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Application of invasive medical and pharmacological measures by German emergency paramedics

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Introduction: German emergency paramedics are to avert serious damage to the patient's health in the event of acute illness or accidents. For this purpose, they have a variety of invasive medical and pharmacological measures at their disposal in addition to their three-year professional training. The aim of this thesis is to investigate the use of invasive medical and pharmacological measures by emergency paramedics in the German rescue service by means of instruments of professional scientific research. In doing so, the motivations of emergency paramedics to refrain from using these measures will be investigated for the first time.

Methods: For this study, rescue missions were analyzed during the period July 1, 2022, to June 30, 2023. The chosen method involved a quantitative document analysis of the deployment protocols to investigate the use of invasive and pharmacological measures by emergency paramedics and the reasons against their use.

Results: During the period, $N = 10{,}102$ (100%) rescue missions could be evaluated. Analysis of the data revealed that invasive medical measures were used by emergency paramedics in $n = 1{,}211$ (11.9%) missions and pharmacologic measures were used in $n = 1{,}403$ (13.8%) missions. Most frequently, emergency paramedics concluded that invasive medical measures were not required.

Discussion: In summary, the use of invasive medical measures is not a standard part of the emergency medical services mission. Rather, the focus is on diagnostics and transport of patients to an appropriate destination hospital. An adjustment of prehospital care structures based on evidence-based data and an update of the catalog of indications for emergency physician interventions would be elementary for this goal. Further studies of professional fields of action in emergency and rescue medicine are necessary in order to analyze and optimize care structures. This would not only allow conclusions to be drawn about the future education, further education and training of rescue service personnel, but also allow care structures to be adapted to the current state of science and the care needs of patients.

KEYWORDS

invasive medical measures, pharmacological measures, emergency paramedics, occupational science research, non-invasive measures

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Introduction

In recent years, there has been a steady increase in the number of missions in the German rescue service (1). Emergency paramedics in the rescue service complete about 70% of rescue missions without an emergency physician (2). The majority of rescue service missions do not involve the care of emergency patients (3). Examples include requests for help such as a mild cough, problems with catheters and excessive demands in the care of relatives (1). The discrepancy that arises between the invasive medical measures learned in training and the trivial interventions experienced in reality leads to a high level of frustration and the questioning of the own activities of emergency paramedics in Germany (7). The higher costs for personnel, rescue equipment and rescue stations, as well as declining employee satisfaction, the resulting staff turnover and an increase in sick days are consequences of this development.

Background and state of research

"Vocational science research is a discipline that deals with the contents and forms of skilled work organized in occupations and occupational fields in their interrelationship with the object of work and the qualification and educational processes interacting with it

TABLE 1 Invasive measures performed by emergency paramedics.

Measure	Frequency	Percentage	Cumulative percentages
I.v. access	1.105	91.3%	91.3%
Immobilization, extension	40	3.3%	94.6%
Supraglottic airway	19	1.6%	96.2%
Deep endobronchial suctioning	12	1.0%	97.2%
Pelvic sling	9	0.7%	97.9%
Manual defibrillation	7	0.6%	98.5%
Laryngoscopy-foreign body removal	4	0.3%	98.8%
NIV CPAP + ASB	4	0.3%	99.1%
Airway problem tracheal cannula carrier	4	0.3%	99.3%
Vasalva compressive maneuver	3	0.2%	99.6%
Tourniquet-pneumatic tourniquet	2	0.2%	99.8%
Sepsis	1	0.1%	99.9%
I.o. access	1	0.1%	100%
Total	1.211	100%	

TABLE 2 Pharmacological measures performed by emergency paramedics.

Measure	Frequency	Percentage	Cumulative percentages
Administration of full electrolyte solution	1.105	78.8%	78.8%
Bronchoobstruction Administration of salbutamol sulfate+ ipratropium bromide	56	4.0%	82.8%
Ipratropium bromide	43	3.0%	85.8%
Massive nausea/ vomiting VEL+ dimenhydrinate i.v.	41	2.9%	88.7%
Severe pain adult esketamine/ midazolam	21	1.5%	90.2%
Other pain metamizole/ butylscopolamine	20	1.5%	91.7%
Hypoglycemia adults Gage glucose	15	1.1%	92.8%
Hypertensive emergency administration of urapidil	14	1.0%	93.8%
Brochobstruction adult prednisolone equivalent i.v.	13	0.9%	94.7%
STEMI administration ASS + Heparin	12	0.9%	95.6%
Anaphylaxis adult administration of epinephrine i.m./nebulized	8	0,5%	96,4%
Cardiac pulmonary edema administration	8	0.5%	97.2%
glycerol trinitrate + furosemide	7	0.5%	97.9%
Anaphylaxis adults prednisolone equivalent + dimetindene	5	0.4%	98.4%
ACS administration glycerol trinitrate spray	5	0.4%	98.9%
Epiglottitis, pseudocroup, asthma child epinephrine/ salbutamol nebulization	4	0.3%	99.2%
Seizure adult + child 14 years and older administration of midazolam nasally	4	0.3%	99.5%
Bradycardia atropine/epinephrine	4	0.3%	98.7%

(Continued)

TABLE 2 (Continued)

Measure	Frequency	Percentage	Cumulative percentages
Seizure adult + child 14 and older	3	0.2%	98.9%
Midazolam i.v./nasal	3	0.2%	99.2%
Seizure child Diazepam rectal/ midazolam nasal, paracetamol supp, ibuprofen supp.	2	0.1%	99.3%
Cardiac pulmonary edema glycerol trinitrate	2	0.1%	99.4%
Epiglottitis, pseudocroup, asthma child prednisolone rectally	2	0.1%	99.5%
Anaphylaxis child administration of epinephrine i.m./nebulized	2	0.1%	99.6%
Hypoglycemia child gage glucose	1	0.1%	99.7%
Anaphylaxis child administration of epinephrine i.m./nebulized	1	0.1%	99.8%
Hypoglycemia child gage glucose	1	0.1%	99.9%
Hypertensive emergency administration of nifedipine crushing capsule	1	0.1%	100%
Total	1.403	100%	

TABLE 3 Justifications for the decision against invasive and pharmacological measures.

Justifications	Frequency	Percentage	Cumulative percentages
No invasive measures required	6.198	74.8%	74.8%
Emergency physician on site	1.812	21.8%	96.6%
No measures for tactical reasons	165	2.0%	98.6%
Uncertainties of action	16	0.2%	98.8%
Legal uncertainties	27	0.3%	99.1%
Refusal of the measure by patient or authorized representative	77	0.9%	100%
Total	8.295	100%	

as well as your future potentials" (4). Vocational research includes several instruments, qualitative and quantitative investigation as well as expert interviews, to identify current conditions within a specific occupational field (5). In this way, relevant insights into the current state and future development of an occupational field can be gained (5). Against this background, it seems only logical to scientifically investigate the profession of emergency paramedic and the associated work and business processes in the rescue service. This forms the basis for prospective, patient-oriented perspectives through the design of professional curricula, of graded qualifications, teacher training and professional teaching and learning in emergency medical services (6).

German emergency rescue service

An essential part of the German healthcare system is the emergency rescue service.

According to the Thuringian State Rescue Service Act (2018), its main task is the medical care of patients with acute illnesses or injuries, but also the qualified transport of patients between different care facilities of the German healthcare system. A central task of the rescue service is the provision of an infrastructure that ensures comprehensive, economical and demand-oriented rescue service provision for the population.

Currently, in the Social Code Book Five (V) under § 60 and § 133, the rescue service is not considered an independent service area, but rather a transport service. This means that the costs of out-of-hospital rescue services are covered by the health insurance funds and that the refinancing of the rescue service is based on this. However, only those services for which there is a transport condition for the patient may be billed.

The term "medicine" is defined in the law on the professional practice of medicine without a license (Heilpraktikergesetz, HeilprG):

"The practice of medicine within the meaning of this Act is any professional or commercial activity undertaken to diagnose, cure or alleviate illness, suffering or physical injury in humans, even if it is carried out in the service of others."

The HeilprG classifies measures to diagnose an illness on the basis of complaints and symptoms as well as measures to heal and alleviate physical and mental complaints as medicine. Therapeutic measures can be differentiated into invasive and non-invasive measures. In an invasive measure, the integrity of the patient is violated. A measure penetrates the body, e.g., when placing a peripheral venous access (i.v. access). Non-invasive therapeutic measures include all measures that do not violate the integrity of the patient, such as positioning the patient.

Participants in emergency rescue services in Thuringia are required by Section 3 Sentence 3 of the Thuringia Rescue Services Act to carry out all measures to save lives or prevent serious damage to the health of emergency patients at the scene of the emergency. Another key objective of the rescue service in Thuringia is to reduce mortality and the consequences of serious illnesses and injuries by providing rapid and qualified first aid and rapid transport to suitable medical facilities. In order to be able to fulfill these tasks,

rescue service employees in Thuringia must have the appropriate training and regularly attend advanced training courses.

Current state of research

In the study by Sauerbier and Koch, $N = 1{,}542$ emergency medical technician rescue missions were evaluated. Invasive-healing interventions were performed in n = 306 (19.8%) of the missions. Pharmacologic interventions were used in $n = 45$ (2.9%) missions (7). In another study by Koch et al., $N = 2{,}247$ emergency paramedic missions were evaluated. Here, it was found that analgesia was performed by emergency paramedics in the German rescue service in only $n = 21$ (0.9%) (8).

Objective

This study investigates the frequency of use of invasive medical and pharmacological measures by emergency paramedics in the rural German ambulance service area of the Eichsfeld district. In addition, the motivations that lead emergency paramedics not to use invasive medical measures or not to transport patients despite the presence of a patient are investigated.

Method

For this study, a quantitative document analysis of the deployment protocols of the DRK Kreisverband Eichsfeld e. V. was carried out in order to investigate the use of invasive and pharmacological measures by emergency paramedics and the reasons against their use.

Approval

The chairmen of the board as well as the chairmen of the works council of the DRK Kreisverband Eichsfeld e. V. as well as the medical director of the rescue service of the district Eichsfeld were asked by e-mail in April 2022 whether the study may be carried out. After personal discussions, approval was granted in May 2022.

Implementation of the study

Every rescue service operation carried out in Germany must be documented. In Germany, the documentation is done analog or digitally on mission logs. For missions without medical involvement, this is usually the emergency paramedic. If an emergency physician is involved in the care, he or she must take over the documentation. Demographic data, as well as diagnostic, invasive, non-invasive and pharmacological measures are written down on the protocols. Likewise, a diagnosis or suspected diagnosis is identified. The deployment protocols are collected at the ambulance stations and forwarded at regular intervals to the medical directors of ambulance services for checking and archiving.

TABLE 4 Reasons for not transporting a patient.

Reasons	Frequency	Percentage	Cumulative percentages
No indication for rescue service	599	58.0%	58.0%
Patient/authorized person declines	333	32.3%	90.3%
No patient at the scene	100	9.7%	100%
Total	1.032	100%	

The documentation of operations in the rescue service of the Eichsfeld district is carried out analogously.

Evaluation

Data collected during the survey period from July 1, 2022 to June 30, 2023 were then analyzed descriptively using Microsoft Excel.

Ethics

The study protocol was submitted to the Ethics Committee of the Medical Faculty of the Martin Luther University Halle/Wittenberg and positively reviewed (Edit. No. 2022-102).

Results

In $N = 10{,}102$ (100%) deployments, invasive measures were performed in $n = 1{,}211$ (11.9%) deployments and pharmacologic measures were performed in $n = 1{,}403$ (13.8%) deployments (Tables 1, 2).

Emergency paramedics' justifications for not using invasive and pharmacological measures

For the justification for not using invasive and pharmacological measures, $N = 8{,}295$ (100%) feedback was provided by the emergency paramedics. Multiple responses also occurred. With $n = 6{,}198$ (74.8%), emergency paramedics most frequently indicated that no invasive measures were required (Table 3).

Reasons for not transporting a patient

During the survey period, $n = 1{,}032$ (10.2%) of the missions across the county were completed without transporting a patient. On the population of missions, it can be seen that $n = 599$ (6%) of the patients encountered showed no indication for transport by the

ambulance service and $n = 333$ (3.3%) of the citizens seeking help refused transport by the ambulance service (Table 4).

Discussion

This study concludes that emergency paramedics performed at least one invasive measure as well as pharmacological measure on their own responsibility with a percentage of <15% of rescue missions. This result is consistent with the 2021 study by Sauerbier and Koch. The reasons for this low percentage are complex. One reason is the increase in the number of trivial incidents described by Kuhnke and Pfaff. If the ambulance service is increasingly called out for "trivial" missions without a life-threatening condition of the patient, there is no need for the emergency paramedics to perform an invasive measure (9).

As already described by Lechleuthner and Neupert, intravenous access and the administration of whole electrolyte solution are also the most frequently performed invasive and pharmacological measures by emergency paramedics in the present study (10). This is due to the fact that intravenous access is the essential basis for further pharmacological measures.

The clear trend that emergency paramedics also performed invasive medical measures in just over one-fifth of the independently performed missions similarly raises the question of competency retention of the learned invasive curative measures (7). The discrepancy between the competencies taught in the 3-year emergency paramedic training program and the professional reality was highlighted by the present data. These data underscore the suggestion that invasive paramedic competencies are difficult to obtain. In many cases, this could additionally lead to frustration among emergency paramedics. Although the measures were learned in training by emergency paramedics, it is questionable whether they will continue to be mastered without adequate performance.

The reasons for the increase in the number of call-outs cannot be clearly determined. Sieber et al. attribute this development to various factors such as the "decrease in the inhibition threshold to make an emergency call," the population's sense of entitlement, the lack of "availability of alternative medical services," "individual socio-economic factors" and demographic developments. Demographic trends are a key factor in the measured increase (11).

In the current development of deployment types, the ambulance service is increasingly encountering patients with non-life-threatening illnesses or injuries for whom hospital admission is not indicated and who are not transported to a hospital by the ambulance service. The proportion of these patients is around 10% (11). This is where a change in the patient clientele is most clearly visible. Due to these changes, a reform of the German Social Code (SGB), which recognizes the ambulance service as a separate service area, is being discussed. The handling of so-called "sub-acute emergencies" and the outpatient treatment of patients is not a regular subject in emergency paramedic training and is often neglected in the vocational training of emergency paramedics.

For more far-reaching analyses and better comparability, primary and further studies are lacking in all federal states and rescue service areas. Further studies of professional fields of action in emergency and rescue medicine are necessary to analyze and optimize care structures. This would not only allow conclusions to be drawn about the future education, training and continuing education of emergency paramedics, but care structures could also be adapted to the current state of science and care needs.

Critique and limitation

The present study exclusively discloses the invasive and pharmacological measures performed by emergency paramedics from a rural German rescue service area of the Eichsfeld district over a short study period. No generally valid statements for the entire German rescue service can be drawn from the discussion that has thus arisen. For this, further Germany-wide investigations in the rescue service would have to follow.

Another limitation is the analogous documentation of operations. The quality of the documentation depends on the emergency paramedics. Both errors due to unclear legibility of the protocols and incomplete documentation can be assumed. It can be assumed that more invasive, non-invasive and pharmacological measures were performed, but these were not documented on the deployment protocols.

Conclusion

When comparing the results of this study with similar studies, it can be seen that throughout Germany, the work situation for emergency paramedics is a similar one. The training and examination for emergency paramedics only reflects the realistic working life to a limited extent. The results of the present and cited studies can be used to improve job satisfaction and job loyalty of trained emergency paramedics in order to adapt framework curricula as well as school-internal curricula. Another approach to improving working conditions in the emergency medical services would be to reduce the number of so-called "bagatelle" missions. This would require a survey of the reasons given by the citizen seeking help for using the resources of the rescue service and a subsequent conception of suitable care strategies. At the present time, from a professional scientific point of view in the German emergency rescue service, we have to state that we do not know what, why and how we do it.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

Author contributions

SK: Writing – original draft. MH: Writing – original draft. DK: Writing – original draft, Resources.

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Conflict of interest

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