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DISSERTATION

COMPARISON OF GERMAN PRE-HOSPITAL PHYSICIAN PRACTICE TO PARAMEDIC PROTOCOLS AND PARAMEDIC PRACTICE

zur Erlangung des akademischen Grades
Dr. medicinae (Dr. med.)

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I. Introduction

The American and German systems of pre-hospital care provide different approaches to the challenge of caring for patients in the field. In the German model, a physician with years of training and specialization is brought to the patient's side, where he or she performs a comprehensive assessment, forms a presumptive diagnosis, provides treatment, and plans a disposition for the patient. There are no formal guidelines or rules in existence for the management of particular presentations. It is up to the physician on scene to determine the most likely diagnosis and appropriate management. Treatment, diagnosis, and disposition have been shown to be accurate in the Berlin Emergency Medical Services (EMS) system, with a high correlation of on-scene diagnosis and hospital discharge diagnosis.[1]

The systems in Germany and the US are geared towards different needs: German pre-hospital physicians are intended to be used for acute life-threatening conditions only, while American Emergency Medical Technicians' responsibilities include the transport of patients of varying acuity levels to an emergency department staffed by a physician. Comprehensive primary care and the continued availability of house calls by the legislatively mandated on-call "Doctor's Emergency Service" covers a large part of off-hour emergency care in Germany. This dual system of emergency care by general practitioners on one hand and hospital-based pre-hospital emergency physicians is specifically regulated by law.[2] The coverage provided by community physicians "on call" may be an important factor in reducing the number of calls to emergency services. The quality of this tier of emergency care has been studied and been found to be less than satisfactory, in particular with respect to equipment such as ECGs, intravenous access, and oxygen for patients with potentially life-threatening diseases.[3]

EMS physicians in the United States do not routinely respond to medical or traumatic emergencies. The role of the EMS physician in the US is largely an administrative one, ensuring the education, quality, and efficiency of the providers working as physician surrogates in the EMS system.[4] Since all out-of hospital advanced life support is the responsibility of the physician in charge of medical direction, some physicians in this role, in the US, choose to respond to advanced life support (ALS) and traumatic calls in an observational role. Historically, there have been examples of physician involvement in pre-hospital response in the US, in particular in early EMS systems. The first description of nonphysicians providing advanced care was by Cobb in 1976. In this system, physicians responded to life-threatening calls together with ambulance technicians. By means of a closely supervised apprenticeship of over 200 hours of duty, these technicians were trained to provide interventions previously reserved for medical doctors[5]. Most of Canada uses the American model of physician surrogates; however, Montreal provides all ALS care through physicians. One study showed that pre-hospital physicians are available in a minority of US EMS systems(29%). The main uses for field physicians in the US are field triage, direct medical control, tube thoracosotmy and amputation[6]. Protocol-based management of common emergency presentations is safe for certain conditions but does not always obviate the need for direct medical oversight (previously called "on-line medical control")[7]. In one system, a study showed that up to 19% of cases treated by paramedics required a radio or phone call to an emergency department physician to direct care[8]. Protocol based treatment does not guarantee that there are appropriate protocols for each individual patient, or that these protocols will be applied appropriately. It has been shown that paramedics deviate from protocols in a significant number of cases for a condition such as chest pain[9].

EMS systems evolve to meet the challenges of their environments. Ultimately, the success or failure of a system is measured by its ability to meet the needs of the population it serves. Outcome data for different EMS systems is lacking. In the case of trauma mortality, a prior comparison between the US and German systems, with similar demographic characteristics, showed no difference over a one year period.[10]

A previous comparison of practitioners in two air medical systems in Germany and the US yielded marked differences in the types of interventions performed[11]. In comparing a physician surrogate system in the United Kingdom to a physician based system in Germany, it was found that patients were managed more aggressively in Germany, with a more frequent use of pharmacologic interventions by the physicians and greater improvement in clinical condition. Using the Mainz Emergency Evaluation Score, a measure of disease severity in patients presenting to EMS systems, German physicians were able to improve the overall condition in twice the number of patients compared to the British paramedics, and the proportion of cardiac arrest patients surviving to discharge was three times higher [12]. One American study showed an association with improved survival to discharge in out-of hospital cardiac arrest patients when cared for by an on-scene physician as compared to paramedic care. The main difference in this observational study was a more frequent dosing of medications in the physician treated group, with the patients treated by physicians receiving medications at almost twice the rate as those treated by paramedics.[13] This may suggest that a more aggressive approach to the management of cardiac arrest could be of benefit.

Notwithstanding the difference in training of their providers, both systems have the goal of providing state of the art emergency care to their patients. In the American system this is attempted by categorizing the patients' complaints into main areas that are addressed with standing orders. In the German system the treatment is determined by the physician's judgement. Paramedics are trained to specifically recognize certain life-threatening chief complaints and intervene on those, making assessments instead of diagnoses, while German physicians rely on medical school education and postgraduate experience to recognize these conditions and intervene appropriately. The main difference is that paramedics are trained in a goal-directed, protocol-driven fashion whereas to date there are no protocols for the management of emergency conditions for German pre-hospital care. This does not necessarily imply that emergency care by German physicians is less efficacious than that of paramedics, though it may be less consistent.

Training of Pre-hospital ALS Providers in Germany and the United States

The training of pre-hospital physicians in Germany relies on medical school education (six years) which includes basic life support (BLS) and a university-based emergency medicine course encompassing the principles of pre-hospital care including cardiac resuscitation. Standardized training is being introduced in the form of Advanced Cardiac Life Support (ACLS) courses or equivalent courses sponsored by the European Resuscitation Council. Certification as a pre-hospital physician in Germany is legislated in many provinces. In Berlin, pre-hospital physicians are required to be provided by hospitals, and have sufficient knowledge of emergency medicine as well as several years of training.[14] The training guidelines for the proof of specialization in pre-hospital medicine have been issued by the German Medical Association. These include 24 months of postgraduate practice, including six months of critical care; skills in intubation, venipuncture, resuscitation and CPR; 50 supervised ALS calls; and the completion of an 80 hour course on general and specialized emergency care followed by a board examination [15]. In the Berlin EMS system studied, all pre-hospital physicians were board certified or in their final years of training in anesthesiology or cardiology.

Paramedics in the United States are trained according to standard curriculum guidelines issued by the federal National Highway Traffic Safety Administration (NHTSA). The prerequisite for paramedic training in the United States is cardiopulmonary resuscitation (CPR) certification and training as an Emergency Medical Technician-Basic (EMT-B). EMT-B training includes a minimum of 110 hours of theoretical instruction and at least five patient interactions in a clinical setting. Emergency Medical Technician-Paramedic (EMT-P) education typically consists of 1200 hours of theoretical and practical training including time spent in clinical settings and the field. A practical test and written examination follow. Many states including Connecticut use a test conducted by the National Registry of Emergency Medical Technicians (NREMT) as the standard for certification. [16, 17]

New Haven EMS

The primary service area of the New Haven Sponsor Hospital Program encompasses a population of approximately 378,000 in twelve towns.[18] There are 20 agencies providing EMS in the service area, among which American Medical Response – New Haven (AMR-NH), a commercial ambulance company, is the largest. There are between 10 and 24 ALS ambulances and 0 to 8 BLS ambulances in service depending on the time of day. Two physician-staffed vehicles are available for response to complex extrications and mass casualty incidents, with one EMS physician on duty at all times.

While there is much variation in EMS system structure, the dominant model in the twelve towns is a fire-based first response (either BLS or ALS, depending on the town), with commercial ambulance transport. The response to ALS calls is two tiered, with BLS and ALS units activated simultaneously. ALS units can be cancelled by the BLS unit on scene if there is no apparent need for advanced care. The majority of patients from the service area are brought to one of two acute care hospitals in New Haven, or a suburban free-standing emergency department staffed by emergency physicians.

Telephone access to emergency services occurs through the statewide unified 911 telephone number, which routes calls to one of twelve public safety answering points (PSAP). The majority of emergency medical dispatch centers use an index-card based systems for interrogating callers and prioritizing calls to the ALS or BLS level care. Regional ambulance traffic is coordinated though the South Central Connecticut Regional Emergency Communications System (known locally as CMED). The call volume is approximately 100,000 calls per year, including Basic Life Support (BLS) and Advanced Life Support (ALS) transports. There are approximately 200 paramedics and 500 EMT-Basics operating under the auspices of one medical director.

Direct medical oversight (formerly known as on-line medical control) is available to field personnel at all times by board certified emergency physicians at the receiving emergency departments. This enables providers to manage patients outside of the standing orders provided in protocols and to obtain assistance with difficult treatment decisions or logistical problems, such as patients refusing transportation to the hospital.

Indirect medical oversight (formerly known as off-line medical control) is the responsibility of the system's physician medical director. It includes the development and revision of treatment protocols and standing orders, training and testing of new personnel, ongoing education and re-credentialing of field personnel, and system surveillance and continuous quality improvement.

Quality assurance is performed by monitoring of radio transmissions, on-scene supervision, and manual review of all patient care reports by an EMS coordinator at each sponsoring hospital.

Berlin EMS

The Berlin Fire Department is the main provider of EMS in Berlin. For the population of 3.45 million, approximately 100 BLS ambulances and 14 to 16 physician staffed ALS vehicles (NAW) are available, including one helicopter (RTH). The service area of the University Clinic Benjamin Franklin (UKBF) comprises the districts of Steglitz-Zehlendorf with a population of approximately 288,521 as well as districts covered by the helicopter.[19] A single ALS vehicle and the helicopter provide all ALS care for this population.

The helicopter is used during daytime hours to deliver physicians to the scene. It is dispatched simultaneously with ground based ALS units in order to ensure the shortest response times throughout the city, and is treated as a flexible unit to cover areas where the current ALS vehicle is engaged. In addition, there are two specialized obstetric ambulances available, staffed with a midwife and paramedic, and one helicopter dedicated to interfacility transfer. There is approximately one physician-staffed ALS vehicle available per 200,000 people.

Access to emergency care is provided through a unified emergency number for fire and medical emergencies (112) and is coordinated by a single dispatch center. At the time of this study, the dispatch of physician-staffed vehicles was based on seven "key words" as determined by experienced dispatch staff. Interviews of the caller were not structured. The key words for ALS response were "chest pain," "loss of consciousness," "respiratory distress," "bleeding," "major trauma," and "shock." A system of structured interviews and computerized prioritization of medical dispatch was introduced in April 2005 (after the conclusion of data collection for this study).

Response to ALS calls is two-tiered, and BLS units arriving on scene can cancel the physician if there appears to be no need for advanced care. All BLS units are equipped with automated external defibrillators (AED) to ensure early defibrillation. Patients are taken to one of six level-one trauma centers or appropriate local hospitals. Medical oversight and quality assurance for early defibrillation if performed by non-physician personnel is provided by the leading emergency physician (LNA) of the base hospital in each district.

Quality assurance of ALS calls is performed by review of individual cases by the LNA with the physician who responded to the call.[20]

Question

To date, no study has examined the differences in interventions performed by practitioners in the field of ground based ALS services in different nations. Given the universal body of knowledge in medicine, it is reasonable to assume that for a given diagnosis or field assessment, the treatment performed should be fairly similar from system to system. For example, an asthmatic patient with acute bronchospasm would receive a beta-agonist, or a patient with suspected myocardial infarction (MI) would receive aspirin and other medications shown to be of benefit.

The primary objective of this study was to describe the management of common medical conditions encountered in a German physician-based EMS system with those performed in an American paramedic-based system. The secondary objective was to determine what proportion of interventions provided by German EMS physicians were included in the standing orders of treatment protocols provided by indirect medical oversight in the American system.

II. Methods

Preparation

Patient care reports (PCR) from Berlin and New Haven were analyzed to determine what data would be available for study, and patient care protocols from New Haven were analyzed to determine what interventions are provided by paramedics. Medication and equipment lists for New Haven EMS agencies were obtained from the paramedic protocols, and for Berlin ALS units were obtained through personal interviews with EMS physicians during a visit to Berlin and review of the literature.

Database Design

Using the information obtained as above, a database entry form was developed using Filemaker Pro (© 1984-2004 Filemaker, Inc., Santa Clara CA, USA). Sections in the data entry form included EMS information, times and methods of ALS activation and transport, patient demographics and chief complaint, assessments and measurements, outcome, interventions performed, and medications given.

Primary EMS assessment and diagnosis was divided into 37 categories. Data entry on the form was restricted to checkboxes to minimize variability in data entry. Strict guidelines were developed prior to data entry by the investigators in Berlin and New Haven to ensure consistency of data entry. An option for free text entry was provided. In order to ensure the quality of data recorded, first-level validation routines were included in the database. This ensured that every form recorded contained a minimum amount of information such as times and patient demographics. The data entry form is shown in the appendix.

Data Acquisition

The study period included January 15 - March 15, 2005. The intention was to include all ALS level dispatches and transports meeting the inclusion criteria in that time period in both locations. In Germany, all physician-staffed dispatches from the university clinic were recorded. The inclusion criteria for analysis were all German physician dispatches that resulted in patient contact and a diagnosis. Patient care reports (PCR) in Germany were manually analyzed and abstracted into the database. All PCRs that fell within the study period were recorded regardless of the outcome or completeness of the form. To assess the completeness of data collection, each recorded form was matched with its entry in a dispatch list obtained from the Berlin Fire Department.

In New Haven, all ALS transports to Yale-New Haven Hospital (accounting for approximately two-thirds of all system transports) with an available PCR were abstracted into the database. Inclusion criteria were all run forms identified as ALS by the provider charting. The number of ALS transports to YNHH during the study period (as determined by CMED data) was compared to the number of ALS run forms available, to determine the percentage of transports captured.

Complete dispatch lists for the study period from Berlin and New Haven were obtained for analysis of scene and response times. These lists included but were not limited to cases meeting inclusion criteria for analysis of interventions by providers.

Data Analysis

All statistical analysis was performed using Stata for Macintosh (©1985-2004 StataCorp LP, College Station TX, USA).

Demographic information was analyzed for statistically significant differences with an unpaired t-test.

Response times (vehicle dispatch to arrival on scene) and scene times (arrival on scene to leaving scene) were calculated from dispatch lists in Berlin and New Haven. Normal distribution of times was assumed and graphically tested using the qnorm function in Stata. The mean times were analyzed for differences using an unpaired t-test.

The most common German diagnoses were identified, and these diagnoses were matched with New Haven paramedic assessments. Using filters in the database software, interventions performed for each diagnosis were extracted. Data was organized into tables in which German interventions were classified as either contained, or not contained, in paramedic protocols. The significance of differences in the percentage of cases receiving a particular measure were calculated using a test for difference of proportions in Stata. Medication utilization in both systems was evaluated.

For each assessment, the total number of interventions performed by German physicians was calculated. The fraction of interventions that was available under paramedic protocols in New Haven was determined.

III. Results

In Berlin, 1,106 PCRs were reviewed. This represented 97% of physician vehicle dispatches during the study period. Of these, 584 met the inclusion criteria of physician-patient contact and diagnosis. In New Haven, 2,356 PCRs were reviewed during the same time period, and 1,537 met the inclusion criteria of ALS level care. This represented 73% of ALS transports to YNHH, indicating that no PCR was available for the remaining 27%.

Demographics

The demographic distribution of patients is shown [Tables 1,2 and Figures 1,2]. The average age of patients meeting inclusion criteria for ALS level care in New Haven (48) was younger (OR 4.3, 95%CI 2.9-6.3) than in Berlin (67). There were significantly more males treated in Berlin (53%) than in New Haven (47%) (OR 1.25 95%CI 1.03-1.5).

Berlin	Female	Male
Median Age	78	66
Mean Age	72	62
n	263	288

Table 1: Berlin Demographics

New Haven	Female	Male
Median Age	51	44
Mean Age	51	45
n	820	717

Table 2: New Haven Demographics

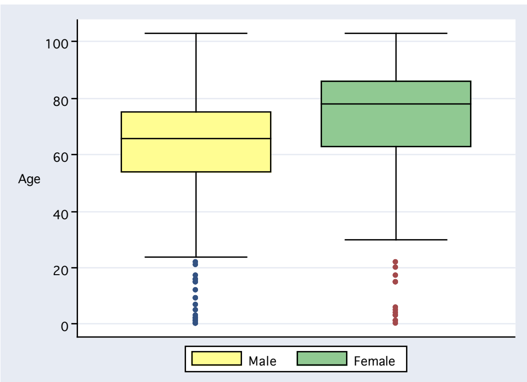

Figure 1: Age and Gender in Berlin

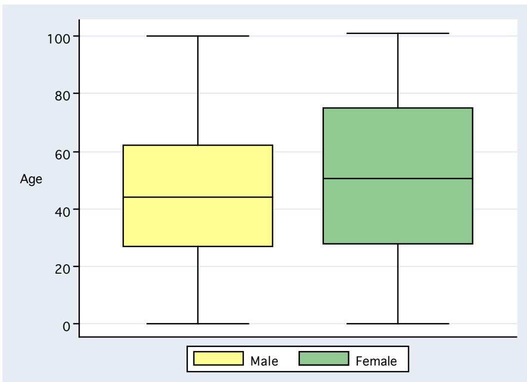

Figure 2: Age and Gender in New Haven

Response Times and Scene Times

Response times were defined as time of dispatch to time of arrival of the vehicle on scene. A continuous list of ALS dispatches during the study time period was used to calculate response times. These dispatches included, but were not limited to cases included in the comparison of interventions.

Times for Berlin ground based and helicopter based physician dispatches were calculated from a sample of 1114 dispatches. Analysis included 839. Transfers (66), cancellations (191), and dispatches with incomplete recorded times (17) and an outlier of >55 minutes were excluded.

Response times for ALS units in New Haven were calculated from a sample of 3224 dispatches. Analysis included 2867 calls. Transfers (81), entries with incomplete times (275), and an outlier of > 55 minutes were excluded. The mean and median response times are shown in Table 3.

The fractile response times for both cities were rendered in histograms.[Figure 3,4]

Times	**Berlin** [min]	**N. Haven** [min]	p (t-test)
n	839	2867	
Mean Response Time	9.5	8.8	0.001
Median	9	7	
n	124	1514	
Mean Scene Time	21.1	13.9	0
Median	18.5	13	

Table 3: Response Times and Scene Times

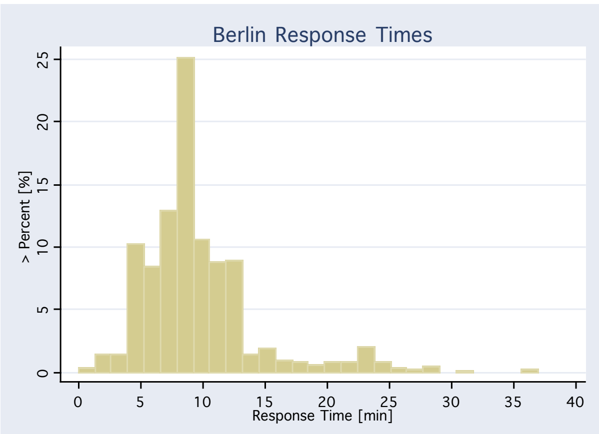

Figure 3: Berlin Fractional Times

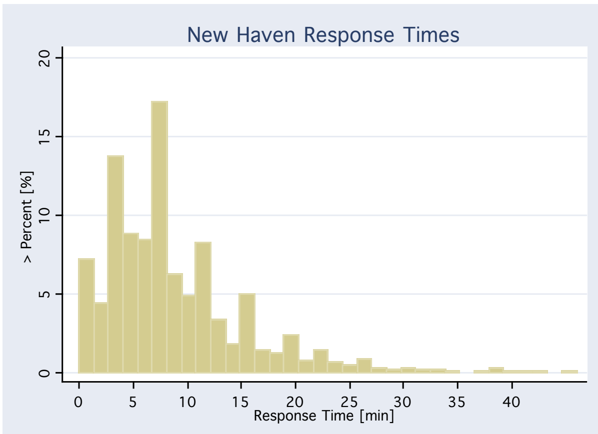

Figure 4: New Haven Fractional Times

Most common Diagnoses in Berlin

A total of 581 diagnoses were recorded by EMS physicians in Berlin. 461 diagnoses fell into 10 categories. The percentages of these ten most common diagnoses encountered by German physicians are shown in Table 4. A complete list of diagnoses in Berlin is found in the appendix.

After identifying the most common diagnoses, related conditions were consolidated in diagnostic groups based on similar treatment modalities: angina and suspected myocardial infarction, asthma and COPD. Trauma and two other painful conditions, fractures and dislocations, were grouped together after data collection in order to assess the frequency of analgesic use.

Angina/ROMI	23%
Field Pronouncement	12%
Asthma/COPD	9%
Hypoglycemic Coma	6%
Dysrhythmia	6%
Seizure	6%
Pulmonary Edema/CHF	5%
Trauma, Fracture and Dislocation	6%
CVA	4%
Hypertensive Crisis	2%
Others	21%

Table 4: German Physician Diagnoses

Interventions for the Most Common Diagnoses

Diagnoses by German physicians were matched with paramedic assessments during data entry into 37 categories. The most common interventions are listed in descending frequency as shown in Tables 5-14. Interventions available to both paramedics and German physicians are shown as well as interventions available only to physicians. When available to both practitioners, the p-value of the test for difference of proportions is provided to illustrate significant differences in how often the intervention was actually provided.

Angina and Suspected Myocardial Infarction

Paramedics were more likely to apply oxygen, provide continuous ECG rhythm monitoring, and obtain a pulse oximetry reading. German physicians obtained 12-lead ECGs more frequently and provided morphine more often. In addition, interventions used in Germany but not available to paramedics in the US system studied included heparinization, thrombolysis, beta blockade, and nausea control. Most of the interventions provided by the German EMS physicians (566/598, or 81%) would have been covered by paramedic standing orders.

ANGINA/MI					
INTERVENTION	BERLIN	(%)	N. HAVEN	(%)	p
n	125		112		
Aspirin	91	73%	78	70%	0.61
Heparin	85	68%			
Oxygen	76	61%	109	97%	0
Nitro	72	58%	59	52%	0.35
Morphine	32	26%	4	4%	0
Metoclopramide	28	22%			
Metoprolol	13	10%			
Thrombolysis	6	5%			
No Medications	11	9%	2	2%	0.02
ECG	117	94%	58	52%	0
IV Access	104	83%	104	93%	0.02
ECG-Monitoring	26	21%	111	99%	0
Pulse Oximetry	37	30%	79	71%	0

Table 5: Interventions for Angina and suspected MI

Asthma and Chronic Obstructive Pulmonary Disease (COPD)

There were no significant differences in the use of oxygen and epinephrine. Paramedics were more likely to provide an inhaled beta-agonist to patients with bronchospasm, while German physicians were more likely to provide a beta agonist intravenously. Intravenous theophylline and steroids were the most common methods of asthma treatment by physicians in Berlin. The protocols in the comparison US system would have covered 58% (148/253) of the interventions performed in Berlin.

ASTHMA/COPD					
INTERVENTION	BERLIN	(%)	N. HAVEN	(%)	p
n	51		64		
Steroids	44	86%			
Oxygen	40	78%	57	89%	0.1
Theophylline	39	76%			
ß-2 I.V.	21	41%			
ß2-Aerosol	7	14%	49	77%	0
Epinephrine	1	2%	3	5%	0.4
Diazepam	1	2%			
No meds	2	4%	2	3%	0.77
IV Access	48	94%	44	69%	0.001
Pulse Oximetry	41	80%	49	77%	0.7
ECG	11	22%	7	11%	0.11

Table 6: Interventions for Asthma and COPD

Hypoglycemia

German EMS physicians were more likely to give intravenous glucose to hypoglycemic patients. Glucagon, available only to the US paramedics, was used in three instances in New Haven. All measures provided by German physicians were included in the New Haven paramedic protocols.

HYPOGLYCEMIA					
INTERVENTION	BERLIN	(%)	N. HAVEN	(%)	p
n	37		38		
Glucose	35	95%	26	68%	0.003
NaCl	3	8%	21	55%	0
Glucagon			3	8%	
IV Access	35	95%	32	84%	0.12
Pulse Oximetry	8	22%	15	39%	0.11

Table 7: Interventions for Hypoglycemia

TRANSPORT AFTER TREATMENT OF HYPOGLYCEMIA					
TRANSPORT	BERLIN	(%)	N. HAVEN	(%)	p
n	37		38		
ALS	1	3%	36	95%	
BLS	22	59%	0	0	
Not Transported	13	35%	2	6%	0.03
n/a	1	3%	0	0	

Table 8: Transport of hypoglycemic Patients

Dysrhythmia

German physicians were more likely to provide antidysrhythmic medication for a diagnosis of dysrhythmia. Paramedics and physicians used adenosine, which is available to both systems, equally. Paramedics were more likely to provide continuous ECG rhythm monitoring, while physicians obtained a 12-lead cardiogram more frequently. The number of dysrhythmia cases in the paramedic group was small. Most interventions provided in Germany (210,234, or 90%) were included in paramedic protocols.

DYSRHYTHMIA					
INTERVENTION	BERLIN	(%)	N. HAVEN	(%)	p
n	33		13		
Oxygen	20	61%	12	92%	0.04
Epinephrine	9	27%	0	0	
Metoprolol	7	21%			
Atropin	7	21%	0	0	
Aspirin	3	9%	2	15%	0.6
Adenosine	3	9%	1	8%	0.9
Defibrillation	3	9%	0	0	
Vasopressin	3	9%			
Heparin	3	9%			
Lasix	2	6%	0	0	
Cardioversion	2	6%	0	0	
Other	6	18%			
ECG	25	76%	4	31%	0.004
IV Access	24	73%	10	77%	0.78
ECG Monitoring	12	36%	12	92%	0

Table 9: Interventions for Dysrhythmias

Seizures

German physicians were more likely to provide benzodiazepines for seizure control than New Haven paramedics. German physicians also provided additional anti-epileptic therapy not available to paramedics, and fever control in pediatric febrile seizures. Paramedic charts showed a higher rate of oxygen administration. A total of 84% (75/89) of the interventions provided for seizures in Berlin were contained in New Haven's standing orders.

SEIZURE					
INTERVENTION	BERLIN	(%)	N. HAVEN	(%)	p
n	35		68		
Oxygen	18	51%	47	69%	0.07
Diazepam	17	49%	4	6%	0
Nitro	3	9%			
Midazolam	3	9%			
Phenytoin	3	9%			
Metoclopramide	3	9%			
Glucose	2	6%			
Acetaminophen	2	6%			
No Meds	5	14%			
IV Access	20	57%	30	44%	0.21
Pulse Oximetry	18	51%	33	49%	0.85

Table 10: Interventions for Seizures

Pulmonary Edema and CHF

Furosemide was the most frequently administered drug for patients judged to be in pulmonary edema in Berlin. Physicians were more likely to give a diuretic and morphine, as well as to obtain a 12-lead ECG. Except for antiemetics, all measures (136/150, or 91%) provided by German physicians were contained in the paramedic protocols.

PULMONARY EDEMA AND CHF					
INTERVENTION	BERLIN	(%)	N. HAVEN	(%)	p
n	28		32		
Furosemide	25	89%	12	38%	0
Oxygen	24	86%	31	97%	0.12
Nitro	10	36%	6	19%	0.14
Morphine	11	39%	2	6%	0.002
Other	10	36%			
Metoclopramide	4	14%			
IV Access	26	93%	26	81%	0.17
Pulse Oximetry	22	79%	23	72%	0.53
ECG	18	64%	5	16%	0

Table 11: Interventions for Pulmonary Edema and CHF

Trauma, Fractures, and Dislocations

Analgesia and sedation were used more liberally by German physicians for patients with painful conditions and for major trauma. They were also more likely to establish intravenous access, and colloid infusion and intubation were more frequent in Berlin. There was no difference in the proportion of patient receiving crystalloid infusions. During the time period studied, there was a higher absolute number of patients with injuries treated by ALS level care in New Haven compared to the district of Berlins studied. Only 65% (93/144) of the interventions provided by German EMS physicians were covered by New Haven's paramedic protocols.

TRAUMA/FRACTURE/DISLOCATION					
INTERVENTION	BERLIN	(%)	N. HAVEN	(%)	p
	33		232		
Analgesia	28	80%	0	0%	0
Oxygen	18	51%	47	20%	0
Sedation	13	37%			
HAES	11	31%			
Cristalloid	9	26%	47	20%	0.43
Succinylcholine	3	9%			
No Meds	4	11%			
IV Access	32	91%	61	26%	0
Pulse Oximetry	20	57%	35	15%	0
ECGMonitoring	10	29%	55	24%	0.53

Table 12: Interventions for Trauma, Fractures and Dislocations

Cerebrovascular Accident (CVA) and Transient Ischemic Attack (TIA)

CVA was included in the differential diagnosis with other conditions. German physicians were more likely to administer antihypertensives and sedatives to patients who were assessed to have a suspected CVA or TIA. Paramedics were more likely to provide continuous cardiac rhythm monitoring. Most measures (77%, 63/82) that German physicians provided were contained in paramedic protocols.

CVA/TIA					
INTERVENTION	BERLIN (n=24)	(%)	N. HAVEN	(%)	p
	24		43		
Oxygen	17	71%	35	81%	0.37
NaCl	5	21%	25	58%	0.002
Nitro	3	13%			
HAES	3	13%			
Urapidil	2	8%			
Morphine	2	8%	0		0
Midazolam	2	8%			
Glucose	2	8%	2	5%	0.62
Etomidate	2	8%			
Verapamil	1	4%			
Metoclopramide	1	4%			
Epinephrine	1	4%	0		0
IV Access	16	67%	36	84%	0.11
Pulse Oximetry	15	63%	24	56%	0.58
ECG-Monitoring	4	17%	33	77%	0
ECG	4	17%	7	16%	0.92

Table 13: Interventions for CVA and TIA

Hypertension and Hypertensive Urgency

German physicians used a number of interventions not available to paramedics to treat these conditions, and were more likely to provide intravenous access in order to do so. A 12-lead ECG and pulse oximetry was obtained more frequently by physicians. The measures performed were available under other protocols within the scope of practice of paramedics in 83% (79/95) of cases.

HYPERTENSION/HYPERTENSIVE URGENCY					
INTERVENTION	BERLIN	(%)	N. HAVEN	(%)	p
n	17		11		
Nitro	14	82%	1	9%	0
Oxygen	9	53%	7	64%	0.58
Diuretic	6	35%	0		
Aspirin	6	35%	0		0
Urapidil	5	29%			
Morphine	4	24%	0		0
Heparin	4	24%			
Metoprolol	3	18%			
Metoclopramide	3	18%			
Verapamil	1	6%			
IV Access	14	82%	7	64%	0.003
ECG	14	82%	0		0
Pulse Ox	12	71%	3	27%	0.03

Table 14 Management of Hypertension

IV. Discussion

Demographics

ALS units in New Haven served a population that was younger and had more female patients. EMS utilization at the ALS level in New Haven was higher than in Berlin in the time period studied for a similarly sized population (3224 dispatches vs. 1106). This may be due to a less developed primary care system in particular in urban areas, and the lack of on-call primary care physicians seeing patients outside of regular office hours. There has been a tendency in Germany to activate the pre-hospital physician for acute medical conditions that do not meet the seven traditional criteria for the disposition of this valuable resource (chest pain, loss of consciousness, respiratory distress, bleeding, major trauma and shock). The need for integrated dispatch and specialized training of primary care physicians on call in acute-care and emergency medicine has been recognized in Germany[21]. In addition, the less affluent demographics of the New Haven study area may result in the EMS system being used for transportation purposes as opposed to only for acute medical emergencies. However, inclusion criteria for the study clearly defined that some level of ALS care was rendered (1537 in New Haven vs. 584 in New Haven), leading to the conclusion that the population in New Haven may have more serious illness at a younger age. It is also possible that ALS level care may be initiated for many patients who do not require this level of care, due to conservative protocols that are based on the worst possible cause for each presenting complaint or initiation of ALS by paramedics in cases where it may not be warranted.

Response times

The most accurate definition of response time is the time from call received at the dispatch center to arrival of the provider at the patient's side. Due to logistical restrictions inherent to EMS research it was not possible to record this interval. Mean response times as defined for the purpose of this study were shorter in New Haven. Median response times, i.e. the time in which 50% of patients were reached, were also shorter in New Haven. Fractile response time histograms show that the majority of patients are reached in less than ten minutes from dispatch in both systems. The "standard" of ALS response time for cardiac arrest of less than 8 minutes[22] has been called into question for unselected non-cardiac patients.[23] The small sample size in Berlin may have unfavorably affected the time intervals recorded, as well as the more liberal use of ALS level dispatch in New Haven with more ALS units in the field.

Scene Times

Mean scene times in Berlin were longer than in New Haven (21.1 min vs 13.2, p=<0.005).
In traumatic emergencies, the fact of longer scene times in physician based systems is most commonly attributed to time taken by extensive physician interventions[24]. In contrast, interventions and procedures on scene in traumatic injuries have been shown to make up only a fraction of total scene time[25], and ALS level care for trauma patients has been shown not to prolong scene time [26, 27]. It should also be noted that ALS level care at the scene has not been shown to be of benefit in trauma.[28] For certain medical conditions such as chest pain and hypoglycemia, the administration of medications has been shown to be effective in improving the patient's field condition and in reducing hospital utilization [29].
The task of paramedics is stabilization and transport, while the German physician's care includes the additional task of accurate disposition to the inpatient setting. Also, German physicians are able to treat and release the patient, which is not an option in New Haven. Factors prolonging scene time in acute medical conditions are a detailed history and physical examination, review of available medical records at the patient's location, and contacting the patient's primary physician[30]. In many cases, these are essential components of accurate disposition of the patient from the field to the appropriate level of care. Given these additional challenges, a scene time of on average 8 minutes longer is not surprising.

Management of Acute Coronary Syndromes

The management of acute coronary syndromes (ACS) includes risk stratification, screening for acute myocardial infarction by means of a 12-lead ECG, and addressing the underlying pathophysiology using pharmacologic agents. The American College of Cardiology has recently called for a more extensive use of 12-lead ECGs in the pre-hospital setting[31]. Interventions that have been shown to be of proven benefit in ACS are aspirin and heparin to prevent thrombosis in the coronary artery, nitroglycerin and morphine to reduce preload and sympathetic output, as well as metoprolol to decrease myocardial oxygen demand and supplemental oxygen. Adding heparin to aspirin results in a 33% reduction in mortality in acute coronary syndromes[32]. In the pre-hospital setting, administration of heparin plus aspirin results in a higher initial patency rate of coronary arteries after a reperfusion strategy[33]. Nitroglycerin is considered a standard of care and its use in the pre-hospital setting has been shown to be safe for the indication of acute coronary syndrome[34], even though no pre-hospital trial has shown a conclusive benefit. Twelve-lead ECGs in the pre-hospital setting are the only intervention that has been studied and shown to be of benefit in the long-term outcome of patients with acute coronary syndromes[31]. ECGs are performed significantly more often in Berlin. Similar to American physicians deployed in the field in one study[13], German physicians appear to manage acute coronary syndromes more aggressively with the medications at their disposal. This may reflect the role of the physician in that they are expected to establish the most likely diagnosis and initiate comprehensive management. Paramedics under-utilize pre-hospital 12-lead ECGs in the system studied, but provide more consistent use of oxygen and continuous ECG rhythm monitoring than German physicians. A combination of measures from both systems would likely have provided the most comprehensive care.

Management of Asthma and COPD

The most striking differences in patient management were evident in this group. Only 57% of interventions provided by German physicians were contained in the US paramedic protocols. Nebulized bronchodilators are the preferred agents for the management of acute asthma[35], but the most commonly used modality for the treatment of asthma in Berlin is the administration of steroids. Corticosteroids exhibit their effects by decreasing inflammation and decreasing the down-regulation of beta-receptors. Their predominantly anti-inflammatory effects do not become evident until 1-2 hours after administration[36]. Inhaled corticosteroids have not been shown to be of conclusive benefit in acute exacerbations[37]. These are available to German physicians on ALS units, but were not utilized in any of the cases analyzed. Theophylline is the second most commonly used pharmacologic agent in the management of acute asthma and COPD in Berlin. Methylxanthines such as theophylline currently have no role in the management of acute asthma [35], and have been shown to have significant adverse effects[38]. Their continued use in Germany is best explained by their persistence as a therapeutic option in a widely used German pre-hospital care textbook[39] and force of habit. Physicians in Berlin administer beta agonists through an IV. This confers no added benefit over continuous nebulized beta agonists[40]. Nebulized beta agonists are only available as metered dose inhalers (MDI) in the Berlin system, explaining the preference for parenteral beta-2 agonist therapy.

Management of Hypoglycemia

The initial management of hypoglycemia and hypoglycemic coma by ALS providers did not differ between Berlin and New Haven. In both systems, an IV was established and a form of glucose given. In addition to glucose, New Haven paramedics have the option of giving glucagon when no IV access can be obtained. The overall management of the hypoglycemic patient differed markedly in that the ALS unit in Berlin did not take 35% of these patients to a health care facility, compared to only 6% of hypoglycemic cases in New Haven that were not transported. This reflects the broader decision making capability of a physician on scene, and can result in substantial improvement of resource management in the health care system. Leaving a hypoglycemic patient at home requires ensuring adequate monitoring by family and contacting the primary care physician to arrange follow-up. This is another example where prolonged scene times are likely well invested if they result in fewer burdens to the health care system. Paramedics can arrange not to transport a patient with hypoglycemia after contacting the direct medical oversight physician. This usually occurs at the patient's request for refusal of transport. Paramedics do not routinely recommend this option to patients, whereas German physicians will. Of note, the patients that were transported in Berlin were sent by BLS, freeing up the ALS unit in a timely fashion. The disposition of such straightforward cases may be a vital element in covering a large population with a small number of ALS units.

Management of Dysrhythmias

Dysrhythmias are encountered in pre-hospital care. Bradydysrhythmias include sinus bradycardia and atrioventricular block (AV Block). Tachydysrhythmias include paroxysmal supraventricular tachycardia (PSVT), atrial fibrillation with rapid ventricular response (RAF) and perfusing ventricular tachycardia. Treatment is indicated to prevent cardiovascular decompensation in the unstable patient.

The most commonly used medication for dysrhythmias in Berlin were atropine, epinephrine, metoprolol and adenosine.

Atropine is indicated for the management of bradydysrhythmias.[41] It has been shown to be safe and effective in the pre-hospital setting, with half of patients having either complete or partial response to therapy[42, 43]. Atropine was used by German physicians in 7 cases of bradycardia. Epinephrine infusion is indicated for symptomatic bradycardia in patients without response to atropine and transcutaneous pacing[42]. It was used in 9 cases in Germany. Adenosine has been show to be effective for terminating PSVT[44]. Rare side effects are angina, ventricular tachycardia (VT), bronchospasm and respiratory arrest. Deaths have occurred when given inappropriately to patients with sinus tachycardia or RAF[45, 46]. A ten-year review of paramedic interpretation of rhythm strips showed an inappropriate use of adenosine in 20% of cases[47]. In this study, adenosine was used by the German physicians and American paramedics in a similar proportion of dysrhythmia cases.

German physicians encountered more cases diagnosed as dysrhythmia than paramedics in this study and were more likely to provide pharmacologic management. All agents used for dysrhythmias management in Germany except metoprolol are available in the New Haven paramedic system under standing orders.

Management of Seizures

Out-of –hospital treatment of status epilepticus has potential benefits. Status epilepticus can cause pulmonary congestion and edema, cardiac arrhythmias, hypotension, hypoglycemia, acidosis and rhabdomyolysis. These complications worsen with the duration of the seizure[48]. Prolonged status also leads to loss of neurons[49].

Benzodiazepines have been shown to be safe and effective in the management of seizures in the pre-hospital setting in a randomized controlled trial[50]. Benzodiazepines can cause hypotension and respiratory depression in patients with status epilepticus[51], in particular in children[52]. Diazepam is available to practitioners in both systems. Nearly half (48%) of all patients with a presenting complaint of seizure in Berlin received a benzodiazepine, while only 6% in New Haven did. In the New Haven protocols, it is indicated only for the actively seizing patient. In keeping with the principle of allowing medication administration by paramedics for emergency conditions only, giving benzodiazepines for prophylactic purposes is not indicated in most US systems. Physicians may be more likely to administer benzodiazepines in a patient with a recent history of seizure in order to prevent a seizure during transport. Phenytoin is available to physicians in Berlin and was used in some cases. It has been shown to be less effective for the management of status epilepticus than lorazepam[51]. Midazolam was used in Berlin in two cases. It has been shown to be safe and effective, with a lower incidence of respiratory depression in children[53].

Pre-hospital physicians in Berlin made more liberal use of antiepileptic medications for a diagnosis of seizure than paramedics in New Haven.

Management of Pulmonary Edema and CHF

When diagnosed accurately, pre-hospital management of congestive heart failure with medications improves survival.[54] It has been emphasized that an accurate history and physical examination by paramedics is the prerequisite for appropriate treatment of the patient with suspected CHF[55]. One study showed that paramedics are capable of diagnosing acute cardiogenic pulmonary edema in the majority of cases[56]. A recent study showed an inappropriate (42%) and potentially harmful (17%) use of diuretics by paramedics[57]. Nitroglycerin was the most commonly used agent in the New Haven paramedic-based system. This agent has been shown to be effective in the pre-hospital setting[58]. Less than 2% of patients suffer side effects of hypotension and apnea[59]. A prior multi-center analysis of EMS systems in the US described under-utilization of sublingual nitroglycerin when an assessment of pulmonary edema or chest pain was identified[60]. This was not seen in this study. German EMS physicians used nitroglycerin in an equal proportion of patients, but furosemide was used more frequently. This may imply a higher diagnostic certainty in cases treated by physicians, as paramedics are aware of the potentially deleterious outcome of inappropriate diuretic administration[61]. Though not used during the study period, German EMS physicians in Berlin have the option to give intravenous nitroglycerin, which has been shown to reduce mortality when given in the field in a physician based system[58]. Paramedics were less likely to obtain a 12-lead ECG than German physicians. This reflects the paramedic's approach of stabilization and transport as opposed to the physician's attempt to diagnose accurately the cause of the exacerbation.

Management of Trauma and Painful Conditions

German physicians were more likely to provide analgesia when diagnosing a painful condition. Opioid analgesics have been shown to be safe and effective in the hands of paramedics[62]. Historically paramedics were allowed to administer morphine only as part of care for chest pain[63]. The New Haven paramedic protocols require on-line medical direction for the administration of morphine for painful conditions. Another barrier to administering a controlled substance in Connecticut may be the additional administrative work and re-stocking at the pharmacy of a hospital. Underutilization of analgesia in US paramedic systems has been previously described[64-67], and the causes of oligoanalgesia have been attributed to an over-emphasis on the possible side effects of analgesia without emphasis on the physiological benefits of controlling pain[68]. Oligoanalgesia in a paramedic-based system is again shown in this study. Of 232 traumatic cases cared for by paramedics in New Haven during the study period, not one patient received morphine. The more liberal use of analgesia in Berlin may be influenced by the fact that at least half of the emergency physicians studied are primarily anesthesiologists who are accustomed to providing analgesia. Even though the number of trauma cases transported by ALS in Germany is small, 80% of the 28 cases with a potential for pain cared for by physicians received a form of analgesia.

The number of trauma cases receiving ALS level care recorded in the district of Berlin studied was smaller than in New Haven. In addition to differences that may exist in the prevalence of this presenting complaint, dispatch decisions in Berlin and New Haven with regards of the level of response to traumatic emergencies may differ. In addition, a BLS unit on scene frequently cancels ALS units in Germany. The most common type of call with ALS cancellation after dispatch in Berlin was a chief complaint of trauma (see appendix).

A small number of patients in Berlin during the study period were intubated using rapid sequence intubation (RSI) including a paralytic. This procedure has been shown to be safe and effective in the hands of German physicians with a success rate of 94% without and 99% with a rescue airway device such as LMA or combitube[69, 70]. In the US, success rates of RSI in the hands of paramedics in a large trial were 84%[71-73]. Though not available in the system studied, RSI is available in some US paramedic systems. Intubation is regarded as the "gold standard" of airway maintenance, but its safety and efficacy in the hands of paramedics have been called into question[74-76], and its outcome benefits have never been proven. Opportunities for intubation are rare among paramedics[77], and RSI by paramedics has been shown to be harmful in certain populations [71, 72]. The National Association of EMS Physicians (NAEMSP) has issued a position paper outlining strict guidelines for the use of RSI for paramedics, including close monitoring of patients by appropriate equipment, ongoing supervision, quality assurance and skills maintenance[78].

Management of Hypertension and Hypertensive Urgency

Hypertensive emergencies present as CHF, renal failure and focal neurological deficits. Paramedics in New Haven have protocols for the treatment of CHF. Similar to most US paramedic systems, standing orders do not include an algorhythm for the management of asymptomatic hypertension. No studies to date have examined the efficacy of pre-hospital blood pressure control in asymptomatic patients. One study showed that Urapidil, a calcium antagonist used in Berlin, is effective in the pre-hospital treatment of hypertensive emergencies[79]. The most common interventions provided by German physicians are available to paramedics under standing orders for the treatment of CHF. As the study design was not targeted towards assessing whether it was appropriate to administer an intervention in a particular case, it can only describe the fact that antihypertensives are given frequently in the field in Berlin.

Management of CVA and TIA

While a TIA has by definition resolved when this diagnosis is made, the role of EMS has been recognized to be of importance in this time-dependent condition[80]. The role of the pre-hospital practitioner in the management of acute CVA is primarily recognition and rapid transport to an appropriate facility. Targeted education has been shown to improve paramedics' accuracy in recognizing stroke victims[81]. Neurological examination by paramedics has been shown to be in agreement with that of physicians in suspected CVA[82]. There were no statistically significant differences in the management of suspected CVA or transient neurological deficits. In cases with concomitant hypertension, German physicians made use of their treatment modalities for hypertension. The appropriateness of this particular management cannot be assessed in this study. Aside from this treatment approach, German pre-hospital physicians and paramedics provided similar measures including oxygen, an IV, and transport of the patient.

Utilization of Medications and Procedures

German physicians used 38 of 52 medications available to them. This large arsenal of medications in Germany shows a high rate of utilization (73%) and appears to be close to actual needs of German physicians. Excluding the antidote kit, utilization rate was even higher at 86% of available medications. Many of the most frequently used medications in Germany are not included in the paramedic protocols in the system studied. Paramedics used 16 of 23 potentially available medications over the two month period studied resulting in a utilization rate of 70%. Medications not available in the US system studied include those for the comprehensive management of acute coronary syndromes with heparin and beta blockade. Sedation and antiemetic medications are not available in the US system studied, though prochlorpherazine has been added to the New Haven protocols. Asthma management differs, which accounts for the frequency of IV medication use for this condition in Germany. On the other hand, paramedics frequently establish an IV line but do not use it to administer fluids or medications. The unnecessary financial and time cost associated with this has been described previously.[83, 84] Paramedics were more likely to establish continuous ECG rhythm monitoring and to record pulse oximetry. This reflects the standardized approach in North American pre-hospital care, in particular the concept of "routine paramedic care". No such routine care standard exists in Germany, and physicians are not trained to perform routine IV, O2 and ECG monitoring on all patients. German physicians are significantly more likely to obtain 12-lead ECGs in presentations that may have a cardiac cause such as chest pain and difficulty breathing. This may reflect a more in-depth approach that a physician would have towards managing the cause of the emergency. Disposition in Berlin is done in the field from where the patient can be for example directly admitted to an ICU or taken to cardiac catheterization. Stabilization and transport to the emergency department are the focus of American paramedics, which may explain why they were less likely to perform time-consuming procedures such as a cardiogram, which will not affect the patient's immediate disposition. This disposition is almost always the emergency room of the closest appropriate facility.

Availability of Interventions under Standing Orders

Most of the interventions provided by German EMS physicans (1346/1721, or 78%) were available to New Haven paramedics under standing orders. German paramedics have administered many of these such as CPR, oxygen, routine cardiopulmonary monitoring, IV access and medications. In this trial they were found to be appropriate measures by subsequently arriving physicians[85]. A large number of interventions not available under the New Haven protocols are available in other systems, such as metoprolol in acute coronary syndrome, rapid sequence intubaton and antiemetics for nausea. As shown in the individual results sections, the basic management of most diagnoses assessed in this study is included in the paramedic treatment protocols.

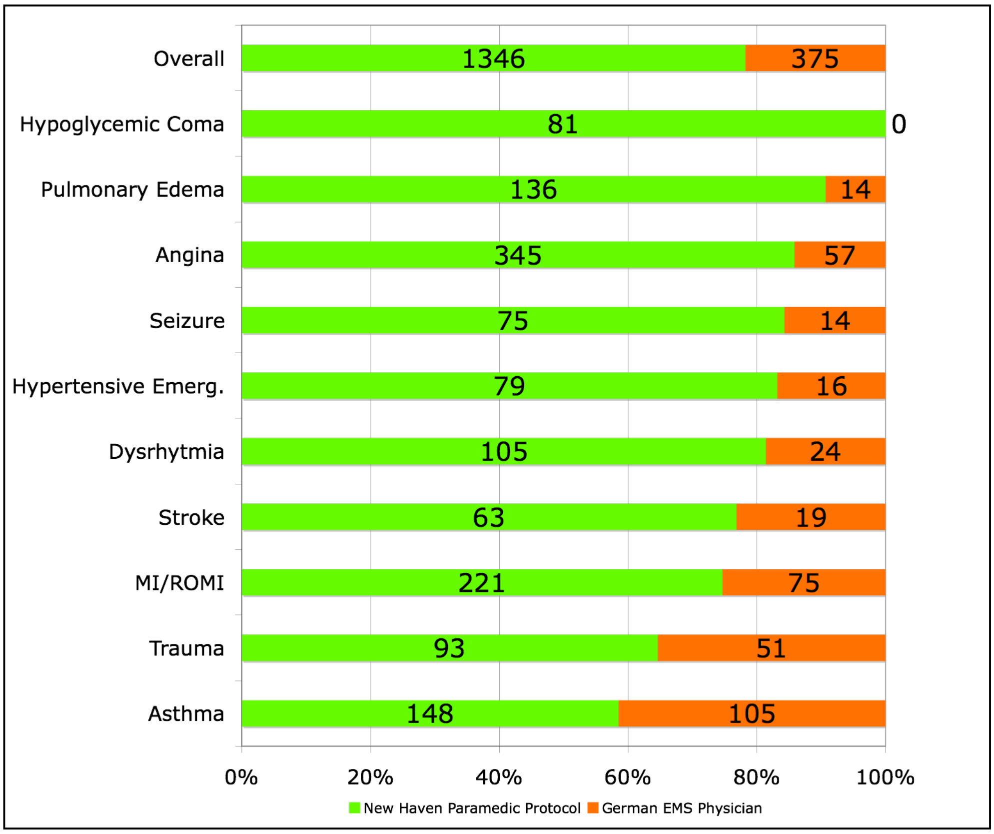

Figure 5: German Physician Measures Contained in Paramedic Protocols

V. Summary

Limitations

The focus of this study was to assess the types of interventions provided in the two EMS systems studied. It is limited by its retrospective nature and unmatched patients in the subgroups. Information available was limited to the documentation of interventions noted by providers on the PCRs. There was no assessment of the patients' initial state of health, the efficacy of EMS treatment, or patient outcomes either short- or long-term. Thus, the conclusions of this study must be limited to which interventions are provided, not whether these are appropriate or efficacious.

Conclusion

New Haven has a younger population receiving ALS level care. Response times for ALS are similar in both systems, despite the use of fewer staffed vehicles in the Berlin system. German physicians use a higher percentage of the medications available to them, and use medications more frequently than paramedics.

Many interventions provided by German EMS protocols are available to US paramedics through protocols and standing orders. Practice patterns of German EMS physicians appear to differ from paramedic protocols for certain assessments. In particular, the management of asthma differs in the use of IV bronchodilators, and hypertension is managed more aggressively in the field in Germany. Paramedics are more likely to provide intravenous access, oxygen, and continuous cardiac rhythm monitoring as part of routine care. German EMS physicians are more likely to obtain 12-lead cardiograms when encountering an emergency presentation. While most interventions performed by them are included in paramedic protocols, they make use of their broader scope of practice in providing liberal analgesia in painful conditions, sedation, and nausea control. German physicians spend more time on scene, obtain diagnostic tests, and provide a final disposition.

Each system appears to meet the needs of its patients in providing a timely response and necessary medical treatment for emergency conditions.

VI. Bibliography

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VII. Appendix

Abbreviations

AAA	Abdominal Aortic Aneurysm
ACS	Acute Coronary Syndromes
ALS	Advanced Life Support
AMR-NH	American Medical Response – New Haven
BLS	Basic Life Support
CHF	Congestive Heart Failure
CMED	Central Medical Dispatch
COPD	Chronic Obstructive Pulomnary Disease
CP	Chest Pain
CPR	Cardiopulmonary Resuscitation
CVA	Cerebrovascular Accident
DKA	Diabetic Ketoacidosis
ECG	Electrocardiogram
EMS	Emergency Medical Services
EMT	Emergency Medical Technician
EMT-B	Emergency Medical Technician - Basic
EMT-P	Emergency Medical Technician - Paramedic
LNA	Leitender Notarzt = Medical Director
MEES	Mainz Emergency Evaluation Score
MDI	Metered Dose Inhaler
MI	Myocardial Infarction
NAEMSP	National Association of EMS Physicians
NAW	Notarztwagen = Emergency Physician Vehicle
NHTSA	National Highway Traffic Safety Association
NOS	Not Otherwise Specified

NREMT	National Registry of Emergency Medical Technicians
PCR	Patient Care Reports
PSAP	Public Service Answering Point
PSVT	Paroxysmal Supraventricular Tachycardia
RAF	Rapid Atrial Fibrillation
RTH	Rettungshubschrauber = Rescue Helicopter
TIA	Transient Ischemic Attack
UKBF	Universitätsklinikum Benjamin Franklin

New Haven Patient Care Report

CMED No.	DISP. No.	Unit No.	Patient No.	Date of Transport	Date of Inj.	Time of Inj.	Day

Patient's Last Name | First Name | MI | Date of Birth | Age | Sex ❑ M ❑ F

Patient's Home Address --- No. and Street | City | State | Zip | E.R. Disp.

Incident Location --- Street Address or Intersection | City | State | Zip | E.R. Arrival

Pickup Location --- Street Address or Intersection | City | State | Zip

Pickup Location Was ❑ Street/Highway ❑ Home ❑ Business/Industry ❑ Public Place ❑ Other ❑ SNF | Pt. Accompanied By

Services Provided ❑ BLS ❑ ALS ❑ Intercept ❑ Transport ❑ Ref Treatment ❑ Ref Trans ❑ Assistance ❑ Standby ❑ No Medical Emerg. ❑ Cancelled

Trans. By ❑ Ambulance ❑ Air Amb. ❑ FD ❑ PD ❑ Pvt. MV ❑ Other | **Transp. Pos.** ❑ Supine ❑ Prone ❑ Shock ❑ Lat Rec. L or R ❑ Head Up ❑ Other

Service **AMR-CT #L093P1** | Rec. Fac. Designated By ❑ Patient ❑ Family ❑ MD ❑ Police ❑ Closest Facility ❑ No Pref. ❑ Regulation/Protocol ❑ Other

Disp.	Respond	Arrive	Extrication Time	Enroute Destination	At Destination	Available

Trauma/Agent of Inj.	**Vehicular**	**Prot. Dev.**	Extricating Agency	**Non-Vehicular Causes**	**PPE**
❑ Knife ❑ Smoke ❑ Blunt Obj ❑ Fire - Heat ❑ Gun ❑ Other ____ ❑ Toxin-Ing. ________	**Pt. Was** ❑ Driver ❑ Passenger ❑ Pedestrian ❑ Bicyclist	❑ Seatbelt ❑ Air Bag ❑ Helmet ❑ Car Seat ❑ None	**In/On**: ❑ MV ❑ Truck/Bus ❑ MC ❑ Bicycle ❑ Object **With**: ❑ MV ❑ Truck/Bus ❑ MC ❑ Bicycle ❑ Object	❑ Medical ❑ Machinery ❑ Assault ❑ Self Inf. ❑ Fall ___ ft ❑ Work Rel. ❑ Electricity ❑ Other ❑ Sports	❑ Gloves ❑ Gown ❑ Mask ❑ Goggles ❑ Other

Eye Opening	**Verbal Response**	**Motor Response**	R **Pupils** L	**Skin**	R **Chest Snds** L	**Abdomen**
4 ❑ Spontaneous 3 ❑ Voice 2 ❑ Pain 1 ❑ None **Cap Refill** ❑ Norm ❑ None ❑ Delayed ____ sec	5 ❑ Oriented 4 ❑ Confused 3 ❑ Inapprop Words 2 ❑ Incomp Sounds 1 ❑ None	6 ❑ Foll/Commands 5 ❑ Localize Pain 4 ❑ Withdraws Pain 3 ❑ Flexes - Pain 2 ❑ Extends - Pain 1 ❑ None	❑ Equal ❑ Reactive ❑ ❑ Non-Reactive ❑ ❑ Dilated ❑ ❑ Constricted ❑ ❑ Sluggish ❑ ❑ Cataracts ❑	❑ Warm/Dry ❑ Pale ❑ Cyanotic ❑ Diaph. ❑ Hot ❑ Cool ❑ Jaundiced	❑ Clear ❑ ❑ Rhonchi ❑ ❑ Stridor ❑ ❑ Rales ❑ ❑ Wheeze ❑ ❑ Decreased ❑ ❑ Retracted ❑ ❑ Absent ❑	❑ Soft/Non-Tend. ❑ Rigid ❑ Distended ❑ Tender ❑ RUQ ❑ LUQ ❑ RLQ ❑ LLQ

Patient's Complaint | Patient's Physician

History of Present Illness or Injury

Allergies ❑ NKMA | Medications

Past Medical History | Name of Med Cont MD

Time	Time	Time
B/P	B/P	B/P
Pulse R I	Pulse R I	Pulse R I
Resp	Resp	Resp
GCS	GCS	GCS
% SaO_2	% SaO_2	% SaO_2

Clinical Impression | Protocol Codes

ECG

Defib x	Joules	To Rhythm	Tech
Defib x	Joules	To Rhythm	Tech
Defib x	Joules	To Rhythm	Tech

Medication - Rte.	DOSE 1 TIME	DOSE 2 TIME	DOSE 3 TIME

ECG Rhythm

Medication - Rte.	DOSE 1 TIME	DOSE 2 TIME

IV Fluid | Rate/Amt | Ga. | Site L R

A | S | Tech | A | S | Tech

IV Fluid | Rate/Amt | Ga. | Site L R

Pace Rate Ma ❑ Success | Tech | Airway ❑ OPA ❑ NPA ❑ EOA ❑ ETT ❑ NTT | Size Depth Attempts ❑ Success | Tech

Cardiovert Joules ❑ Success | Tech | ❑ PASG Inflated | Tech | ❑ Blood Sample | ❑ bG Check ______ mg/dL

❑ CPR _____ Time ❑ EMS ❑ Other First CPR | ❑ O_2 ❑ NC ❑ Mask ___ LPM | ❑ Restraint | ❑ Extrication Dev. - Short Bd. | ❑ C I D - Hd Block.
❑ Suction | ❑ Dressing - Bandage | ❑ Sling - Swathe | ❑ Cervical Collar | ❑ Other
❑ Vent. ❑ BVM ❑ Demand Valve | ❑ Occlusive Dress. | ❑ Ext. Splint ________ | ❑ Long Back Board

Support Services | Med Cont Fac | Rec. Fac. | ALS Auth. Sig. ❑ Standing Order | Diversion Auth. By

Crew Name | No. | Crew Name | No. | Preparer's Signature | Date

Berlin Patient Care Report

Für NAW-Archiv

Stützpunkt-Nr. **05** Anschrift siehe Blatt 4

1 Ereignismeldung Tag Monat Jahr 6 | 7 Fw.-Einsatz-Nr. 10

NAW-/RTH-Bericht
Blatt 1

Alarmierungszeit Std. Min | laufende Nr./Patienten-Nr.

Geburtsdatum Tag Monat Jahr | Geschlecht ☐ m ☐ w

Name, Vorname

Wohnort

Einsatzort

angef. Krankenhaus | Abt./Station/Arzt

Schmerz	Trauma	Verband	Abbindung

Bemerkungen

Alarmierungsstichwort: Bewußtlosigkeit ☐ Brustschmerz ☐ Atemstillstand/Atemnot ☐ Blutung ☐ Schwere Verletzung ☐ Schockzustand ☐

Alarmierung
- 60 ☐ ohne RTW
- 61 ☐ mit RTW
- 62 ☐ durch RTW
- 63 ☐ Verlegung

Transport durch
- 70 ☐ NAW
- 71 ☐ RTW
- 72 ☐ kein Transport
- 73 ☐ Abbruch
- 74 ☐ RTW mit Arzt

Zeit zwischen d. Auftreten erster akuter Symptome und dem Eintreffen des Arztes
80 Tage 83 Stunden 85 Minuten

Verdachtsdiagnosen
- 90 ☐ Angina pectoris
- 91 ☐ Verdacht auf Herzinfarkt
- 92 ☐ Herzinfarkt
- 93 ☐ primäre Herzrhythmusstörungen
- 94 ☐ Herzinsuffizienz links/rechts
- 95 ☐ Lungenödem
- 96 ☐ hypertensive Krise
- 98 ☐ Schocksyndrom
- 99 ☐ apoplektischer Insult
- 100 ☐ Krampfanfall
- 101 ☐ Schädel-Hirntrauma
- 102 ☐ hypoglykämischer Schock
- 103 Bewußtseinsstörung, unklar oder
- 105 ☐ Verdacht auf Lungenarterienembolie
- 106 ☐ Asthma/Status/COLD
- 107 ☐ Hyperventilationssyndrom
- 108 ☐ sonstige Ventilationsstörungen
- 110 ☐ gastrointest. Blutung
- 111 ☐ Blutung
- 112 ☐ Polytrauma
- 113 ☐ Verletzung
- 114 ☐ Verbrennung/Verätzung
- 116 ☐ Intoxikation
- 117 ☐ akzidentelle Intoxikation

Name/Dosis
- 118 ☐ Elektrounfall
- 120 ☐ andere Diagnosen:
- 121 ☐ Todesfeststellung
- 122 Hauptdiagnose

Maßnahmen
Reanimation begonnen durch
- 11 ☐ NAW/RTH
- 12 ☐ Feuerwehr/RTW
- 13 ☐ paramedizinisches oder ärztl. Personal
- 14 ☐ Laien
- 15 ☐ Absaugen
- 16 ☐ Intubation
- 17 ☐ manuelle Beatmung
- 18 ☐ maschinelle Beatmung
- 19 ☐ Sauerstoff
- 20 ☐ manuelle Herzmassage
- 21 ☐ Pulsoxymetrie
- 22 ☐ EKG
- 23 ☐ EK-Scope
- 24 ☐ EK-Monitoring
- 25 ☐ Defibrillation
- 26 ☐ Schrittmacher
- 27 ☐ zentraler Zugang
- 28 ☐ peripherer Zugang
- 29 ☐ Injektion i.v. i.m. s.c.
- 30 ☐ Blutstillung/Verband
- 31 ☐ Lyse-Therapie
- 32 ☐ Medikamente verabreicht

Name/Dosis

Status
- 40 ☐ tot aufgefunden

verstorben
- 41 ☐ am Einsatzort
- 42 ☐ beim Transport
- 43 ☐ Atemstillstand
- 44 ☐ Asystolie
- 45 ☐ Kammerflimmern
- 46 ☐ bewußtseinsklar
- 47 ☐
- 48 ☐ somnolent
- 49 ☐ soporös
- 50 ☐ comatös
- ☐ Haut
- ☐ Foetor
- ☐ weite Pupillen re. li.
- ☐ keine Lichtreaktion re. li.
- ☐ neg. Cornealreflex re. li.
- ☐ MEReflexdifferenz re. li.
- ☐ pos. Babinski re. li.
- ☐ Bradycarde HRST
- ☐ ventr. Extrasystolia
- ☐ supraventr. Tachycardie
- ☐ Kammertachycardie

RR Puls

nach

Beurteilung des Einsatzes
- 125 ☐ bislang erfolgreiche cardiopulmonale Reanimation
- 126 ☐ Inkompletter Vitalfunktionsausfall beherrscht
- 127 ☐ erfolgloser Reanimationsversuch durch NAW/RTH
- 128 ☐ akute Vitalgefährdung gegeben oder möglich (Reanimationsbereitschaft)
- 129 ☐ klinische Abklärung und Therapie erforderlich, keine akute Vitalgefährdung
- 130 ☐ ambulante Abklärung und Therapie möglich
- 131 ☐ keine akute ärztl. Maßnahme erforderlich
- 132 ☐ Feststellung akuten Todes, kein Reanimationsversuch durch NAW/RTH
- 133 ☐ Bereitstellung 134 korrigierte Einsatzbeurteilung

Alarmierungswort zutreffend
137 ☐ ja 138 ☐ nein

Unterschrift des Notarztes

Mat. 2100. Dokumentationsbeleg Notarztwagen / RTH (11.02)

Database Form

ASSESSMENT

VITAL SIGNS

	PULSE	BLOOD PRESSURE	SaO2
first set	130	130 / 80	94
last set		/	

GCS/Mental Status: COMATOSE (GCS 8 OR

Initial Rhythm: SINUS TACHYCARDIA

12 LEAD EKG: ○ YES ○ NO

Blood Sugar: ___ mg/dl ___ mmol/L= mg/dl

COURSE

ONLINE MEDICAL CONTROL: ◉ YES ○ NO

REASON (US)

CPR INITIATION

PRONOUNCED IN FIELD: ○ YES ○ NO

INTERVENTIONS

AIRWAY
- ☐ COMBITUBE
- ☐ INTUBATION
- ☐ NASALAIRWAY
- ☐ ORALAIRWAY
- ☐ SURGICAL AIRWAY

BREATHING
- ☐ BAG-VALVE-MASK ASSISTE
- ☐ MANUAL VENTILATION
- ☐ MECHANICAL VENTILATION
- ☒ OXYGEN
- ☐ NEEDLE DECOMPRESSION
- ☐ PULSE OXIMETRY
- ☒ SUCTION
- ☐ TUBE THORACOSTOM

CIRCULATION
- ☐ IV ACCESS
- ☐ CENTRAL LINE
- ☐ 12 LEAD EKG
- ☒ EKG MONITORING
- ☐ CHEST COMPRESSIONS
- ☐ INTRAOSSEUS
- ☐ DEFIBRILLATION
- ☐ CARDIOVERSION
- ☐ PACING

NEW HAVEN MEDICATIONS

ANALGESICS
- ☐ MORPHINE

BENZOS
- ☐ DIAZEPAM

PRESSORS
- ☐ DOPAMINE
- ☐ EPINEPHRINE

DYSRHYTHMIA
- ☐ ADENOSINE
- ☐ ATROPINE
- ☐ CALCIUM
- ☐ LIDOCAINE
- ☐ MAGNESIUM

CORONARY
- ☐ ASPIRIN
- ☐ NITROGLYCERIN

DIURETIC
- ☐ BUMETHANIDE
- ☐ FUROSEMIDE

RESPIRATORY
- ☐ ALBUTEROL
- ☐ RACEMIC EPI

ANTIHISTAMINE
- ☐ DIPHENHYDRAMINE

GLUCOSE
- ☐ DEXTROSE
- ☐ GLUCAGON

IV FLUID
- ☐ NACL
- ☐ SODIUM BICARB

TOX
- ☐ IPECAC
- ☐ CHARCOAL
- ☐ NALOXONE
- ☐ THIAMINE

OTHER

BERLIN MEDICATIONS

ANALGESICS
- ☐ BUSCOPAN
- ☐ DIPIDOLOR
- ☐ FENTANYL
- ☐ METAMIZOL
- ☐ MORPHIUM

ANTIEMETIC
- ☐ ATOSIL
- ☐ PASPERTIN

GI
- ☐ RANTIC

ANESTHETICS
- ☐ ETOMIDAT
- ☐ KETANEST
- ☐ PROPOFOL
- ☐ TRAPANAL

PARALYTICS
- ☐ NORCURON
- ☐ PANTOLAX

BENZOS
- ☐ DIAZEPAM
- ☐ DORMICUM

PSYCH
- ☐ AKINETON
- ☐ HALDOL
- ☐ PSYQUIL

DIURETIC
- ☐ LASIX

ANTIEPILEPTIC
- ☐ PHENHYDAI
- ☐ RIVOTRIL

PRESSORS
- ☐ AKRINOR
- ☐ ARTERENOL
- ☐ DOBUTREX
- ☐ DOPAMIN
- ☐ VASOPRESSIN
- ☐ SUPRARENIN

DYSRHYTHMIA
- ☐ ADREKAR
- ☐ ALUPENT
- ☐ ATROPIN
- ☐ BREVIBLOC
- ☐ BELOC
- ☐ CALCITRANS
- ☐ CORDAREX
- ☐ GILURYTHMAI
- ☐ ISOPTIN
- ☐ LIDOCAIN
- ☐ MAGNORBIN

CORONARY
- ☐ ASPIRIN
- ☐ ASPISOL
- ☐ HEPARIN
- ☐ METALYSE
- ☐ INTEGRILIN
- ☐ RAPILYSIN
- ☐ STREPTASE
- ☐ TRASYLOL

HYPERTENSION
- ☐ ADALAT
- ☐ BAYOTENSIN
- ☐ EBRANTIL
- ☐ NEPRESOL
- ☐ NITROPOHL
- ☐ NITROSPRAY

RESPIRATORY
- ☐ BEROTEC
- ☐ SALBUTAMOL
- ☐ BRONCHOSPASMIN
- ☐ BRONCHOPARAT
- ☐ BRICANYL

STEROIDS
- ☐ BECLOMET
- ☐ BUDESONID
- ☐ FORTECORTIN
- ☐ RECTODELT
- ☐ SOLUDECORTIN
- ☐ URBASON

ANTIHISTAMINE
- ☐ FENISTIL

GLUCOSE
- ☐ GLUCOSE

COLLOID
- ☐ HAES
- ☐ HYPERHAES

IV FLUID
- ☐ NACL
- ☐ RINGER
- ☐ NABICARB

GYN
- ☐ METHERGIN
- ☐ OXYTOCIN
- ☐ PARTUSISTEN

TOX
- ☐ 4DMAP
- ☐ ANEXATE
- ☐ ANTICHOLIUM
- ☐ MEDKOHLE
- ☐ NALOXON
- ☐ NATHIOSULFAT
- ☐ TOXOGONIN
- ☐ TOLUIDINBLAU

OTHER

PRIMARY EMS ASSESSMENT

- ☐ ACUTE ABDOMEN
- ☐ ALTERED MENTAL STATUS
- ☐ ALLERGIC REACTION
- ☐ ANGINA PECTORIS
- ☐ ASTHMA-COPD
- ☐ BACK PAIN
- ☐ BURN
- ☐ CHEST PAIN
- ☐ CONGESTIVE HEART FAILURE
- ☐ COMA
- ☐ CARBON MONOXIDE
- ☐ DYSRHYTHMIA
- ☐ ELECTRICAL INJURY
- ☐ FIELD PRONOUNCEMENT
- ☐ FRACTURE
- ☐ GI BLEED
- ☐ HEAD INJURY
- ☐ HYPERTENSIVE CRISIS
- ☐ HYPOGLYCEMIA
- ☐ HYPOGLYCEMIC COMA
- ☐ HYP-ER-THERMIA
- ☐ HYP-O-TENSION
- ☐ HYP-O-THERMIA
- ☐ MI-RULE OUT MI
- ☐ INGESTION
- ☐ INTOXICATION
- ☐ NEAR DROWNING
- ☐ NEPHROLITHIASIS
- ☐ PSYCHIATRIC
- ☐ PNEUMONIA
- ☐ PULMONARY EDEMA
- ☒ SEIZURE
- ☐ SEPSIS
- ☐ STROKE TIA
- ☐ SYNCOPE
- ☐ TRAUMA
- ☐ POLYTRAUMA

OTHER

Chief Complaints of Cancellations of ALS units in Berlin by BLS

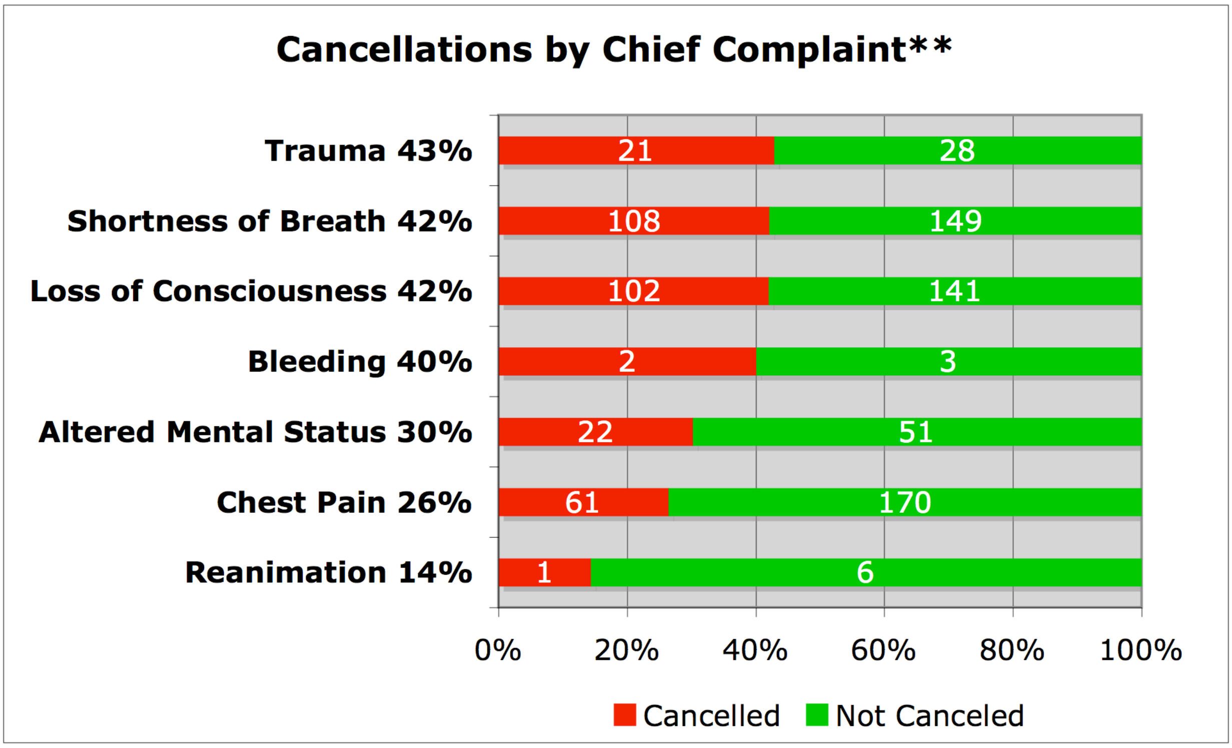

Figure 6: Cancellation of ALS in Berlin

Diagnoses established by Berlin Pre-Hospital Physicians

Angina Pectoris	77	Acute Abdomen	2
Field Pronouncement	67	Bronchitis	2
MI-Rule out MI	59	Burn	2
Asthma/COPD	51	Dislocation	2
Dysrhythmia	33	DKA	2
Hypoglycemic Coma	37	Functional Chest Pain	2
Seizure	35	Gastritis	2
Pulmonary Edema	28	Musculoskelettal CP	2
Trauma&Polytrauma	25	Other NOS	2
Stroke	24	Ascites	1
Hypertensive Crisis	14	Croup	1
Pneumonia	11	Dissection rule out	1
Altered Mental Status	10	Eclampsia	1
Fracture	9	Esophageal For. Body	1
Syncope	9	Fall	1
Orthostasis	8	Gyn Bleeding	1
Aspiration	6	Hyperglycemia	1
Intoxication	6	Hyperosmolar Coma	1
GI Bleed	5	Infection	1
Psychiatric	5	Ingestion	1
Dehydration	4	Meningitis	1
Head Injury	4	Palpitations	1
Hypotension	4	Sciatica	1
Pre-Final	4	Sepsis	1
Pulmonary Embolism	4	Uvula Swelling	1
Allergic Reaction	3		
Hypoxia	3	Total:	581
AAA	2		

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The results of this study have been partially presented as a **poster** presentation:
"Comparison of German Pre-Hospital Physician Practice to Paramedic Protocols and Paramedic Practice"
D. MacDonald, E. Nix, J. Breckwoldt, D.Cone
National Association of EMS Physicians Annual Meeting, Tuscon, Arizona 1/17-1/20 2006
Abstract: Prehosp Emerg Care. 2006 Jan-Mar;10(1):107-49

The results of this study are being presented as an **oral presentation**:
"Comparison of German Pre-Hospital Physician Practice to Paramedic Protocols and Paramedic Practice"
D. MacDonald, E. Nix, J. Breckwoldt, D.Cone
11th International Conference on Emergency Medicine, Halifax, Nova Scotia 6/3-6/7 2006
Abstract: Canadian Journal of Emergency Medicine 2006 May;8(2)