022).

Dataset: Single-center, retrospective: **96** LACC patients (2015-2018) for development; **13** for independent validation (Macchia et al., 2022).

Applications in Oncology (Tumor Board Workflow)

- **Before MTB:** On scheduling, the system retrieves EHR data; runs NLP/ML; produces predicted staging and a summary dashboard, reducing manual case prep (Macchia et al., 2022).
- **During MTB:** Dashboard shows **predicted staging** and a **discrepancy/discrimination** cue to prioritize complex cases; clinicians can drill down and compare source reports side-by-side (Macchia et al., 2022).
- **After MTB:** Structured outputs support **retrospective analyses** and knowledge-base growth; authors note **potential portability** of methods to other centers (Macchia et al., 2022).

Interoperability & Integration

Bespoke, single-institution integration with Gemelli's internal **data-lake/ETL** and automated EHR extraction. The paper **does not report** standards-based APIs (e.g., **HL7 FHIR**) or connectors to commercial EHRs (e.g., Epic, Cerner).

Status: Standards-based interoperability - **Not disclosed** (Macchia et al., 2022).

Security & Compliance

The study reports that **patients provided written informed consent**; the project was **reviewed/approved by the Scientific Director** of IRCCS Policlinico Gemelli (Ethics Statement). **Encryption, access control, audit trails, and GDPR alignment are not detailed.**

Technical safeguards: **Not disclosed** (Macchia et al., 2022).

Market Maturity & Case Studies

Stage: Early academic **PoC**, not commercial.

Evidence: Single-center study-**training accuracy 94%** (MR+EUA; **98%** with PET-CT); **validation accuracy 93%** on 13-patient cohort; implemented within a high-volume university hospital (Macchia et al., 2022).

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5. AI-Based Tumor Board (AITB by ML6)



Description

The AI-Based Tumor Board (AITB) is a **PoC** by ML6 that pre-analyzes complex oncology cases with specialized AI agents and produces a preparatory report for clinicians. It was designed around the **international Leukemia/Lymphoma Target Board (iLTB)**, a weekly virtual panel of European experts for relapsed/refractory pediatric hematologic malignancies. (Pannemans, 2025; Prinses Máxima Centrum, 2025).

Core Features & Functionality

- **Multi-agent case simulation:** Virtual “experts” (e.g., genetics, cellular/immune therapy, clinical trials) debate options and **cross-check** each other to reduce single-model blind spots. (Pannemans, 2025).
- **Evidence-grounded recommendations:** Agents are **restricted to pre-screened literature and trial data**, compare **survival/event-free rates**, and check **contraindications** against the patient profile. (Pannemans, 2025).
- **Automated reporting:** After the simulated debate, the system creates a **structured report** with rationale, candidate therapies, and citations. (Pannemans, 2025; ML6 Demos).
- **Clinical-trial matching:** Suggested plans are linked to **relevant trials** based on disease context and biomarkers. (Pannemans, 2025).

Technology & Architecture

- **LLM foundation:** Each agent runs on an LLM (e.g., ChatGPT/Gemini families) with task-specific instructions. (Pannemans, 2025).
- **Agent capabilities:**
 1. **Knowledge** - curated, specialty-specific literature sets;
 2. **Memory** - retains discussion context;
 3. **Tools** - iterative retrieval via toolcalls over the knowledge base. (Pannemans, 2025).
- **Collaborative reasoning:** Deliberate multi-agent “peer review” to challenge assumptions and refine outputs; aligns with broader literature on multi-agent cross-verification in medical reasoning. (Pannemans, 2025; cf. MDAgents, NeurIPS 2024; Tree-of-Reasoning 2025).
- **Planned extensions:** Future support for real-time sources (e.g., PubMed/Google Scholar) and automated fact-checking are noted as roadmap items. (Pannemans, 2025).

Applications in Oncology (e.g., Tumor Board Workflow)

- **Before MTB:** Ingest patient profile; agents run a simulated discussion and produce an **evidence-based preparatory report** with trial leads. (Pannemans, 2025).
- **During MTB:** Clinicians start from a **baseline of options and citations**, focusing discussion on nuanced trade-offs rather than literature search. (Pannemans, 2025).
- **After MTB:** The report can be **archived** alongside the case as documentation of sources considered. (ML6 Demos).

Interoperability & Integration

- **Current status:** Standalone **PoC** focused on the reasoning engine; **no live EHR/PACS/LIS integrations** are reported; **data entry appears manual** from case summaries. **Standards/APIs (e.g., HL7 FHIR): Not disclosed.** (Pannemans, 2025).

Security & Compliance

- **Demo disclaimer:** The blog states the scenario uses **fictitious, unverified medical data**, is **not for clinical use**, and requires human validation/governance. **HIPAA/GDPR/CE compliance: Not disclosed.** (Pannemans, 2025).

Market Maturity & Case Studies

- **Maturity:** PoC / demonstration, not commercially available; no peer-reviewed clinical evaluation of AITB itself. (Pannemans, 2025; ML6 Demos).
- **Collaboration context:** Built around the **iLTB** network and meeting cadence (non-interventional study **NCT05270096**; weekly MS Teams meetings; 112 cases across 25 countries reported on the research page). (Prinses Máxima Centrum, 2025; HemaSphere abstract 2023).

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6. Virtual Medical Board (VMB)



Description

- VMB is a joint initiative of **Open Line Vitaly** (formerly Parsek) and **Open Line B.V.** to develop and commercialize a digital platform that optimizes MDT/MTB meetings and supports a more **patient-centric** decision process. Strategic aims include **cost-effective, scalable** deployment across European markets. (Open Line Vitaly, n.d.).

Core Features & Functionality

- **Enhanced patient involvement:** Configurable workflows define **when/how** patients participate in MDT decisions. (Open Line Vitaly, n.d.).
- **Automated meeting minutes (STT):** Medical-tuned transcription with **speaker identification** to speed creation of conclusions/diagnoses and reduce manual errors. (Open Line Vitaly, n.d.).
- **AI-enabled decision support:** Algorithm compares current session content to **historical diagnoses/health data** to generate suggestions. (Open Line Vitaly, n.d.).
- **Remote & asynchronous collaboration:** Experts can participate **regardless of location/time**, enabling cross-hospital reviews. (Open Line Vitaly, n.d.).

Technology & Architecture

- **Cloud-based SaaS:** Hosted model for scalability and simplified roll-out; Open Line provides cloud expertise and implementation into a cloud service. (Open Line Vitaly, n.d.).
- **AI & STT components:** AI supports decision suggestions; STT powers automatic transcription. **Specific model/engine vendors: Not disclosed.** (Open Line Vitaly, n.d.).

Applications in Oncology (e.g., Tumor Board Workflow)

- **Before MTB:** Schedule/coordinate meetings; register patients; **aggregate relevant data** inside the platform. (Open Line Vitaly, n.d.).

- **During MTB:** Virtual meeting room; **real-time AI suggestions;** STT captures the discussion. (Open Line Vitaly, n.d.).
- **After MTB: Auto-generated minutes** for review/finalization; decisions documented to inform the care plan and future reference. (Open Line Vitaly, n.d.).

Interoperability & Integration

- **VMB-specific details:** Integration with EHR/PACS/LIS and **standards/APIs (e.g., HL7 FHIR)** are **Not disclosed** on the VMB page. (Open Line Vitaly, n.d.).
- **Vendor/platform context (non-VMB-specific):** Open Line Vitaly's MDT/Vitaly materials describe support for **IHE profiles (e.g., XDW/XDS), FHIR, OpenEHR and open secure APIs;** analytics and research-use options are also noted. Applicability to VMB is **not confirmed** in public VMB docs. (Open Line Vitaly, MDT solution; Platform/Standards pages).

Security & Compliance

- **VMB-specific posture:** Technical controls (encryption, access control, audit trails) and regulatory claims (GDPR, HIPAA/CE/MDR) **Not disclosed** on the VMB page. (Open Line Vitaly, n.d.).
- **Vendor/platform context (non-VMB-specific):** Platform pages reference **MDR/MHRA alignment, ISO 14971/13485, IEC 62304, and ISO/IEC 27001** under a quality/safety framework; these are general platform claims and **not stated for the VMB project** specifically. (Open Line Vitaly, Platform).

Market Maturity & Case Studies

- **Stage:** Development/commercialization phase. **Project duration: 1 Jul 2020 - 30 Jun 2023; ERDF co-financing: €298,885;** partners: **Open Line B.V., Parsek.** (Open Line Vitaly, n.d.).
- **Go-to-market:** Open Line targets **Netherlands/Belgium;** Parsek/Open Line Vitaly targets **other markets.** (Open Line Vitaly, n.d.).
- **Deployments/case studies: None** disclosed for VMB specifically. **Related (vendor platform) evidence:** Open Line's MDT platform is described as used in the **Oncomid** regional oncology network with **EPR** and national **XDS** integration (registration from the EPR; real-time data via XDS). These illustrate organizational experience but are **not VMB case studies.** (Open Line NL eHealth; DDMN/Oncomid reference).

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7. DeepScribe for Oncology



Description

DeepScribe provides oncology-focused ambient AI documentation designed to reduce manual charting and improve visit quality (DeepScribe, 2025).

Core Features & Functionality

- **Oncology-specific ambient scribe:** Captures clinician-patient conversations and generates context-aware notes; vendor reports **600,000+ oncology visits** used to tune oncology models (DeepScribe, 2025).
- **AI Pre-Charting:** Curated pre-visit summary to reduce chart review time (DeepScribe, 2025).
- **Coding intelligence:** Suggests **ICD-10, E/M, and HCC** codes from the encounter (DeepScribe, 2025).
- **Context-aware notes & structured outputs:** Pulls forward relevant prior details and writes discrete fields via native EHR elements where supported (DeepScribe, 2024; TechTarget, 2024).
- **Customization Studio:** Note templates, custom exams, macros (DeepScribe, 2023).
- **DeepScribe Assist (real-time prompts):** In-visit guidance for chart completeness and program requirements (DeepScribe, 2024).

Technology & Architecture

- **Ambient AI + NLP/STT:** Proprietary ambient platform trained on multi-million-conversation datasets; vendor communications cite **5M+ conversations** across specialties (DeepScribe, 2024; 2023). (Vendor-reported)
- **Performance claims:** Vendor reports parity with expert human scribes and improved accuracy vs general models in internal benchmarks; external verification not disclosed (DeepScribe, 2023-2024). (Vendor-reported)
- **Cloud delivery:** SaaS access across devices (DeepScribe, 2025).

Applications in Oncology (e.g., Tumor Board/Clinic Workflow)

- **Before visit (Pre-Charting):** AI summary of recent status and priorities (DeepScribe, 2025).
- **During visit (Documentation):** Ambient capture; **Assist** provides real-time prompts (DeepScribe, 2024).
- **After visit (Finalization & billing):** Note and suggested codes generated; with supported EHRs, approved content writes back to the chart. Trade press reports **up to 75% reduction** in after-hours documentation for deployments leveraging Epic SmartData integration (HIT Consultant, 2024).

Interoperability & Integration

- **Epic:** Updates include compatibility with **Epic SmartData elements** and customization tools; vendor and press coverage

detail the integration scope (DeepScribe, 2024; PR Newswire, 2024; TechTarget, 2024).

- **OncoEMR® (Flatiron Health): First ambient-AI partner;** integration anchors oncology workflows for 4,200+ providers (Flatiron Health, 2025; PR Newswire, 2025).
- **iKnowMed (Ontada):** Integration via **Ontada Developer Marketplace;** collaboration publicized in Texas Oncology announcement (DeepScribe, 2024; PR Newswire, 2024; Ontada, n.d.).

Security & Compliance

- **HIPAA:** Vendor states HIPAA compliance (DeepScribe, n.d.).
- **Encryption & privacy: End-to-end AES-256** encryption; PHI de-identification described in product/security pages (DeepScribe, n.d.; DeepScribe, 2024).
- **Trust & Safety:** “Trust and Safety Suite” adds traceability (Clinical Moments), **audit dashboards** (Note Insights), and **expert human audits;** SOC 2 is referenced on the same page (DeepScribe, 2024).

Market Maturity & Case Studies

- **Maturity:** Commercial stage with rapid expansion; **KLAS Emerging Company Spotlight score 98.8/100** (Jan 2025) (DeepScribe, 2025; PR Newswire, 2025).
- **Selected oncology customers:**
 - **CARTI Cancer Center** (deployment announced, Apr 2025) (PR Newswire, 2025; DeepScribe, 2025).
 - **New York Cancer & Blood Specialists (NYCBS)** on **OncoEMR®** (Apr 2025) (PR Newswire, 2025; NYCBS, 2025).
 - **Texas Oncology** on **iKnowMed** (Jun 2024) (DeepScribe, 2024; PR Newswire, 2024).
- Adoption claims: Some figures are **vendor-reported;** independent third-party verification not disclosed. (**Not disclosed**)

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8. Oncoscribe



Description

- Oncoscribe is an oncology-specific AI medical scribe from Oncentric. It automates documentation and orders to reduce manual charting and support patient-facing time. (Oncentric, n.d.-a).
- The product sits within Oncentric's broader oncology platform (clinical, administrative, financial services). (Oncentric, n.d.-c).

Core Features & Functionality

- **Ambient AI scribing:** Listens to the visit and creates a note; **transcribes into structured fields and orders directly in the EHR.** (Oncentric, n.d.-a).
- **Instant order entry:** Create/modify tests, meds, treatments; generate a **comprehensive treatment** plan with discrete orders without leaving the workflow. (Oncentric, n.d.-a).
- **Oncology-specific documentation:**
 - Interim histories with response and toxicity tracking;
 - **Chemotherapy plan integration** with side-effect and lab tracking;
 - **HCC/RAF capture** to support value-based billing. (Oncentric, n.d.-a).
- **Simple approval flow:** Provider reviews, edits, and approves notes and orders in a few clicks. (Oncentric, n.d.-a).

Technology & Architecture

- **AI + STT/NLP pipeline** converts conversation to structured data and orders. (Oncentric, n.d.-a).
- **Model details / hosting: Not disclosed** in public materials. (Oncentric, n.d.-a).

Applications in Oncology (e.g., Tumor Board Workflow)

- **Before visit/meeting: Not disclosed.**
- **During encounter:** Ambient capture; note structuring; order suggestion/creation during the conversation. (Oncentric, n.d.-a).

- **After encounter:** Draft note and proposed orders ready for quick review/approval; vendor cites **up to 75% time savings** for documentation. (Vendor-reported) (Oncentric, n.d.-a).

Interoperability & Integration

- Positioning: “Effortless integration... sync seamlessly with your existing systems” to update records. **Specific EHRs, standards (e.g., HL7 FHIR), and API details: Not disclosed.** (Oncentric, n.d.-a).

Security & Compliance

- **HIPAA compliance** stated on the product page. (Oncentric, n.d.-a).
- **Technical controls** (e.g., encryption, access control, audit trails) and certifications: **Not disclosed.**

Market Maturity & Case Studies

- **Company background:** Oncentric highlights **20+ years of oncology experience** across its platform offerings. (Oncentric, n.d.-b).
- **Oncoscribe deployments/case studies: Not disclosed** in public materials reviewed.
- **Positioning:** Marketed as a current product within the Oncentric ecosystem. (Oncentric, n.d.-a; n.d.-c).

References

1. Oncentric. (n.d.-a). *Oncology AI Medical Scribe: OncoScribe.* Oncentric
2. Oncentric. (n.d.-b). *Oncentric - Industry-leading oncology solution provider (homepage).* Oncentric
3. Oncentric. (n.d.-c). *Oncology Practice Management.* Oncentric

9. Sporo AI



Description

Sporo Health develops AI tools to reduce clinician documentation burden and accelerate chart review. The portfolio centers on two products: (1) Patient Chart Review for rapid, structured summaries of multi-year records, and (2) AI Scribe for ambient documentation from audio/transcripts into EHR-ready notes. Target settings include high-volume clinics and research-intensive environments.

Core Features & Functionality

- **Patient Chart Review:** Searches across large record sets and produces concise, clinically relevant histories to support case preparation and care transitions.
- **AI Scribe:** Converts clinician-patient conversations (or transcripts) into structured notes; supports editable outputs (learning from corrections), templates, a chatbot copilot, and multilingual use.
- **Research acceleration:** Vendor materials emphasize summarization/analytics workflows for data-intensive studies.

Technology & Architecture

- **Model stack:** Sporo reports a fine-tuned, medical LLM stack and an agentic design specialized for clinical documentation; API materials describe models “distilled from top open-source LLMs” and tailored for healthcare tasks. (Interpretation: proprietary specialization/fine-tuning on open-source bases.)
- **Agentic approach:** Product family frames “medical AI agents” that adapt to specialty-specific documentation patterns.
- **API exposure:** Capabilities (audio→notes, transcripts→notes, chart review, health assessment reports, agentic chatbot) are available via an API for embedding in client systems.
- **Bias/safety posture:** Vendor posts discuss bias-reduction and safety methods in the context of clinical scribes.

Applications in Oncology (e.g., Tumor Board Workflow)

- **Pre-MTB case preparation:** Use Patient Chart Review to synthesize multi-year oncology records into a concise timeline/summary for MTB slides and presenter notes.
- **During encounters (follow-ups):** Use AI Scribe to capture treatment response, toxicities, and status changes into structured documentation that remains consistent with the EHR problem list and plans.
- **Research/quality:** Summarize cohorts for outcomes reviews and hypothesis generation in academic cancer programs.

(Note: Oncology/MTB mappings above reflect logical clinical applications of the documented features; vendor does not publish oncology-specific MTBs claims beyond general workflows.)

Interoperability & Integration

- API-first model enabling direct embedding into EHR/EMR and clinical applications; client engineering effort is typically required.

Security & Compliance

- **Privacy/security measures** highlighted by the vendor include encryption, access controls, and regulatory compliance practices (HIPAA/GDPR) presented in public materials.
- **Private deployments** and security layers are discussed in vendor channels. (Evidence is vendor-reported.)

Market Maturity & Case Studies

- **Comparative studies (vendor-authored)** report higher precision/recall/F1 for Sporo AI Scribe versus baseline LLMs (e.g., GPT-4o/4o-mini) on de-identified clinical conversation datasets; clinician PDQI-9 satisfaction ratings also favored Sporo.
- **Peer-reviewed context:** A Frontiers in Digital Health review (with Sporo co-authors) discusses AI clinical summarization for chart review burden reduction.

- **Ecosystem visibility:** Sporo is listed with Harvard Innovation Labs. (Signal of startup maturity; not clinical validation.)

References

1. *Sporo Health - Home*
2. *Sporo AI Scribe (product page)*
3. *Sporo Patient Chart Review (product page)*
4. *Sporo Health - API Service*
5. *Sporo Health - Research & Case Study hub*
6. *Blog - Leading AI Models for Healthcare (LLMs/customization)*
7. *Blog - Bias in Clinical AI Scribe*
8. *Blog - Protecting Patient Privacy with AI*
9. *YouTube (Sporo CSO talk incl. HIPAA/GDPR/EU AI Act mentions)*
10. *Frontiers in Digital Health - Clinical summarization review (Lee et al., 2024)*
11. *ArXiv - Comparative Study vs GPT-4o mini (Lee et al., 2024)*
12. *ArXiv - Agentic architecture vs leading LLMs (Lee et al., 2024)*
13. *Harvard Innovation Labs - Sporo Health listing*

10. Heidi Health AI Scribe



Description

Heidi Health is an ambient AI medical scribe for clinicians across specialties (physicians, psychologists, nurses, veterinarians, allied health). It aims to reduce documentation burden and return time to patient care through a versatile, customizable note-generation workflow. Although generalist, the system supports specialty-specific needs, including oncology, via templates and personalization (Heidi Health, n.d.).

Core Features & Functionality

- **Ambient transcription & note generation:** Transcribes clinical visits and generates clinical notes, referral letters, and related documents (Heidi Health, n.d.).
- **Customization & templates:** Template editor to build formats (e.g., SOAP, DAP); “Memory” learns preferences, corrections, and macros over time (Heidi Health, n.d.).
- **“Ask Heidi” command interface:** Natural-language commands to modify or generate outputs (e.g., write a referral, split notes, fill a form) (Heidi Health, n.d.).
- **“Context” input:** Allows adding non-verbal details (e.g., exam findings) before/during/after a visit for inclusion in the final note (Heidi Health, n.d.).
- **Multilingual & multi-platform:** Supports many languages; available on web/desktop/iOS; offline mode and background syncing are provided (Heidi Health, n.d.).
- **Team collaboration:** Shared templates and administrative controls for clinics/hospitals (Heidi Health, n.d.).

Technology & Architecture

Cloud-based AI/NLP stack for speech-to-text and structured documentation. Output is personalized using stored preferences via the “Memory” feature. The vendor emphasizes an intuitive interface and strong security controls (Heidi Health, n.d.).

Applications in Oncology (e.g., Tumor Board Workflow)

- **Oncology consult documentation:** Use oncology-specific templates (e.g., staging, treatment history, performance status, review of systems) for complex new or follow-up notes (Heidi Health, n.d.).
- **Referral letters:** Generate referral letters (e.g., to radiation or surgical oncology) using “Ask Heidi,” drawing on note content (Heidi Health, n.d.).
- **Tumor board preparation:** Time saved on routine documentation (vendor-reported) can be used for MTB case preparation; structured notes provide a consistent source for case summaries (Heidi Health, n.d.).

Interoperability & Integration

- **Named EHR connections:** Vendor materials cite connections with Epic, Best Practice, and athenahealth for schedule sync and note flow into the EHR (Heidi Health, n.d.).
- **Depth of integration:** Extent of bi-directional, field-level write-back is **Not disclosed** on public pages (Heidi Health, n.d.).

Security & Compliance

- **Regulatory posture:** Vendor states alignment with HIPAA (US), GDPR (EU), PIPEDA (Canada), and APP (Australia) (Heidi Health, n.d.).
- **Certifications:** SOC 2 Type II and ISO 27001 are stated by the vendor (Heidi Health, n.d.).
- **Data handling:** Vendor indicates no audio recordings are stored and users can permanently delete sessions; encryption and access controls are standard (Heidi Health, n.d.).

Market Maturity & Case Studies

- **Go-to-market:** Freemium/product-led growth to drive individual adoption and subsequent enterprise uptake (Heidi Health, n.d.).
- **Scale indicators:** Vendor reports assisting over 1 million consults per week; testimonials span multiple specialties (Heidi Health, n.d.).
- **Oncology evidence:** No oncology-department case studies are publicly detailed; status **Not disclosed** beyond general testimonials (Heidi Health, n.d.).

References

1. Heidi Health. (n.d.). *Heidi Health - Home*
2. Heidi Health. (n.d.). *Frequently asked questions (security, compliance, features)*.
3. Heidi Health. (n.d.). *Trust Center (certifications & policies)*.
4. Heidi Health. (n.d.). *athenahealth integration overview*.

11. Microsoft Healthcare Agent Orchestrator



Description

The Microsoft Healthcare Agent Orchestrator is an open, Azure-anchored framework and code sample for coordinating multiple, specialized AI “agents” to support complex clinical workflows, with an initial emphasis on cancer care management and tumor boards (Lungren, 2025). The intent is to move beyond single-model tools toward modular, interpretable, collaborative agent systems that surface multimodal insights and embed directly into Microsoft 365 tools such as Teams and Word (Lungren, 2025).

Core Features & Functionality

- Multi-agent orchestration: Coordinates specialized agents, maintains shared context/memory, and resolves conflicts across tasks (Lungren, 2025; Gu, Mandel, & Wei, 2025).
- Pre-configured and customizable agents: Starter oncology agents are provided; developers can build/fine-tune agents for specific models, tools, and data sources (Lungren, 2025).
 - Patient History agent: applies universal abstraction to produce chronological timelines from EHR data (Lungren, 2025).
 - Medical Research agent: retrieves evidence and guidelines using graph-based sources (Lungren, 2025).
 - Report Creation agent: generates integrated, formatted MTB reports (Lungren, 2025).
- Multimodal data reasoning: Supports clinical notes, genomics, pathology WSIs, and imaging (e.g., DICOM) (Lungren, 2025).
- Human-in-the-loop collaboration: Agent workflows can be surfaced inside Teams for interactive Q&A and on-demand analyses during clinical collaboration (Lungren, 2025).

Technology & Architecture

- Orchestration frameworks: Implements Microsoft’s agent orchestration patterns (Semantic Kernel) and leverages the Magentic-One approach (orchestrator + specialists) for plan/execute/repair cycles (Fourney et al., 2024; Microsoft, 2025b).
- Azure AI Foundry: Agents run general-purpose and healthcare-specific models; the agent catalog streamlines deployment of the orchestrator sample and related tools (Lungren, 2025; Microsoft, 2025a).
- Open and extensible: Designed to integrate approved third-party agents via APIs/tool wrappers and MCP endpoints (Lungren, 2025; Microsoft, 2025d).

Applications in Oncology (e.g., Tumor Board Workflow)

- **Before the MTB:**
 1. Patient History agent builds an EHR-based timeline;
 2. Radiology agent analyzes DICOM images;
 3. Pathology agent connects to external pathology agents (e.g., partner integrations) for WSI review;
 4. Medical Research agent surfaces guidelines/clinical trials;
 5. Report Creation agent synthesizes a single MTB summary (Lungren, 2025).

Intended outcome (vendor-reported): hours of manual prep reduced to minutes (Lungren, 2025).

- **During the MTB:**

Teams channel acts as the collaboration surface where clinicians can ask follow-ups or trigger additional reasoning from agents within the same thread (Lungren, 2025).

Interoperability & Integration

- Ecosystem connectivity: Agent-mediated access to EHRs, PACS, and other systems; data can be connected via Microsoft Fabric/FHIR services within orchestrated workflows (Lungren, 2025; Burt et al., 2025).
- Microsoft 365 integration: Native surfacing in Teams with hand-offs to Word/PowerPoint for reporting and review (Lungren, 2025).
- Third-party agent participation: MCP and open APIs enable external tools (e.g., pathology AI vendors) to join an orchestrated workflow (Lungren, 2025; Microsoft, 2025d).

Security & Compliance

- Platform baseline: As an Azure-based framework, deployments inherit Azure security and compliance controls; HIPAA-related safeguards are available for in-scope Azure services under a BAA (Microsoft, 2023).
- Orchestrator-specific certifications: **Not disclosed**.
- Deployment responsibility: Security posture and regulatory compliance depend on implementer configuration and governance (Lungren, 2025).

Market Maturity & Case Studies

Stage/availability: Research/early-access accelerator; sample and deployment assets available via the Azure AI Foundry Agent Catalog (Lungren, 2025; Microsoft, 2025a; Microsoft, 2025c).

Academic/clinical collaborators: Microsoft cites exploration with Stanford, Johns Hopkins, Providence Genomics, Mass General

Brigham, and the University of Wisconsin (Lungren, 2025).

MTB-focused pilots: Reported aims include streamlining tumor-board preparation and enabling interactive, agent-supported discussions in Teams (vendor-reported) (Lungren, 2025; Gu et al., 2025).

References

1. Burt, C., Mandel, J., Jain, S., Tuan, F., Miller, E., Blondeel, M., ... Guyman, W. (2025, June 26). *Connecting the Healthcare Agent Orchestrator to your Electronic Health Record and Microsoft Fabric*. Microsoft Tech Community.
2. Fourney, A., Bansal, G., Mozannar, H., Tan, C., Salinas, E., Zhu, E., ... Amershi, S. (2024). *Magentic-One: A generalist multi-agent system for solving complex tasks* (arXiv:2411.04468). arXiv.
3. Gu, A., Mandel, J., & Wei, M. (2025, May 22). *Healthcare Agent Orchestrator: Multi-agent framework for domain-specific decision support*. Microsoft Tech Community.
4. Lungren, M. (2025, May 19). *Developing next-generation cancer care management with multi-agent orchestration*. Microsoft Industry Blogs.
5. Microsoft. (2023, April 6). *HIPAA-Azure compliance offerings*. Microsoft Learn.
6. Microsoft. (2025a, June 16). *How to use the AI agent catalog-Azure AI Foundry*. Microsoft Learn.
7. Microsoft. (2025b, July 21). *Semantic Kernel-Agent orchestration*. Microsoft Learn.
8. Microsoft. (2025c). *Healthcare Agent Orchestrator* [GitHub repository]. GitHub.
9. Microsoft. (2025d, May). *Microsoft Build 2025 Book of News (Agent Service GA; A2A/MCP support)*. /

12. Autoscriber



Description

Autoscriber is a commercial ambient clinical intelligence platform from Autoscriber B.V. (Netherlands). Founded in 2021 (roots in CAIRELab at Leiden University Medical Center), it aims to reduce documentation burden by transcribing clinician-patient conversations and generating structured, medically coded summaries for EHRs, to improve data quality and free clinician time (Autoscriber, n.d.-a; Founda Health, n.d.; VDS, n.d.).

Core Features & Functionality

- **Ambient transcription & summarization:** Captures the visit in real time and outputs concise, clinically relevant summaries (Autoscriber, n.d.-a).
- **Structured data & coding:** Extracts key items into standardized formats (e.g., SOAP) and assigns codes (e.g., ICD-10, SNO-MED CT) to support search and interoperability (Autoscriber, n.d.-a).
- **Templates & template builder:** Library of 70+ clinician-validated templates and a builder for custom structures (Autoscriber, n.d.-a; VDS, n.d.).
- **Multilingual support:** Multiple languages (e.g., English, Dutch, German, French, Spanish) for diverse care settings (Autoscriber, n.d.-a; Founda Health, n.d.).

Technology & Architecture

- **NLP with LLM-agnostic design:** Flexible architecture to incorporate different large language models for clinical understanding and summarization (Autoscriber, n.d.-a).
- **OpenAmbient framework:** Vendor-developed framework for real-time audio processing and workflow automation that supports ambient listening at scale (Autoscriber, n.d.-a).

Applications in Oncology (e.g., Tumor Board Workflow)

- **Oncology consult documentation:** Use oncology-specific templates (e.g., staging, treatment history) to generate structured notes from complex visits (Autoscriber, n.d.-a).
- Referral/summary letters: Turn summaries into referral letters or concise updates to oncology colleagues (Autoscriber, n.d.-a).
- MTB preparation: Structured, coded outputs (problems, timelines) can support pre-MTB case summaries. Oncology department case studies: Not disclosed (Autoscriber, n.d.-a).

Interoperability & Integration

- EHR connectivity: Integrates with Epic, Cerner, ChipSoft (HiX), and Nexus; a pilot at Radboudumc demonstrated Epic integration (Autoscriber, n.d.-b; Autoscriber, n.d.-d; VDS, n.d.).
- Integration methods:
 - Embedded web app (iframe) for lightweight embedding,
 - Scribe SDK for a native experience,
 - API for deep integration and custom workflows (Autoscriber, n.d.-b).
- Standards & formats: Structured outputs (e.g., JSON) with HL7/FHIR support for interoperability (Autoscriber, n.d.-b).

Security & Compliance

- Certifications: ISO 27001 and NEN 7510 (Autoscriber, n.d.-c).
- Regulatory posture: GDPR compliance and stated alignment with the evolving EU AI Act (Autoscriber, n.d.-c).
- Data handling: Encryption in transit/at rest; processing and storage in the EEA on secure cloud platforms. In integrated deployments, transcripts/summaries are often not stored by Autoscriber; in the standalone version, data is retained until user deletion (Autoscriber, n.d.-c).

Market Maturity & Case Studies

- Stage & funding: Early-stage commercial product; seed funding of €1.2 million (e.g., LUMO Labs, BOM) (VDS, n.d.; Founda Health, n.d.).
- Partnerships & pilots: Collaboration with Microsoft to scale commercialization in EMEA; Radboudumc pilot (Epic) as a key deployment example (Autoscriber, n.d.-d; LUMO Labs, n.d.).

- Oncology evidence: Department-level oncology case studies are **Not disclosed**.

References

1. *Autoscriber. (n.d.-a). Autoscriber-Ambient clinical intelligence.*
2. *Autoscriber. (n.d.-b). Healthcare systems.*
3. *Autoscriber. (n.d.-c). Resource hub.*
4. *Autoscriber. (n.d.-d). Radboudumc launches innovative Autoscriber pilot integrated into Epic EHR.*
5. *Founda Health. (n.d.). Autoscriber.*
6. *LUMD Labs. (n.d.). Microsoft and Autoscriber join forces to save doctors valuable time and improve clinical insights in the EMEA region.*
7. *VDS. (n.d.). Autoscriber-Exhibitor profile.*

COMPARATIVE INSIGHTS

1. MTBs Workflow Solutions (7)

- Cloud/web platforms like OncoLens and NAVIFY centralize EHR/pathology/imaging into patient dashboards, automate agendas/protocols, and support remote boards; evidence highlights measurable efficiency gains (e.g., prep/documentation reductions in digitized ITBs) and wide adoption claims for leading vendors.
- Interop is mixed: HL7/DICOM common; FHIR details often “Not disclosed.” Security/compliance are table stakes (HIPAA/GDPR; selected SOC2/ISO27001).

2. Interoperability in MTBs Solutions (5)

- DACH-centric systems (ONKOSTAR, ODS-TumorBoard, CREDOS, ULTIMA, MTBP) focus on registry-grade documentation (BKRG/ADT) and accreditation workflows; named sites show scale (e.g., ONKOSTAR: >20,000 LKR submissions at CCC Karlsruhe in 2023; CREDOS used across 13 clinics).
- Deployment skews on-prem or tightly embedded in HIS (e.g., ULTIMA in SAP IS-H); ODS emphasizes on-premises, no patient-identifying data are stored on the internet.

3. Imaging & XR in MTBs Solutions (11)

- Most entries are research pilots/PoCs for immersive 3D review (VRMDT, IMHOTEP, TVASurg); commercial examples exist (Brainlab MR Viewer, Medicalholodeck) with positive user-reported understanding but sparse objective outcomes and limited live EHR/PACS integration.
- Hardware spans MR (Magic Leap) and PC-VR (e.g., Oculus Rift) across studies; Brainlab reports >110 installations as a notable commercial footprint.

4. AI in MTBs Solutions (12)

- Mature “ambient scribe” tools (Nuance Dragon Ambient eXperience (DAX) – builds on Dragon Medical; DeepScribe; Heidi; Autoscriber; Oncoscribe) automate structured notes with expanding oncology integrations (Epic/SmartData, OncoEMR, iKnowMed).
- Upstream AI/CDS platforms (e.g., Azra AI) automate case identification/triage and structured MTB outputs; multi-agent/orchestrator concepts are tracked.

5. Cross-Cutting & Multi-Axis Insights

- **Readiness:** Workflow and many AI scribes are commercial; Imaging-XR skews to pilots/PoCs; few products report peer-reviewed MTB outcomes. **Implication:** evidence generation is a differentiator.
- **Interop depth:** HL7/DICOM common; FHIR/IHE specifics often “Not disclosed.”
- **Dominant players:** Workflow-OncoLens/NAVIFY (feature--, multi-site); Interop-ONKOSTAR/ODS (registry-anchored, DACH scale); XR-Brainlab (install base); AI-Dragon/DeepScribe (health-system integrations).