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TECHNISCHE UNIVERSITÄT
BERGAKADEMIE FREIBERG
Die Ressourcenuniversität. Seit 1765.

TMR

Tactical Medical Mining Rescue

Advanced First Aid for Mining and Remote Areas

TMR Tactical Medical Mining Rescue I TU Bergakademie Freiberg | Akademiestraße 6 I 09599 Freiberg | www.tu-freiberg.de

Underground rescue operations pose special challenges:
distances, hazardous areas, non-breathable atmosphere, lack of medical and technical equipment as well as means of communication, darkness, confined spaces and legal regulations that limit the use of public rescue services in these environments.

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How can we address / eliminate the disadvantage of the miner in a severe medical emergency compared to any person in a public area?

Response time in Germany:

12 minutes in urban areas until public paramedic or emergency physician rescue arrives

hours in underground environments with dangerous zones, non-breathable athmosphere etc.

→ Severe pain over a prolonged period of time,
→ Risk of permanent severe deterioration of health status due to prolonged start of definite treatment
→ Increased risk of death

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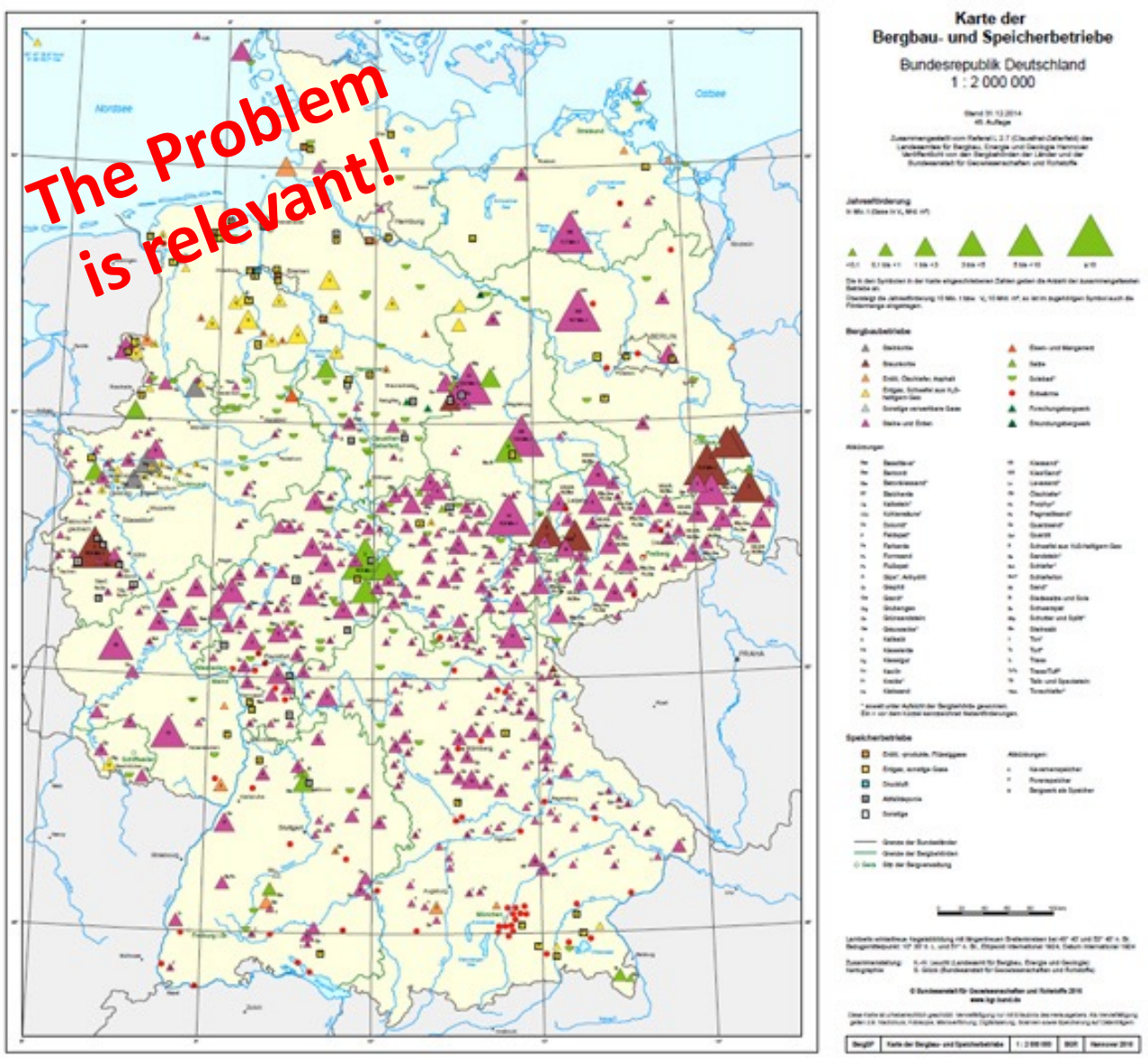
MINING ACTIVITIES IN GERMANY

Germany is a Mining Country

- Lignite
- Rock Salt
- Potash
- Kaoline
- Quarzsand
- Industrial minerals
- Construction minerals
- …

Approximately 3800 active surface operations and quarries

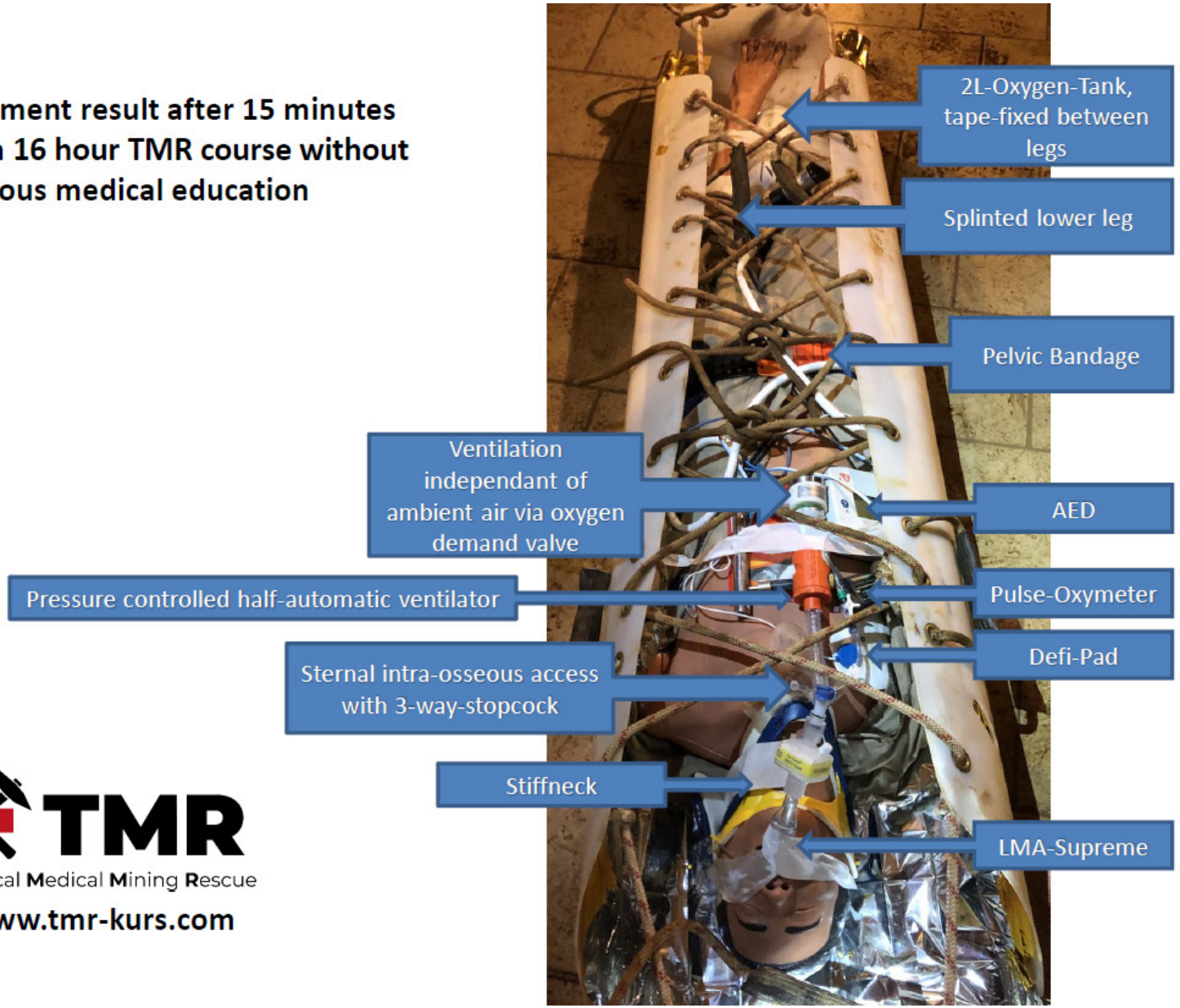
Approximately 42000 known abandonend underground mine sites from 1000 years of mining



Closing the gap…

In a two-day didactically optimised course, medical laypersons, especially mine rescue teams, are taught medical skills that are otherwise reserved for emergency medical professionals, with validated results and proven competence.

Treatment result after 15 minutes and a 16 hour TMR course without previous medical education



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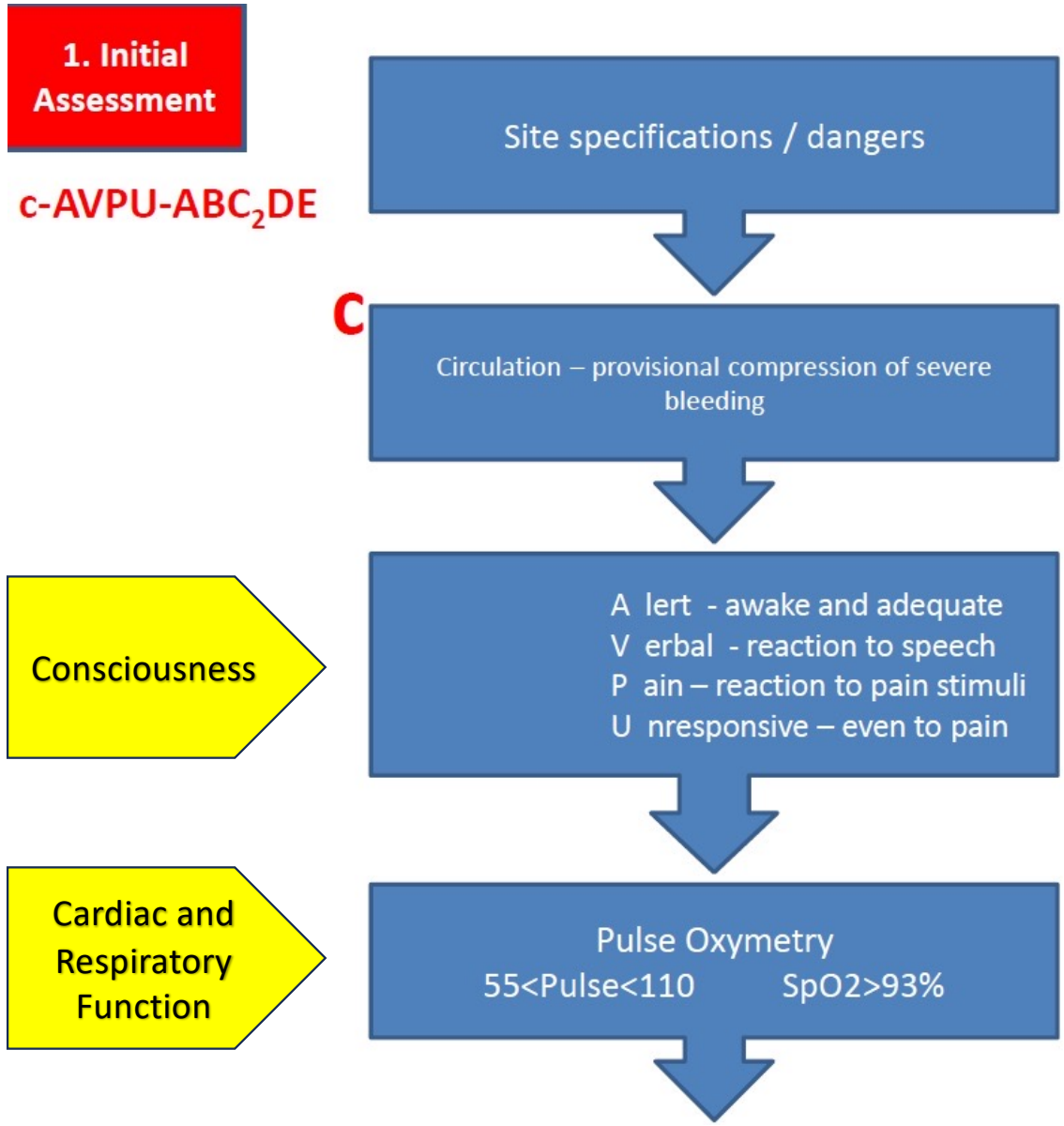
Treatment algorithm with procedures according to a modified c-ABC2DE scheme - dichotomous decision tree for medical laypersons.



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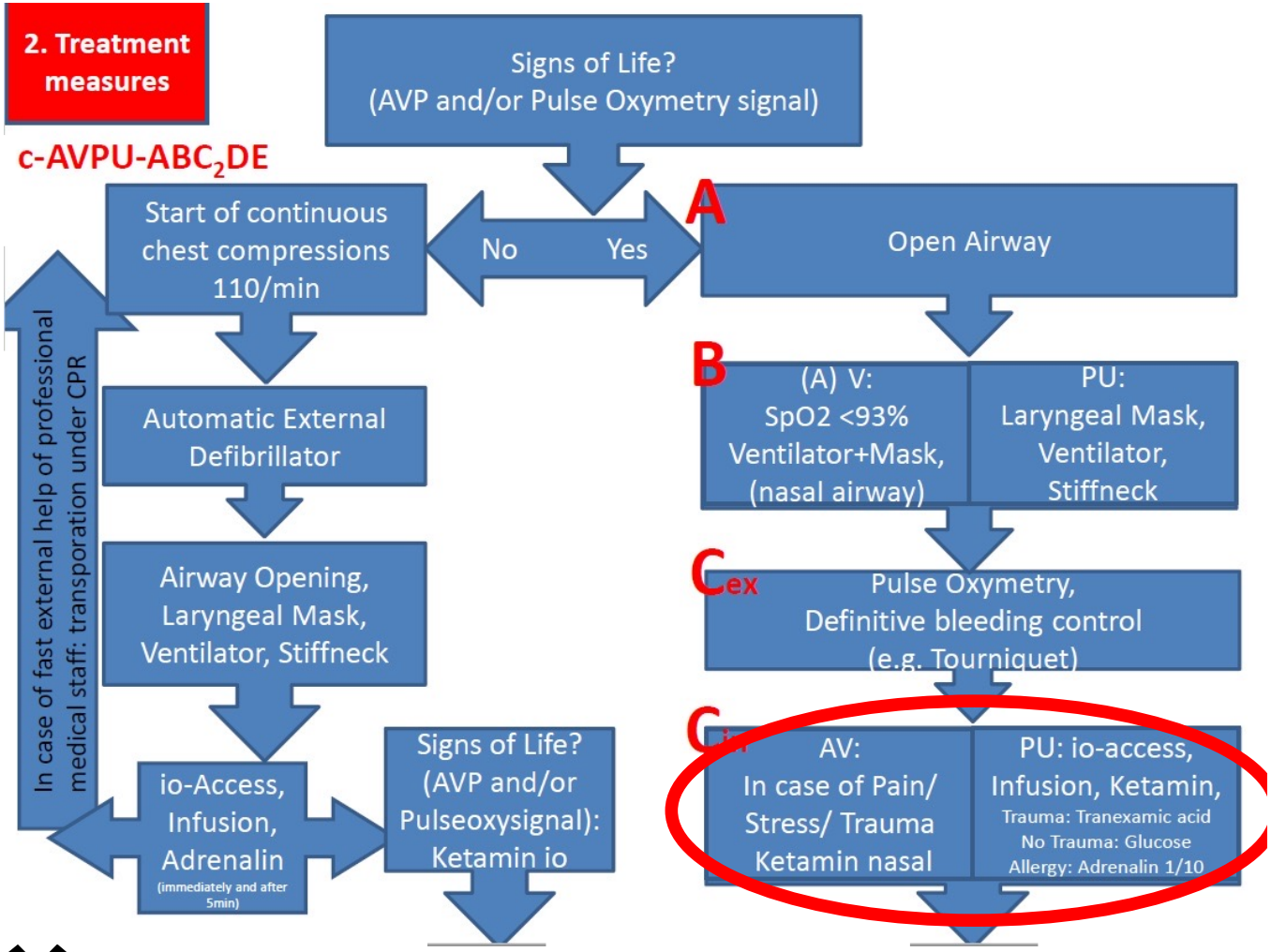
How can a trained miner determine the right amount of medicamentation?



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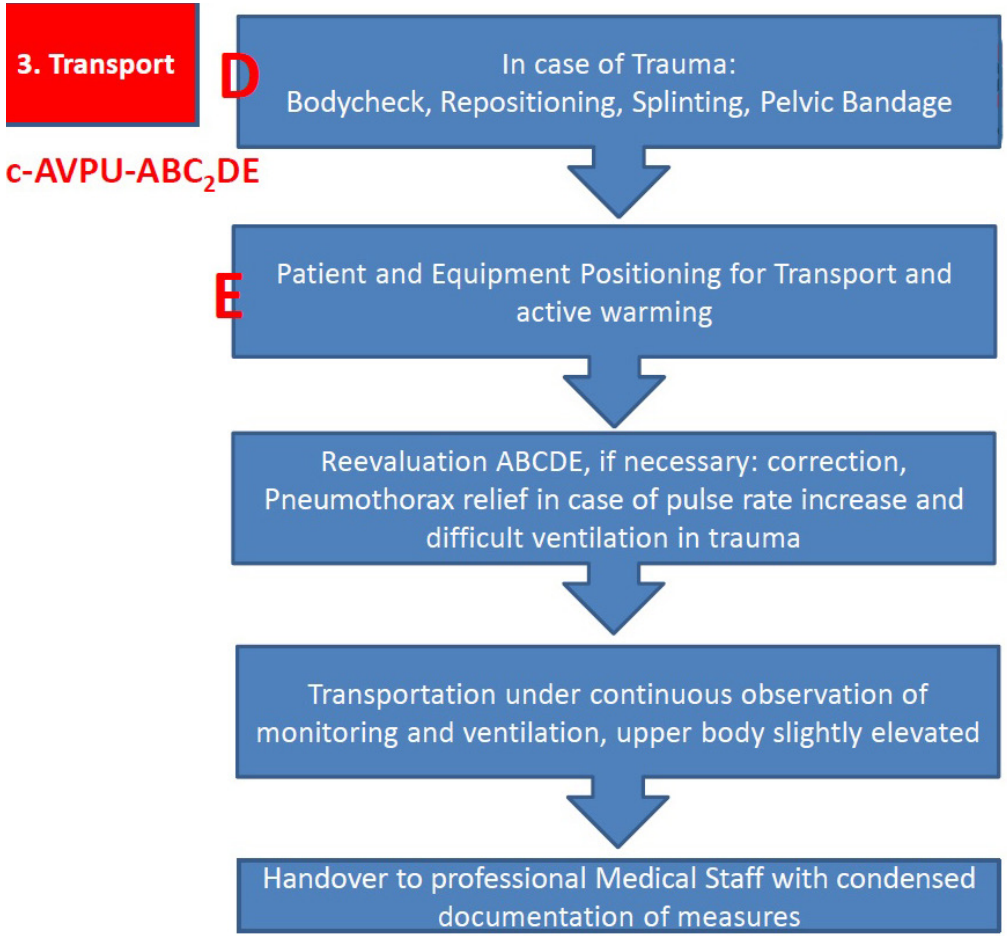

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Resuscitation in cardiac arrest with invasive ventilation, automatic external defibrillator use and adrenaline administration via intraosseous access.

Administration of adrenaline via sternal intraosseous access during resuscitation.

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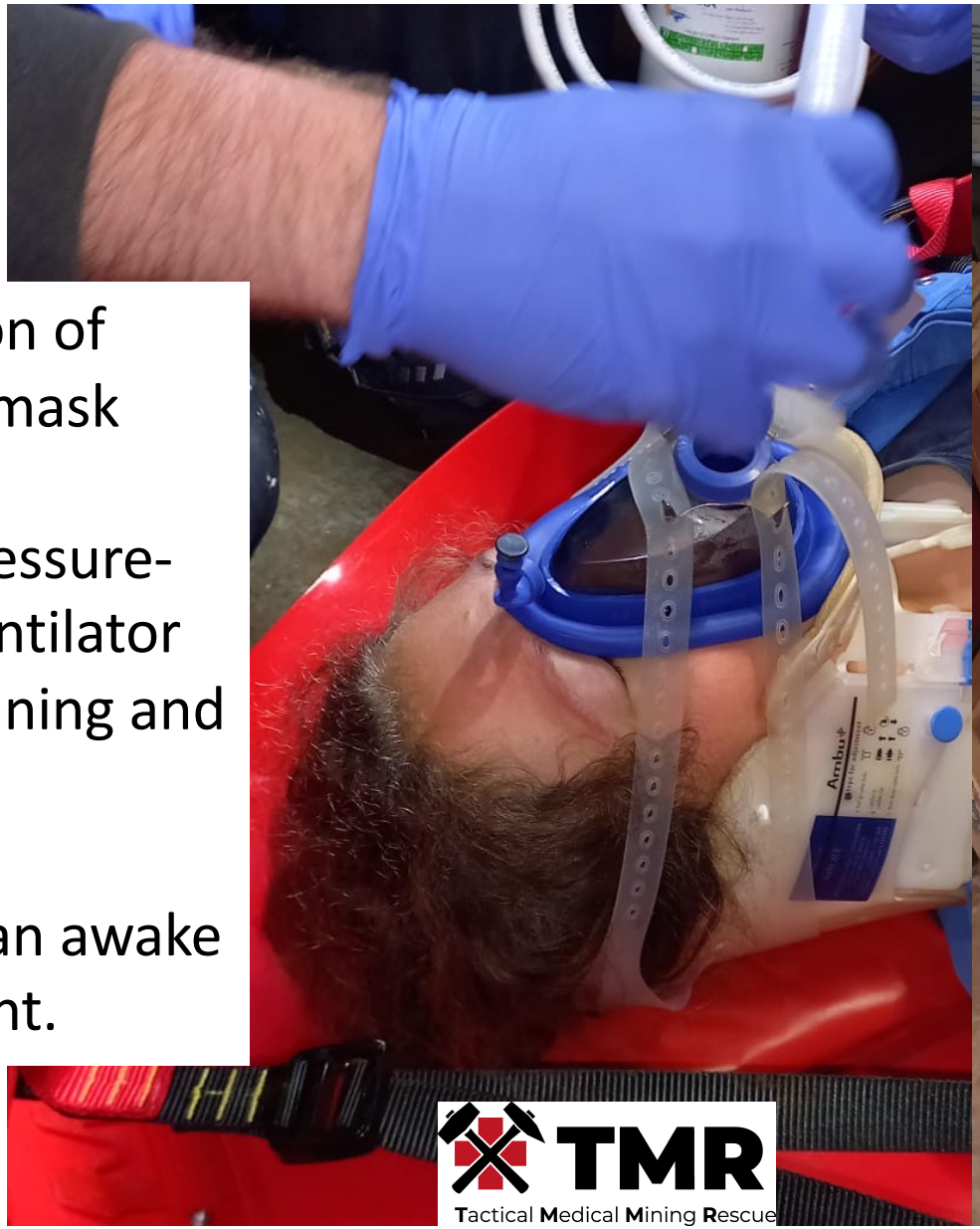
Transport of a cardiac arrest patient via dragging the stretcher under continuous resuscitation – for quick handover to public rescue services.

Immobilization of the cervical spine after trauma.

Administration of oxygen via a mask using a semi-automatic pressure-controlled ventilator while maintaining and supporting spontaneous breathing in an awake trauma patient.



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Placement of a nasopharyngeal tube to keep the airway open during reduced consciousness.

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Securing the airway with a special rugged laryngeal mask in an unconscious patient.

Securing the airway with a special rugged laryngeal mask in an unconscious patient and controlled invasive ventilation.

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Wound care and cervical spine protection before extriction.

Bleeding control by using an efficient "tactical wrap“.

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Administration of
potent painkillers
via a nasal nebulizer.

Placing of an intraosseous access into the sternum for administration of necessary medication and fluids.

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Injection of maximum 4 available vital medicines via intraosseous access.

Transfer to the stretcher: Using the log roll technique, the patient is moved without flexing the spine.

Preparation for safe transportation including invasive ventilation, active warming and operational equipment storage at the patient.

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Specifically developed, electrically driven active heating mat to avoid increased bleading through impaired coagulation, runtime 1.5 hrs

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Documentation of injuries and all treatment measures at a small laminated plastic card for structured handover to public rescue team.

Re-evaluation of
the treatment measures
and planning of the next
steps before
transportation.

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Patient transport under continuous observation of vital signs and treatment measures in narrow underground environment…

…and in spacy underground environment.

Vertical transportation of a narcotized and invasively ventilated person in a narrow shaft.

Upon handover to public emergency services, the patient already received full emergency medical care, including invasive ventilatory support, volume and pain therapy via an intraosseous access, as well as bleeding control and reduction and splinting of fractures.

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Complete equipment stored in a comparably tiny backpack of just 47 cm height. The laminated treatment algorithm as part of the equipment is guiding efficiently through emergency care.

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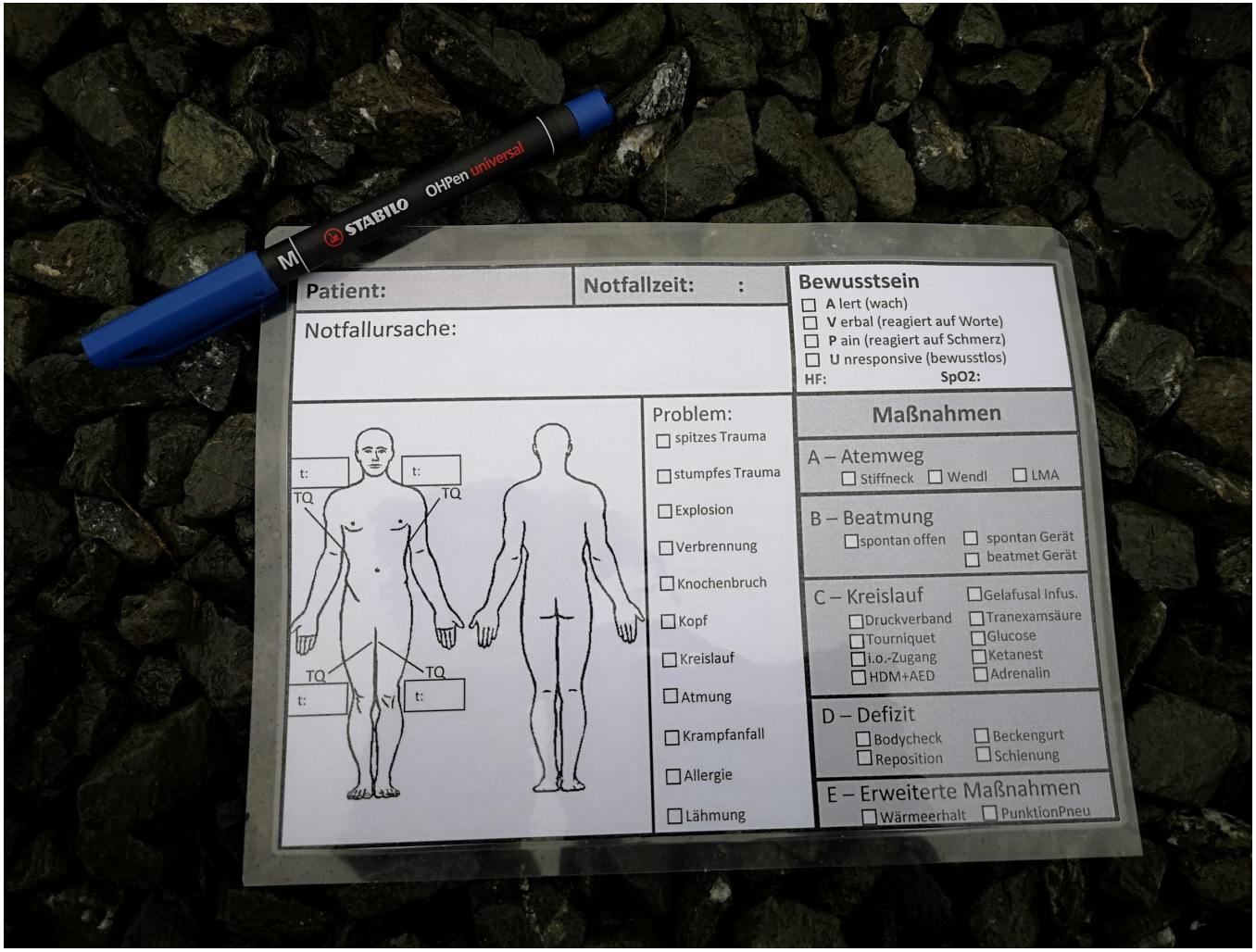
Documentation of the rescue operation using a small laminated card for injuries and treatment measures.



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How can this be taught to medical lay people?

…through highly standardized
fully practical Training with maximum hands-on
experience and peer-practice for self-experience!

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Training of individual skills and overcoming reluctancy through bidirectional training with course participants.

Life-saving measure: relief of a tension pneumothorax.

How can the training be realistic?

1. Through **complete training directly at the workplace** without the need for transfer into another environment

2. Through **didactically optimized teaching approach** and

3. Through **realistic injuries**

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Realistic accident presentation with acting patients and development of realistic adhesive wound moulages.

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How sufficient, efficient and sustainable ist the training?

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The acquired skills are examined in each course participant using objective structured practical examinations (OSPE).

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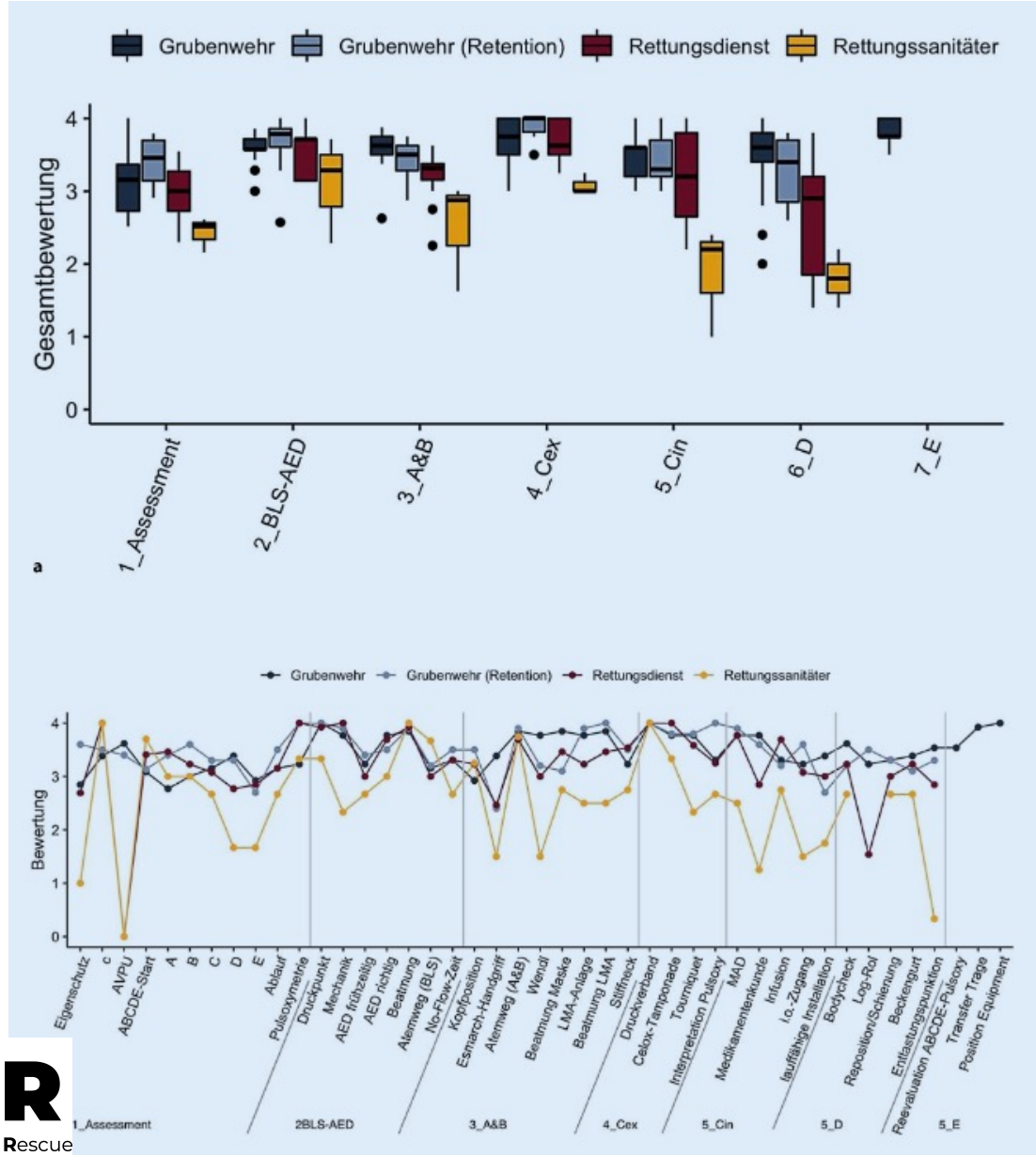
The TMR concept is validated and has been proven to achieve sufficient competency levels comparable to public emergency rescue services



- Mine Rescue Team after a 16 hour TMR course: scores: 3.42 +/- 0.18
- Mine Rescue Team 6 months after TMR course: 3.54 +/- 0.19
- Paramedics (3 years training): 3.28 +/- 0.18
- First Responders (3 months training): 2.10 +/- 0.33

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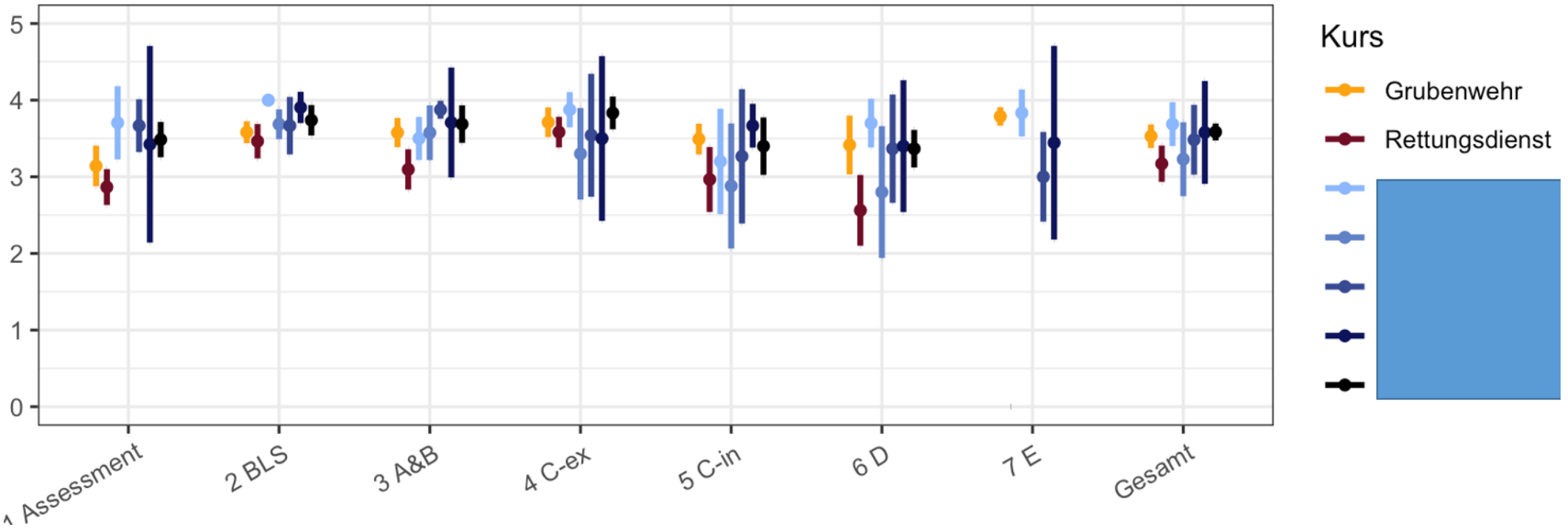
Continuous Monitoring of Course Quality



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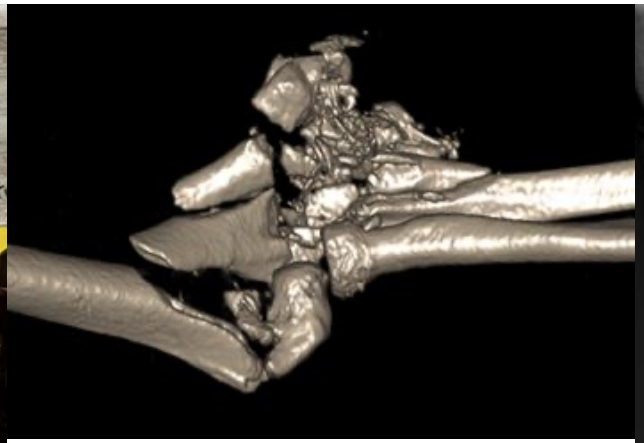
Mine Rescue Concept Implementation

- 2021: Approved by the German Society for Emergency Medicine (DGINA), Hans-Werner-Feder Award
- 2022: Approved by the German Board for Mining Rescue as guideline

Has it been successful?

- The majority of German Mining companies including storage mines for atomic waste has been trained and retrained
- After implementation, 3 real life-threathening emergencies have been treated with the TMR-approach by mine rescue teams in Germany
- International implementation has been started in 4 more countries



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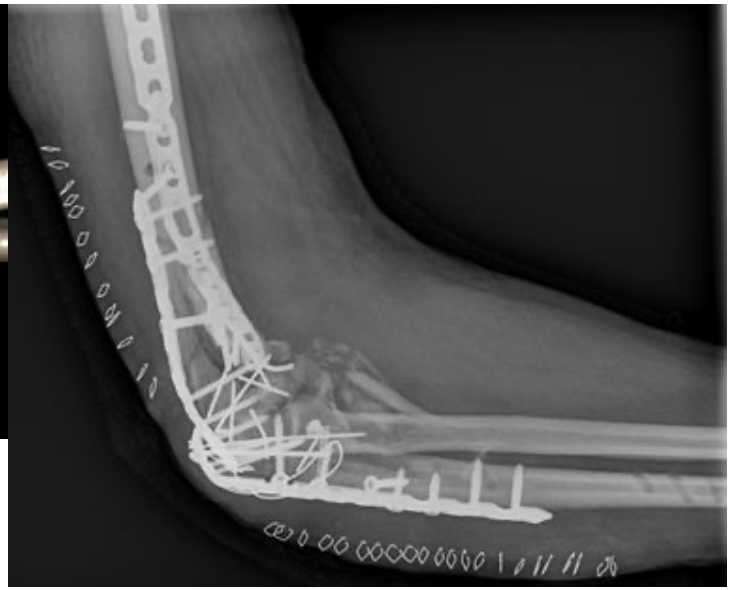

And what is the future?

- International legal acceptance as emergence competence / Good Samaritan law
- Transfer in extended First Aid Environment in remote non-underground working areas
- 24/7 Telemedicine Guidance trough experienced Emergency Physicians and TMR-Instructors
- Research on quick and extended range Telemedicine technical solutions together with TU Bergakademie Freiberg and Industry partners

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Notfall+ Rettungsmedizin

Medizinrecht

Notfall Rettungsmed
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Erweiterte Traumarettung durch Ersthelfer

Standardisierte Ausbildung und Notkompetenz – eine rechtliche Einordnung am Beispiel der Rohstoffindustrie

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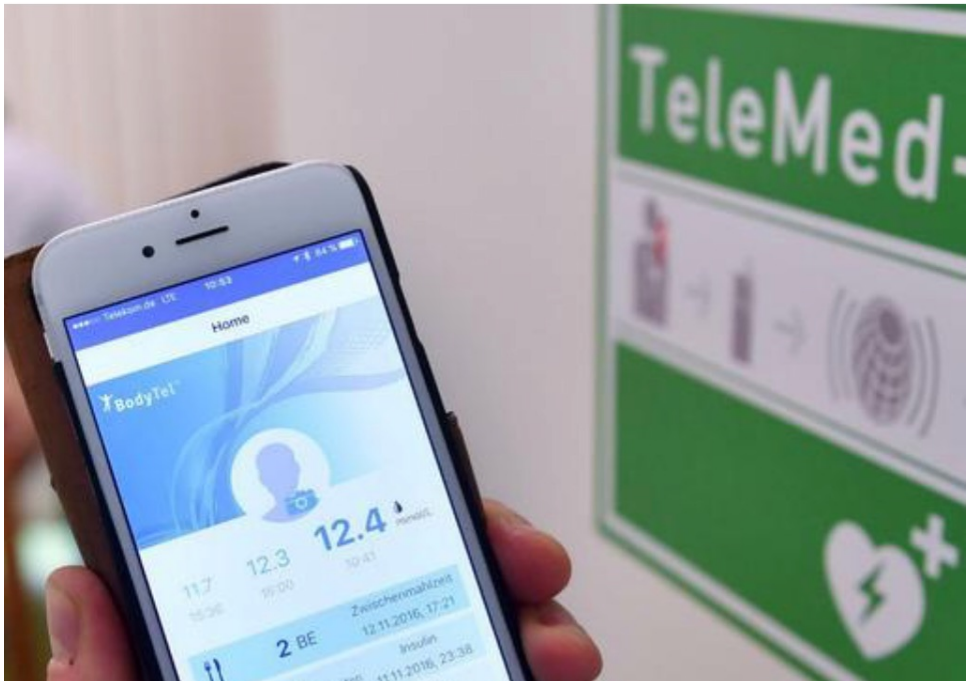

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University course certificate provided by the TU Bergakademie Freiberg.

Availability of provider courses, instructor courses and refresher courses.

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The TMR-rescue concept is

validated, real-world proven, university-certified, awarded and German guideline-content