

# Tele-Stroke experience in Germany

Telemedicina, Collegio Cairoli, March 8<sup>th</sup> - Pavia

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*Innovative partner for telemedical and diagnostic solutions and services in stroke care*



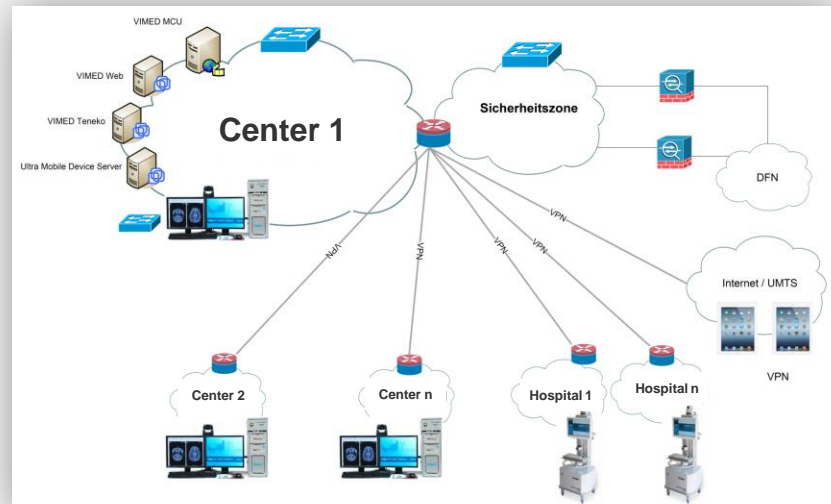
# Telemedicine in stroke care – What is needed?

**Pre-hospital** – (Telemedicine) Stroke Network

**Acute therapy** – Intra-hospital Network

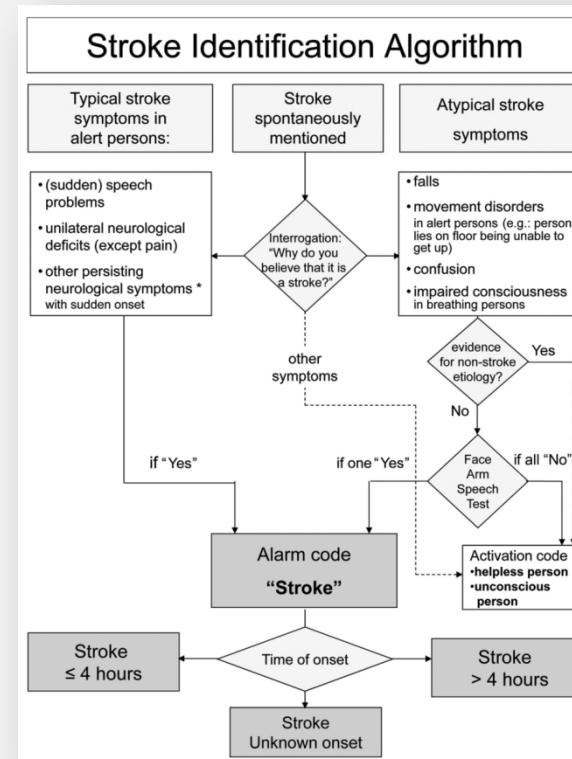
**Inter-hospital** – Tele-Stroke Network

**Post-hospital** – Tele-Stroke Network



## Pre-hospital – Stroke identification algorithm

- ▶ Interview algorithm to identify potential strokes\*
  - ▶ Sensitivity: 53 % of stroke cases
  - ▶ Positive predictive value: 59 % (stroke & TIA)



\* Krebs et al., Stroke 2012

## Tele-Stroke reality – Germany 2014 / 2015

**Phantom-S\*** – (Pre-Hospital Acute Neurological Therapy and Optimization of Medical care in Stroke patients)

### Results:

- ▶ 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
- ▶ 25 min cut of mean Alarm - to - Needle time
- ▶ no safety concerns have been raised

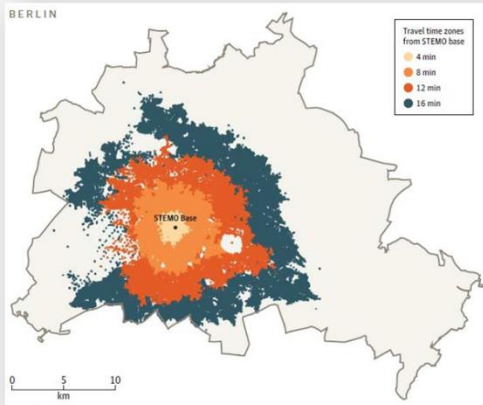
**Alarm – to – Needle time: 52 min (STEMO) vs. 77 min**



Image: Sebastian Dörken

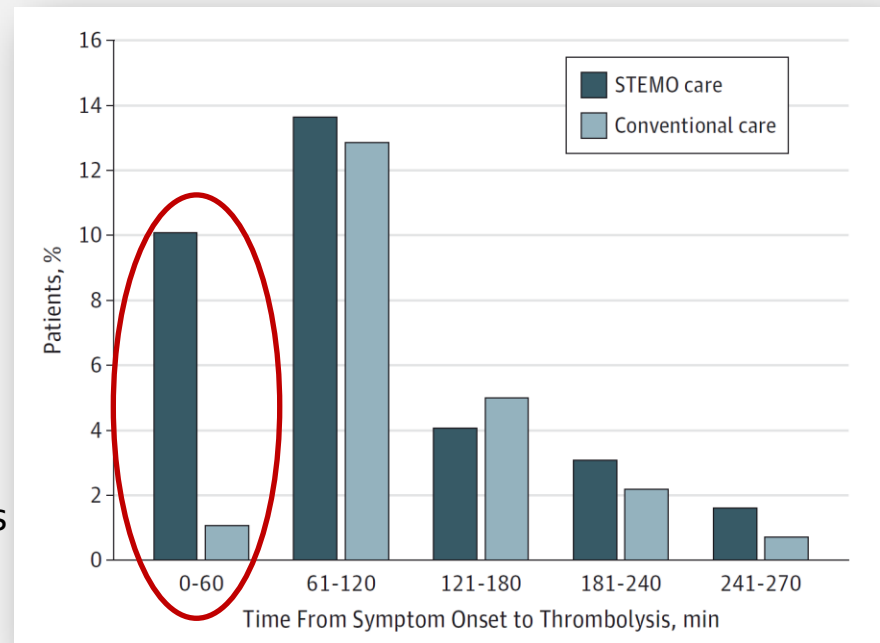
\* Ebinger et al., JAMA 2014

# Tele-Stroke reality – Germany 2014 / 2015 – „Golden Hour 1.0“



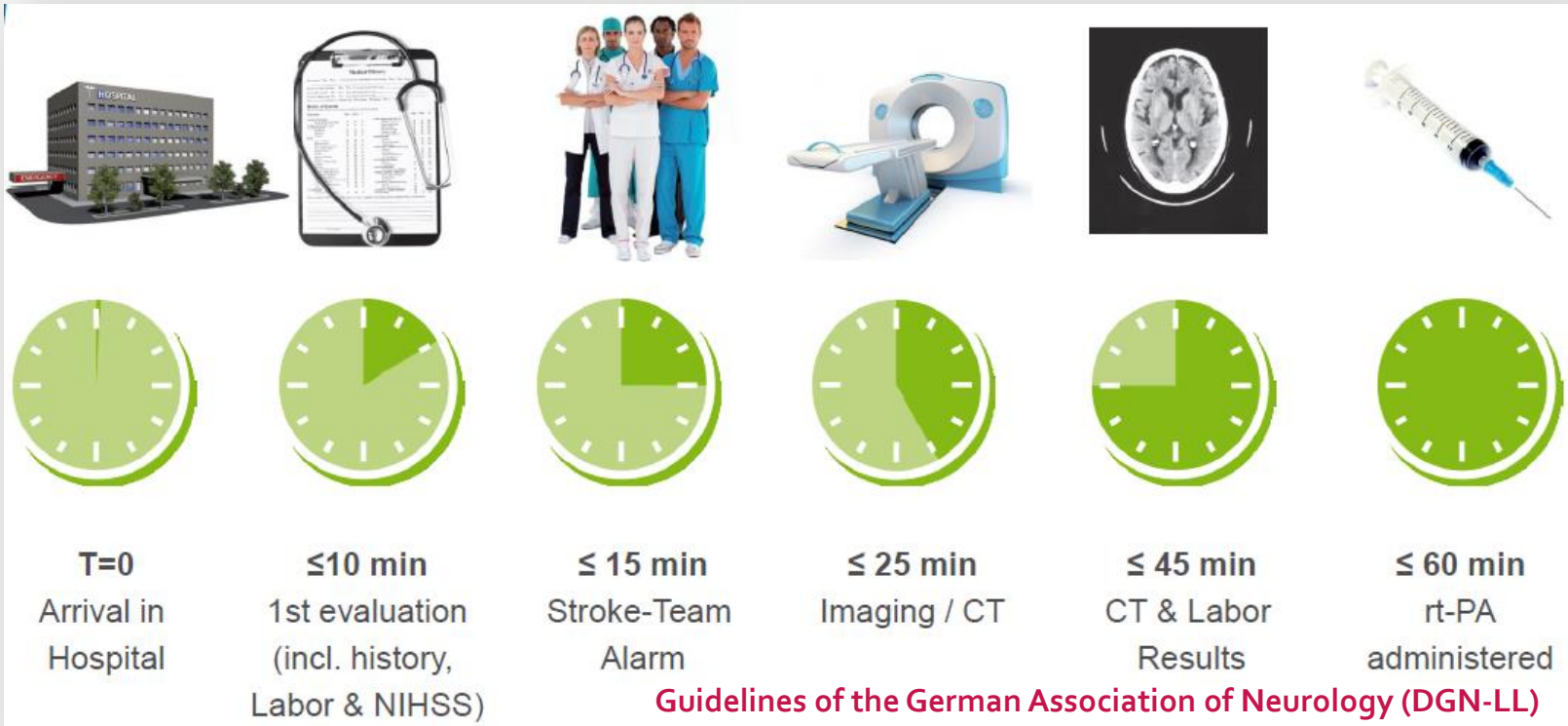
## Results:

- ▶ **“Golden Hour”**-thrombolysis patients with higher chance of discharge at home\*



\* Ebinger et al., JAMA Neurol. 2015

# Intra-hospital – The Golden (half) Hour

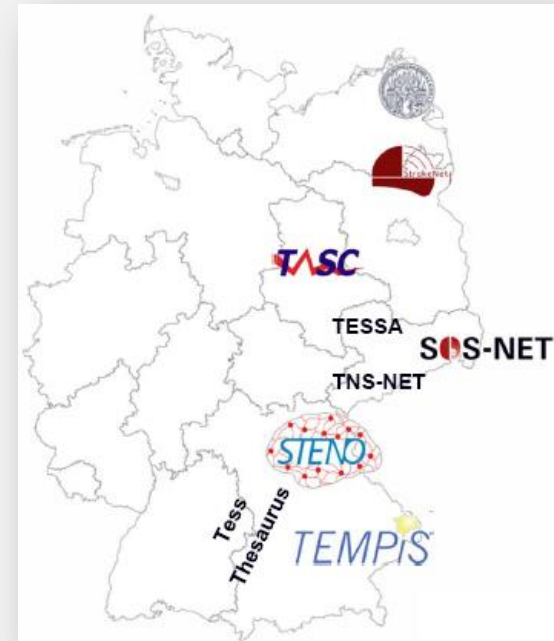


## Tele-Stroke Medicine – Germany

278 Stroke Units in Germany (10.01.2016)

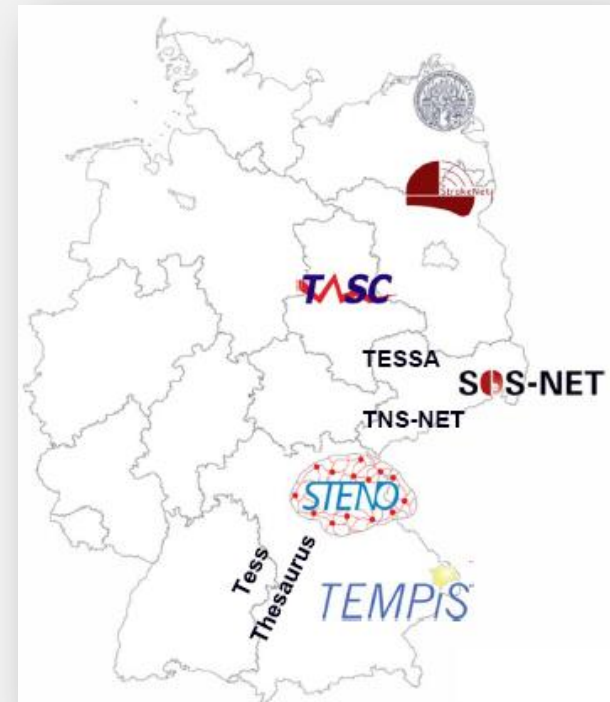


> 12 Tele-Stroke Networks



## Stroke reality – Germany

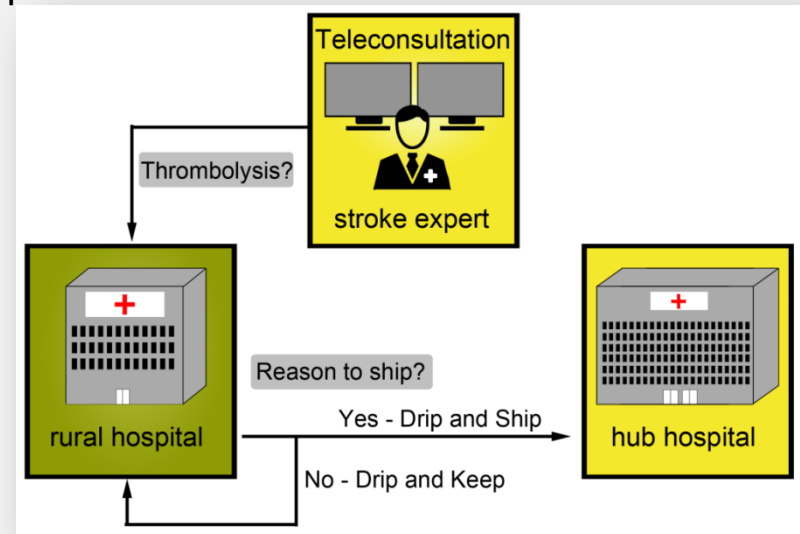
- ▶ Approx. 50 % of all stroke patients not treated in Stroke Units (ca. 140,000 patients per year)
- ▶ Shortfall between regional (standard) and university care
- ▶ Shortage of specialized staff (doctors, nurses, therapists)
- ▶ > 12 Tele-Stroke Networks -> 10,000 patients per year





## Tele-Stroke Network Concepts

- ▶ TEMPiS – integrated Tele-Stroke Network
- ▶ “Drip & Ship” vs. “Ship & Drip” vs. “Trip and Treat”
- ▶ “Hub & Spoke”
- ▶ „Specialist on call”



# Tele-Stroke Networks in Germany

## Countrywide:

- ▶ **HELIOS-NEURONET** (<http://www.helios-kliniken.de/helios-neuronet/helios-neuronet.html>)
  - ▶ 4 Centers
  - ▶ 5 Hospitals

## Saxony:

- ▶ **SOS-NET** (<http://www.neuro.med.tu-dresden.de/sos-net/>)
  - ▶ 3 Centers
  - ▶ 15 Hospitals
- ▶ **TESSA** (<http://www.sanktgeorg.de/medizinische-bereiche/kliniken-abteilungen/neurologie-und-neurologische-intensivmedizin.html>)
  - ▶ 2 Centers
  - ▶ 7 Hospitals
- ▶ **TNS-NET** (<http://www.helios-kliniken.de/klinik/aeue/fachabteilungen/neurologie-und-stroke-unit/tns-net-suedwestsachsen.html>)
  - ▶ 3 Centers
  - ▶ 2 Co-Centers
  - ▶ 5 Hospitals

## Hessen:

- ▶ **NEURO-NETZ Mitte** (<http://www.klinikum-kassel.de/index.php?parent=8590>)
  - ▶ 1 Center
  - ▶ 8 Hospitals

## Bavaria:

- ▶ **TEMPiS** (<http://www.tempis.de/>)
  - ▶ 2 TEMPiS-Centers
  - ▶ 19 TEMPiS-Hospitals
- ▶ **TESAURUS** ([http://www2.klinikum-augsburg.de/2827/Projekt\\_TESAURUS.htm](http://www2.klinikum-augsburg.de/2827/Projekt_TESAURUS.htm))
  - ▶ 1 Center
  - ▶ 6 Hospitals
- ▶ **TRANSIT Stroke** (<http://www.transit-stroke.de/>)
  - ▶ 4 Centers
  - ▶ 8 Hospitals
- ▶ **NEVAS** (<http://www.klinikum.uni-muenchen.de/Neurovaskulaeres-Versorgungsnetzwerk/de/index.html>)
  - ▶ 3 Centers
  - ▶ 14 Hospitals
- ▶ **STENO** (<http://www.steno-netz.de/>)
  - ▶ 3 Centers
  - ▶ 18 Hospitals

## Tele-Consultation Standards (DSG, DGN)



- Stability, integrity / authenticity, liability, confidentiality (VPN)
- Tele-Consultation available (24 x 7 x 365)
- Immediate direct patient evaluation by Tele-Stroke Consultant (NIHSS oriented)
- High resolution bidirectional real-time audio- & video transmission
- Parallel access to original imaging data of patient
- Law compliant data safety concept (min 128 AES coding)
- Written consultation opinion on status and procedure

## Tele-Consultation Indication

- **Framework agreement** (hospital association, ministry of health, health insurance companies, Network)
- 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

# Tele-Consultation Compartments

## Video-Software

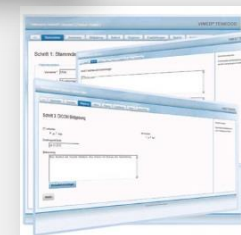
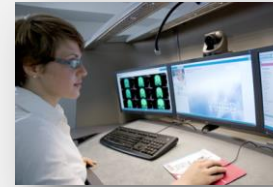
- ▶ Audio/Video based examination (exchange with colleagues)

## Imaging-Software

- ▶ Judgement of cranial imaging (no radiological report!)

## Consultation-Software

- ▶ Summary on neurological status (NIHSS)
- ▶ Imaging judgement
- ▶ Suggestions for further procedures (surgery, diagnostics, monitoring, second. prevention)



## Tele-Stroke Network Financing

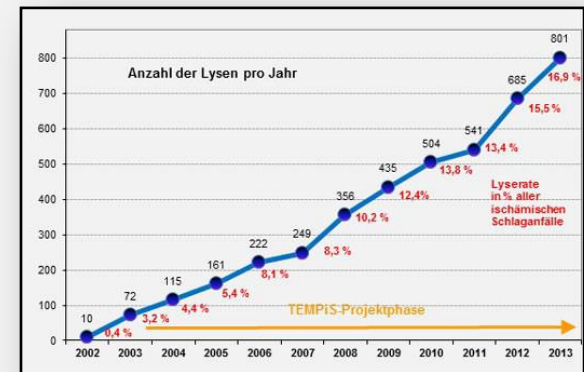
- ▶ Investment of ministry of health (initial hardware implementation)
- ▶ Tele-Consultation reimbursed through health insurance companies (DRG-system)
- ▶ Or through Quality assurance fee payed by health insurance companies (framework agreement)
- ▶ No grants, no industrial funding



## Tele-Stroke Effects – General

### Results:

- ▶ Better quality indicators in cooperating regional hospitals\*,\*\*
  - ▶ Immediate imaging (74 % vs. 32 %),
  - ▶ Immediate vascular imaging (83 % vs. 63 %),
  - ▶ Thrombolysis (5 % vs. 0 %),
  - ▶ Faster start of thrombolysis,
  - ▶ Tele-Thrombolysis Safety,
  - ▶ Reduction of worse neurological outcome (44 % vs. 54 %)
  - ▶ Reduction of unnecessary patient transfers
  
- ▶ Telemedical communication more effective than phone-based communication\*\*\*



\* Audebert et al., Lancet Neurol. 2006

\*\* Audebert et al., Stroke 2009

\*\*\* Meyer et al., Lancet Neurol. 2008

## Summary: Network Management

- ▶ Pre-hospital: Education, Politics , Rescue chain
- ▶ Intra-hospital: ER, Thrombolysis, Thrombectomy, ICU
- ▶ Inter-hospital: Tele-Stroke Network (growing importance)
  - ▶ Tele-Stroke Units, Diagnostics, Thrombolysis, Thrombectomy
  - ▶ SOP, technical improvement
  - ▶ Includes implementation of structures and procedures (Tele-Stroke Unit)
- ▶ Post-hospital: „Hand-in-Hand“



## Tele-Stroke Medicine

- ▶ Stroke – Model disease for Telemedicine:
  - ▶ Symptoms easily captured via audio-video
  - ▶ Cerebral imaging transmitted via DICOM
  
- ▶ Proven:
  - ▶ Reliability
  - ▶ Correctness of Tele-Neurological examination
  - ▶ Improvement of patient 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
- ▶ Personnel and effective interactions between stroke center and Coop-hospitals most important issue
- ▶ Effective Tele-Stroke relationships fulfill clinical and economic needs of stroke center and Coop-hospital – but require ongoing and repeated contact between both (personnel as well as over virtual connections)
- ▶ Tele-Stroke Networks increases multidisciplinary knowledge & ability in dealing with neurological cases „on both sides“

**Grazie mille!**

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A stylized version of the MEYTEC logo, where the letters are white and set against a red rounded rectangular background.

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**For assistance feel free to get in touch with Bernardo Weisenburger and Paola Mazzoni.**