CHARLES UNIVERSITY IN PRAGUE

**THIRD FACULTY OF MEDICINE**

**Cameron Scott**

# Comparing Morbidity and Mortality in Trauma Patients in the Franco-German System and the Anglo-American System of Emergency Medicine

*Diploma thesis*

Prague, April 2010

Author of diploma thesis: Cameron Scott

Master's programme of study

Advisor of the thesis: Prof. MUDr Jan Pachl C.Sc.

Department of the advisor of the thesis: Clinic of Anaesthesiology and Resuscitation

Date and year of defence: April 2010

## Written Declaration

I declare that I completed the submitted work individually and only used the mentioned sources and literature. Concurrently, I give my permission for this diploma/bachelor thesis to be used for study purposes.

Charles University, 3rd Faculty of Medicine Cameron Scott
Prague, Czech Republic
April 2010

# Contents

# INTRODUCTION

Emergency medicine in the developed world is traditionally performed in two different ways. The first is the well-known Anglo-American system (AAS) with skilled Emergency Departments (ED), and a pre-hospital emergency medical service using paramedics [1, 2]. The second is the Franco-German system (FGS), with a highly developed pre-hospital emergency physician service, but only a basic organization of hospital-based emergency medicine [2]. Furthermore, most countries using the FGS system use anesthesiologists as emergency physicians for pre- and in-hospital patient care in trauma situations [3, 4]. The gap in the two systems is now closing fast because of the rapid advancement of hospital-based emergency medicine in Europe [3, 4, 5, 6]. In the Czech Republic specifically, Emergency Medicine (EM) is now recognized as its own specialty, but the FGS system is still used [5, 7, 11]. Although there has been some research done based on the benefits and drawbacks of the two systems, there has not been enough research done to evaluate the two systems as regards to their specific efficacies on trauma patients and the resulting mortalities and morbidities [2, 7, 8, 11, 12].

The most significant differences between the two systems can be summarized as either the pre-hospital and multi-disciplinary approach (Franco-German) or as the in-hospital and specialty approach (Anglo-American) [2, 9]. The Franco-German

model is often described as "bringing the hospital to the patient" [2, 4, 9]. In this system, patients access the pre-hospital system through non-EM physicians (anesthesia, critical care, or emergency medicine) who commence medical treatment and transport to the hospital. Emergency Medicine is accomplished mostly in the pre-hospital environment, with patients being triaged and admitted directly to inpatient specialty units [2, 14, 16]. It should be noted that countries using this FGS model of Emergency Medicine do so under many forms not limited exactly to the one described, but this is how the bulk of Emergency Medicine is practiced in the Czech Republic [2, 5, 7, 11]. This description oversimplifies a multidisciplinary system of emergency medical care practiced in many countries.

"Bringing the patient to the hospital" is the term often used to describe the Anglo-American model. In this model, patients access the pre-hospital system through physician extenders (emergency medical technicians and paramedics) who commence basic care and transport to the hospital [2, 11, 28]. Emergency physicians typically take control of the patient upon arrival to the emergency department (ED) and assume medical control for the pre-hospital care-givers [2, 36, 38]. Furthermore, their focus is to first stabilize the patient and diagnose as many conditions as they can before activating specialty units [2]. Patients are triaged in the hospital, rather than at the scene, with all patients being brought to the hospital as fast as possible [2,36].

These systems need also to be compared as a specialty model versus the multidisciplinary model. The specialty model, used in the AAS, is an organizational system in which EM is viewed as a uniquely integrated horizontal body of medical knowledge and skills; on other words, one department horizontally crossing many unique areas of specialty [2, 17, 19]. Patients are treated in the Emergency Departments in many countries and in the out-of-hospital environments in others [2, 19, 36]. These skills cover the acute form of all types of disease and injury. The most important part of this system is that Emergency Medicine is recognized as an independent medical specialty within the health care system [2, 11, 17].

In the multidisciplinary model, EM is made up of several vertically oriented (specialty) areas of medical knowledge and skills that depend on other medical specialties, such as internal medicine, obstetrics, pediatrics, anesthesia, or surgery [2, 3, 5, 7-9, 11]. In this model, non-EM specialists are felt to be the most qualified to deliver emergency medical care in their areas of expertise [2, 3, 5, 7-9, 11, 23, 24].

It also needs to be noted that there is a significant cost difference in running the respective models of Emergency Medicine [2, 18] . The Anglo-American System runs a separate, centralized emergency department staffed with physicians trained in treating acutely ill and injured as well as urgently ill in injured patients [2]. It is

easy to understand that if you compare operating costs of running such a department to the Franco-German System of using physicians which are already working in their respective departments, that a significant decrease in expense will be seen in the FGS[2, 19]. However, it has also been noted that the per capita costs during trauma is also significantly reduced using the Franco German System [2].

The scope of this project is to examine 50 trauma patients from the Brooklyn Hospital Center in Brooklyn, New York, USA and 50 trauma patients from Fakultní Nemocnice Královské Vinohrady (Vinohrady Hospital) in Prague, Czech Republic and compare these randomly selected groups in terms of morbidity and mortality. Both groups will be selected from the calendar years of 2007, 2008 and 2009. Each individual patient will be scored by the Trauma Score – Injury Severity Score (TRISS) and the outcomes will be followed in terms of time to life saving treatments, time from trauma to the hospital, and individual morbidity and mortality after 28 days. The exclusion criteria will exclude patients with significant pre-existing morbidities such as Chronic Obstructive Pulmonary Disease (COPD), end stage renal failure, and congestive heart failure. It will also exclude the pediatric age group, the elderly over 75, and the morbidly obese with a body mass index (BMI) over 40 due to the special circumstances that these cases would present.

The data from the two groups will then be analyzed using the Wilicox test to observe any significant differences between the cases from Brooklyn versus the cases from Prague. The null hypothesis that there is no significant difference between the two groups in terms of morbidity and mortality will be calculated at a significance of ($p=0.05$). The Wilicox test is most appropriate to use because the two groups will also be further subdivided amongst their respective TRISS scores and compared in several categories outlined above. The software UNASYS will be used for statistical calculations. The limitations of the study will mainly be due to the small sample sizes taken that may cause a decrease in precision.

The study should aid in determining if there is a benefit in the Anglo-American System versus the Franco-German System of Emergency Medicine in terms of trauma outcomes. This is of significant value for many countries that are now implementing Emergency Medicine as its own specialty [13, 15]. It may also be especially useful for countries considering implementation of the Anglo-American system. Additionally, it will help to determine whether emergency physicians at the scene of a trauma are of significant benefit over paramedics alone. Finally, this may have special significance for developing countries as they improve their health care systems and consider what type of system or combination of systems they may like to implement for emergency services.

# MATERIALS AND METHODS

This is a retrospective study of 50 cases from each hospital in the calendar years 2007, 2008, and 2009. Each case was pulled from the medical records beginning from the end of 2009 and moving in reverse chronological order, excluding cases where the patient's age was less than 18 years or greater than 75 years. Cases were also excluded if the patient's body mass index was greater than 40 or those whose Injury Severity Scores (ISS) were less than 16 or greater than 75. Then cases were excluded if there were significant pre-existing conditions that would have complicated the management of the patient. This included patients with COPD, recent surgery within the last two weeks, end stage-renal failure, heart failure, and severely immuno-compromised patients. After each case was vetted, specific information was extrapolated for evaluation. All cases that were excluded were also recorded with their reason for exclusion documented; this was to aid in keeping track of how many cases were ultimately excluded.

The specific aim of this study was to examine the critical differences between the AAS and the FGS in terms of trauma management. The time from Emergency Medical Services activation, usually by phone call, until the time when the ambulance arrived at the scene of the trauma was recorded. Then the time of ambulance arrival at the scene of trauma until the time when the ambulance

returned to the hospital was recorded. The time from ambulance arrival at the scene of trauma until the time when life-saving treatment was implemented was then recorded. Life saving treatment was defined as any treatment outlined by the Advanced Trauma Life Support (ATLS) guidelines and was further described by a quick description of the life saving techniques used (intubation, central line placement, etc). The patient's age and sex and presumed Glasgow Coma Scale (GCS) were also recorded. The time from patient arrival at the hospital until surgery if it was required was recorded. The time from arrival at the hospital until the patient was stabilized was also recorded.

The Trauma Injury Severity Score (TRISS) was then calculated if it had not been calculated before in the patient's notes. This was calculated by using the TRISS calculator from *www.trauma.org*, which incorporates the Injury Severity Score (ISS), the Revised Trauma Score (RTS), and the patient's age to give a probability of survival for both penetrating and blunt injuries in a percentage value. The Injury Severity Score employs the Abbreviated Injury Scale (AIS). This is an anatomical scoring system that was first introduced in 1969. Since this time it has been revised and updated against survival so that it now provides a fairly accurate ranking of the severity of injury. Traumas are rated on a scale of 1 to 6, with 1 being minor, 5 being severe, and 6 is an indicator of absolute mortality. This illustrates the 'threat to life' connected with an injury and is not meant to

symbolize an inclusive calculation of severity. The ISS calculates injuries to the face, head, chest, abdomen, extremities, and external injuries. The Revised Trauma Score is a physiological scoring system, with reasonably high consistency between doctors observing patients and excellent precision in predicting mortality. It is scored from the first set of results observed on the patient in question, and includes Glasgow Coma Scale, Systolic Blood Pressure and Respiratory Rate. TRISS determines the probability of survival (Ps) of a patient from the ISS and RTS using the following formulae:

$$Ps = 1 / (1 + e^{-b})$$

Where 'b' is calculated from:

$$b = b0 + b1(RTS) + b2(ISS) + b3(Ageindex)$$

The coefficients b0 - b3 are derived from multiple regression analysis of the Major Trauma Outcome Study (MTOS) database. Age Index is 0 if the patient is younger than 54 years of age or 1 if over 55 years old. b0 to b3 are coefficients which are diverse for blunt and penetrating trauma. If the patient is less than 15, the blunt coefficients are used regardless of mechanism.

| | Blunt | Penetrating |
|---|---|---|
| **b0** | -0.4499 | -2.5355 |
| **b1** | 0.8085 | 0.9934 |
| **b2** | -0.0835 | -0.0651 |
| **b3** | -1.7430 | -1.1360 |

The TRISS calculator determines the probability of survival from the ISS, RTS and patient's age. ISS and RTS scores can be put in separately or calculated from their base parameters.

Finally, morbidity and mortality within 28 days of the trauma was recorded. All values were recorded into an Excel spreadsheet. Excel was used to create all tables and charts for ease of comparing the data.

To determine if there were any significant differences between the two groups, they were compared using statistical analysis. Comparing the two data sets, it cannot be assumed that they have a normal distribution; therefore, a Wilicox test will be used. The null hypothesis that there is no significant differences between

the two sets of data will be used and tested at a significance level of p=0.05. The software UNASYS will be used to test for statistical significance.

# RESULTS

Due to time and travel constraints, the Results section of this paper will not be completed until September 2010.

However, the appendix shows the spreadsheet that is being used to gather the data.

Tables and graphs will include :

Table 1. Comparison between time from EMS activation until ambulance arrival at the scene (minutes).

Table 2. Comparison between time from EMS activation until arrival at hospital (minutes).

Table 3. Comparison between time from ambulance arrival until life-saving techniques were implemented (minutes).

Figure 1. Bar graph comparing the three above tables.

Table 4. Comparison between types of life-saving techniques used.

Table 5. Comparison between TRISS scores and Glasgow Coma Scale (GCS).

Table 6. Comparison between time until surgery (if applicable).

Table 7. Comparison between time until patient was stabilized.

Table 8. Comparison between Morbidity and Mortality.

Table 9. Comparison between sex, BMI and age in patients studied.

Figure 2. Line chart comparing Morbidity and Mortality in the two data sets with TRISS scores.

## DISCUSSION

There are three possible outcomes to the research in question each having implications for both emergency medical systems being examined. First, the null hypothesis that there is no difference in the morbidity and mortality in the Franco-German system versus the Anglo-American system is accepted. The other two possibilities are that the null hypothesis is rejected and either the Franco-German or the Anglo-American system has lower mortality and morbidity. The implications of the results will be further studied in this discussion.

If the null hypothesis is accepted and there appears to be no significant difference in terms of mortality and morbidity in the two systems, then this will imply that both systems work equally as well in treating victims of trauma. However, because the Franco-German Systems operates at a significantly decreased cost per capita, the argument could be made that this is a more effective means in treating trauma patients [2, 18, 19, 22]. Although the scope of the Anglo-American System operates far outside the scope of trauma, in terms of trauma patients, the costs still have been managed at far less in the FGS [2, 18, 22]. The implications of this would be that the AAS is wasting money with the centralized system and that pre-hospital treatment of trauma patients provides a better outcome [26]. The question arises here that perhaps implementing emergency physicians in pre-hospital

treatment rather than using paramedics to transport the patient to the hospital would be equally effective and more cost efficient [32, 37]. However, even if it is considered more cost-efficient, the implications of losing the centralized Emergency Department would have ripple effects throughout the AAS system of Medicine and would not be confined to the ED [6, 21, 22]. Most patients are now treated in the ED before being transferred to other departments, making the ED a gateway of sorts to more specialized fields [2].

If the AAS is seen to be more effective in terms of mortality and morbidity and the null hypothesis is rejected, then the argument could be made that the FGS should adopt the centralized version of the AAS [2, 20]. There are several reasons that could account for such a finding. First of all, perhaps treating patients at the scene of an accident is more detrimental in terms of complications and time to stabilization [2]. It could be that getting the patient to the hospital where conditions are more controlled and more adaptable is beneficial to trauma patients [2]. There is also a question of experience that emergency physicians in the AAS obtain because they are more focused in their training in terms of trauma [2]. Finally, there have been many accusations that triage outside of the hospital can miss important internal injuries in cases where several people are injured [2]. The most famous example of this is Princess Diana when her companion was transported first leaving her to decompensate from her internal injuries before

more help arrived [2]. However, to change the FGS over to the AAS would be made as a sacrifice to the operating costs of their hospitals and health care systems [2, 7,19, 20] . Also, it would include integrating a new field of medical training in the post-graduate education system for health care systems operating under the FGS [10, 11, 31].

If, however, the null hypothesis is rejected and the Franco-German System appears to have better outcomes in terms of mortality and morbidity, then the argument may be made that the FGS shows improved outcomes at a much cheaper per capita cost to the hospital. This may raise questions in terms of hospital and health care costs of operating the Anglo-American System of Emergency Medicine in a time when health care costs are spiraling out of control [5, 6, 17]. Reasons that the FGS shows improved outcomes may be seen because of numerous reasons as well. Perhaps, implementing life saving treatments like appropriate drugs, central lines and endo-tracheal intubation by trained physicians within minutes is far more important than getting the patient to the hospital [2, 22]. Also, these patients are often sent straight to specialist departments like Surgery or an Intensive Care Unit, rather than stabilizing and diagnosing all the injuries in an Emergency Room, which could improve their outcomes [2, 23]. However, the AAS, as mentioned before, functions well outside of the realm of just trauma. Significantly changing this system would upset the safety-net features it builds

into the Anglo-American Medical system in general [2]. Also, Emergency Physicians trained in the AAS are trained to function inside the hospital with all the capabilities that this entails [2, 12]. It would require a significant undertaking, to train all of these emergency physicians to function in the pre-hospital setting as well as in-hospital settings [12].

In this author's opinion, changing a system of Emergency Medicine in the developed world would take a lot more research in all aspects of both their systems to weigh benefits and detriments [2, 24, 25]. This may never be possible considering the vast lack of data and variation between the two systems [25]. That being said, weighing the risks and benefits of each is well beyond the scope of this project. The real value of determining the rates of morbidity and mortality in trauma patients between these two systems, however, is in the developing world where socialized medicine is in its infancy [13].

In illustrating no difference between the two systems, developing countries can decide which system would better be implemented depending on other factors. For example, the Franco-German system as mentioned previously is much more cost effective [2] . And as mentioned earlier, the Anglo-American system works as a safety net for patients without primary care physicians in the area, or those with

other urgent problems that cannot be immediately seen by their primary care physician [2]. If either system proves to be more effective in terms of traumatic morbidity and mortality, however, then the choice to implement that system may be more desirable.

The development of Emergency Medicine in developing countries is a difficult topic for discussion, partly because there is so little data comparing the two systems [13, 25, 27]. In developing emergency medicine in these countries several questions must be asked. What parts of emergency medical care systems are common? Is there a generic skeleton for EM development? It has been said that the development of an Emergency Medical system can and should have a similar developmental philosophy despite any cultural or geographical differences [15]. This may suggest that development of Emergency Medicine can have similar stages in their development before a specific model is decided [13, 15, 39]. So the development should have a similar basic anatomy which is then followed by a standardized and capable training in leadership roles [13, 35, 40]. It is through the development of these leadership roles where the final models of Emergency Medicine must then be developed and this is where more research comparing the two systems and their respective advantages and drawbacks will have a significant purpose for these countries [8, 13, 15, 19]. Universal components of development can be seen in a series of published articles describing the state of EM in many

countries [1, 10, 17, 29, 30, 31, 33, 34]. Establishing EM as an independent medical specialty benefits health care systems in many ways [2, 8, 13, 15, 28]. EM development results in a group of in-country specialists who improve and refine the pre-hospital and in-hospital emergency medical care systems in their country, ranging from clinical operations to administration [10, 13, 19, 20, 21, 24].

There are several areas where the results may have errors in this research project. These will hopefully have been minimized by controlling for multiple variables like age, sex, and the severity of the trauma. However, a type I or type II error could still be made, but with a small probability having used the appropriate power with the Wilicox test. It will be important to fully examine each aspect of data to hopefully account for any variability that could appear. This is why it was so important to examine factors like age, sex, BMI, TRISS, GCS, and time from activating Emergency Medical Services until they arrive at the scene of the accident.

It will also be of the utmost importance to examine the data to see possible causal factors if one system appears to be an improvement over the other. Factors like time until life saving treatment is applied, time until the emergency services arrived to the scene, time until the patient arrived at the hospital are important

factors that could seriously affect outcomes in trauma patients. It may be assumed that time until life saving treatment is applied will be faster in the Franco-German system, but perhaps the type of life-saving treatment will be different with more complex life saving treatments being applied slower when compared to the Anglo-American system [2, 7, 9, 12, 17, 36]. Also, it has been postulated that there may be significant morbidities associated with such in-field treatment [2].

It has also been claimed that that time until surgery and other definitive treatments is quicker with the multidisciplinary FGS [9, 16]. But the question as to whether this reduces mortality and morbidity remains to be seen. On the other hand, it has been claimed that time until stabilization of the patient will be faster in the AAS and that this system has a better success rate of diagnosing all concurrent injuries in poly-trauma cases. This may result from the advantage of triaging in the hospital as opposed to triage in the field [2].

The importance of this study is not to just say one system is better than the other in terms of mortality and morbidity, but to see where the differences in each system lie. In the future this may open many other research possibilities. Examining these differences may help to elucidate possible weaknesses and strengths in each system [11, 25]. This may open the door to strengthening areas found lacking in

each type of emergency medical system, a more palatable option than completely changing either system [2, 11]. Perhaps inclusion of more Emergency Physicians in the field will find a place in the Anglo-American system [12, 24]. Likewise, perhaps a more centralized area for trauma victims with immediate access to multiple imaging and laboratory techniques will improve outcomes in the Franco German system [2, 24].

Comparing the two systems is difficult because of the multiple factors that complicate individual trauma cases [25]. Hopefully, by examining 50 cases from each hospital and by examining the multiple techniques implemented and when they were implemented, a fairer outcome will be obtained. However, no matter the outcome obtained in this study, more research will needs to be done [25]. There is an extreme paucity in this research and as developing countries continue to look for assistance from both systems as they develop their own emergency medical systems, it will be necessary to have a better understanding of their differences, similarities, and overall weaknesses and strengths.

In conclusion, it will be interesting to see if there is any difference in the morbidity and mortality rates using the different systems of Emergency Medicine. It will also be of value to explore the differences between each model in terms of how and

when treatments are applied. This information will need to be explored in greater depth in the future, but it may be used to create better, more efficient models of Emergency Medicine at perhaps a reduced per capita cost. Where this information will be of most value, however, is in the development of future Emergency Medical Systems in the developing world.

## APPENDIX A

| Time from EMS activation until ambulance arrival (minutes) | Time from EMS activation until arrival at hospital (minutes) | Time from ambulance arrival until life-saving techniques were implemented (minutes) | Type of life-saving techniques used |
|---|---|---|---|
| 12 | 26 | 30 | CVL, fluids, ET tube placement |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

| TRISS Score upon arrival at hospital | Glasgow Coma Scale (presumed) | Age of patient (years) | Body Mass Index (BMI) | Sex of Patient |
|---|---|---|---|---|
| 96 | 10 | 35 | 27 | M |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| Time until Surgery if applicable (hours) | Time until patient was stabilized (hours) | Morbidity (up to 28 days later) | Mortality (up to 28 days later) | Exclusion Criteria |
|---|---|---|---|---|
| **4** | **1** | **0** | **0** | **N/A** |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

# BIBLIOGRAPHY

**1:** Emergency medicine in Southern Brazil.

Tannebaum RD, Arnold JL, De Negri Filho A, Spadoni VS.

Ann Emerg Med. 2001 Feb;37(2):223-8. Review.

**2:** Anglo-American vs. Franco-German emergency medical services system.

Dick WF.

Prehosp Disaster Med. 2003 Jan-Mar;18(1):29-35; discussion 35-7. Review.

**3:** The anesthesiologist in prehospital and hospital emergency medicine.

Moecke H, von Knobelsdorff G.

Curr Opin Anaesthesiol. 2008 Apr;21(2):228-32. Review.

**4:** The development of international emergency medicine: a role for U.S. emergency physicians and organizations. SAEM International Interest Group.

Kirsch TD, Holliman CJ, Hirshon JM, Doezema D.

Acad Emerg Med. 1997 Oct;4(10):996-1001. Review.

**5:** International emergency medicine and the recent development of emergency medicine worldwide.

Arnold JL.

Ann Emerg Med. 1999 Jan;33(1):97-103.

**6:** International report: current state and development of health insurance and emergency medicine in Germany. The influence of health insurance laws on the practice of emergency medicine in a European country.

Platz E, Bey T, Walter FG.

J Emerg Med. 2003 Aug;25(2):203-10.

**7:** Emergency medicine in modern Europe.

Fleischmann T, Fulde G.

Emerg Med Australas. 2007 Aug;19(4):300-2.

**8:** International emergency medicine and the role for academic emergency medicine.

Alagappan K, Schafermeyer R, Holliman CJ, Iserson K, Sheridan IA, Kapur GB, Thomas T, Smith J, Bayram J.

Acad Emerg Med. 2007 May;14(5):451-6. Epub 2007 Mar 23.

**9:** International EMS systems: France.

Adnet F, Lapostolle F.

Resuscitation. 2004 Oct;63(1):7-9.

**10:** Update on the development of emergency medicine as a specialty in Turkey.

Cevik AA, Rodoplu U, Holliman CJ.

Eur J Emerg Med. 2001 Jun;8(2):123-9.

**11:** A survey of emergency medicine in 36 countries.

Arnold JL, Dickinson G, Tsai MC, Han D.

CJEM. 2001 Apr;3(2):109-18.

**12:** Role of the physician in prehospital management of trauma: North American perspective.

Benitez FL, Pepe PE.

Curr Opin Crit Care. 2002 Dec;8(6):551-8.

**13:** Problems in the development of the emergency health care system

Hasić Z, Sisić I.

Med Arh. 2000;54(4):205-7. Croatian.

**14:** Emergency medicine in France.

Nikkanen HE, Pouges C, Jacobs LM.

Ann Emerg Med. 1998 Jan;31(1):116-20.

**15:** The development of international emergency medicine: a role for U.S. emergency physicians and organizations. SAEM International Interest Group.

Kirsch TD, Holliman CJ, Hirshon JM, Doezema D.

Acad Emerg Med. 1997 Oct;4(10):996-1001. Review.

**16:** Prehospital emergency medicine services in Europe: structure and equipment.

Huemer G, Pernerstorfer T, Mauritz W.

Eur J Emerg Med. 1994 Jun;1(2):62-8.

**17:.** Emergency medicine around the world.

Kirsch TD

Ann Emerg Med 1998;32:237-8.

**18:** International emergency medicine and recent development of emergency medicine worldwide.

Arnold JL.

Ann Emerg Med 1999;33:97-103.

**19:** International models for the practice of emergency care [editorial].

Dykstra EH.

Am J Emerg Med 1997;15:208-9.

**20**: International emergency medicine: recent trends and future challenges.

Arnold JL, Della Corte F.

Eur J Emerg Med 2003;10:180-8.

**21:** Emergency medicine and international health: increasing impact by broadening the mandate.

Davis MA

Ann Emerg Med 2004;43:9-10.

**22:** Emergency medicine in Germany.

Moecke H.

Ann Emerg Med 1998;31:111-5.

**23:** Emergency medicine in France.

Nikkanen HE,Pouges C, Jacobs LM.

Ann EmergMed1998; 31:116-20.

**24:** Practice model for emergency medicine in both out-of-hospital and in-hospital settings [letter].

Randazzo A.

Ann Emerg Med 2001;37:416-7.

**25:** The complexity of comparing different EMS systems: a survey of EMS systems in Europe.

Bossaert LL.

Ann Emerg Med 1993;22:99-102.

**26:** International EMS: assessment of developing pre-hospital systems abroad.

Van Rooyen MJ, Thomas TL, Clem KJ.

J Emerg Med 1999;17:691-6.

**27:** Planning recommendations for international emergency medicine and out-of-hospital care system development.

Holliman J, Van Rooyen MJ, Green GB, et al.

Acad Emerg Med 2000; 7:911-7.

**28:** Integration of United States emergency medicine concepts into emergency services in the New Independent States.

Aghababian RV, Levy K, Moyer P, et al.

Ann Emerg Med 1995;26: 368-75.

**29:** Early development of emergency medicine in Chennai (Madras) India.

Alagappan K, Cherukvri K, Narang V, et al.

Ann Emerg Med 1998;32:604-8.

**30:** The recent development of emergency medicine in South Korea.

Arnold JL, Song HSS, Chung JM.

Ann Emerg Med 1998;32:730-5.

**31:** Emergency medical care in Turkey: current status and future directions.

Bresnahan KA, Fowler J.

Ann Emerg Med 1995;26:357-60.

**32:** Emergency, disaster, and defense medicine: the Swedish model.

Brismar B, Totten V, Persoon BM.

Ann Emerg Med 1996;27:357-60.

**33:**. Emergency medicine in Thailand.

Church AL, Plitponkarnpim A

Ann Emerg Med 1998;32:93-7.

**34:**. Emergency medicine in the new South Africa.

Clarke ME

Ann Emerg Med 1998;32:373-6.

**35:** United States physician assistance in development of emergency medicine in Hangzhou, China.

Clem KJ, Thomas TL, Wang Y, et al.

Ann Emerg Med 1998;32:86-92.

**36:** Accident and emergency medicine in the United Kingdom.

McHugh DR, Driscoll PA

Ann Emerg Med 1999;33:702-9.

**37:** Emergency medicine in Eastern Europe: the Hungarian experience.

Nemeth J, Piko K.

Ann Emerg Med 2001;37:399-401.

**38:**. The development of international emergency medicine: the role of United States emergency physicians and organizations.

Kirsch TD, Holliman CJ, Hirshon JM, et al

Acad Emerg Med 1997;4:996-1001.

**39:**. Guidelines for evaluation of international assistance and development projects.

Holliman CJ, Kirsch TD, Green GB, et al

Ann Emerg Med 1997;30:811-5.

**40:** An international training program to assist with establishing emergency medicine in Ethiopia.

Bayleygne TM, Shahar A, Tsadic AW, et al.

Ann Emerg Med 2000;36:378-82.