Quality Management in HEMS

Dr. med. Erwin Stolpe
EHAC Board Member
Head of Medical Board, ADAC Air Rescue Service
Trauma Surgeon
Munich, Germany
Achievements of the last years
Infrastructure of German EMS
Development of Injured and Fatalities in Traffic Accidents in Germany

Population: 62 Mio.  82.5 Mio
EMS in Germany

- 24 hours a day / 7 days a week / 365 days a year
- EMS must reach the scene within 12 minutes (AV to BayRDG, Bavarian EMS law)
- RTW (Ambulance)
- NAW (Ambulance with emergency physician)
- NEF (Rendezvous system)
- RTH (Rescue Helicopter)
HEMS in Germany

- Controlled by the Ministry of the Interior
- Entire area coverage in Germany
- Mission radius 50 km
- Primary rescue mission
- Urgent secondary missions
- Stations are based at a hospital
- Operated by state and private carriers
Infrastructure of HEMS
Bases and Missions 2011

- Europe ~550 ???
- Germany 78 ~100,000
- Christoph 1, Munich 1,500
Missions and HEMS bases
Air Rescue Bases in Germany
Mission Profile Christoph 1, Munich

- Trauma: 50%
- Medicine: 31%
- Pediatric: 11%
- Others: 8%
Operational standards in HEMS

- Helicopter based at hospital
- Medical crew: Emergency Physician and paramedic
- Dispatch only by Integrated dispatch centers: 112 (no private calls)
- Takeoff time within two minutes
- Regular daylight service
- Backup helicopter always available
- Complementary 24 hrs service
Technical Requirements
Technical Requirements

- Performance class I (JAR OPS 3 / EU OPS)
- 2 turbines with high power (JAR OPS 3 / EU OPS)
- Compact helicopter dimension
- High main and rear rotors
- Optimal visibility conditions
- Conformity to European standard EN 13718-1/2
Medical vehicles and their equipment — Air ambulances — Part 2:
Operational and technical requirements of air ambulances

ICES:
Descriptors: ambulance, air ambulance, emergency helicopter ambulance, medical device, interface, interchangeability, interoperability, patient care, rescue systems

Figure 1 — Patient Compartment Horizontal
Helicopter Types
EC 145 HEMS Cabin Configuration
Cabin Space EC 135 – 145
Equipment
Medical Equipment I

- Respirator *e.g.* *Oxylog 3000*
- Monitoring *e.g.* *Propaq MD*
- ECG/Defibrillator *e.g.* *Corpuls c3*
- Syringe pumps
- Suction Unit
- Drugs
Medical Equipment II

- Backpack (Intravenous drips, Drugs, Intubation, Coniotomy, Chest tube…)
- Mobile Ultrasound Device
- Vacuum mattress

- Winch equipment (Salvage bag, Harness, Antirotation line, Rescue sling and Rescue basket)
Medical Equipment
Winch Equipment
Physician

- Specialist standard
- ICU expert knowledge
- Expert knowledge rescue medicine
- In mission training
- ATLS®, ACRM® Training recommended
Staff Qualification

Paramedic

- Long term experience in EMS
- HCM, ACLS, ACRM etc. training
- Rotation in HEMS and ground EMS
Staff Qualification

Operator
- Technical qualification as TechRep

Pilot
- > 1000 flight hours
- ADAC: > 1500 flight hours
- ACRM®
- Interview with CEO of HEMS, Germany
Medical Guidelines and Quality Management
European Resuscitation Council Guidelines for Resuscitation 2005
Section 2. Adult basic life support and use of automated external defibrillators

Anthony J. Handley, Rudolph Koster, Koen Monsieurs, Gavin D. Perkins, Sian Davies, Leo Bossaert

- Basic for medical standard operating procedures
Education in Prehospital Life Support
Medizinische Daten: NACA-Score
Einsatzzahlen 2006, LIKS-Stationen (ADAC, BPol und UMCG, n = 37,623)
Goal of medical quality management must be the best possible adaption of a system’s actual state to the target state.
## Mission Data

<table>
<thead>
<tr>
<th>Mission Data</th>
<th>History</th>
<th>Condition and Findings</th>
<th>Therapy / Condition during transport</th>
<th>Initial Diagnosis</th>
<th>Status at admission</th>
<th>Results / Remarks</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

## Layout – Digital HEMS-Protocol
Missions 2011 by type

51,218 missions (+ 8.4 %)
Missions 2011 by diagnosis

- CNS: 32.2%
- Circulation: 29.8%
- Respiration: 18.8%
- Abdomen: 6.6%
- Psychiatry: 3.4%
- Metabolism: 2.8%
- Gynaecology: 2.0%
- Misc. diseases: 0.4%
- Trauma: 4.1%

Total: n = 51,218
Data Quality

User manual

- Available at every base (online & printed version)
- Unambiguous definition of each documented feature
Auswertung der medizinischen Daten
LIKS-Stationen (ADAC-Luftrettung GmbH, Bundespolizei und UMCG) und Christoph 62 (ELBE Helicopter)

2008

Verantwortlich für den Inhalt: Dr. Th. Schechtzehren
Leiter medizinisches Qualitätsmanagement, ADAC Luftrettung GmbH
IT-Support: Beatrice Möller, Guido Bradschiet, Alex Brömb
Tracer Diagnosis

Guidelines and recommendations based upon International, European and National scientific societies (e.g. ERC, DGU, ADAC QM-Board)

- Acute coronary syndrome
- Stroke
- Severe brain injury
- Major multiple trauma

75% of all missions
Tracer Diagnosis Protocols

**Stroke**
- Upright position of upper body
- Oxygen
- $O_2$ - Sat at hospital admission $>95$
- Venous access
- Blood sugar measurement
- Monitoring
- Administration of catecholamine when $RR_{sys} < 110$ mmHg
- Administration of Urapidil when $RR_{sys} > 220$ mmHg
- $RR$ optimized at hospital admission ($160 - 200$ mmHg)
- Scene time $< 20$ min
- Total prehospital time $< 60$ min
- Admission to stroke unit

**Severe Brain Injury**
- Upright position of upper body
- Blood sugar measurement
- Venous access
- Cervical spine protection
- Analgesia (Opioids/Ketamin)
- Intubation, ventilation
- Monitoring (ECG, RR, Sat)
- $O_2$ - Sat at hospital admission $>95$
- $RR$ at hospital admission $> 120$ mmHg
- Total prehospital time $< 60$ min
- Neurotraumatology Center with 24 h operative Intervention
  - CCT, NMR, Angiography

**Major Trauma**
- Venous access
- Immobilization
- Analgesia (Opioids/Ketamin)
- Intubation, ventilation
- Blood sugar measurement if SBI
- Monitoring (ECG, RR, Sat)
- $O_2$ - Sat at hospital admission if possible $>95$
- $RR$ at hospital admission $\geq 120$ mmHg
- Traumacenter
- Total prehospital time $< 60$ min
- Neurotraumatology Center with 24 h operative Intervention
  - CCT, NMR, Angiography

**Acute coronary syndrome**
- Upright position of upper body
- Oxygen
- $O_2$ - Sat at hospital admission $>95$
- Venous access
- Monitoring
- Nitrates
- Analgesia
- ASS
- Lysis
- Lysis
- Total prehospital time $< 60$ min
- 24 h PTCA - hospital

**Leitlinien: Akutes Koronarsyndrom (ACS)**
Teil 2: Akutes Koronarsyndrom mit ST Hebung
Evaluation: Tracer Diagnosis

To what extent have our medical recommendations been implemented?

How was the performance of our base:
- compared to ADAC in total
- compared to the previous year
<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Complied</th>
<th>Not Complied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placement of upper part of the body</td>
<td>65.7%</td>
<td>34.3%</td>
</tr>
<tr>
<td>Oxygen treatment</td>
<td>90.1%</td>
<td>9.9%</td>
</tr>
<tr>
<td>paSO2 &gt; 95% at committal</td>
<td>88.9%</td>
<td>11.1%</td>
</tr>
<tr>
<td>IV line</td>
<td>94.9%</td>
<td>5.1%</td>
</tr>
<tr>
<td>12-lead ECG</td>
<td>78.6%</td>
<td>21.4%</td>
</tr>
<tr>
<td>Monitoring (ECG, BP, paSO2)</td>
<td>97.7%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Nitroglycerin (BP&gt;90 mmHg; initial)</td>
<td>52.7%</td>
<td>47.3%</td>
</tr>
<tr>
<td>Analgesia (Opiat) in acute pain (initial)</td>
<td>88.2%</td>
<td>11.8%</td>
</tr>
<tr>
<td>ASS</td>
<td>67.7%</td>
<td>32.3%</td>
</tr>
<tr>
<td>Pre-clinical lysis (only MI)</td>
<td>0.5%</td>
<td></td>
</tr>
<tr>
<td>Hospital with PTCA capacity (only MI)</td>
<td>80.7%</td>
<td>19.3%</td>
</tr>
<tr>
<td>Pre-hospital treatment &lt; 60 min</td>
<td>77.4%</td>
<td>22.6%</td>
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</tbody>
</table>
ACS: Deviation by all bases
Ranking by Tracer Diagnosis

Deviation within ADAC
Deviation from last year
If the prerequisite for a conclusion is absent, the conclusion is worthless.

Never ever a blind athlete has been brought to justice due to doping...
Base Comparison

Problems

- Some documented features are not generally accepted (technically disputable)
  - BP 120 mmHg in trauma patients
  - Intubation in trauma patients
  - general lysis in STEMI

- Documentation difficulties in some features
  - Appropriateness of the hospital
  - Placement of upper part of the body (CCI vs spineboard)

- Different weighting of documentation features
  - Placement of upper part of the body vs 12-lead ECG

- Low case numbers
  - Statistical errors due to low case numbers
What could be done by the operator?

- Improve documentation possibilities
- Improve evaluations
  - Evaluation data bank (automated evaluation)
  - “Quality of quality management”
- Improve education and training
  - ACRM training (human factor training, team building)
  - Training concept (manual “Medical Chapter”)
- Formal definitions
  - Quality as business goal
  - Medical manual as contractual part between hospital, doctor and operator (definition of structural quality standards and process quality)
  - Formal consequences in case of neglecting QM goals
What could be done by each base?

- Deeply committed cooperation in QM process
  - Discussion and recondition of identified deficits
  - Continuous education and training
  - Constructive criticism and monitoring of QM development
- Candid conversation between base and HQ
- Potential consequences
  - Modification of organizational processes (structural quality)
  - Modification of support processes – personnel consequences (process quality)
Reduction of Mortality

Multiple Trauma

- 1959: 45% alive at hospital admission
- 1994: 80% alive at hospital admission
- Increase of survival probability
- Increase of quality of life

Kuner, Freiburg, 1994
Outcome studies

Air versus ground transport of major trauma patients to a tertiary trauma centre: a province-wide comparison using TRISS analysis.

Mitchell AD, Tallon JM, Sealy B.

CONCLUSION: The transport of trauma patients with an ISS = 12 by a provincially dedicated *rotor wing air medical service was associated with statistically significantly better outcomes than those transported by standard ground ambulance.* This is the first large Canadian study to specifically compare the outcome of patients transported by ground with those transported by air.

Can J Surg. 2007; 50(2): 129 - 133
Conclusion

- HEMS became an integral part of the rescue system in Europe and has no supplemental character any more
- Quality management has led to a significant improvement in patient's outcome
- The achieved level of efficiency needs permanent evaluation and efforts to optimize the results
- Scientific studies (prehospital and clinical) are required for further development of standard procedures and guidelines
Thank you !