Tele-Emergency Medicine:
Structure and Benefits of a Telemedicine Supported Emergency Ambulance System

Rolf Rossaint
Travel distance (train):
- Aachen - Brussels: 2 h
- Aachen - Paris: 3 h
- Aachen - Amsterdam: 3.5 h
- Aachen - London: 4.5 h
- Aachen - Berlin: 5.5 h
Conflicts of Interests

• Research interest since 2003

• Co-founder of Docs-in-Clouds

• Co-founder of P3 Telehealthcare
Milestones in rescue structure
1. Emergency physician

Ambulance Cologne 1957
Milestones in German rescue structure

1. Emergency physician
   - Ambulance
     - Cologne 1957

2. Rescue helicopter
   - Christoph 1
     - Munich 1970
Problems of the current rescue system

1. Prolonged arrival time of emergency physician

The emergency physician arrives at the scene in 95% within

![Bar chart showing prolonged arrival time of emergency physician from 1995 to 2009]
Problems of the current rescue system

2. Communication technology

...is much older than that!
Mobile devices, wireless communication
Problems of the current rescue system

3. Increasing number of emergency cases due to demographic changes (3% per year)
Regional differences in the disposition of emergency physicians

• % emergency physicians
  – nationwide 50% Behrendt et al., Notfall Rettungsmed 2006
  – Bavaria: 53% (range: 25% – 71%) INM, München 2010
  – Aachen 33% BF Aachen 2011

• Average personnel engagement times per case
  – Hamburg: 40 ± 26 min Schuster et al., Emerg Med J 2010
  – Aachen: 53 min
  – NEF Mechernich (Kr. EU, rural district): 79 min
Physicians at scene: Always a necessity?

Gries A et al
Anästhesist 52:718–724, 2003

→ Conclusion:
The manual ability are needed only in ~14%!
Problems of the current rescue system

4. Shortage of qualified physicians!
5. Non-existing systematic quality control

- Residents are allowed to act as out-of-hospital emergency physicians 18 months after beginning
- Unexperienced physicians acting beyond their training
- No supervision by specialists
- Often not guideline-based
Why tele-emergency medicine?

- Allows in combination with the existing physician-based ground and air rescue system

Quality improvement by

- Reduction of therapy-free interval
- Introduction of SOPs and checklists
- Supervision

Compensation for

- Increasing number of out-of-hospital emergencies
- Lack of (qualified) emergencies physician

Goal-specific use of emergency physicians

- Exactly there, where they are needed
How did we target this project?
Main objective

- Development and implementation of a telemedical assistance system
- Providing immediate medical support for the EMS personnel on site
- By transmitting audio and video data, vital signs and 12-lead-ECG in real-time from the emergency site to the teleconsultation center.
How did we target this project?

1. Examination of the legal preconditions

- Are paramedics allowed to administered the needed drugs?
- Is it allowed that the patient with a potential life-threatening emergency is treated by a physician via telemedicine?
- Who of the team is the legal responsible person?
How did we target this project?

1. Examination of the law

2. Analysis: Are there already tele-rescue systems established?
Example of tele-emergency consultation: Germany

The project „Stroke Angel“
www.strokeangel.de

Improvement of stroke treatment:

„TIME IS BRAIN“

[Mobile computing systems in preclinical care of stroke. Results of the Stroke Angel initiative within the BMBF project PerCoMed].
Example of tele-emergency consultation: Germany

Project „Cardio Angel“
www.cardioangel.de

Improvement of myocardial infarction treatment:
„TIME IS MUSCLE“
Example of tele-emergency consultation: Germany

- **12-ECG-transmission in STEMI:**

  Effectiveness of prehospital wireless transmission of electrocardiograms to a cardiology-held device for patients with acute myocardial infarction (STEMI)

  ST-segment Analysis Using Wireless Technology in Acute Myocardial Infarction (STAT-MI) trial

  The STAT-MI trial improves outcomes  Sanchez-Ross et al., JACC Cardiovasc Interv. 2011: 222-227

**But:** 2011 in Germany: Transmission of 12-lead-ECG was only established in 44%
Mann V. Innovative Techniken in der präklinischen Notfallmedizin in Deutschland. Anaesthesiol Intensivmed 2011;52:824-833

- **Stroke Angel: Only regional transition into routine care**
  - Standorte: Rhön-Grabfeld, Bad Kissingen, Hassberge, Dachau, Uelzen...
  - Lyserate erhöht und innerklinische Versorgungszeiten verkürzt
  Ziegler et al. Anaesthesist 2008
Realtime inter-hospital consultation in trauma at the University Hospital in Tucson, Arizona, USA

Southern Arizona Telemedicine and Telepresence (SATT) Program

The Southern Arizona Telemedicine and Telepresence (SATT) Program, directed by Dr. Rifat Latif, is a regional inter-hospital link between the UMC and 5 rural hospitals in Southern Arizona using telemedicine systems. The SATT program facilitates the virtual presence of an experienced trauma surgeon using high quality live audio and video which is streamed from a dedicated telemedicine network. Advances in technology including telemedicine and telepresence applications for trauma, emergency management, and intensive critical care may be the solution to reducing and/or eliminating the gap in trauma care between rural and urban areas.

The SATT Program was made possible by a generous grant from Blue Cross Blue Shield of Arizona.
Example of tele-emergency consultation: Arizona

The Southwestern Surgical Congress

Initial experiences and outcomes of telepresence in the management of trauma and emergency surgical patients

Rifat Latifi, M.D.\textsuperscript{a,b,*}, George J. Hadeed, M.P.H.\textsuperscript{a}, Peter Rhee, M.D.\textsuperscript{a}, Terrence O’Keeffe, M.D.\textsuperscript{a}, Randall S. Froise, M.D.\textsuperscript{a}, Julie L. Wynne, M.D.\textsuperscript{a}, Michelle L. Ziembka, R.N.\textsuperscript{c}, Dan Judkins, R.N.\textsuperscript{c}

• Teleconsultation (country Hospital\rightarrow Trauma Center) for 59 surg. patients
• 35 trauma patients
• 6 potential life-saving tele-consultations
Example of tele-emergency consultation: Texas
Example of tele-emergency consultation: Texas

Lifebot-Entwicklung (www.lifebot.us.com)
Example of tele-emergency consultation: Las Vegas

HP, US-Army et al

Both the ambulance and the cart systems utilize DREAMS™, a $14 million research project that has built the first Digital Telemedicine Ambulances. The project was the brain child of a Texas surgeon, Dr. James “Red” Duke, Jr. and was funded by the Telemedicine and Technology Research Center (TATRC) and U.S. Army Medical Research and Material Command (USAMRMC), Department of Defense agencies.
Example of tele-emergency consultation: Texas

The LifeBot 5: The most advanced Mobile Integrated Healthcare in the world.

Disaster Relief and Emergency Medical Services, or DREAMS™ was developed using $14 million in funding through U. S. Army Medical Research and Materiel Command and the Telemedicine and Technology Research Center (TATRC) as a Congressionally Funded military research project.

DREAMS™ has been proven in actual use for over six years in real-time life-saving operations aboard five ambulances in Liberty County Texas. No other system is more proven or more efficacious as an ambulance to hospital based telemedicine system. The motto for DREAMS™ is "Saving lives in real-time.™" and it has done that longer than any other system in the history of the industry.

DREAMS™ offers not only direct live transmission of voice and video but complete patient physiologic data, e.g. ECG, 12-lead STEMI, blood gases, ultrasound, e-PCR, EHR, blood pressure, and a lot more.

First and foremost, One System Does It All without the need to cobble together separate products or systems. This can not only provide higher levels of care, but also save money, substantially lower the chances of risks or errors, and save lives.
Prehospital Utility of Rapid Stroke Evaluation Using In-Ambulance Telemedicine
A Pilot Feasibility Study

Tzu-Ching Wu, MD; Claude Nguyen, MD; Christy Ankrom, BS; Julian Yang, MD; David Persse, MD; Farhaan Vahidy, MD; James C. Grotta, MD; Sean I. Savitz, MD

*Stroke*. 2014;45:2342-2347

Establishing the First Mobile Stroke Unit in the United States

Stephanie A. Parker, RN; Ritvij Bowry, MD; Tzu-Ching Wu, MD; Elizabeth A. Noser, MD; Kamilah Jackson, RT; Laura Richardson, BS; David Persse, MD; James C. Grotta, MD

*Stroke*. 2015;46:1384-1391
Prehospital telemedicine in rural patients in need of primary coronary intervention (Canada/Quebec)

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0736-4679/$ - all see front matter

Selected Topics: Prehospital Care

RURAL PATIENT ACCESS TO PRIMARY PERCUTANEOUS CORONARY INTERVENTION CENTERS IS IMPROVED BY A NOVEL INTEGRATED TELEMEDICINE PREHOSPITAL SYSTEM

Alain Tanguay, MD,* Renée Dallaire, PhD,*† Denise Hébert, RN, BSN,* François Bégin, MD,* and Richard Fleet, MD, PhD*†

*Centre hospitalier affilié universitaire Hôtel-Dieu de Lévis, Lévis, Québec, Canada and †Laval University, Québec, Québec, Canada
Reprint Address: Richard Fleet, MD, PhD, CHAU Hôtel-Dieu de Lévis, 143 rue Wolfe, Lévis, QC G6V 3Z1, Canada
Objectives: Ability of an STEMI system serving suburban and rural populations to achieve the recommended 90-min interval benchmark for PCI.

Methods: Implementation of a prehospital telemedicine program: Three patient groups between August 1, 2006 and October 20, 2012:

1) patients already en route to a PCI center,
2) patients initially directed to the nearest hospital who were subsequently diverted to a PCI center during transport, and
3) patients directed to the nearest hospital without transfer for PCI.

Results: 208 patients diagnosed with STEMI:
- 14.9% were already on their way to a hospital with PCI capabilities,
- 75.0% were rerouted to a PCI center, and
- 10.1% were directed to the nearest local hospital.

All patients but one arrived at the PCI center within the 60min prehospital care interval, considering an additional 30 min for balloon inflation for PCI.
Feasibility of AmbulanCe-Based Telemedicine (FACT) Study: Safety, Feasibility and Reliability of Third Generation In-Ambulance Telemedicine

Laetitia Yperzeele¹,²*, Robbert-Jan Van Hooff¹,², Ann De Smedt¹,², Alexis Valenzuela Espinoza², Rita Van Dyck¹, Rohny Van de Casseye³, Andre Convents², Ives Hubloue⁴,⁵, Door Lauwaert⁴,⁵, Jacques De Keyser¹,²,⁶, Raf Brouns¹,²

¹Department of Neurology, Universitair Ziekenhuis Brussel, Brussels, Belgium, ²Center for Neurosciences (C4N), Vrije Universiteit Brussel (VUB), Brussels, Belgium, ³Flanders District of Creativity, Leuven, Belgium, ⁴Department of Emergency Medicine, Universitair Ziekenhuis Brussel, Brussels, Belgium, ⁵Research Group on Emergency and Disaster Medicine (ReGEDIM), Vrije Universiteit Brussel (VUB), Brussels, Belgium, ⁶Department of Neurology, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands

Results: Prehospital teleconsultation was obtained in 41 out of 43 cases (95.3%). The success rates for communication of blood pressure, heart rate, blood oxygen saturation, glycaemia, and electronic patient identification were 78.7%, 84.8%, 80.6%, 64.0%, and 84.2%. A preliminary prehospital diagnosis was formulated in 90.2%, with satisfactory agreement with final in-hospital diagnoses. Communication of a prehospital report to the in-hospital team was successful in 94.7% and prenotification of the in-hospital team via SMS in 90.2%. Failures resulted mainly from limited mobile connectivity and to a lesser extent from software, hardware or human error. The user acceptance was high.

Conclusions: Ambulance-based telemedicine of the third generation is safe, feasible and reliable but further research and development, especially with regard to high speed broadband access, is needed before this approach can be implemented in daily practice.
How did we target this project?

1. Examination of the law

2. Analysis: Are there already tele-rescue systems established?

3. Establishment of a safe and robust data transfer unit, a physician-based tele-emergency center and software
Components of „our“ tele-emergency system:

1) Real-time data transfer
2) Audio-video communication
3) Documentation and decision support system

24/7 telemedicine center

Telemedicine equipped ambulances

Skorning et al Der Anaesthesist 2010; Bergrath et al J Telemed Telecare 2011
„Our“ tele-emergency system:

The architecture
„Our“ tele-emergency system: The data transfer unit
P3 peeqBOX

- Ultra-mobile communication unit
- Data prioritization and splitting
- Simultaneous use of three different mobile radio networks
- Bluetooth interfaces to medical and communication devices
peeqBOX technology enables reliable data communication for real-time based medical applications in mobile environments.

„Our“ tele-emergency system: The data transfer unit
Is there a need for such an extensive technical solution?

„Our“ tele-emergency system: The data transfer unit

Verfügbarkeit Datendienst innerhalb von Gebäuden in Med-on-Telekom
Vodafone
E-Plus
O2
peeqBOX

(Quelle: P3 communications, 2011) @ix
Devices in the ambulance

- bespoke aerials
- video camera
- thermal printer

Our tele-emergency system: The ambulance
„Our“ tele-emergency system: The telemedicine center

Details as big as you like ...

Mobile PC and video-camera
„Our“ tele-emergency system: The telemedicine center

Vital parameters / communication
<table>
<thead>
<tr>
<th>Vital parameters</th>
<th>Protocol / Documentation</th>
<th>SOP´s / Checklists</th>
<th>GPS-tracking</th>
</tr>
</thead>
</table>

„Our“ tele-emergency system: The telemedicine center
The ambulance in Med-on-@ix

...3.12.2009 – 30.09.2010 on duty (40h/week)
... ca. 450 patients treated
How did we target this project?

1. Examination of the law

2. Analysis: Are there already tele-rescue systems established?

3. Establishment of a safe and robust data transfer unit and a physician-based tele-emergency center

4. Quality increase by development of telemedicine applicable SOP / checklists and integration of the software package
„Our“ tele-emergency system: The decision support system

- Vital parameters
- Protocol / Documentation
- SOP´s / Checklists
- GPS-tracking
Decision support system

Standard Operating Procedures
Decision support system
How did we target this project?

1. Examination of the law

2. Analysis: Are there already tele-rescue systems established?

3. Establishment of a safe and robust data transfer unit and a physician-based tele-emergency center

4. Quality increase by development of telemedicine applicable SOP / checklists and integration of the software package

5. Development of educational concepts for the use of tele-emergency for physicians and paramedics
How did we target this project?

1. Examination of the law

2. Analysis: Are there already tele-rescue systems established?

3. Establishment of a safe and robust data transfer unit and a physician-based tele-emergency center

4. Quality increase by development of telemedicine applicable SOP / checklists and integration of the software package

5. Development of educational concepts for the use of tele-emergency for physicians and paramedics

6. Field tests
Phase 1: The Med-on-@ix Project (2007-2010)

- Design and engineering of the tele-emergency system
- Field test from 12/2009 bis 9/2010:
  tele-emergency physician treated the patient
  (possible back-up by conventional physician present at the scene)

Feasability: Med-on-@ix

Emergencies treated by the tele-physician

Delegation of drugs to paramedics: n=268 Fälle
Reduction of therapy-free interval

Disposition for emergency physicians was not changed!
Phase 2: The TemRas project (2010 – 2013)

- Use of a technical improved system in five different districts
- Paramedics were enabled to contact the tele-emergency physician RA (freiwillig)
- Field test from 12/2009 bis 9/2010
- Evaluationsbetrieb 08/2012-07/2013

Brokmann JC et al. Anaesthesist 2015
Results from the project TemRas:

Potential for savings of physicians at scene

Shorter time for physician at scene
TNA takes over for transport, rare: second opinion by telephysician

Reduction of therapy free interval
Increase in patient safety, control of physicians measures in real-time
(n=22 in cardial emergencies)

Improvement of quality! Increase in patient safety!
Efficiency and safety of the tele-emergency system

Treatment duration

None medical complication in more than 1000 cases!
Quality in acute coronary syndrome: telemedical vs. conventional emergency physician

- prospective, interventional multicenter-study
- telemedical supported or by conventional emergency physician (matched pairs)
- 150 patienten with cardiac/circulatory symptoms treated by tele-emergency physician, 39 with acute coronary syndrome
- Treatment according guideline with respect to the following 5 items:

<table>
<thead>
<tr>
<th></th>
<th>Telemedical group n=39</th>
<th>Conventional group n=39</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-lead-ECG performed</td>
<td>38 (97%)</td>
<td>39 (100%)</td>
<td>1,0</td>
</tr>
<tr>
<td>ASS correct</td>
<td>31 (79%)</td>
<td>33 (85%)</td>
<td>0,73</td>
</tr>
<tr>
<td>Heparin correct</td>
<td>34 (87%)</td>
<td>33 (85%)</td>
<td>1,0</td>
</tr>
<tr>
<td>Morphin correct</td>
<td>29 (74%)</td>
<td>27 (69%)</td>
<td>0,5</td>
</tr>
<tr>
<td>Sauerstoff correct</td>
<td>29 (74%)</td>
<td>18 (46%)</td>
<td>0,007</td>
</tr>
</tbody>
</table>

Data 08/2012 – 07/2013 presented at DAC 2015

clinicaltrials.gov, NCT01644006
Main results from the projects:

- Prehospital emergency telemedicine
  - is feasible in nearly all emergency situations
  - will reduce the therapy–free interval especially in rural areas
  - will be a quality improvement for the whole rescue system
  - will increase the availability of the emergency physician

Transition in routine care is needed!
Step-by-step implementation of tele-emergency medicine

- Start of an insurance reimbursed prehospital emergency system in Aachen beginning from 4/2014

- Step-by-step implementation of 24/7 availability

- In addition: 2 conventional prehospital emergency physicians both available 24/7
Procedural instruction

*Suited for tele-emergency consultation:
- Hypertensive crisis
- Pain management in non life-threatening trauma
- Stroke (without unconsciousness)
- Hypoglycaemia
- Assistance in unclear emergency situations
- Assistance with interpretation of ECG
- Secondary transport of non-ventilated ICU-patients

*Indications for physician at the emergency scene:
- Resuscitation
- Unconsciousness
- Acute coronary syndrome (STEMI)
- Cerebral seizure
- Severe dyspnoe/respiratory insufficiency
- Polytrauma, critical gun shots or stab wounds
- PsychKG-Indication or psychiatric emergency with children
- Burns
- Acute life-threatening emergency

Pending arrival of the emergency physician
Step-by-step implementation of tele-emergency medicine

1st training paramedics

12h-TNA, 4 Amb.

24h-TNA, 6 Amb.

2nd training paramedics and disponents

Primäreinsätze

Sekundäreinsätze
<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>acute coronary syndrome</td>
<td>37</td>
<td>8.1%</td>
</tr>
<tr>
<td>NSTEMI</td>
<td>25</td>
<td>5.5%</td>
</tr>
<tr>
<td>hypertensive crisis</td>
<td>57</td>
<td>12.6%</td>
</tr>
<tr>
<td>trauma</td>
<td>56</td>
<td>12.4%</td>
</tr>
<tr>
<td>stroke</td>
<td>31</td>
<td>6.8%</td>
</tr>
<tr>
<td>acute abdomen</td>
<td>32</td>
<td>7.1%</td>
</tr>
<tr>
<td>arrhythmia</td>
<td>22</td>
<td>4.9%</td>
</tr>
<tr>
<td>seizure</td>
<td>18</td>
<td>4.0%</td>
</tr>
<tr>
<td>respiratory distress</td>
<td>15</td>
<td>3.3%</td>
</tr>
<tr>
<td>others (Neuro/Kreislauf/Psych/Infekt)</td>
<td>129</td>
<td>28.5%</td>
</tr>
</tbody>
</table>
Severity of emergencies in conventional vs. tele-emergency patients

Data 07/14 – 09/14 in Aachen

<table>
<thead>
<tr>
<th>NACA Level</th>
<th>NEF (%)</th>
<th>TNA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NACA I</td>
<td>3.43</td>
<td>0</td>
</tr>
<tr>
<td>NACA II</td>
<td>7.02</td>
<td>8.44</td>
</tr>
<tr>
<td>NACA III</td>
<td>47.13</td>
<td>57.78</td>
</tr>
<tr>
<td>NACA IV</td>
<td>30.14</td>
<td>25.33</td>
</tr>
<tr>
<td>NACA V</td>
<td>7.81</td>
<td>8</td>
</tr>
<tr>
<td>NACA VI</td>
<td>0.96</td>
<td>0.22</td>
</tr>
<tr>
<td>NACA VII</td>
<td>3.51</td>
<td>0.22</td>
</tr>
</tbody>
</table>

NEF: Non-Endangered, TNA: Triage Not Available
Feasibility of AmbulanCe-Based Telemedicine (FACT) Study: Safety, Feasibility and Reliability of Third Generation In-Ambulance Telemedicine

Laetitia Yperzeele\textsuperscript{1,2*}, Robbert-Jan Van Hooff\textsuperscript{1,2}, Ann De Smedt\textsuperscript{1,2}, Alexis Valenzuela Espinoza\textsuperscript{2}, Rita Van Dyck\textsuperscript{1}, Rohny Van de Casseye\textsuperscript{3}, Andre Convents\textsuperscript{2}, Ives Hubloue\textsuperscript{4,5}, Door Lauwaert\textsuperscript{4,5}, Jacques De Keyser\textsuperscript{1,2,6}, Raf Brouns\textsuperscript{1,2}

Reliability of data transfer and communication

Tele-emergency system Aachen 2014: 95-98%

...in 41 of 43 cases ... the success rates for transmission of blood pressure, heart rate, blood oxygen saturation, glycemia and electronic patient identification were 78,7%, 84,8%, 80,6%, 64,0% and 84,2%...

PLOS ONE 2014
In 18 of 30 scenarios NIHSS assessment could not be performed due to loss of audio-video signal...

...not an acceptable level for clinical use, at least on the basis of the used technology...

Stroke 2012
What did we achieve?

• Teaching and training of 17 tele-emergency physicians

• Teaching and training of 263 paramedics

• > 3000 patients treated with prehospital tele-emergency care
Cases in the prehospital emergency system in Aachen

Number

<table>
<thead>
<tr>
<th></th>
<th>Quarter 2 2013</th>
<th>Quarter 2 2014</th>
<th>Quarter 2 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>1934</td>
<td>1934</td>
<td>2000</td>
<td>1530</td>
</tr>
<tr>
<td>Teleconsultations without EMS physician presence</td>
<td>130</td>
<td></td>
<td>456</td>
</tr>
<tr>
<td>EMS physician missions</td>
<td></td>
<td></td>
<td>1530</td>
</tr>
</tbody>
</table>
Efficiency of (our) prehospital emergency telemedicine system

• Telemedicine supported emergencies:
  – Duration including documentation: 31 min

• Conventional prehospital emergencies:
  – Duration including documentation and return to basis: 54 min

Needed time ~ 50% shorter if telemedicine is used

Daten 3. Quartal 2014, BF Aachen
Cumulative personnel engagement times of physicians

- Quarter 2 2013: 1773 hrs
- Quarter 2 2014: 1909 hrs
- Quarter 2 2015: 1661 hrs

Duration of all tele-EMS physician missions (hrs):
- Quarter 2 2013: 1773 hrs
- Quarter 2 2014: 1833 hrs
- Quarter 2 2015: 1403 hrs

Duration EMS physician missions (hrs):
- Quarter 2 2013: 0 hrs
- Quarter 2 2014: 76 hrs
- Quarter 2 2015: 258 hrs
Benefits of a telemedicine supported prehospital emergency system

System related benefits:
- Reduction in physician-directed therapy free time lapse
- Reduction of personnel engagement time of physicians
- Optimization of the use of the emergency physician
- Support/supervision for paramedics and physicians
- Increase in legal certainty of paramedics

Software related benefits:
- Diagnosis and therapy according guidelines and checklists
- Improvement in quality of diagnosis and therapy
- Systems reminds you, if you forget something
- Automated quality checks (Adherence control)

Economic benefits
- A 24/7 tele-emergency physician is able to deal with ~12,000 - 15,000 cases
- 30-40% of all inter-hospital transports can be supervised
- If implemented transregional, it results in a reduction in the increasing need of additional conventional emergency physicians
One prehospital emergency telemedicine center serves several emergency districts.
Several prehospital emergency telemedicine centers serve nationwide.
Take home messages

Telemedical Rescue Assistance

- **A TELE-EMS PHYSICIAN FOR EMERGENCY MEDICAL SERVICES**
  - 24/7 teleconsultation services for EMS
  - High qualified EMS physicians supporting missions
  - Live transmission of patient data

- **QUALITY MANAGEMENT IN EMERGENCY MEDICAL SERVICES**
  - Seamless qualified documentation of the treatment
  - Equal, guideline compliant treatment
  - Using defined standard operation procedures

- **HIGH QUALITY MEDICAL SUPPORT AT THE TOUCH OF A BUTTON**
  - Immediate medical support
  - Using standard communication devices
  - Enhanced legal certainty for EMS by means of medical delegation

- **SEAMLESS INFORMATION MANAGEMENT ALONG THE RESCUE CHAIN**
  - Preinformation from the EMS mission to the clinic
  - Seamless digital documentation of the treatment
Milestones in German rescue structure

1957
Ambulance Cologne

1970
Christoph 1 Munich

2014
Tele-emergency Aachen