



HiGHmed
Medical Informatics

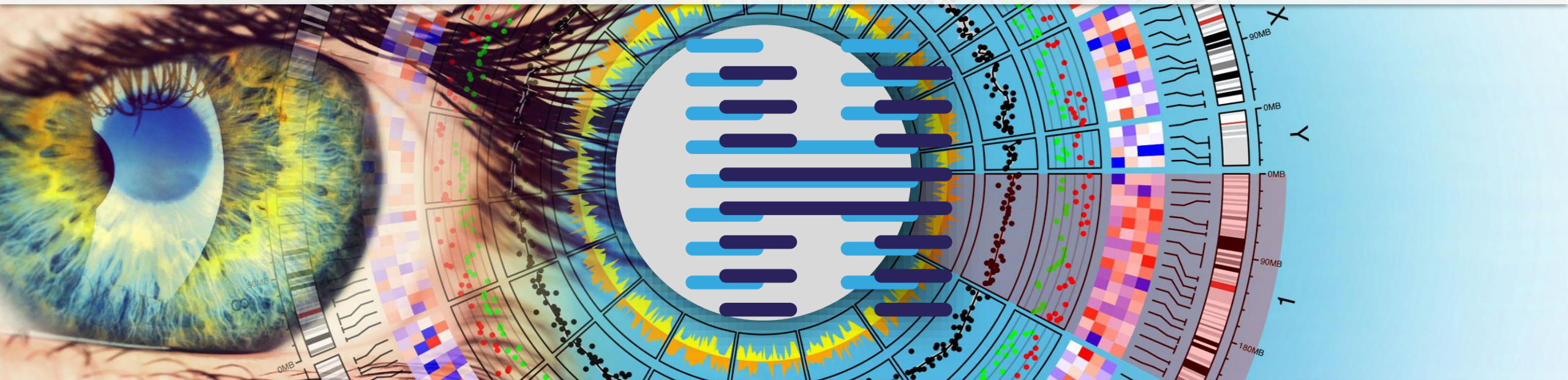
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HiGHmed – Digital Networking in Medicine



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HiGHmed-PI Heidelberg

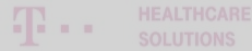
HiGHmed Partners

Associate Partners

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BMBF-funded HiGHmed Project Partners



BERLIN

- Robert Koch-Institut
- Ada Health GmbH
- Charité – Universitätsmedizin Berlin

BRAUNSCHWEIG

- Technische Universität Braunschweig
- Helmholtz-Zentrum für Infektionsforschung GmbH

COTTBUS

- Carl-Thiem-Klinikum Cottbus gGmbH

DARMSTADT

- Technische Universität Darmstadt

ERLANGEN

- Siemens Healthcare GmbH

FRANKFURT AM MAIN

- Dell Technologies

GÖTTINGEN

- Universitätsmedizin Göttingen
- Hochschule für angewandte Wissenschaft und Kunst Hildesheim/Holzminde/Göttingen

HANNOVER

- Medizinische Hochschule Hannover
- Hochschule Hannover

HEIDELBERG

- Universitätsklinikum Heidelberg und Ruprecht-Karls-Universität Heidelberg
- Deutsches Krebsforschungszentrum
- NEC Laboratories Europe GmbH

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KÖLN

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- Westfälische Wilhelms-Universität Münster und Universitätsklinikum Münster

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WALLDORF

- InterComponentWare AG

WÜRZBURG

- Universitätsklinikum Würzburg und Julius-Maximilians-Universität Würzburg

LEGENDE

- **AKADEMISCHE PARTNER**
- **INDUSTRIEPARTNER**
- **VERNETZUNGSPARTNER**
- **DATENINTEGRATIONSZENTREN**

8 University hospitals
9 Academic partners
5 Industry partners
1 Network partner

8 university hospitals
developing data
integration centers

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HiGHmed – Approach and Goals

- Development of an open, interoperable and research-compatible **eHealth platform** to support local and cross-site patient care and research
- **Reuse of medical data** from healthcare for research
- **Rapid exploitation** of research findings in healthcare
- **Comprehensive concept for training and further education**
- **Demonstration of benefit** from three clinical use cases with excellent researchers and clinicians
- **Innovative technical concept** :
 - **Semantic layer** (based on international standards)
 - **Joint information management / cooperative modeling**
 - **Cross-site requests and analyses**
- **Multi-level roll out concept** (participation model)

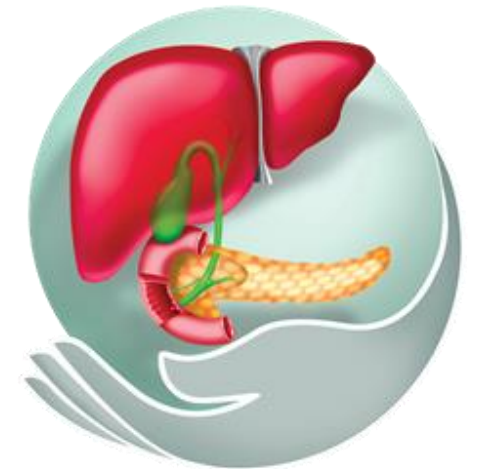
- 🏥 **Oncology** - Integration of various data types for personalized tumor boards
 - Supporting existing organ-specific tumor boards
 - Cross-institution molecular tumor board with experts
 - Discovery of „similar patients“, involvement of recent / newest scientific information and knowledge
 - Consulting according to recent / newest therapy approaches
- 🏥 **Cardiology** – Continuous monitoring of patients with heart insufficiency
 - Study registry for identifying risk factors of heart insufficiency
 - Long-term support for patients following stay in hospital
 - Connected with sensoric & app
- 🏥 **Infection Control** – Smart Infection Control System for pathogen outbreaks in hospitals
 - Early recognition of clusters and spreading of pathogens in hospitals
 - Reducing risks of infection in hospitals
 - Close cooperation with Robert Koch Institute in Berlin

■ The challenge in oncology

- More precise tumor characterization leads to ever smaller patient subgroups
- Expertise for all subgroups and therapy options cannot be provided at every HiGHmed-location
- Cooperation across locations is essential

■ Clinical focus in the Use Case Oncology (UCO)

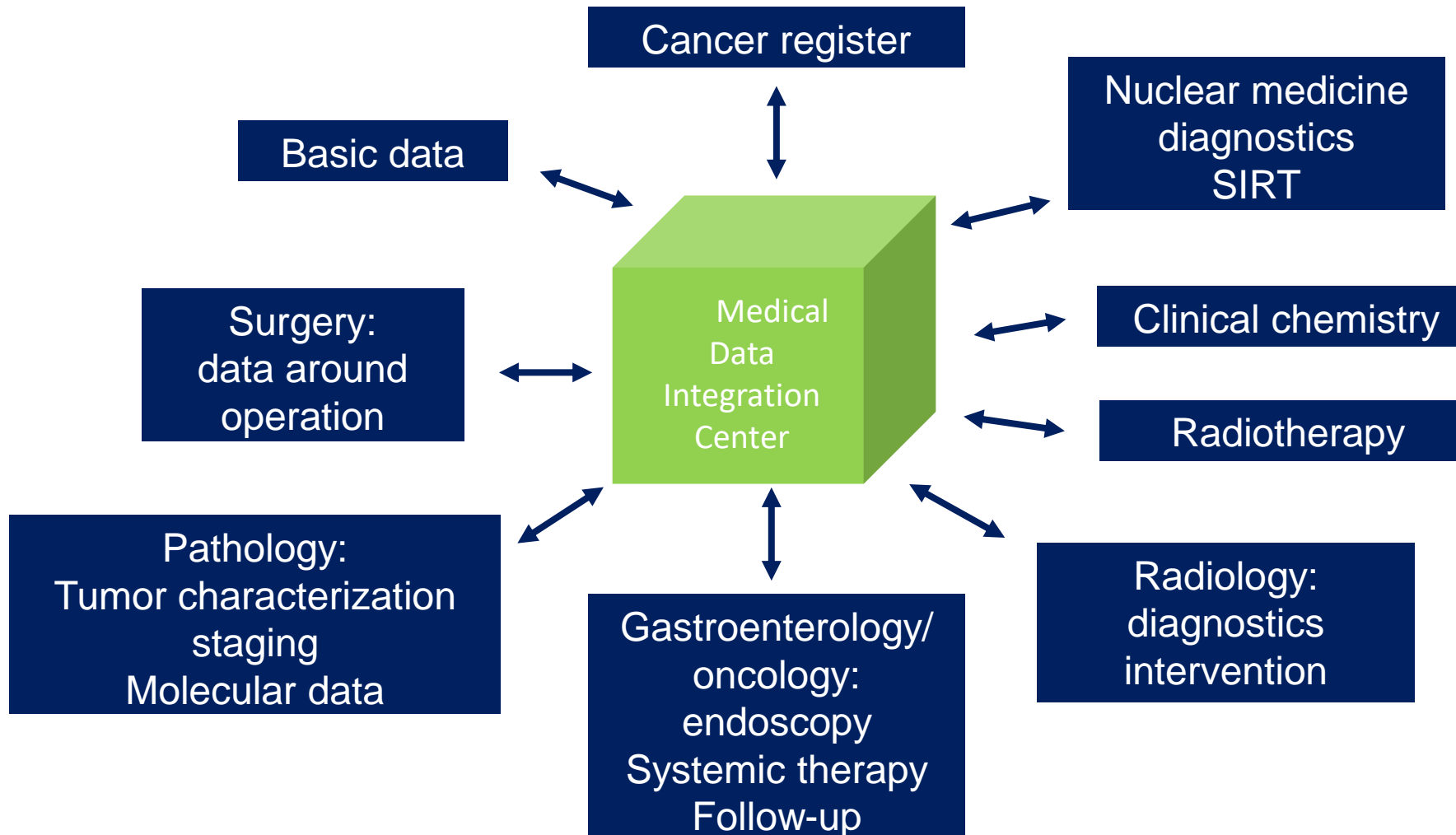
- Hepato-pancreatic biliary tumors (HPB)
- Aggressive course
- Always require a multidisciplinary therapy
- High demand for innovative strategies



Goals/ Objectives

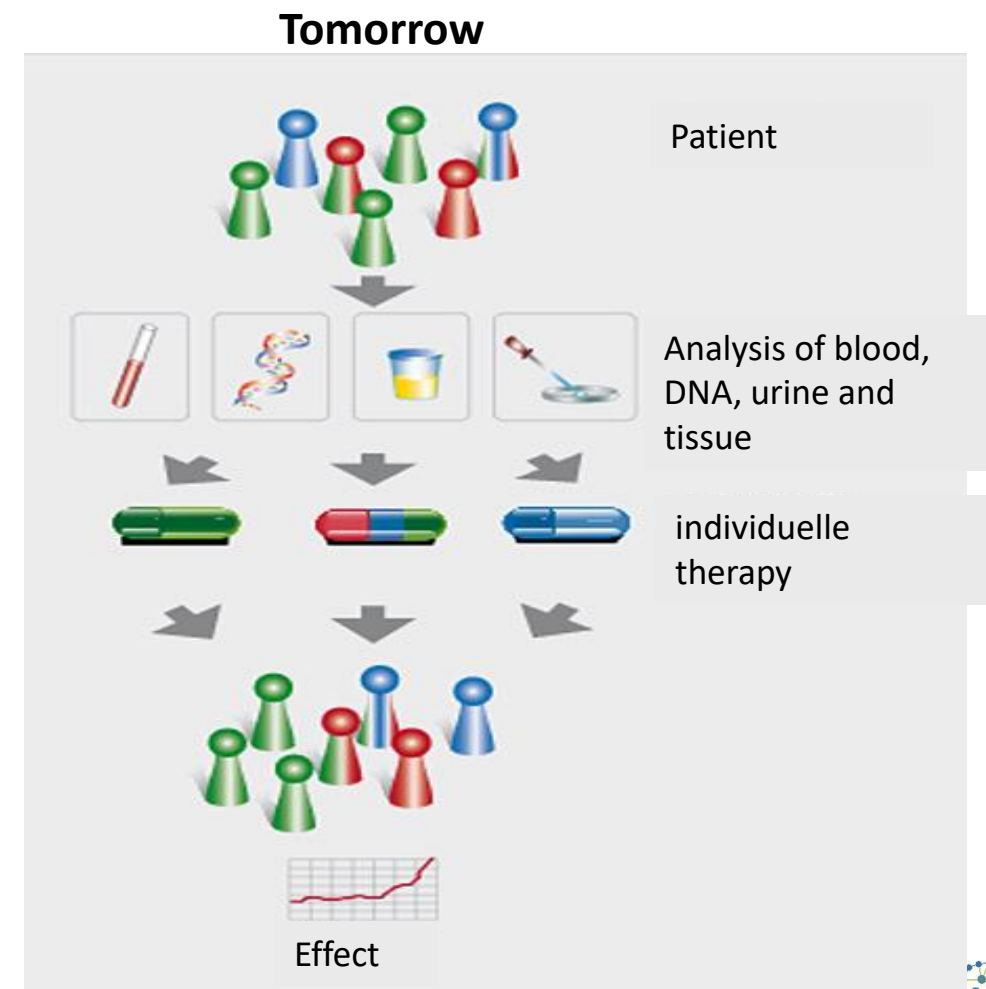
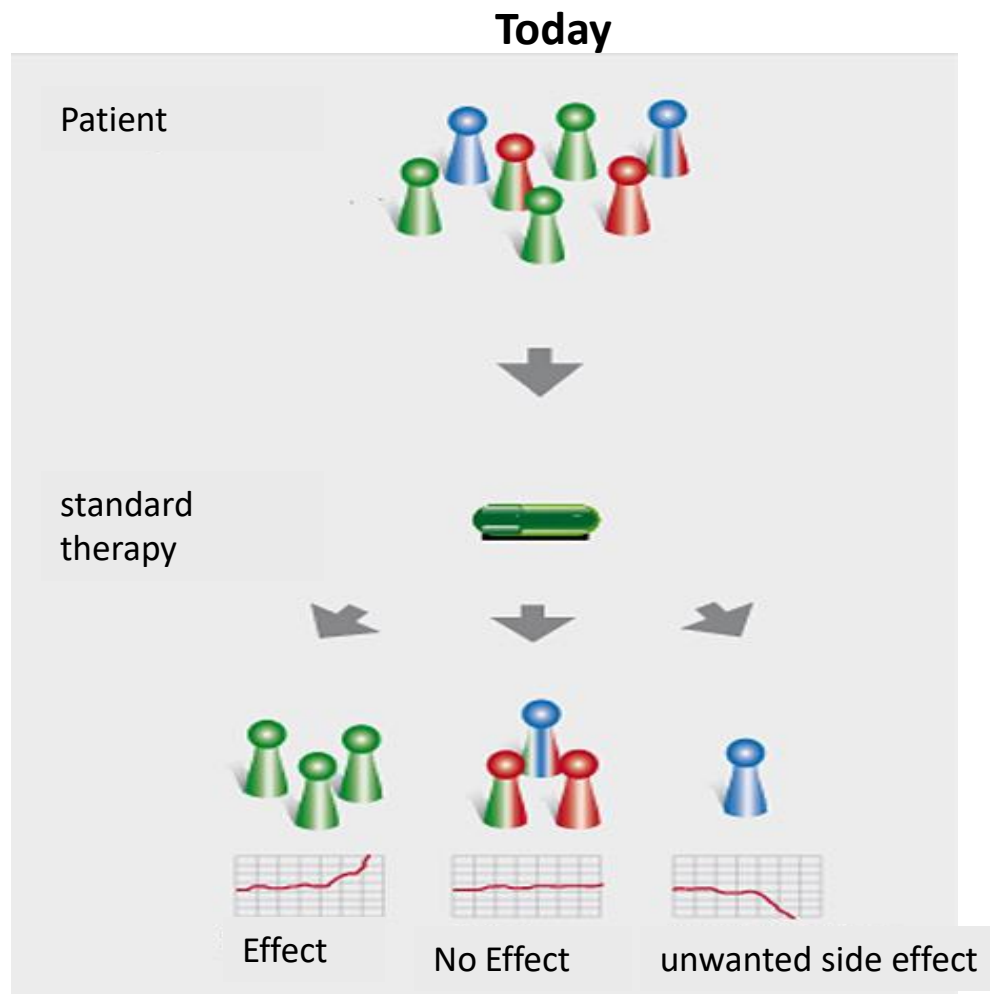
- Integration of all relevant clinical and scientific data sources
- Establishment of a cross-institutional Molecular Tumor Board (MTB)
- Therapy recommendation based on molecular tumor characterization
- Validation and initiation of innovative clinical studies in selected patient groups (basket/umbrella studies)
- Use of the generated knowledge to develop new treatment strategies
- Establishment of an extensive oncological database across all locations
- Support of a cross-site search for "similar patients"
- Integration of the latest scientific findings ("world knowledge")

Use Case Oncology- Data sources



Courtesy of M. Wieland, P. Schirmacher

Therapy recommendation based on molecular tumor characterization



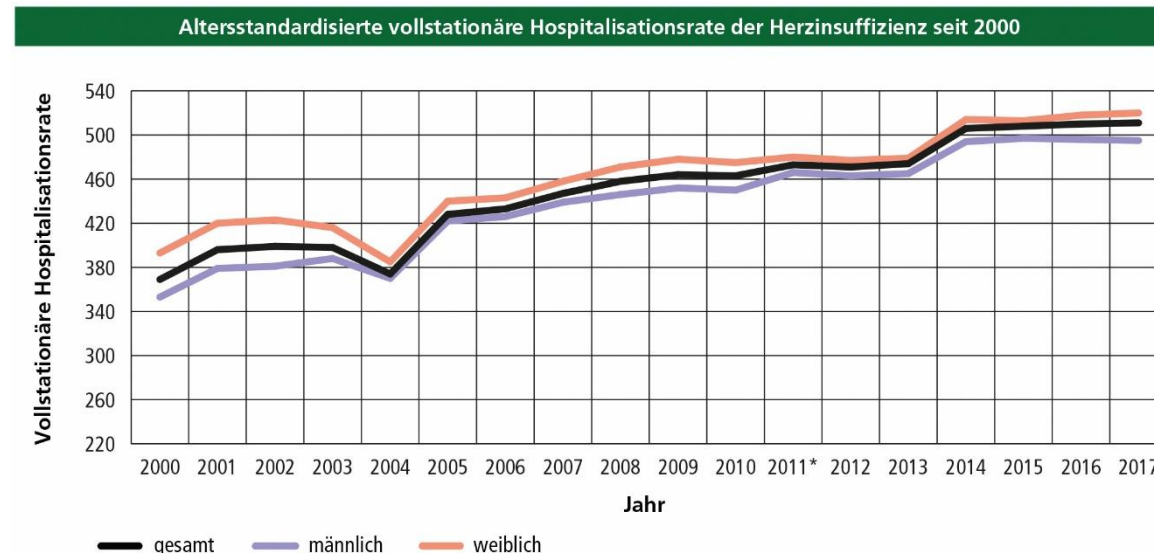
Use Case Oncology- Prospects for 2020

- ☰ Focus on software support of the MTB
- ☰ Project for panel evaluation of all locations by NCT MASTER
- ☰ Project for the follow-up survey
- ☰ Project to evaluate the benefit of the MTB software

HiGHmed Use Case Cardiology- Motivation

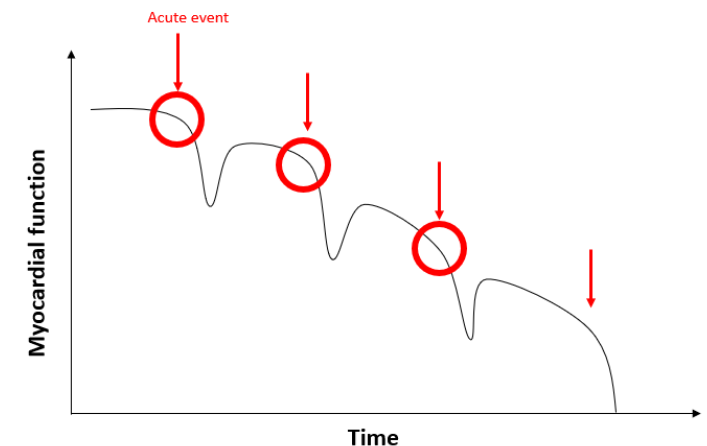
Importance for the healthcare system:

- 2-3 million patients with chronic heart failure
- Most common reason for hospitalization in Germany (500,000 per year)
- approx. 50,000 heart failure-related deaths (third most common cause of death)
- approx. 5 billion € per year health-related costs due to heart failure

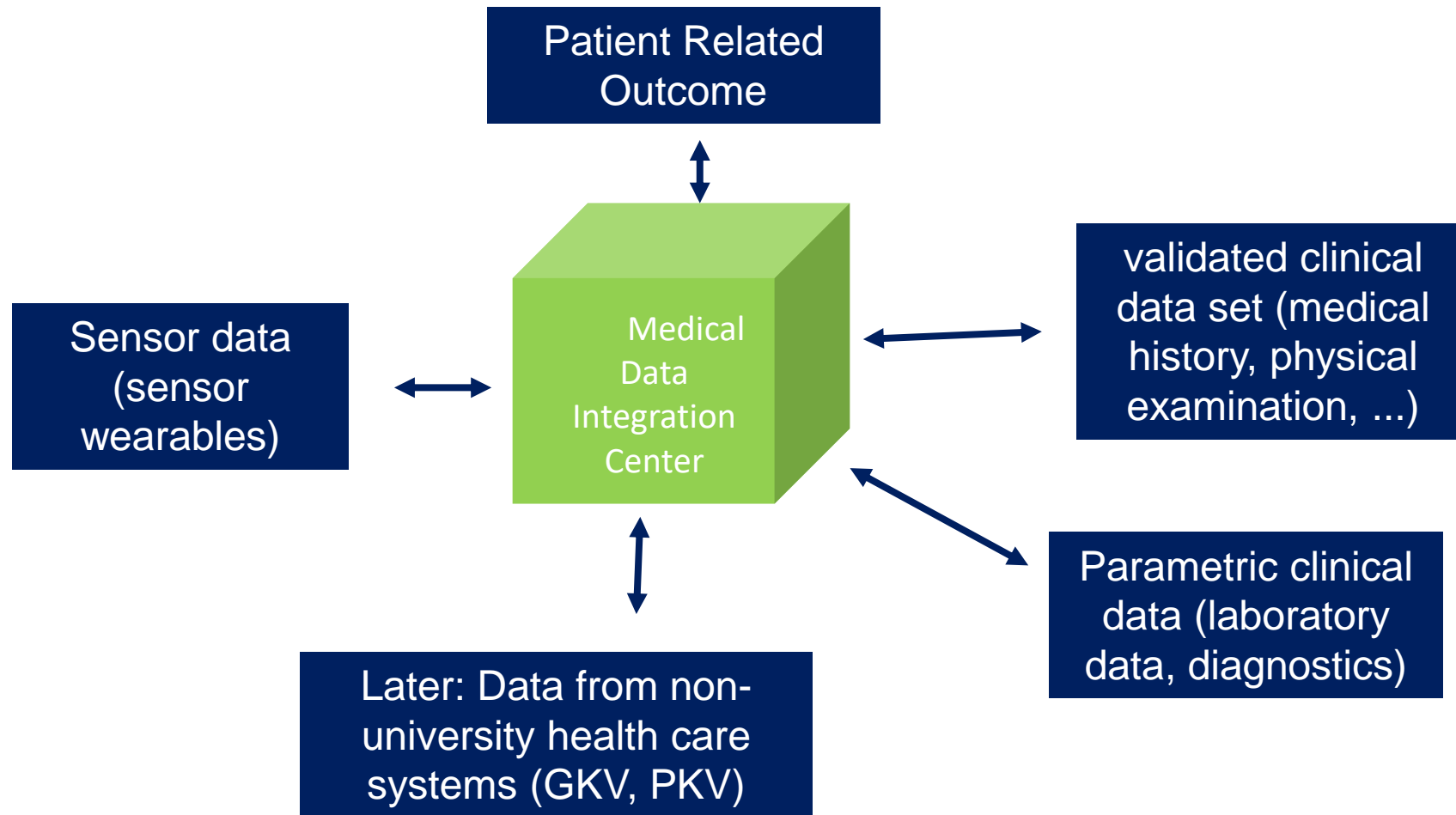


Berechnung auf Grundlage von Daten des Statistischen Bundesamtes
* ab 2011 Bevölkerung auf Grundlage des Zensus 2011

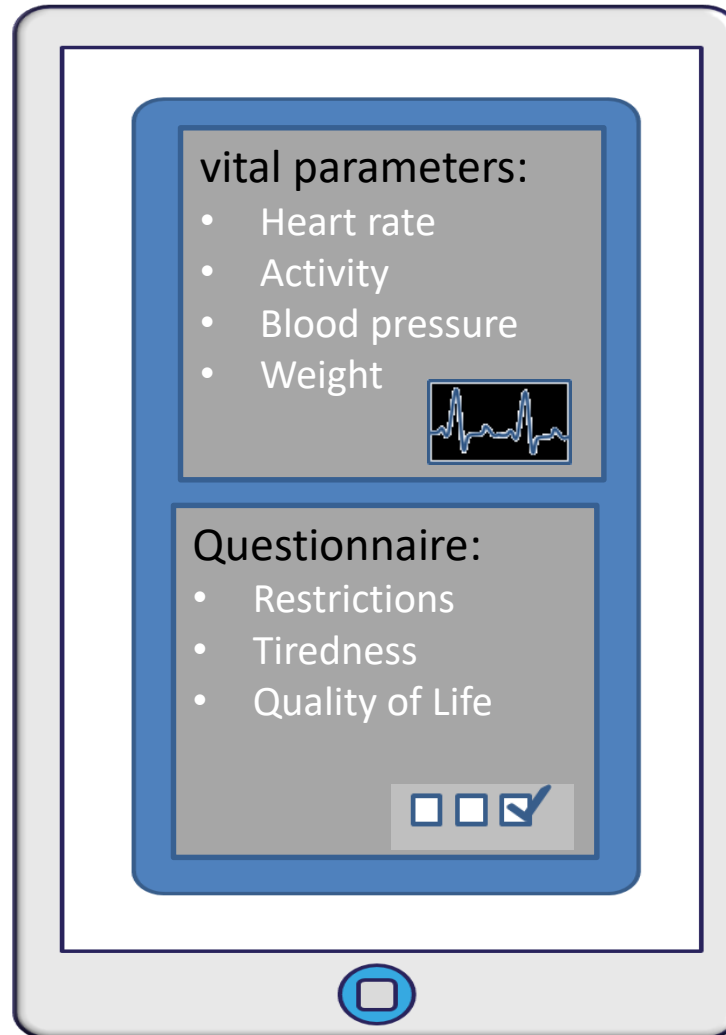
- 📊 **Goal/ Objectives:** Reduction of hospitalization and mortality of HI-risk patients through clinical decision support
 - Identification of high risk patients
 - Use of wearables & apps for recording longitudinal data
 - Adaptation of medical treatment to personal patient risks due to different data sources
 - data exchange between the different HiGHmed-locations



Use Case Cardiology- Data sources



Use Case Cardiology- App& Sensorik



Motivation

- Longitudinal survey of the patient's everyday life (out of the hospital)
- Connection to clinical development can be understood

Concept

- Physical parameters and KCCQ12

Challenges

- Personal resources and logistics
 - Consent, Onboarding, First Level Support

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Use Case Cardiology- Prospects for 2020

- Collection of structured data sets from clinical routine care (also harmonization across sites)
- Identification and optimization of infrastructural factors that limit effective data collection from clinical routine
- Development of first models for the cross-site analysis of longitudinal data from routine clinical care (depending on follow-ups)
- Implementation of wearables in clinical care and survey longitudinal sensor data (including activity) and patient-reported outcomes (PROs)

HiGHmed Use Case Infection Control- Motivation

Microbiological data:

- High complexity
- High granularity
- Restricted availability
- Low degree of standardization
- Highly interpretable

Transaction data:

- additional source systems
- increased susceptibility to errors
- unsafe information content
- Highly interpretable
- not enough standardization



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Today: *Reaction*



Tomorrow: *Anticipation*



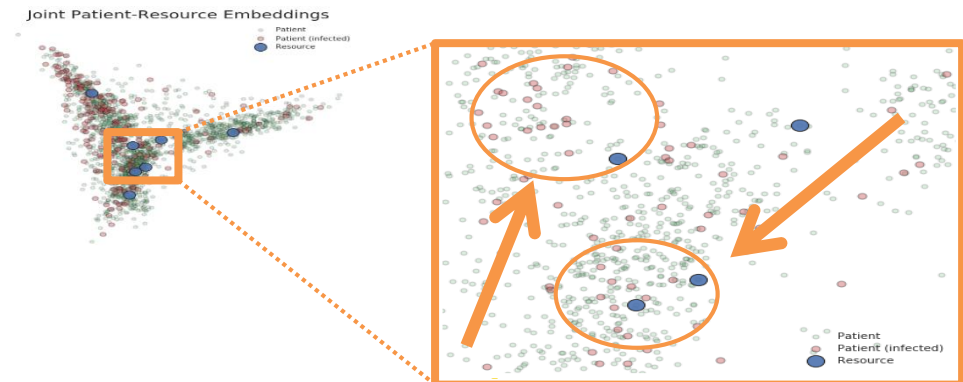
Outbreaks cannot be completely prevented

But:

- The number of clusters can be reduced
- The number of detected clusters can be increased
- The number of affected people and effects can be reduced

Use Case Infection Control

- **Goal/ Objectives: Development of an „Smart Infection Control System (SmICS)“ - automatic early warning system for clusters and outbreaks**
 - Interactive visualization of patient, movement and microbiology data
 - Algorithmic detection of pathogens, clusters and outbreaks
 - Identification of pathogen clusters
 - Automatic pathogen surveillance
 - New insights through inter-institutional data exchange and machine learning, e.g.
 - Intersection points of patient movements
 - Identification of information sources

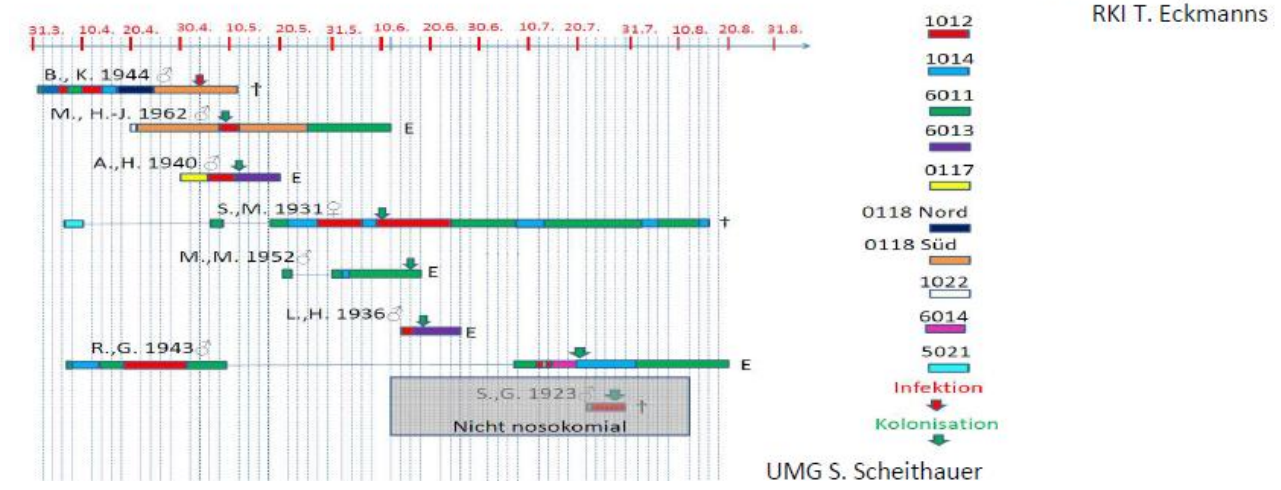
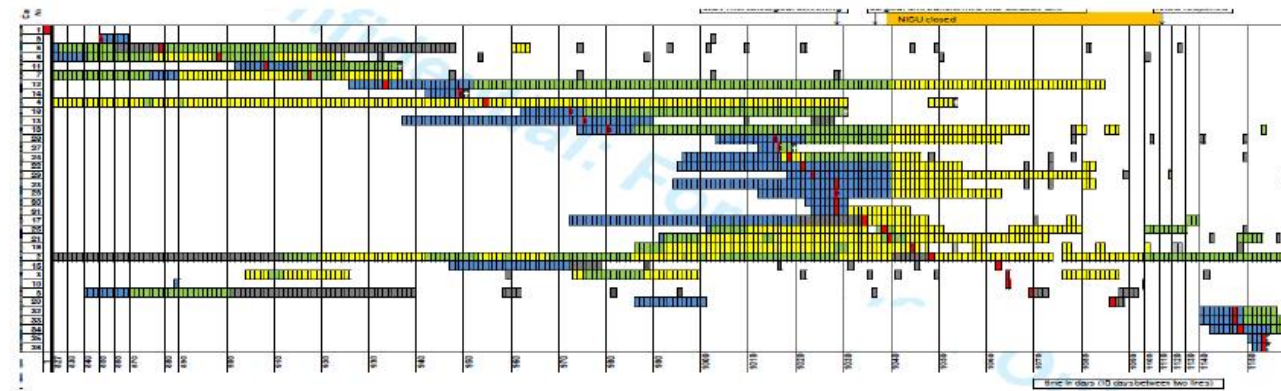


Use Case Infection Control - SmICS

Requirements for the SmICS system

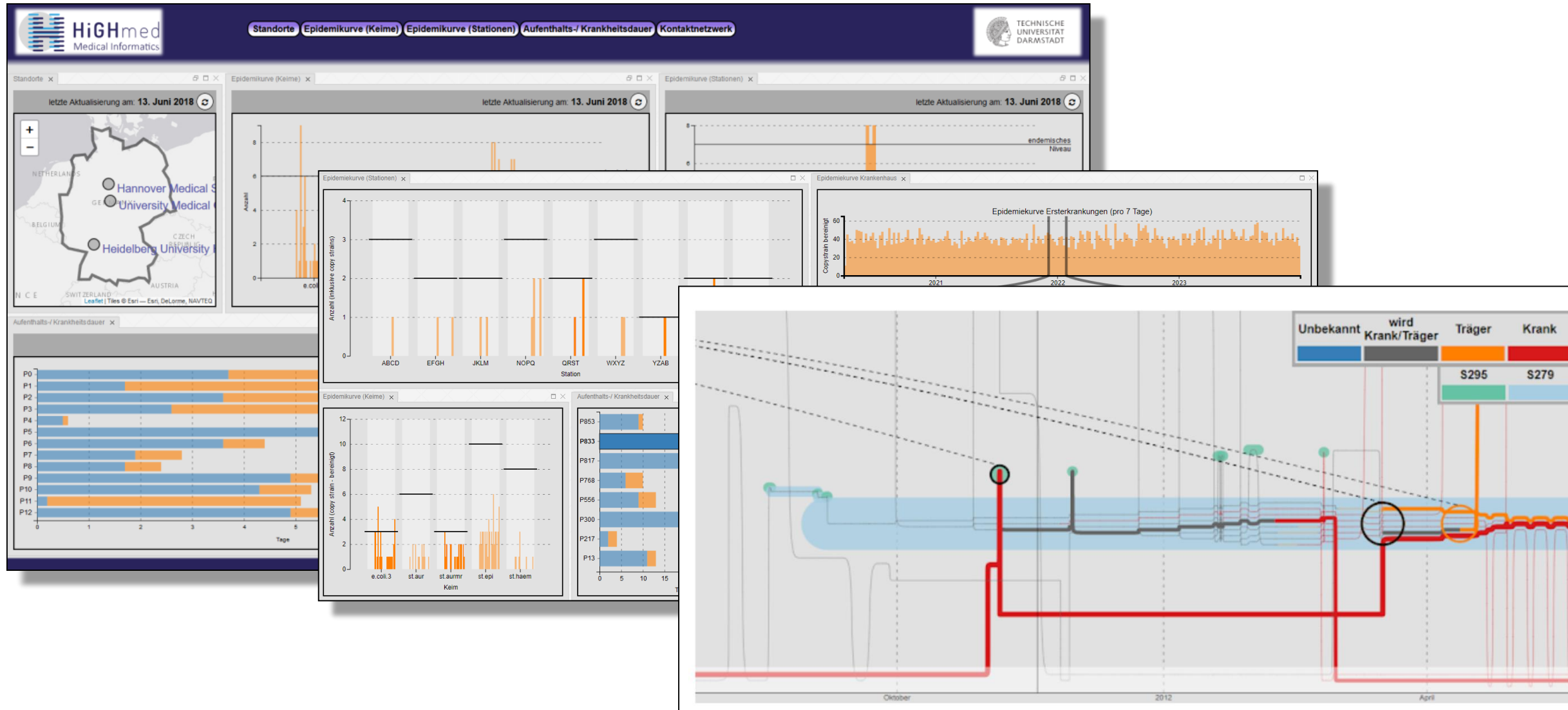
- User friendly, intuitive
- Real-time capability
- Stable, scalable, open, expandable
- Learnable
- Hypothesis Generation
- Independent of institutions

→ Time saving and Knowledge



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Use Case Infection Control- Prototype SmICS visualization component



Use Case Infection Control- Prospects for 2020

- Advancement of **visualization and algorithms** on the basis of meaningful (large-scale) data sets for test and analysis purposes
- **Pilot SmICS V1.0 => COVID-19**
- **Test of further algorithms** of known data sets (outbreaks) with questions regarding to sensitivity, specificity und precision
- **Molecular genetic characterization** of a pathogen sentinel for the precision of SmICS

- 1. **Open Service Models:** All specifications of the APIs are openly accessible to everybody. Specifications include data security and privacy, electronic health record management, and database queries.
- 2. **Open Information Models:** All clinical models (e.g. lab values) are well defined based on established open standards. Data based on these models can be reliably processed and computed in local and distributed environments.
- 3. **Open System Specifications:** All system components and protocols are openly specified using licenses feasible for commercial and non-commercial use. i.e. every component in the system can be replaced by software from multiple vendors or by an open source project.

IHE Integrating
the Healthcare
Enterprise

*open***EHR**

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Technical Concept

- Each HiGHmed site establishes a **Data Integration Center** according to common HiGHmed standards
- Local implementation of the HiGHmed platform to establish **shared services and data models**
- Use of **IHE XDS Cross-Enterprise Document Sharing** to establish vendor-neutral archives and to support continuity of care processes
- Working on joint semantics through **openEHR**; with common archetypes and AQL query language interface
- Implement **FHIR interfaces** to enhance data exchange capabilities
- Each site can setup **local data analytics layers**
- Striving for vendor neutrality in the implementation of the technological stack to support a dynamic **ecosystem of contributions following common standards**
- Providing a support **structure for rollout at different sites** with exchange of best practice guidelines

- The Conference of Independent Data Protection Commissioners of the Federal Government gave their agreement to a nationwide standard model text for patient consent (Broad Consent)
- Initial HiGHmed Privacy Concept approved by TMF Data Protection Working Group
- Approval from the ethical committee for the clinical use cases
- Minimal data sets generated for the clinical use cases Identification of source systems and interfaces
- Governance model established (governs the responsibilities and processes of the preparation, and the cross-site revision of archetypes and templates)
- Harmonization of terminology use for the core data set and the extension modules in the medical informatics initiative

The HiGHmed team says thank you for your attention!

