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Telemedicine & Tele-Stroke. Speed up!

San Benedetto del Tronto
29 Octobre 2016

Telemedicine

- **Definition:** Performance of diagnostics and therapy with distance between doctor and patient using modern telecommunication and information technique
- **Telecooperation** (store & forward)
- **Teletherapy** (interactive service)
- **Telemonitoring** (remote monitoring)

Telemedicine

- History:
  - Tele-EKG 1905
  - Tele-Stethoskop 1910
  - Tele-Consultation in surgery 1917
  - Projects for NASA, Internet 1990s
  - Teleradiology, etc.

- Critics:
  - Interferes with medical ethos – displaces personal caring
  - Distant treatment – contradicts with professional rules
  - Medical benefit - not sufficiently proven
  - Absolut secure data safety – technical illusion

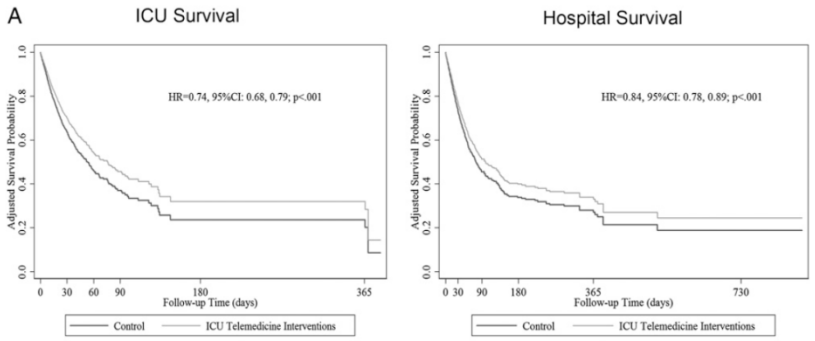
Tele-Intensive Care Medicine

- 24h presence of Tele-ICU-team
- real-time examination of ICU-Patient
- transfer of vital parameters, alarms
- transfer of structured patient data

CHEST Original Research
CRITICAL CARE

A Multicenter Study of ICU Telemedicine Reengineering of Adult Critical Care

*Craig M. Lilly, MD, FCCP; John M. McLaughlin, PhD, MSPH; Huifang Zhao, PhD; Stephen P. Baker, MScPH; Shawn Cody, RN, MSN, MBA; and Richard S. Irwin, MD, Master FCCP; for the UMass Memorial Critical Care Operations Group**



Lilly et al., 2014

Tele-Stroke - What is needed?

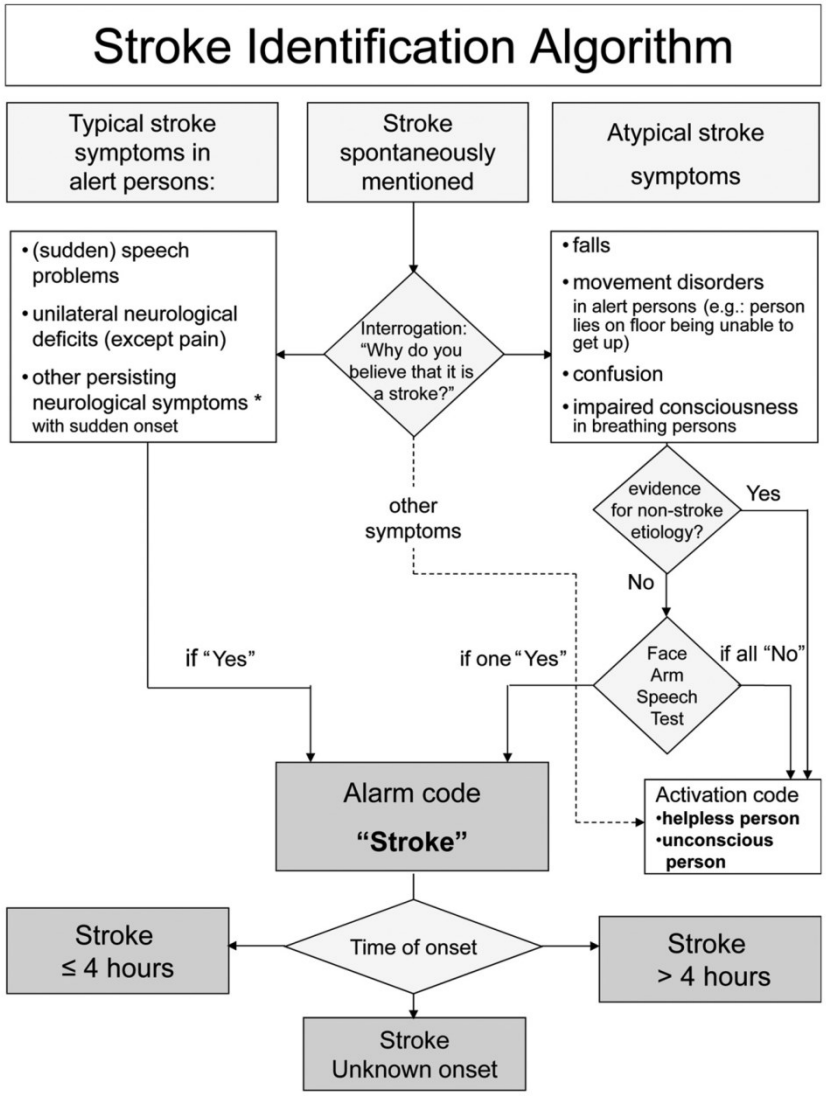
Prehospital Stroke-(Telemedicine) Network

Acute Therapy – „intrahospital Network“

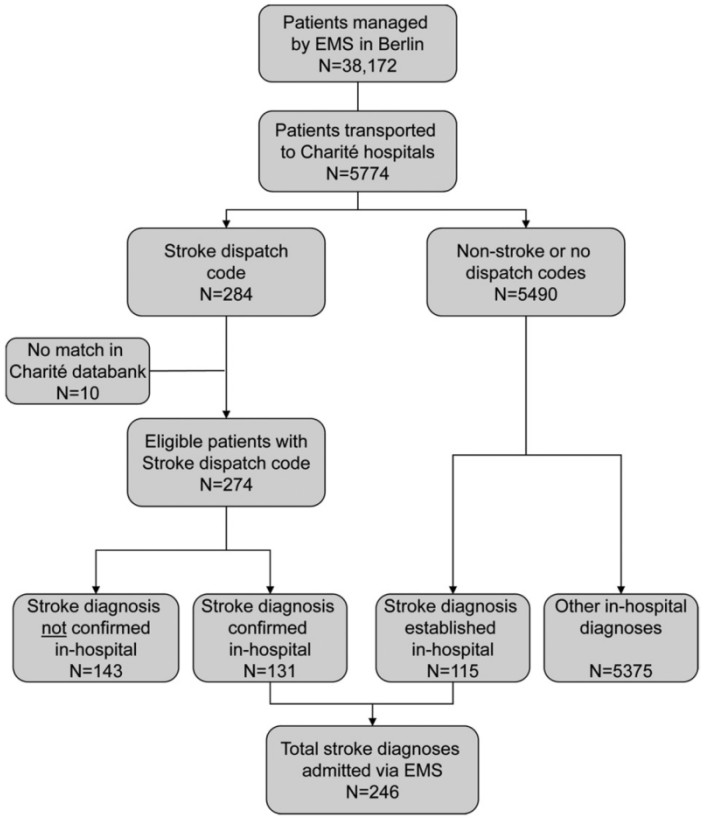
Inter-Hospital-Tele-Stroke´Network

Post-Stroke-(Tele-) Network

Prehospital (118)



Berlin - Interview:

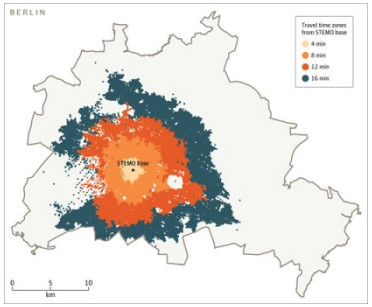


Krebes et al., *Stroke* 2012

Tele-Stroke-Reality 2014/15/16

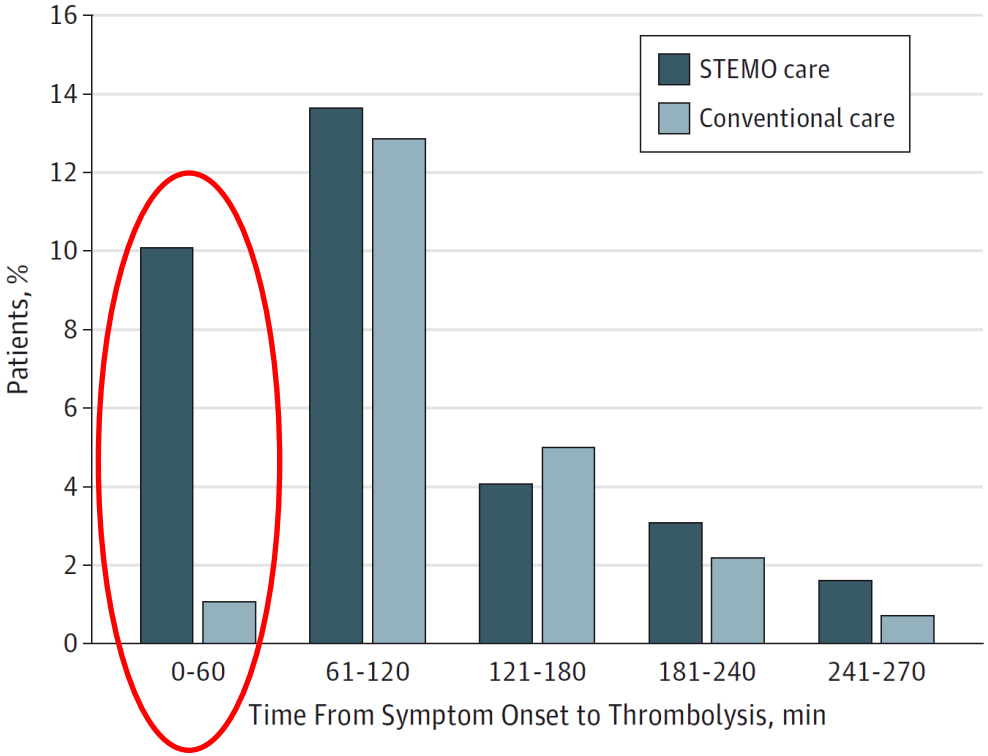
- PHANTOM-S (prehospital aucte neurological therapy and optimization of medical care in stroke patients)
- 6182 patients in 21 months, of them 1804 in STEMO and 2969 controls (age 74 y)
- 28 cooperating hospitals
- 33% thrombolysis-rate in STEMO vs. 21% controls
- 2.2% sICH in STEMO v. 6.4% in controls
- 25 min time reduction „alarm to treatment“; equal safety

(**Alarm - To - Needle - Time**: 52 min vs. 77 min)



Ebinger et al., JAMA 2014

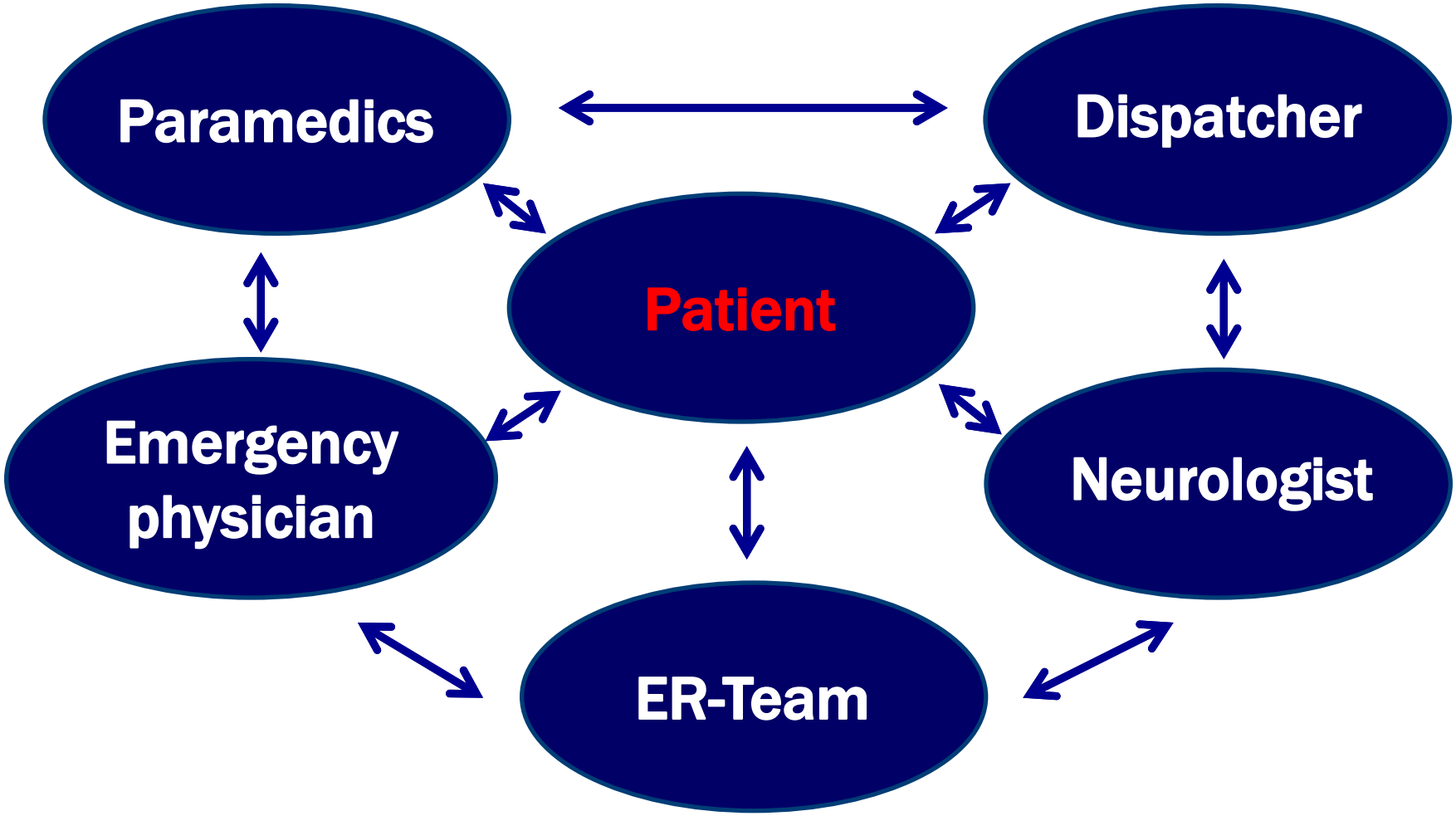
Tele-Stroke-Reality 2014/15 – „golden hour 1.0“



- „Golden-Hour“-thrombolysis patients with higher chance of discharge at home

Ebinger et al., JAMA Neurol 2015

Prehospital-Network



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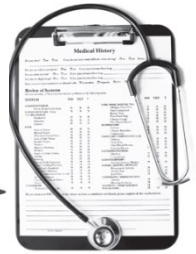
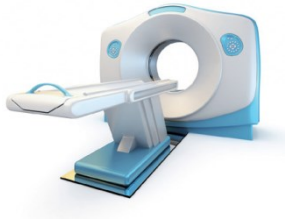
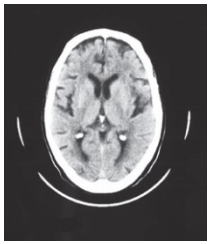
The GOLDEN (half) Hour

Intrahospital







T=0
Arrival in Hospital

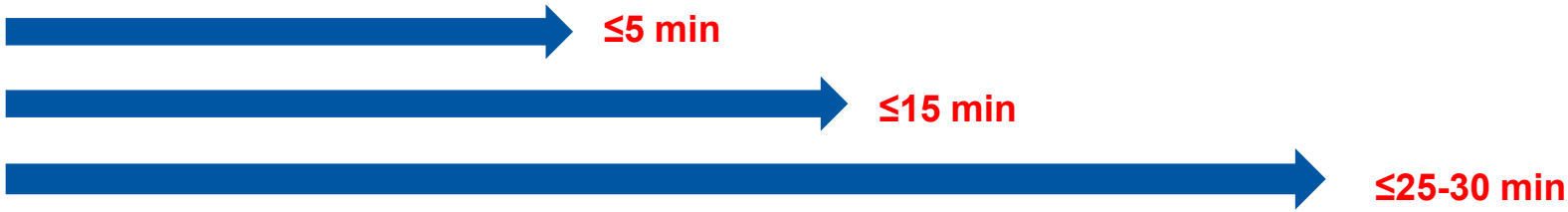
≤10 min
1st evaluation (incl. history, Labor & NIHSS)

≤ 15 min
Stroke-Team Alarm

≤ 25 min
Imaging / CT

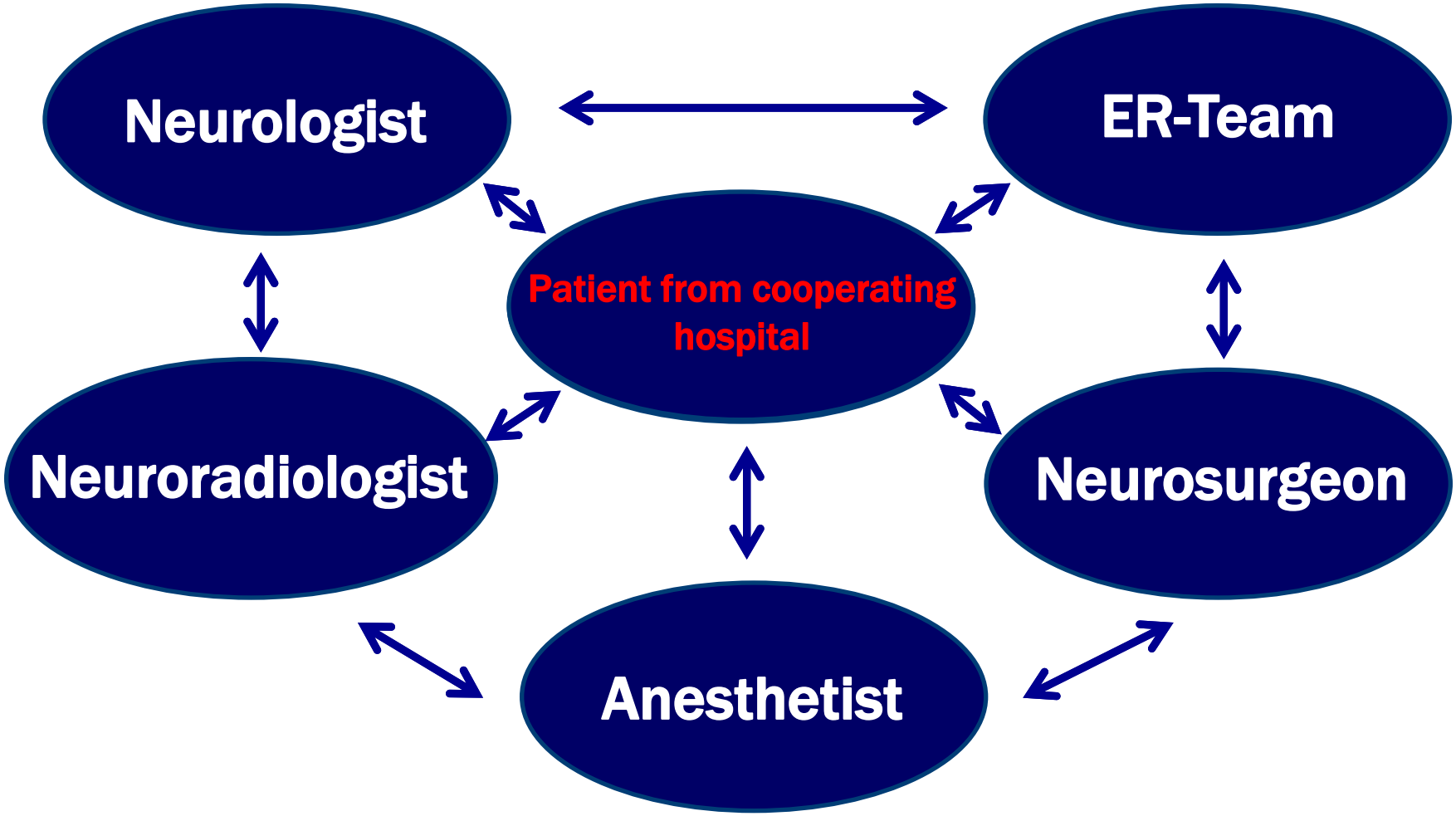
≤ 45 min
CT & Labor Results

≤ 60 min
rt-PA administered



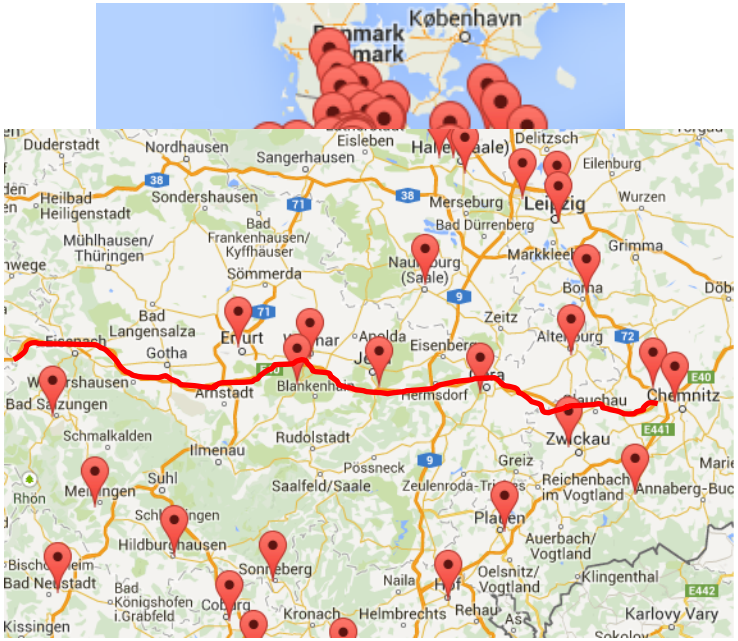
DGN-LL 2012

Intrahospital-Network

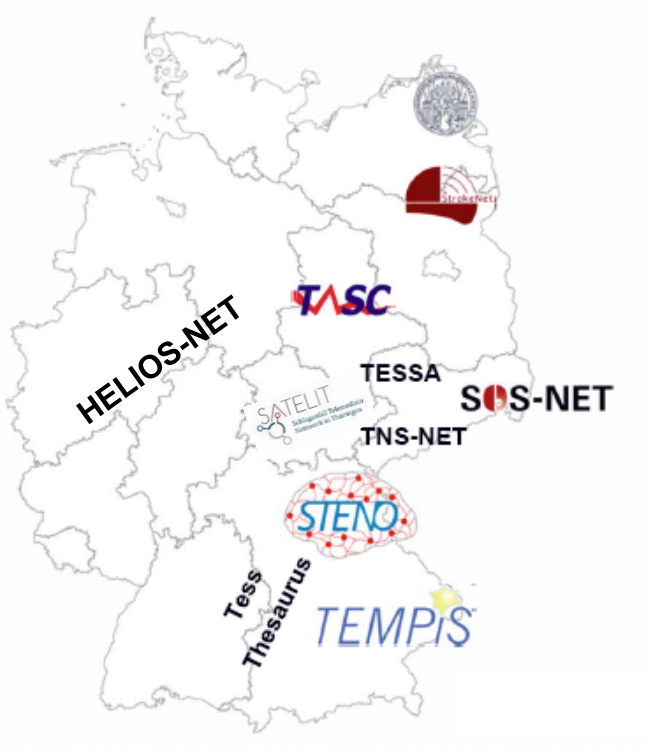


Stroke-Telemedicine

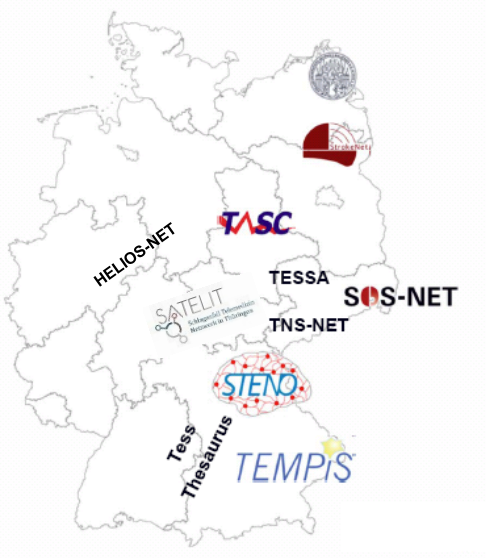
291 Stroke Units in Germany (25.10.16)



>15 Stroke-Telemedicine-Networks



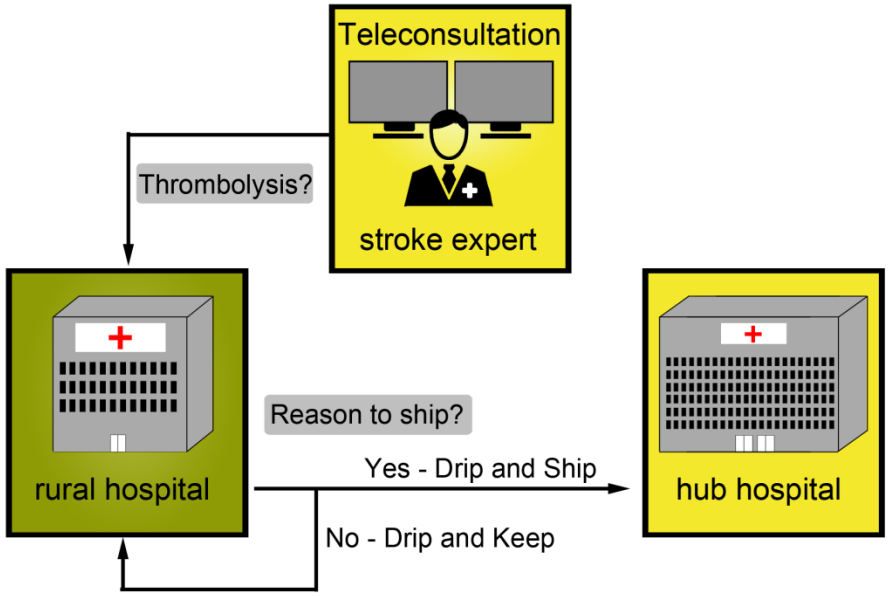
Stroke-Telemedicine



- In Germany app. 50% of all stroke patients not treated in Stroke Units (ca. 140.000 Patients/yr)
- Shortfall between regional (standard) and university care
- Shortage of specialized staff (doctors, nurses, therapists)
- > 15 Tele-Stroke-Networks > 10.000 Patients / year

Stroke-Telemedicine Concepts

- TEMPiS: integrated tele-stroke network
- „Drip & ship“ vs. „Ship & Drip“ vs. „Trip and Treat“
- “Hub & spoke“
- „Specialist on call“



Joubert, 2012; Klingner & Günther, 2016

Thuringia

Marches

Thuringia

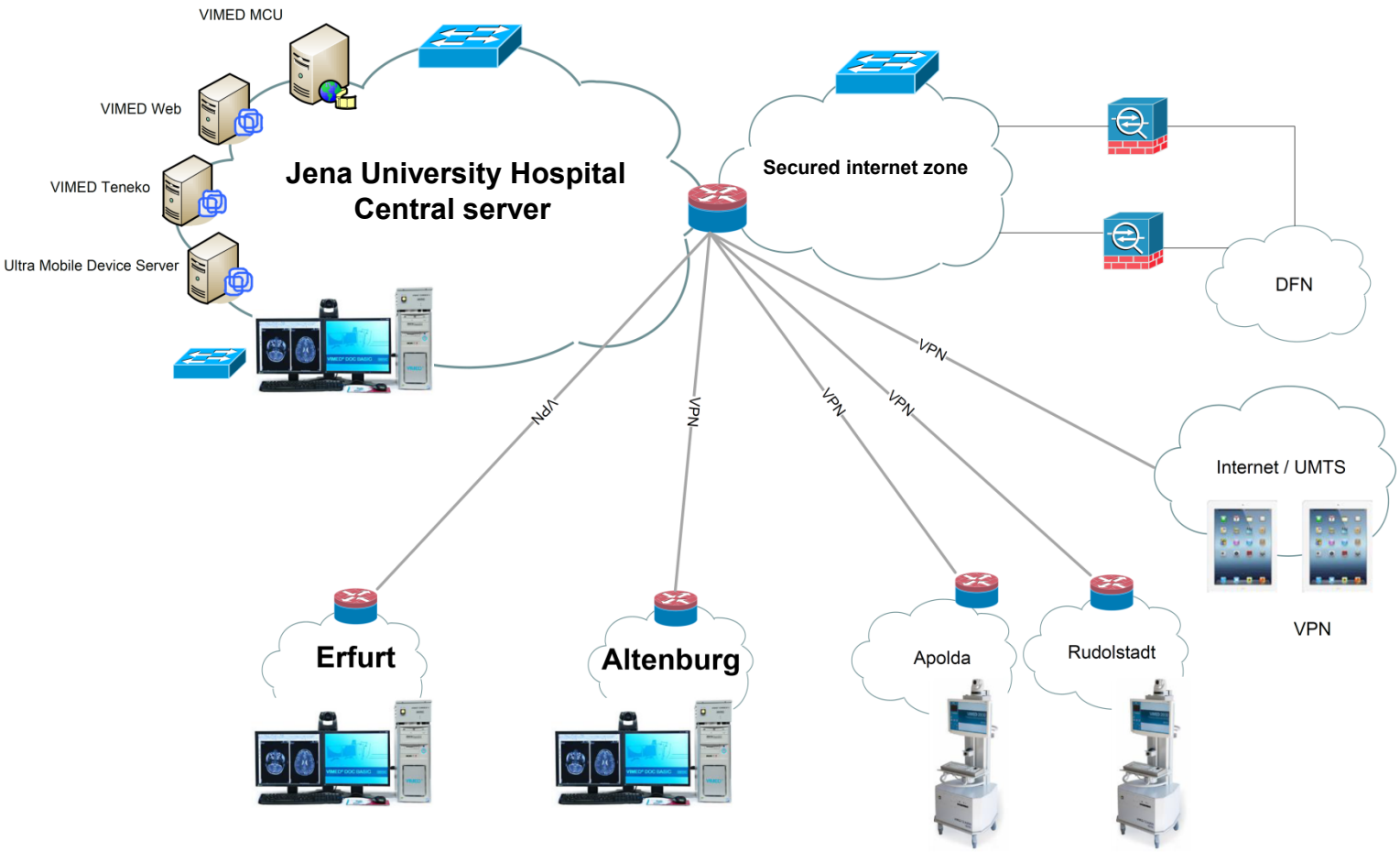
- 16,171 km^2
- 2.29 million inhabitants (130/km^2)
- sixth smallest by area
- fifth smallest by population of Germany's sixteen states.

Thuringia

44 Hospitals with 16 177 beds 35 Rehab./Prevention inst. with 5 816 beds

Health care in Thuringia is currently undergoing a concentration process. Many smaller hospitals in the rural towns are closing, whereas the bigger ones in centres like Jena and Erfurt get enlarged. Overall, there is an oversupply of hospital beds, caused by rationalisation processes in the German health care system, so that many smaller hospitals generate losses. BUT: there is a lack of family doctors, especially in rural regions with increased need of health care provision because of overageing.

This is how we started….



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SATELIT Schlaganfall Telemedizin Netzwerk in Thüringen

Tele-Stroke-Network 10/16

Tele-Consultation standards (DSG, DGN)

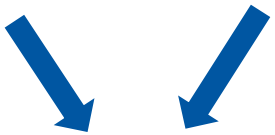
- Stability, Integrity / Authenticity, Liability, Confidentiality (VPN-Tunnel)
- Teleconsultation available and feasible 24x7x365
- Immediate direct patient evaluation by tele-stroke-consultant, NIHSS oriented
- High resolution bidirectional real-time Audio-/Video transmission in a suitable room (patient and on-site-colleague can see and hear each other, can speak freely)
- Parallel access to original imaging data of the patient
- law compliant data safety concept (minimum 128 bit coding)
- Written consultation opinion on status and procedure

Audebert, 2009

Tele-Stroke Network prerequisits (DSG, DGN)

- **Stroke Center**
- certified overregional Stroke Unit
- possibility for interventional and non-interventional diagnostics and therapy (Neuroradiology/N-surgery)
- Consultant Neurologist,
- > 1 year Stroke Unit experience
- no other clinical duties while on tele-stroke-call

- **Cooperating Hospital**
- equipment as a regional Stroke Unit
- neurology consultant monday-friday
- if not: available stroke specialist via telestroke



- regional relationship
- option for quick transfer to stroke center
- obligatory list of indications for consultation
- continued quality management (audits, stroke registry)
- regularly stroke education (doctors, nurses, therapists) 2x/year, bedside-teaching, hospitations
- establishment of Standardized organzied procedures

Busse, 2008

Telestroke-Consultation-Indication

- ***Framework agreement (hospital association, ministry of health, health insurance companies, SATELIT / UHJ)***
- clinically suspected acute ischemic stroke with potential eligibility for thrombolysis,
- intracranial hemorrhage,
- reduced level of consciousness of unknown etiology,
- suspected brain stem symptoms,
- progressive stroke,
- uncertainty about further diagnostic or therapeutic procedures

Consultation algorithm

- Who is my Tele-stroke-partner on the other side?
- Telephon-Contact: „*hello, I have here this young man…*“
  - Fixed tele-stroke phone-number (Stroke Center)
- Send images. Ask if further special imaging necessary (MRI, CTA?)
- Appointment at „teledoc“: „*see you in 3 minutes*…“

(Please try to get / document patients consent for consultation)

Consultation algorithm

- Short history („Coop“-Doctor / Patient)
- Short clinical Evaluation (maybe with help of nurses / Coop-Doctor
- Short feedback about imaging / clinical evaluation

Consultation algorithm

- Agreement on further procedures (thrombolysis, further necessary diagnostic, control imaging, early secondary prevention, possible Re-evaluation indication, etc… - *please make yourself clear upon disagreements*!)
- Fill in of consultation forms and sending per TENEDOC
- printing in cooperating hospital
- Further agreement if immediate transfer is announced
  - Candidate for thrombectomy, neurovascular surgery, ICP-monitoring/therapy at Neuro-ICU, differential diagnosis requiring urgent specialized neurological care
  - Bridging-Lysis ?
  - Proxies phone number

Tele-Consultation-Compartments

Video-Software

Audio/Video based Examination

Exchange with colleagues (history, etc.)

Imaging-Software

Judgement of cranial imaging

(no radiological report!)

Consultation-Software

Summary on neurological status (NIHSS)

Imaging judgement

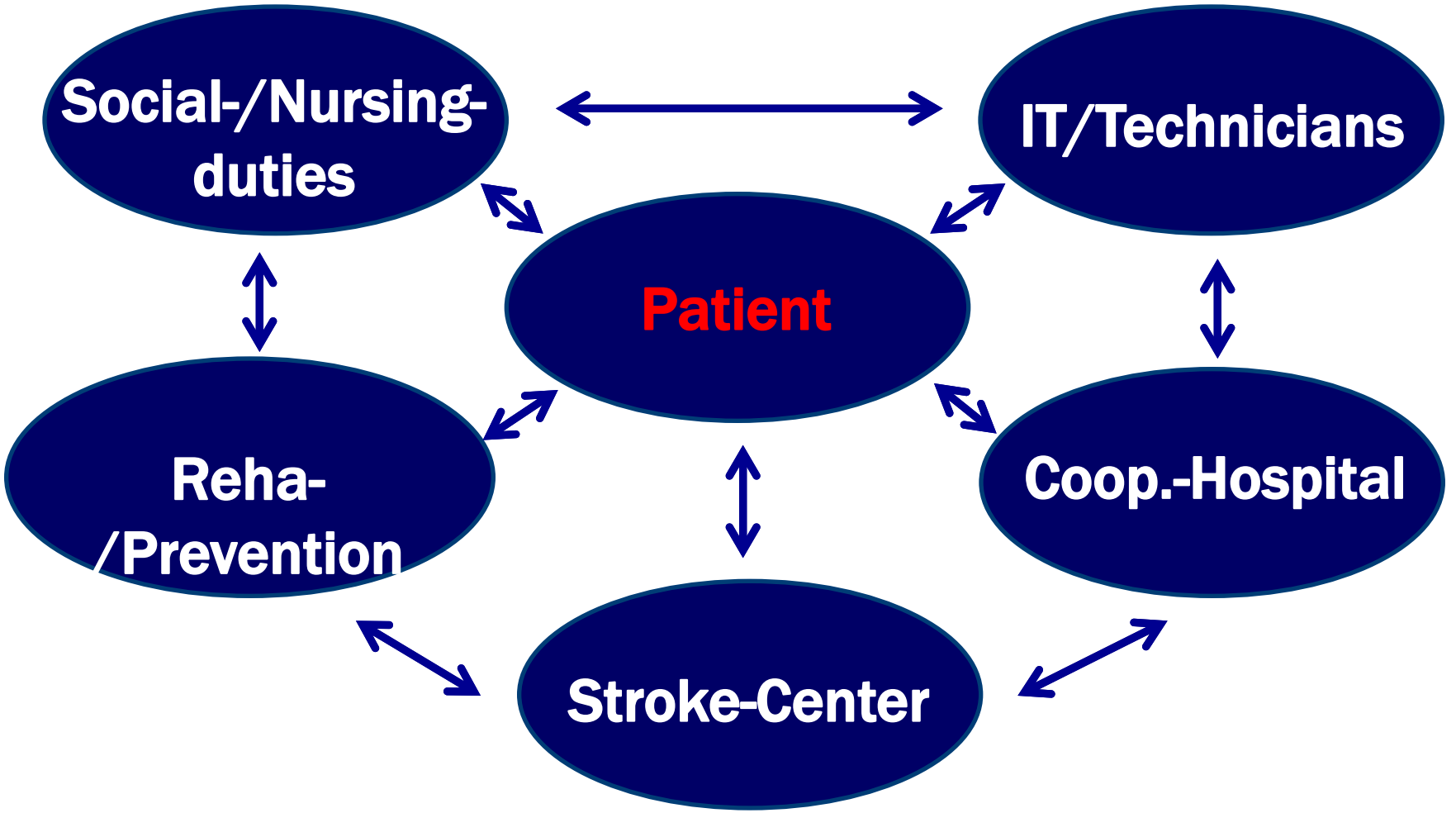
Suggestions for further procedures (Tx, TE, surgery, diagnostics, monitoring, second. prevention

Telestroke-Network

Financing:

- Investment of ministry of health in Thuringia (250 tsd € for initial hardware implementation)
- Tele-consultation reimbursed through health insurance companies (DRG-system)
- Or through *Quality assurance fee* payed by health insurance companies (frame work agreement)
- No grants, no industrial funding

Telestroke-Network



Tele-Stroke-Effects

Telemedicine: Results (Integrated Stroke-Network)

- Better quality indicators in telemedical cooperating regional hospitals[1,2]:
  - Immediate imaging (74% vs 32%)
  - immediate vascular imaging (83% vs 63%)
  - thrombolysis (5% vs 0%)
  - faster start of thrombolysis
  - Tele-Thrombolyse-Safety
  - reduction of worse neurological outcome (44% vs 54%)
  - Reduction of un-necessary patient transfer

- Telemedical communication (i.e. 2-way video conference) more efficient than phone-based communication between regional hospital and stroke center[3]

1: Audebert HJ et al., Lancet Neurol. 2006;5:742-8
2: Audebert HJ et al., Stroke. 2009 Mar;40(3):902-8
3: Meyer BC et al., Lancet Neurol. 2008 Sep;7(9):787-95

Post-Stroke-Network

- Rehabilitation network
- Neurovascular outpatient appointments
- Contact to family doctors
- Evaluation for special diagnostics & therapies (Mb. Fabry, Lp(a)-Apharesis; CAS/TEA)
- Evaluation for clinical studies (ESUS; ACST-2, event recorder, intervention studies etc.)

Zanow, UKJ

Summary: Network-*Stroke management*

- *Preclinical:* Education, Politics, Rescue chain
- *Intrahospital:* The „Golden *(half) Hour*“ –
  - ER, Thrombolysis, Thrombectomy, ICU
- *Tele-Stroke-Network:* growing importance
  - Tele-Stroke-Units, Diagnostics, Thrombolysis, -ectomy
  - SOP, technical improvement
  - Goes far beyond Tele-Thrombolysis
  - Includes implementation of structures and procedures = „Tele-Stroke-Unit“
  - Class I, Level A Recommendation for NIHSS check (AHA) !!!
- *„Post-stroke-Care“:* „Hand-in-Hand“

Stroke-Telemedicine

- Stroke is a model disease for Telemedicine supported treatment
  - Symptoms easily captured via audio-video (acustic&visual)
  - Cerebral imaging transmitted as DICOM
- Proven:
  - Reliability,
  - Correctness of tele-neurological examination
  - Improvement of patients outcome (TEMPiS)
  - Value creation potential (cost reduction) through Tele-Stroke-Networks
- Desired:
  - Decrease supply bottleneck in rural areas
  - Optimization of treatment quality
  - Marketing instrument

Audebert, 2012, Günzel&Storm 2012

Tele-Stroke-Network Determinants

- health care professionals & their *relationships*.
- The *personnel and effective interactions* between stroke center and cooperating hospital are more important than the telemedicine technology.
- Effective telestroke relationships successfully fulfill the clinical and economic needs of the stroke center and cooperating hospitals and health care institutions, but / and require *ongoing and repeated contact between center and cooperating hospital* (both over personal and virtual connections).
- Telestroke network increases multidisciplinary knowledge & ability in dealing with neurological cases “on both sides”.