

MESTRADO INTEGRADO  
MEDICINA

# **Outcomes of having a nationwide specialty in Emergency Medicine**

Rute Raquel Gouveia Torres

**M**

2020



# Outcomes of having a nationwide specialty in Emergency Medicine

Rute Raquel Gouveia Torres

Mestrado Integrado de Medicina

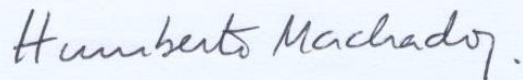
Instituto de Ciências Biomédicas Abel Salazar, Universidade do Porto

Endereço de correio eletrónico: rraquelgtorres@gmail.com

**Orientador:** Humberto José da Silva Machado

Professor Catedrático Convidado do Instituto de Ciências Biomédicas Abel Salazar,  
Universidade do Porto

Assistente Hospitalar Graduado Sénior do Centro Hospitalar Universitário do Porto



---



, junho de 2020

## PREFACE

***“There are challenges for all of us. Although there are threats of war and terrorism and atrocities like 9/11, let us not forget that everyday there are patients needing treatment for anything from sprained ankles, to heart attacks all over the world.”***

Gautam G Bodiwala

## AGRADECIMENTOS

Ao meu orientador, o Doutor Humberto, por, enquanto professor, me ter incutido o “bichinho” da emergência e da gestão hospitalar e, mais tarde, me ter ajudado a combinar os dois mundos da melhor forma possível nesta tese. Muito obrigada!

Um obrigada do fundo do coração aos meus pais, pelo apoio incondicional desde sempre! Sem eles, nada disto seria possível!

Ao Carlos, pelo constante apoio, paciência e carinho. Obrigada por estares lá em todos os momentos, especialmente aqueles menos sorridentes ou em que as palavras não saíam.

Ao Zé, não só pelo tempo dedicado a ler integralmente este documento, mas por todos os outros momentos que partilhamos em vários cantinhos do mundo; e à Rita, por ser a melhor parceira de faculdade e de vida! Vocês são das melhores pessoas que o ICBAS me deu!

Thank you to Margaux, the first person to read my proposal, for the unconditional support.

Ao Filipe e ao Biggie por terem disponibilizado parte do seu tempo a lerem o manuscrito que se segue. As vossas sugestões acalmaram-me muitas vezes a alma.

À Cate e à Teresa, não só pelo apoio, mas por se terem disponibilizado para entregarem a minha proposta enquanto eu andava por terras croatas. Sem vocês, esta tese também não estaria aqui.

À Sofia, à Cátia, à Cláudia, à Cat e ao Duarte por todo o apoio ao longo destes anos.

No fundo, obrigada a todas estas minhas pessoas! Tudo o que sou e cresci ao longo destes anos, devo muito a vocês! Obrigada por todos os momentos, por todos os conselhos, por todas as vezes em que me deram na cabeça, por estarem sempre lá, no melhor e no pior! Adoro-vos do fundo do coração!

Por último, obrigada aqueles meus colegas do 6º ano de 2019/2020 que partilharam o espírito de Biomédicas, se entreajudaram e que lutaram por um ICBAS melhor. Podem apelidar-vos de muita coisa, mas os médicos da era COVID serão, na mesma, incríveis enquanto esse espírito perdurar!

## RESUMO

**INTRODUÇÃO:** Os sistemas de emergência médica são parte fundamental dos cuidados de emergência e Emergência Médica foi uma parte importante da evolução da sua parte intra-hospitalar. Atualmente, apenas quatro países europeus não reconhecem Emergência Médica como especialidade. Esta análise sistemática pretende analisar as consequências, baseadas na evidência, da implementação, a nível nacional, de uma especialidade em Emergência Médica.

**MATERIAIS E MÉTODOS:** Foi realizada uma pesquisa sistemática das bases de dados PubMed, Ovid and Google Scholar entre 1 de janeiro de 2001 e 31 de dezembro de 2019.

**RESULTADOS:** Emergência Médica como a principal especialidade no Serviço de Urgência garante melhores cuidados de emergência, não interfere com o papel das outras especialidades em situações agudas e permite-lhes um maior foco na sua área. Os emergencistas apresentam níveis elevados de *burn-out* e desgaste que podem conduzir à indisponibilidade de médicos. Implementar Emergência Médica como especialidade contribui para melhorar vários indicadores de *performance* do Serviço de Urgência: melhores diagnósticos e triagem, decréscimo de hospitalizações, ocupação de camas, regresso, readmissões e tempo de permanência; porém, implica a tomada de bastantes decisões governamentais e institucionais, e relaciona-se temporalmente com a criação de uma sociedade nacional. Os emergencistas podem melhorar a alocação de recursos, providenciar medicina de desastre de qualidade, ajudar a reduzir a morbilidade, mortalidade e complicações de doenças agudas e melhorar a investigação e a educação.

**CONCLUSÃO:** Estabelecer uma especialidade em Emergência Médica é uma boa opção para melhorar os cuidados de emergência, a gestão hospitalar e do Serviço de Urgência, melhorar a saúde pública, a investigação e a educação, bem como providenciar novas respostas em catástrofes. Contudo, soluções para o *burn-out* dos emergencistas têm de ser abordadas, tendo em vista a manutenção destas vantagens.

## ABSTRACT

**INTRODUCTION:** Emergency medical systems are a fundamental part of emergency care.

Emergency Medicine was a big part of its in-hospital evolution and, currently, only four European countries do not have a recognized specialty in emergency medicine. This systematic review intends to analyze the evidence-based outcomes of the implementation of a nationwide specialty in emergency medicine.

**MATERIALS AND METHODS:** A systematic search of the PubMed, Ovid and Google Scholar databases from January 1, 2000 to December 31, 2019 was performed.

**RESULTS:** Emergency medicine as the main specialty in the Emergency Department grants better emergency care, does not interfere with the role of other specialties in acute care and allows them to focus more on their fields. Emergency physicians present high levels of burn-out and attrition which can lead to doctor's shortage. Implementation of emergency medicine contributes to improve several Emergency Departments key performance indicators with more correct diagnosis and triage, lower hospitalization rates, hospital bed occupancy, returns, readmissions and length of stay; but implies several governmental and institutional decisions and it seems time-related with the creation of a national society. Emergency physicians can improve allocation of resources; deliver quality disaster medicine, help reduce morbidity, mortality and complication rates by acute diseases, and improve research and training.

**CONCLUSION:** Establishment of an emergency medicine specialty enables improvements on emergent patient care, Emergency Department and hospital management, public health, research, training, as well as new innovations in disaster medicine. However, the burn-out of emergency physicians must be considered when assessing these solutions to retain their benefits.

## ABBREVIATIONS

ACEP - American College of Emergency Physicians

CSA - Casualty Surgeon's Association

ECCEM - European Core Curriculum for Emergency Medicine

ECG – Electrocardiogram

ED – Emergency department

EM – Emergency medicine

EMS – Emergency medical system

EP – Emergency physician

IFEM - International Federation for Emergency Medicine

KPI – Key Performance Indicators

UK – United Kingdom

USA – United States of America

## TABLE OF CONTENTS

PREFACE.....	i
AGRADECIMENTOS.....	i
RESUMO .....	ii
ABSTRACT .....	iii
ABBREVIATIONS .....	iv
TABLE OF CONTENTS.....	v
LIST OF TABLES .....	vii
INTRODUCTION .....	1
1.    EMERGENCY MEDICAL CARE .....	1
1.1.    Emergency Medical Systems .....	1
2.    EMERGENCY MEDICINE .....	2
2.1.    The specialty of Emergency Medicine .....	2
2.2.    The beginning of Emergency Medicine .....	3
2.3.    The spread of Emergency Medicine around the world .....	5
2.3.1.    International Federation for Emergency Medicine .....	5
2.3.2.    State of Emergency Medicine internationally .....	5
MATERIALS AND METHODS .....	7
1.    STUDY DESIGN .....	7
1.1.    Literature search.....	7
1.2.    Inclusion criteria .....	7
1.3.    Exclusion criteria.....	7
RESULTS .....	8
1.    IMPACT ON EMERGENT PATIENT CARE .....	8
1.1.    Standard of care provided by emergency physicians.....	8
2.    IMPACT ON THE MEDICAL WORKFORCE .....	10
2.1.    Impact on other medical specialties .....	10
2.2.    Emergency physicians burn-out .....	11
3.    IMPACT ON THE HEALTH CARE SYSTEM .....	12
3.1.    Impact on the emergency department performance.....	12
3.2.    Establishment of a specialty in Emergency Medicine .....	13
4.    IMPACT ON A GLOBAL SCALE .....	14
4.1.    Allocation of resources .....	14
4.2.    Disaster Medicine .....	14
4.3.    Public health .....	14



4.4. Research and education .....	15
DISCUSSION .....	17
RECOMENDATIONS.....	21
CONCLUSION.....	21
BIBLIOGRAPHY .....	22
TABLES .....	1

## LIST OF TABLES

Table 1 - PRISMA 2009 Flow Diagram of Methods and Materials

## INTRODUCTION

### 1. EMERGENCY MEDICAL CARE

Emergency medical care is the treatment of acute medical conditions or injuries in the first few hours after the onset.<sup>1,2</sup> The exact origin of emergency care is unknown, but some authors believe that it might have already been present before 1000 BC, based in some manuscripts.<sup>3</sup>

#### 1.1. Emergency Medical Systems

Emergency Medical Systems (EMS) are a fundamental part of emergency care, as they consist in the coordination of resources in order to give a fast and efficient response to medical emergencies. EMS have two main branches: out-of-hospital EMS and in-hospital EMS.

Out-of-hospital EMS consists in the delivery of pre-hospital care and includes dispatch services and mobile care units that enable monitoring, transport and, sometimes, treatment *in situ*.

In-hospital EMS includes medical institutions with an emergency care dedicated area - usually, the emergency department (ED) - available 24 hours-a-day, 7 days-a-week<sup>4</sup>. In all European Union countries, EDs became a legally required component for all hospitals with universal access and where everyone can access them without any formal indication or appointment<sup>5</sup>, which makes them the main route to access medical care in almost every country, namely secondary and tertiary services.<sup>6</sup>

##### 1.1.1. Models of Emergency Medical Systems

Throughout history, EMS evolved in differently around the world, accompanying the evolution of medicine, technology and also according to each country's unique geography, politics, culture and history.<sup>7</sup> During the 20<sup>th</sup> century, emergency care in developed countries had mainly two models of practice.

###### 1.1.1.1. The Franco-German model

The Franco-German model is based on a "*stay and stabilize*"<sup>8</sup> policy. Pre-hospital care is provided by physicians, patients go through triage at the scene and are transferred directly to inpatient specialty units. The ED and Emergency Room are comprised by different specialties such as anesthesiology, intensive care, trauma surgery, orthopedics, and internal medicine, but no specialist is exclusively dedicated to these departments.<sup>9,10</sup>

This longitudinal model was well developed in many European countries, for instance, France, Germany, Austria, Malta and Greece<sup>8,11</sup>

#### **1.1.1.2. The Anglo-American model**

In contrast, the Anglo-American model follows a “scoop and run”<sup>8</sup> policy, with less interventions on the field and faster transport of the patients to an ED. Ambulances are filled with paramedics and emergency trained technicians, and doctors only see the patient at the hospital. Emergency care is given by specially trained doctors – emergency physicians (EPs) -, with a recognized specialty in emergency medicine (EM).<sup>9,10</sup>

This model was “born” in the United States and the United Kingdom. Australia, Canada, New Zealand, Japan, Taiwan, South Korea, Israel and the Sultanate of Oman also followed the Anglo-American approach to EMS.<sup>8,11</sup>

#### **1.1.1. The Emergency Department**

The essential role of the ED should be the care of patients with acute illnesses or injuries that require immediate treatment. ED is the place where the evaluation and initial treatment of these conditions should be performed. However, due to deficiencies in the healthcare systems, community and governmental responses and the increasing demand for better and faster treatment, along the years, there was an exponential variation in the ED casemix. Currently, the number of patients with minor health conditions outnumbers those with serious injuries and, also due to the increased prevalence of chronic diseases, the elderly population became the most prevalent in this area of the hospital.<sup>11</sup> In the future, it is expected that more patients with serious chronic illnesses and higher expectations regarding the service provided will resort to the ED.<sup>12</sup>

## **2. EMERGENCY MEDICINE**

### **2.1. The specialty of Emergency Medicine**

A medical specialty can be characterized as a clinical area that encompasses a specific field of action, body of knowledge, a dynamic research program and a training curriculum.<sup>13</sup> In 1979, in the article “*The Biology of Emergency Medicine*”, Peter Rosen explained that the field of action of EM is “*the time-dependent exploration of and intervention in the acute physical and/or psychological crises of humans*”<sup>14</sup> and the body of knowledge is all the possible acute conditions that can occur to a person “*despite the organ system or disease process involved*”<sup>14</sup>. According to the International Federation for Emergency Medicine (IFEM), “*Emergency medicine is a field of practice based on the knowledge and skills required for the prevention, diagnosis and management of acute and urgent aspects of illness and injury affecting patients of all age groups with a full spectrum of episodic undifferentiated physical and behavioural*

*disorders; it further encompasses an understanding of the development of prehospital and inhospital emergency medical systems and the skills necessary for this development.”<sup>15</sup>*

Succinctly, EM is the medical specialty that focuses in providing emergency care to any patient presenting with any acute illness or injury, regardless of its gravity or patient’s age, either in the hospital or on the field.<sup>16</sup> However, the IFEM’s definition emphasises that EM is specially tailored to act in the ED, the place where patients with acute conditions are most likely to initially present themselves.<sup>17</sup>

## **2.2. The beginning of Emergency Medicine**

During the 20th century, medicine evolved at a great pace. In the 1950’s, external defibrillation was administered for the first time and mouth-to-mouth ventilation started to be performed; in 1960, closed chest compressions were introduced and, in the 1970’s, Advanced Cardiac Life Support was established.

Simultaneously, hospital-based medicine was rising, reducing the number of domestic emergency consultations and the available means of transportation evolved. There was also a shift in the most common medical emergencies and evidence-based medicine was implemented.

Consequently, the standard of care increased, institutions felt the need to adapt, increasing research, improving out-of-hospital EMS and making medical assistance available 24/7 with the creation of EDs. Together with the advances in anesthesia, surgery and critical care, the fact that lives could be saved with a timely response and the creation of new conditions and means to provide assistance inspired the birth of EM.<sup>18</sup> This new specialty emerged, for the first time, in the United Kingdom (UK) and the United States of America (USA).

### **2.2.1. Emergency Medicine in the United States of America**

EM in the USA began when the Federal Highway Safety Act was approved in 1966, setting standards for pre-hospital care. In the same year, the American College of Emergency Physicians (ACEP) was created. Their goal consisted of having qualified and certified physicians in the area providing emergency care, starting with the development of an educational program.<sup>18</sup> The first ACEP scientific assembly was in Denver, 1969, involving 14 faculties and 128 attendees.<sup>19</sup>

In 1970, the University of Cincinnati had the first EM resident trainee – Dr. Bruce Janiak. To enter the training program, physicians needed to have an internship in other areas of expertise before training 2 years in EM. In the first four years of the program’s implementation, there

established practitioners in emergency care could apply for certification, without additional training. The residency program kept changing and, in the late 1980s, certification required a minimum of 36 months of EM training.

EM was recognized as a specialty by the American Medical Association in 1972 and, in the following year, regional and local EMS were funded by the federal Emergency Medical Services System Act. In 1976, the American Board of Emergency Medicine was established and, in 1979, the specialty board approved EM as the 23rd medical specialty in USA.

Today, EM has subspecializations in toxicology, pediatrics, emergencies and disasters, critical care, hyperbaric medicine, administration/practice management and research. An ED, currently, includes specialized EPs, specialized emergency nurses, emergency technicians, paramedics and physician's extenders (assistants, certified nurse practitioners).<sup>17</sup>

### **2.2.2. Emergency Medicine in the United Kingdom**

The first EP in the world was British. Maurice Ellis was the first doctor appointed as a full-time consultant of an ED<sup>18</sup> and he was one of the biggest boosters of EM in UK. In 1967, Ellis united with other physicians to establish the Casualty Surgeon's Association (CSA) – an association to encourage the *“art and science of casualty medicine and surgery”* – that later became the Accident and Emergency Association.<sup>4</sup>

Until 1962, in UK, the hospital department equivalent to an ED – responsible for acute care – was called the casualty department. In order to reduce its misuse by the public (with non-urgent situations), the Plat Report renamed it to *“Accident and Emergency Department”*.

Throughout the years, more physicians were appointed to work full-time in the Accident and Emergency Department. The outcomes of their work were considered so positive that, in 1972, 30 consultants were chosen by the UK Health Department to oversee several Accident and Emergency Departments around the country.<sup>18</sup>

In 1986, the Royal College of Surgeons of Edinburgh recognized the first EM specialist in UK. Two years later, the Accident and Emergency Association started negotiations with the Royal Colleges of Physicians and Surgeons to establish a faculty in EM so in 1993, the faculty of Accident and Emergency Medicine was inaugurated.

In 2015, EM became one of the eleven specialties in the medical Royal College, after the College of Emergency Medicine – the former Accident and Emergency Association merged with the faculty – being granted with the Royal Charter by Queen Elizabeth II.<sup>18</sup>

Nowadays, EM has its own curriculum consisting of a 6-year program including two years of training in the Acute Care Common Stem, and one year of specialty-specific training, followed

by another three years of Higher Specialty Training in EM. Physicians can also opt to subspecialize in Pediatric EM, Pre-Hospital EM or get additional training in Intensive Care. At the end of the six years, physicians who succeed in the specialty exit exams have a Certificate of Completion of Training in EM and they can apply for posts as consultants. There is also a direct route into Higher Specialty Training for people who have core training in an acute specialty or worked in EM more than three years.<sup>20</sup>

## **2.3. The spread of Emergency Medicine around the world**

### **2.3.1. International Federation for Emergency Medicine**

Gautam Bodiwala, William Rutherford from CSA and Arnold Muller from ACEP, in 1984, discussed the possibility of an international emergency medicine conference.

In 1989, in the ACEP Scientific Assembly, Washington DC, the four founding societies agreed on the establishment of an international organization responsible for conducting conferences about EM every other year. In this meeting, organizational goals were also established: to allow EPs and trainees to exchange knowledge and experiences between them, to train in other countries; to help other nations establishing EM as a medical specialty; to develop an international collaboration for disasters and offer membership to national EM societies.

IFEM was officially established in 1991 and it is the only international federation representing EM societies worldwide. Besides promoting the establishment of EM at an international level, this federation is making efforts to generate a common terminology between physicians, to promulgate new guidelines and protocols, to guide countries in creating unified training programs and curricula and to share academic information.

### **2.3.2. State of Emergency Medicine internationally**

It is hard to quantify the total number of countries with an EM specialty. However, at least 80 countries around the world have already recognized EM as a specialty. Europe is the continent with the highest percentage of countries recognizing EM and Africa has the lowest one.

#### **2.3.2.1. The European case**

Inside the European Union, for a specialty to be obligatorily addressed by all member countries, two-fifths of the member countries must acknowledge the specialty, according to the European Union of Medical Specialists. EM achieved this status in 2011.<sup>5</sup>

In Europe, although with some different curricula, only four countries do not have a specialty in EM: Austria, Latvia, Portugal and Spain. These last two are good examples of a longitudinal emergency care system.<sup>21</sup>

From 2006 to 2017, in a Portuguese University Hospital Emergency Department, the 10 busiest ED specialties were general medicine, internal medicine, orthopedics, general surgery, otorhinolaryngology, urology, neurology, endocrinology, vascular surgery and neurosurgery. Regularly, over 10 different specialties, and doctors with no specialty, are represented in the ED in a rotational basis. The number of specialists decreases in the night shift.<sup>22</sup> In Spain, the majority of specialties present in the ED are family and community medicine, as well as internal medicine. Other specialties are consulted when necessary (e.g. to establish a certain diagnosis or prescribe treatments).<sup>23</sup>

#### **2.3.2.1.1. European Core Curriculum for Emergency Medicine**

The European Core Curriculum for Emergency Medicine (ECCEM) was published in 2002 by the European Society for Emergency Medicine, after being approved by the Multidisciplinary Joint Committee of the European Union of Medical Specialists. Since then, an expanded version was released in 2009, an update in 2017 and a major revision in 2019.

The curriculum describes the core competences and knowledge that an EP needs to acquire during a 5-year residency program such as triage, resuscitation, recognition and management of a variety of signs, symptoms and conditions and decision-making (regarding procedure realization and adequate investigation. EPs also need to master professional competences transversal to all physicians (e.g. organization, communication, cooperation, ...)

Although EPs need to be able to recognize and diagnose a different number of conditions, according to the ECCEM, they should mainly focus *“on mastering approaches that allow for estimating the likelihoods of time-sensitive conditions”*<sup>24</sup>. For instance, it is not the role of the EP to diagnose a chronic renal failure, only to recognize the effect of such a condition *“on the likelihoods of time-sensitive conditions”*<sup>24</sup>, such as an intoxication.



## MATERIALS AND METHODS

### 1. STUDY DESIGN

Bearing in mind the recent evolution of EM, we conducted a systematic review of the literature in order to answer the following question: “What are the evidence-based outcomes of the implementation of a nationwide specialty in Emergency Medicine, from patient care to the global spectrum of the healthcare system?”

#### 1.1. Literature search

The articles included in the present study were identified through a systematic search of the PubMed, Ovid and Google Scholar databases from January 1, 2000 to December 31, 2019. In each database, the search used the following headings: “Emergency Medicine”; “Emergency Department”; “Emergency Care”; “Specialty”.

Reference journals on the subject - American Journal of Emergency Medicine, Academic Emergency Medicine, Annals of Emergency Medicine and European Journal of Emergency Medicine – were searched between November 2019 and March 2020.

Articles were analyzed following the PRISMA guidelines (see table 1). 8953 articles were included after initial screening, based on title and abstract, and removal of duplicates; 356 articles went through a full-text review and 128 were included in this article.

#### 1.2. Inclusion criteria

Articles included in the current review were selected based on the following criteria: 1) peer-reviewed publications; 2) published between January 1, 2000, and December 31, 2019; 3) English and Portuguese-language publication; 4) study utilized quantitative, qualitative, or mixed methods and other review articles.

Some articles published before the cited dates were, exceptionally, included in order to give a more accurate historical context or to build a more precise comparison.

#### 1.3. Exclusion criteria

Articles were excluded based on the following premises: they referred to EM subspecialties, out-of-hospital EM, pre-graduate teaching in EM, EM in the army or they were not compatible with the objectives of this review.

## RESULTS

### 1. IMPACT ON EMERGENT PATIENT CARE

In a country without EM, the patient is triaged to the specialty that best fits his apparent case, amongst the ones present in the ED at the time of arrival.

Several studies have pointed out flaws in the longitudinal model of EMS. Firstly, an urgent patient has some probability of being triaged to the wrong specialty, leading to delays in treatment and, in worst case scenarios, death.<sup>25</sup> Additionally, specialists tend to “*over specialize*” in their respective areas, leading to unfamiliarity with emergent conditions outside of their fields<sup>26</sup>, as well as a predisposition to not consider all patient’s comorbidities.<sup>27</sup>

Another weakness is the absence of some specialties in the ED during the night shift and, in smaller EDs, their total absence which causes an impossibility to attend the patient locally.<sup>22</sup>

In countries where the ED is staffed with EPs – a cross-sectional EMS - consultations with other specialties are still part of the patient’s management. However, EM specialists are supposed to be present 24/7 and to be able to stabilize the patient as well as, most times, manage him without any aid from on-call doctors from different hospital wards.<sup>26,28</sup> The compulsion to refer patients to another hospital also decreases.

When comparing both in-hospital EMS, some authors consider the longitudinal approach to be the best fit for patient care, precisely because the emergency care is the responsibility of the corresponding medical specialty right away<sup>21</sup>. However, others prefer the cross-sectional model, as keeping the patient's re-allocation to a minimum lowers the overall risk and, given the specific body of knowledge of EM (as it includes most emergent conditions), the patient is provided with expert medical care. Authors also state that critical patients are better managed by a specialty designed exclusively to deal with it.<sup>26,29</sup>

#### 1.1. Standard of care provided by emergency physicians

Although EM curriculum states that EPs must have broad knowledge and be highly capable when dealing with different emergencies, it is also important to evaluate if this is reflected in the field. Several studies compared emergency care provided by EPs with the one provided by the previously responsible specialty and analyzed EPs standard of care in general.

Investigations evaluating airway management by EPs found that it is a highly successful procedure as even the most difficult ones present a low rate of long-term complications.<sup>30,31</sup>

According to previous studies comparing EPs management of trauma airway to the same procedure in the hand of anesthesiologists, these two groups of specialists did not differ significantly in the overall success, complications rates and laryngoscopy performance.<sup>32–34</sup> One

of these studies also states that one potential advantage of attributing airway trauma management to EPs the shorter response time (compared to when it is attributed to anesthesiology).<sup>33</sup> Another study refers that each specialty tends to have different specific approaches to airway management, which should be shared in order to increase the safety of the procedure in critical care settings.<sup>35</sup> However, according to Wong et al, success rate of EPs can be even higher if EPs use rescue devices more often.<sup>31</sup>

According to the literature, manage other emergencies adequately by EPs. For instance, Owolabi et al demonstrated that patients with oncologic febrile neutropenia in the ED had the same quality care in ED as if they were directly admitted to the hospital.<sup>36</sup> Additionally, it was proven that EP's have the same competence as cardiologists in insertions of transvenous pacemakers<sup>37</sup>, they perform effective initial resuscitation and treatment of multiple burn victims, even in an ED with a high volume<sup>38</sup>, they accurately diagnose acute appendicitis<sup>39,40</sup>, and they properly recognize severe adverse drug-related events in older patients – although they are more likely to miss low or moderate severity events<sup>41</sup>. Studies also show that EPs are capable of dealing with non-critical responsibilities such as reduction of prosthetic hip dislocations<sup>42</sup> and referral of potential organ donors<sup>43</sup>.

An informal survey applied to Peruvian doctors working in EDs found that physicians with EM training are more comfortable with emergent procedures.<sup>44</sup>

Successful use of ultrasound imaging techniques in the ED is another skill demanded by the ECCEM.<sup>45</sup> Several studies shown that EP's with proper training can perform bedside ultrasound with high accuracy in conditions like abdominal aorta aneurysm<sup>46–48</sup>, cholecystitis<sup>49,50</sup>, cholelithiasis<sup>51</sup>, deep vein thrombosis<sup>52–55</sup>, renal calculi<sup>56,57</sup>, ruptured ectopic pregnancy<sup>58</sup>, small bowel obstruction<sup>59</sup> and emergent causes of acute scrotal pain (e.g. testicular torsion)<sup>60</sup>. EPs can determine gestational age<sup>61</sup>, measure aortic diameters<sup>62</sup> and evaluate blunt abdominal trauma<sup>63</sup> using ultrasound, perform echocardiography to determine left ventricular function in patients presenting hypotension<sup>64</sup> and interpret cranial CT<sup>65</sup> with great sensitivity and specificity.

An additional skill that should be acquired by EPs is electrocardiogram (ECG) interpretation<sup>45</sup>. In a study comparing Internal Medicine and EM residents interpreting ECGs based on clinical scenarios, they were equally likely to choose the correct intervention for complete heart blocks and pulseless ventricular tachycardia, while EP's were more likely to select the best management of unstable supraventricular tachycardia.<sup>66</sup> However, EP's frequently misdiagnose some syndromes presenting with ST-elevation in a patient with chest pain.<sup>67</sup>

## 2. IMPACT ON THE MEDICAL WORKFORCE

### 2.1. Impact on other medical specialties

Along its path to recognition as an independent specialty in each country, EM raised, and still raises, some concerns. In USA, when Peter Rosen was trying to achieve the specialty status, specialists from surgery, internal medicine and pediatrics were against EM because they thought it would compete with primary care and private practice, as well as compromise the residents' training in the ED.<sup>68</sup> In UK, EM was faced "*as the potential fragmentation of medicine*".<sup>13</sup> In Hungary, physicians faced EM as a client stealer, because of patients' discharge without being admitted to a specialty.<sup>25</sup>

Faced with these issues, in the article "*Internal Emergency Medicine: Past and Future*", Peter A. Cameron summed them as "*the entrenched hierarchy of medical specialties*" and "*the resistance to change*".<sup>69</sup> Stroobants and Antman considered the existence of opposition as part of the process, once EM is part of the evolution and opposition to evolution is not a piece of news in healthcare. The author exemplifies with the case of anesthesiology – before its advent, surgeons were responsible for every aspect of the surgery and the growth of a specialty that would take a part of their work (in this case, anesthesiology) was also not welcome at the time, however, nowadays, anesthesiology is an independent specialty with an exact role in healthcare.<sup>70,71</sup>

In countries where EM is now an established specialty, according to the literature, the previous concerns did not become a problem. In Philippines, EPs are responsible for the first stages of trauma management but they work as a team (with other specialties) as soon as possible throughout in-hospital management.<sup>72</sup> In Canada, EPs work side by side with family doctors in the ED.<sup>73</sup> However, some authors consider there is still a threat of isolation between EM and other specialties.<sup>74</sup>

There is also a great number of collaborations between EM and other specialties. In Cardiology, the guidelines for Acute Coronary Syndrome, STEMI and the CRUSADE Quality Improvement Initiative were a joint work of EM and Cardiology. Besides this, the administration of fibrinolytic therapy for patients with Acute Myocardial Infarction transitioned from cardiologists to EPs, due to the fact that an earlier administration was beneficial to the patients.<sup>75,76</sup> Recent studies suggest that the implementation of protocols requiring EPs to activate the interventional cardiology team in patients with ST-elevation significantly reduces the time to percutaneous coronary intervention.<sup>77,78</sup>

Those who defend that EM should be an independent specialty consider that having a specialty only committed to the ED does remove other specialties from the hospital or the acute care.<sup>79</sup>,

since one of the EP's functions after the initial stabilization of the patient is to transfer him to the correspondent specialty, if needed.<sup>80</sup> For example, a trauma patient that needs a spinal decompression is initially stabilized by an EP and then operated by the on-call neurosurgeon. The fact that other specialties do not need to be physically present in the ED is considered an advantage, once it allows physicians to focus on their own patients and their own wards, with a more permanent residency there.<sup>22,70,81</sup>

## **2.2. Emergency physicians burn-out**

Burn-out can be described as a stress associated to the exercise of health practitioners, usually associated to high levels of anxiety and depressive symptoms.<sup>82</sup> The risk of burn-out is associated to demands with longer shifts, frequent night shifts and a lack of the needed resources.<sup>83</sup> According to a USA study, medical doctors experience burn-out more commonly than any other professional, with EM, general medicine, internal medicine and family medicine showing the highest levels of stress.<sup>84</sup>

According to Pek et al. emergency practitioners *"inherit a legacy of stress and burnout, leading to a frustration and shortened career span."*<sup>85</sup> Investigators analyzed the attrition among different professionals (neurosurgeons, general surgeons, plastic surgeons, orthopedists, pathologists, radiologists, nuclear medicine specialist and EPs), in Taiwan, between 1997-2010. They found that attrition among doctors practicing EM was higher than among the doctors from the other specialties. Attrition was also significantly higher in physicians more than 45 years old.<sup>86</sup> This represents a major threat that EPs are more likely to abandon their practices, increasing the likelihood of a doctor shortage in the ED.

Some factors leading to burnout, like long shifts and sleep deprivation, are also the ones which, on a daily basis, lead to intellectuality and physical exertion and, consequently, to poor quality of care and increased risk of medical errors.<sup>83,87</sup> Despite that, a study comparing the quality of chest compressions performed by EPs before and after a night shift found they did not differ significantly.<sup>88</sup> EPs approach to patients with heart failure, COPD and sepsis, before and after a night shift, has no significant difference – concerning the full extent of diagnostic tests, treatments and diagnosis.<sup>89</sup> Another threat is the ability decay verified among ageing EPs (like the one verified in other specialties).<sup>90</sup>

### 3. IMPACT ON THE HEALTH CARE SYSTEM

#### 3.1. Impact on the emergency department performance

Some of the ED most used key performance indicators (KPI) include: admission rate/hospitalization, cost of care, correct diagnosis, discharge rate, ED occupancy/crowding, ED length-of-stay, ED returns, standard care of treatment, time to treatment and triage time.<sup>91</sup> EM main duty is acute care along with rapid diagnostics and early start of treatments. In this study, EPs are dedicated and successful in the treatment of a massive array of emergencies and urgencies, therefore the ED standard of care and the number of correct diagnosis increased with EM's dawn.<sup>85</sup>

Triage represents an important KPI in ED since it is one of the first ways to guarantee a cost-effective utilization of the ED resources - such as hospital staff and supplies – and correct referral of patients.<sup>7</sup> In Bosnia, the Ministry of Health acknowledged that EM must not deliver only effective treatment but also efficient triage.<sup>92</sup> In the wake of this problem, Croatia, Estonia, and Finland implemented standardized nationwide triage, performed by emergency professionals. In Finland, the use of an ABCDE type of triage decreased the waiting time for patients that waited more than two hours to be seen by a physician.<sup>93</sup> A cross-sectional study comparing the performance of an Iranian ED before – performed by general practitioners - and after the establishment of EM showed a significant reduction in triage time in the period after EM.<sup>94</sup>

The Canadian Association of Emergency Physicians states that *“crowded and dysfunctional emergency departments are a direct result of crowded hospitals.”*<sup>95</sup> Bearing this in mind, in-hospital bed occupancy becomes a core issue, with admissions to the correct ward and avoidance of unnecessary admissions as part of the solution. The Veneto region, in Italy, implemented laws to reduce avoidable hospitalization (*DGR n.74/2014* and *DGR n. 1513/2014*) focused on the improvement the emergency personnel training.<sup>93</sup> The application of serial cardiac markers to evaluate and discharge low-risk patients from the ED without hospitalization, in USA, is an example on how EPs help manage hospital bed occupancy.<sup>96,97</sup> Studies describing the outcomes of patients presenting with acute atrial fibrillation treated in an ED observation unit managed by EPs showed the same outcomes as the inpatient care management, a shorter hospital length of stay and no additional need for hospitalization.<sup>98</sup> Portuguese researchers assessed the differences between a typical Portuguese ED – staffed with a big proportion of inexperienced doctors from different specialties working in 12-hour shifts – and an ED operated by a full-time dedicated team of doctors with specific training in

EM. They found that, in the latter, the number of patients seen per hour has risen while ED costs and hospitalization rates declined, significantly, even with an increased demand.<sup>99</sup> Another consensual way to reduce the cost of care is by lowering ED returns, readmissions and the length of stay.<sup>93,100</sup> Lower ED readmissions and returns can be achieved with elevated standard care of treatment that EPs are more than capable of providing. Buck et al. compared patients admitted through the ED before (2008) and after (2010) the establishment of an official ED staffed with EPs and came to conclusion that, although the number of acute cases have increased in 2010, admissions to medical and orthopedic wards decreased in 9% and 17%, respectively. The authors also noticed significant changes in discharge rates after 1-2 days with a 6,7% reduction and a 12,7% decrease in the stationary ward length of stay. Patient readmission within 30 days was 8,8%, having decreased 20,3% compared to 2008.<sup>101</sup>

### **3.2. Establishment of a specialty in Emergency Medicine**

Outcomes of having a specialty in EM were approached previously but establishing a specialty in the real world involves more factors than just the knowledge that the specialty can improve emergency treatment delivery. In more developed countries, healthcare systems already have defined structures that are not easily overcome or flexible enough to immediately launch EM as specialty.<sup>74</sup>

Arnold et al. interviewed physicians working in emergency care in 36 different countries about the barriers to development of EM in those nations. 80% of them found lack of funding to be either great or moderate obstacle. Lack of infrastructure and government support were considered great or moderate obstacles to 63% and 59%, respectively. Hospital administration and other specialties were also seen as obstacles to the development of EM in those countries. On the other hand, public support and support of other physicians in the field of EM are faced as little or no barriers.<sup>102</sup>

Another study analyzed the overall time that took to establish EM in some European countries. According to this, the overall time between the foundation of a national society until the recognition of EM as specialty was six years. In countries where EM was a supraspecialty (or some equivalent) first, it took 7 years for it to get fully recognized, while in countries where EM was recognized as an independent specialty at first it took 4,4 years since the foundation of the national EM society.<sup>103</sup>

#### **4. IMPACT ON A GLOBAL SCALE**

EM plays a substantial role not only in patient care, like stated before, but also in resource allocation, in enhancing research, training and education, in the decision-making processes and the global EMS.<sup>25,27</sup> Tamara L. Thomas stated: *“Comprehensive emergency medical care has much to offer to many countries, including quality, high volume, unscheduled outpatient visits, reduced hospitalizations, up-to-date immediate resuscitation of all patient groups, and integrated prehospital and hospital systems.”*<sup>9</sup>

##### **4.1. Allocation of resources**

Medical care delivery differs significantly between regions, for example: developed countries vs developing countries and urban areas vs rural areas. However, while there is still a disparity between countries regarding healthcare access, EM is now a worldwide reality, even in some developing countries – with 13 African countries and 27 Asian countries recognizing it as a specialty.<sup>104,105</sup> When comparing urban and rural areas, there is also unequal access to healthcare, with less resources available and longer times to obtain care delivery.<sup>106</sup> Although EPs cannot solve the scarcity of resources – material and staff - by themselves, a staff of Australian EPs who visited a rural referral center in South Africa noticed that trained EPs are valuable in these situations as they provide good emergency care with safety and a respectable governance.<sup>107</sup>

##### **4.2. Disaster Medicine**

Another aspect of EM is Disaster Medicine which, briefly, consist in the medical response to catastrophes, natural or man-made. EPs are trained to be first responders and emergency care providers during complicated casualties.<sup>108</sup> They are able to give the most appropriate response due to their training in disaster preparedness and they have updated knowledge acquired during their ED daily work. EM specialists are trained to take action in medical disasters such as bioterrorism, blast, crush, chemical and radiation injuries<sup>45</sup>, to give community advice and cooperate with authorities or other responding agencies.<sup>108,109</sup>

##### **4.3. Public health**

Countries where EM is a stablished specialty present less morbidity and mortality by acute diseases.<sup>69</sup> Studies evaluating effects of having EPs as part of trauma teams, enrolled in the stroke protocols and the care of critically ill patients, showed a decrease in complication rates, progression to organ failure and mortality.<sup>110–112</sup>



EPs can collaborate with Public Health professionals – focusing on the well-being of an entire population - through prevention and reduction of health risks. As the specialty is present in the ED, and therefore the physicians are reaching more people regardless the country, they can recognize a considerable number of health and social problems and intervene in their prevention.

For instance, patients who are victims of physical violence tend to visit the ED at some point. ED workers, and specially EPs, can raise awareness to the situation and, if possible, report it.<sup>113,114</sup> EPs also participate in primary and secondary prevention.-In 2004 and 2005, due to a Hepatitis A epidemic, 122 high-risk patients – substance users, homeless and incarcerated people - were vaccinated in the ED, in a partnership with local, state and federal organizations. In the first 4 months of 2005, the number of Hepatitis A cases reduced in 51%.<sup>115</sup>

#### **4.4. Research and education**

Even with lack of funds, external recognition and limited personnel, EPs involved themselves, individually and through national societies, in research and tried to address educational issues and theories, in order to reach educative and clinical advances. Currently, some of the existing programs include seed grants, annual meetings, dedicated sessions, scientific journals and research networks that engage other researchers and physicians practicing different medical fields.<sup>116,117</sup>

Education, research, participation in the creation health policies and decision-making processes are also attributes of a medical specialty.<sup>118</sup> Although working experience is an important part of every job, appropriate training can raise self-efficacy and knowledge, increase security and quality of care. The same can be said about conducting research, which contributes to clinical improvement, expansion non-clinical related competences and networking<sup>119,120</sup>

EM not only changed the ED, but it also made it possible to generalize emergency training through practitioners solely dedicated to emergency care and to improve the number and quality of research topics.<sup>121</sup> The ED represents an unique source in the research of acute situations, with a significant pool of patients and, in countries with a recognized EM specialty, a pool of physicians working and focusing solely in the emergency area. Additionally, knowing the specific problems of their EDs can help EPs and, consequently, policymakers to identify quality standards and improve its management. One example is the measurement of the cost of episodes of care: a deeper research on how the money was spent (e.g. treatment and diagnostic exams) helps budget management by identifying feasible cuts in expenses.<sup>122</sup>

All countries with an implemented EM specialty follow specific curricula. These can differ in the number of training years or in additional competences, but always involve essential skills in pre-hospital, in-hospital emergency care and education.<sup>123</sup> A study comparing lectures on the emergency topic given by practicing EPs and by other physicians found that lectures given by EPs were better rated, with a significant difference in the pertinence, efficacy and accuracy of the lecture.<sup>124</sup>

Nevertheless, EPs are not the only ones who should be educated in EM. Any doctor, regardless the specialty, will face emergency situations during workhours and, in an area where time is crucial, a physician capable of providing the first steps in life support, for example, can literally be lifesaving. Therefore, universities and medical schools are recommended by The Regional Office for Europe of the World Health Organization to insert EM as part of the curriculum in the undergraduate levels.<sup>7</sup>

## DISCUSSION

The current study analyzed the outcomes of the implementation of a nationwide specialty in EM in different levels of the health care system, from patient care to the global spectrum. In order to analyze the impact of EM in patient care, we compared the two main EMS models, in the in-hospital strand, based on their emergency care delivery - cross-sectional or anglo-american model (ED includes/mainly composed by specialized EPs) and longitudinal or franco-german model (ED composed by specialists from different areas, EM is not recognized as a specialty).

Although some argue that a longitudinal system entails less risk for patients, the defects identified, namely in triage and patient “*over-transportation*” - either between doctors, either between hospitals - point to a lack in hospital-based emergency care delivery more dangerous to the patients due to treatment delays and an incomplete view of the patient - centered only in the current condition. Although the fact that the patient is seen by the corresponding specialty from the beginning was pointed as an advantage of the longitudinal EMS, it is in the origin of part of the previous problems. The necessity to see different specialists according to the organ or system affected with the acute condition carries the necessity for a permanent availability of various specialists in the ED. This is currently not feasible. As medicine grows, specialists are gradually becoming more subspecialized and the patient is less seen as a whole. According to Arnold et al, this “*perpetuates the problem of providing integrated emergency care to patients with multisystem trauma or disease*”.<sup>27</sup> On the other hand, we can consider that a full-time specialty in the ED increases doctors’ exposure to different acute conditions, potentially increasing their differential diagnosis skills.<sup>125</sup>

However, to understand if EM is a real advantage, the standard of care provided by EPs was investigated. Several studies conclude that, although there is always room for improvement, EPs provide high quality care as they successfully deal with several emergent conditions, performing accurate diagnosis and timely institution of resuscitation, stabilization and treatment. In the analyzed studies, EPs performed as well as their colleagues from anesthesiology, general surgery and many others when dealing with acute conditions, with similar outcomes.

Bearing in mind these two comparisons, we conclude that when EM specialists are the primary medical workforce in the ED, like in cross-sectional EMS, treatment delay and interhospital transportation decreases and better triage is performed. Once the EP is trained to deal with most emergent and urgent conditions, regardless the organ or area affected, they can deal with almost any patient presenting to the ED.

To study the impact in the medical workforce, we examined EM's outcomes in other specialists and in their own workforce (EPs) through the analysis of their experience in countries where EM is an already established specialty.

In countries where EM has been established as a specialty for decades, such as USA or UK, most of the initial concerns from other medical specialties (integrated in acute care and management) were related with the monopolization of the emergent patients by one single specialty, its impact in the number of patients seen by those specialties and how that would decrease care. EM enthusiasts saw those concerns as a question of hierarchy and tradition, not a worry that the specialty would put patients in risk.

Nowadays, we analyze those countries experiences and conclude that quite the opposite of the feared happened: specialties such as cardiology, traumatology or family medicine collaborate both in the hospital and in the academic level, and other specialties maintain a solid role in acute care. The difference is that nowadays there is a specialty working full-time in the ED and specialists not interested in acute care do not have to work in the ED, improving their availability to focus on their wards and patients. According to the current literature, introducing more consultant ward rounds during a 24-period improves quality and response to risk situations.<sup>80</sup>

However, EM negatively impacts its own specialized physicians. EPs present higher levels of stress that frequently lead to burn-out, and consequently, a higher attrition in the emergency medicine workforce. The possible consequences in the patient are also relevant, although burnout was not yet directly associated with poor delivery of care. The higher attrition identified in EPs - especially above 45 years old – translates to reduced doctor availability and insufficient professionals in some hospitals.

Solutions to these problems are being discussed in the literature. Regarding attrition (related with aging and loss of capacities, number of ED shifts and chaotic schedules), Lee et al. suggest that EPs can keep doing good hospital work but in a more secondary treatment line (not in the frontline when a catastrophe occurs). For example, in a *"less labor-intensive subspecialty"*<sup>90</sup> like disaster preparedness can be projected. Not only will this allow to improve the management of previous challenges, it will also allow EP's to transmit their experience and knowledge onto newer generations.<sup>90</sup>

EPs at a more advanced age can also work part-time and enter retirement gradually, bearing in mind that they should be periodically examined to ensure their wellbeing and patient safety.<sup>90</sup> Another suggestion to maintain EPs connected with the health care system is to recognize EM as an independent specialty, in order to expand their autonomy and prestige as physicians.<sup>126</sup>

There is no unanimous response to this issue that the moment, however its importance is proven and this problem is currently being handled by a working group from the IFEM.<sup>90</sup>

Outcomes related to the National Healthcare Systems were analyzed recurring to the changes in the ED KPIs and the analysis of the processes necessary to establish a specialty.

Literature suggests that EDs staffed with EPs have a good standard of care and a significant number of correct diagnosis; with a decrease in triage time, hospitalization rates and bed occupancy, ED returns, readmissions and length of stay.

The impact of this is broader as the overall improvement in triage leads to improved efficiency in ED's low-risk urgencies management.<sup>74</sup> On the other hand, ED returns, readmission and length of stay decrease have the potential to reduce ED costs. However, to achieve a significant cost reduction, doctors need to be aware of how much money is being spent with each performed procedure. A single-center study performed in Sweden found out that doctors awareness to ED costs is low, regardless of their experience<sup>127</sup>, which can explain why countries with a chronically established EM specialization are not able to decrease the ED expense.

The institutionalization of EM ranges from creating a national society to being accepted by the government or other medical entities. Funding, lack of infrastructure and governmental support, opposition from hospital administrations and other specialists are seen as possible obstacles. A precocious establishment of a national society can influence the implementation time of EM. This is probably related with the influence of national societies in curriculum and training, as well as dealing with policymakers.

According to some authors, a question that should be raised is if the implementation of an EM specialization inside of an already protocolized longitudinal system might not have a positive outcome.<sup>21</sup> However, the enormous change in European countries' acceptance of EM in recent years – which lead to the creation of the ECCM – signifies that the outcome of changing an already well established longitudinal system might not be negative.

Broader outcomes of the implementation of EM were analyzed.

The interregional differences in health care delivery are a great cause of worse outcomes in specific populations. Although the cause of these differences goes beyond the action of any medical specialty or any doctor, the work of EPs in international EM showed that these professionals can be an asset. Improve care in these regions is possible due to EPs' ability to coordinate emergency care and the ED, as well as to provide good and varied emergency care.

A study analyzing the pros and cons of EM suggested that, in smaller towns, the need for different specialists in emergency care delivery can be substituted by EPs, once their curriculum and skills are aligned with that.<sup>87</sup>

Disaster medicine has proven itself valuable during some calamities and is one of the skills that is not part of the curriculum of any specialty, besides EM. Colin Graham reinforced the role of EPs in this area: *“The excellent performance of the French emergency care systems in response to the Paris attacks demonstrates the absolute need for European countries to recognize the value of effective and well-trained emergency physicians.”*<sup>128</sup>

Morbidity, mortality, and complication rates by acute diseases were shown to decrease after a country recognizes EM as a medical specialty and the Eds become staffed with EPs. In fact, countries like Hungary started to consider EM's implementation due to the considerable number of these negative outcomes happening because of their emergent care weaknesses.<sup>25</sup>

EPs participate in prevention, intervening in social problems (e.g. domestic violence) and public health problem (e.g. Hepatitis A epidemic).

Evidence-based medicine is nowadays the accepted way to practice medicine. However, without research, there is no evidence and without evidence, there is no education, which can lead to harmful outcomes in patient care. The rising interest in improving emergency care, the constitution of national and international societies and the establishment of EM as a specialty improved research in the field which reflected in the practice, leading to the development of better curricula and training, as expected from any specialty.

### **Limitations**

The current study is, to our knowledge, the most comprehensive systematic review analyzing the outcomes of the implementation of a specialty in EM. However, only the outcomes of EM in-hospital were evaluated while the specialty also focus in pre-hospital medicine. The main limitation found was the lack of prospective studies in the field.

## RECOMENDATIONS

1. EM as the main specialty in the ED grants better patient care, due to better triage and less delays in treatment.
2. EPs provide high quality emergency care.
3. Implementation of EM did not interfere with the role of other specialties in acute care and gives them more time to focus on their own field.
4. EPs present higher levels of burnout and attrition than other specialties which can lead to unavailability of doctors and negative impact in care. Solutions to this problem need further investigation.
5. EM contributes to the improvement of several ED KPI with more correct diagnosis, faster and better triage, lower hospitalization rates, hospital bed occupancy, ED returns, readmissions and length of stay.
6. Recognizing EM as a specialty implies several governmental and institutional decisions and it seems time-related with the creation of a national EM society.
7. EPs improved the allocation of resources which can help solve differences in emergency care delivery.
8. Disaster medicine is a part of EM that is well delivered and important any country.
9. Implementation of EM can help reduce morbidity, mortality and complication rates by acute diseases.
10. Development of EM improves research, training and curricula in emergency care.

## CONCLUSION

Establishment of an EM specialty enables improvements in emergency care, the ED and hospital management, public health, research, training, as well as new innovations in disaster medicine. However, the burn-out of EPs must be considered when assessing these solutions to retain their benefits.

## BIBLIOGRAPHY

1. Baldursson J, Björnsson HM, Palomäki A. Emergency medicine for 25 Years in Iceland - History of the specialty in a nutshell. *Scand J Trauma Resusc Emerg Med*. 2018;26(1):1-7. doi:10.1186/s13049-017-0467-9
2. Kobusingye OC, Hyder AA, Bishai D. Emergency Medical Services. 1996;68.
3. Chung C. The evolution of emergency medicine. *Hong Kong J Emerg Med*. 2001;8:84-89. doi:10.1615/JEnvironPatholToxicolOncol.v29.i4.20
4. Bodiwala GG. Emergency Medicine: A global specialty. *EMA - Emerg Med Australas*. 2007;19(4):287-288. doi:10.1111/j.1742-6723.2007.00989.x
5. Totten V, Bellou A. Development of emergency medicine in Europe. *Acad Emerg Med*. 2013;20(5):514-521. doi:10.1111/acem.12126
6. Belcher P, Busse R, Figueras J, et al. Providing emergency medical care. *Eur Obs Heal Syst Policies*. 2015;21(4). <http://www.healthobservatory.eu>
7. *Emergency Medical Services Systems in the European Union*.; 2008. <http://www.euro.who.int/en/health-topics/emergencies/disaster-preparedness-and-response/publications/2009/emergency-medical-services-systems-in-the-european-union>
8. Al-Shaqsi S. Models of International Emergency Medical Service (EMS) Systems. *Oman Med J*. 2010;25(4):320-323. doi:10.5001/omj.2010.92
9. Thomas TL. Developing and Implementing Emergency Medicine Programs Globally. *Emerg Med Clin North Am*. 2005;23:177-197. doi:10.1016/j.emc.2004.09.005
10. Page C, Sbat M, Vazquez K, Yalcin Deniz Z. Analysis of Emergency Medical Systems across the World. Published online 2013. <https://web.wpi.edu/Pubs/E-project/Available/E-project-042413-092332/unrestricted/MQFIQP2809.pdf>
11. Sakr M. Casualty, accident and emergency, or emergency medicine, the evolution. *Emerg Med J*. 2000;17(5):314-319. doi:10.1136/emj.17.5.314
12. Wyatt JP. Restructuring our workforce. *Emerg Med J*. 2004;21:526. doi:10.1136/emj.2003.011791
13. Williams DJ. Brief history of the specialty of emergency medicine. *Emerg Med J*. Published online 2017:1-3. doi:10.1136/emermed-2017-207257
14. Rosen P. The biology of emergency medicine. *J Am Coll Emerg Physicians*. 1979;8(7):280-283. doi:10.1016/S0361-1124(79)80226-9
15. IFEM. About Us|IFEM. Accessed February 11, 2019. <https://www.ifem.cc/about-us/>
16. Edlich RF. The Evolution of Emergency Medicine. *J Environ Pathol Toxicol Oncol*. 2010;29(4):271-291.
17. Suter RE. Emergency medicine in the United States: a systemic review. *World J Emerg Med*. 2012;3(1):5. doi:10.5847/wjem.j.issn.1920-8642.2012.01.001
18. Suter RE. Vietnam — The Next Chapter in the Global. *Acad Emerg Med*. 2011;18:31-35. doi:10.1111/j.1553-2712.2011.01046.x
19. Rainer TH. Emergency medicine-the specialty. *Hong Kong Med J*. 2000;6(3):269-275.
20. RCEM. Curriculum and Assessment Systems for Training in Emergency Medicine. 2015;(August).



21. Robertis E De, Bottiger BW, Søreide E, et al. The monopolisation of emergency medicine in Europe : the flipside of the medal. *Eur J Anaesthesiol*. 2017;34:251-253. doi:10.1097/EJA.0000000000000599
22. Machado HS, Nunes C, Marques A, et al. Ten Years of Activity at a Portuguese University Hospital Emergency Department: A Retrospective Observational Study. *Gen Med Open Access*. 2018;06(01):1-11. doi:10.4172/2327-5146.1000309
23. Busca P, Cancio M, Ventura I. Analysis of the characteristics of interconsultations performed by emergency physicians to other hospital specialists and their evolution over time. *Eur J Emerg Med*. 2014;21:341-348. doi:10.1097/MEJ.0000000000000090
24. Hartel C, Brown R, Prosen G, Dryver E. EUROPEAN CORE CURRICULUM FOR EMERGENCY MEDICINE. 2012;(March):2011-2014.
25. Nemeth J, Piko K. Emergency Medicine in Eastern Europe: The Hungarian Experience. *Ann Emerg Med*. 2001;37(April):399-401. doi:10.1067/mem.2001.114092
26. Fleischmann T, Fulde G. Emergency medicine in modern Europe. *Emerg Med Australas*. 2007;19(4):300-302. doi:10.1111/j.1742-6723.2007.00991.x
27. Arnold JL, Song HS, Chung JM. The Recent Development of Emergency Medicine in South Korea. *Ann Emerg Med*. 1998;(December):0-5.
28. Linhao M, Forsyth DR, Zhaofen L. A Chinese doctor's experience of acute medicine in England. *Clin Med (Northfield Il)*. 2010;10(5):480-483.
29. Alagappan K. History of the Development of International Emergency Medicine. *Emerg Med Clin og North Am*. 2005;23:1-10. doi:10.1016/j.emc.2004.09.013
30. Sakles JC, Deacon JM, Bair AE, Keim SM, Panacek EA. Delayed complications of emergency airway management: a study of 533 emergency department intubations. *West J Emerg Med*. 2008;9(4):190-194.
31. Wong E, Ng Y-Y. The difficult airway in the emergency department. *Int J Emerg Med*. 2008;1(2):107-111. doi:10.1007/s12245-008-0030-6
32. Omert L, Yeaney W, Mizikowski S, Protetch J. Role of the Emergency Medicine Physician in Airway Management of the Trauma Patient. *Clin Intensive Care*. 2011;51:1065-1068.
33. Bushra JS, McNeil B, Wald DA, Schwell A, Karras DJ. A Comparison of Trauma Intubations Managed by Anesthesiologists and Emergency Physicians. *Acad Emerg Med*. 2004;11(1):66-70. doi:10.1197/j.aem.2003.08.013
34. Levitan RM, Rosenblatt B, Meiner EM, Reilly PM, Hollander JE. Alternating Day Emergency Medicine and Anesthesia Resident Responsibility for Management of the Trauma Airway: A Study of Laryngoscopy Performance and Intubation Success. *Ann Emerg Med*. 2004;43(1):48-53. doi:10.1016/S0196-0644(03)00638-3
35. Komasa N, Sanuki T, Haba M, Igarashi H, Mizumoto K, Minami T. Comparison of emergency physician and anesthesiologist attitudes toward difficult airway management. *Am J Emerg Med*. Published online 2016:1-2. doi:10.1016/j.ajem.2016.01.042
36. Owolabi DK, Rowland R, King L, et al. A comparison of ED and direct admission care of cancer patients with febrile neutropenia. *Am J Emerg Med*. 2015;33(7):966-969. doi:10.1016/j.ajem.2015.04.028
37. Birkhahn RH, Gaeta TJ, Tloczkowski J, et al. Emergency Medicine-Trained Physicians Are Proficient in the Insertion of Transvenous Pacemakers. *Ann Emerg Med*. 2004;43(4):469-474. doi:10.1016/j.annemergmed.2003.09.019

38. Leslie CL, Cushman M, McDonald GS, Joshi W, Maynard AM. Management of multiple burn casualties in a high volume ED without a verified burn unit. *Am J Emerg Med*. 2001;19(6):469-473. doi:10.1053/ajem.2001.27147
39. Liu CC, Lu CL, Yen DHT, Chern CH, Wang LM, Lee CH. Diagnosis of appendicitis in the ED: Comparison of surgical and nonsurgical residents. *Am J Emerg Med*. 2001;19(2):109-112. doi:10.1053/ajem.2001.20006
40. Denizbasi A, Unluer EE. The role of the emergency medicine resident using the alvarado score in the diagnosis of acute appendicitis compared with the general surgery resident. *Eur J Emerg Med*. 2003;10(4):296-301. doi:10.1097/00063110-200312000-00011
41. Hohl CM, Robitaille C, Lord V, et al. Emergency physician recognition of adverse drug-related events in elder patients presenting to an emergency department. *Acad Emerg Med*. 2005;12(3):197-205. doi:10.1197/j.aem.2004.08.056
42. Germann CA, Geyer DA, Perron AD. Closed reduction of prosthetic hip dislocation by emergency physicians. *Am J Emerg Med*. 2005;23(6):800-805. doi:10.1016/j.ajem.2005.03.002
43. Michael GE, O'Connor RE. The importance of emergency medicine in organ donation: Successful donation is more likely when potential donors are referred from the emergency department. *Acad Emerg Med*. 2009;16(9):850-858. doi:10.1111/j.1553-2712.2009.00472.x
44. Swanson RC, Soto MRN, Villafuerte GA. EMERGENCY MEDICINE IN PERU. *J Emerg Med*. 2005;29(3):353-356. doi:10.1016/j.jemermed.2005.02.013
45. Medicine ESFE. European Core Curriculum. 2017;(APRIL).
46. Tayal VS, Graf CD, Gibbs MA. Prospective Study of Accuracy and Outcome of Emergency Ultrasound for Abdominal Aortic Aneurysm over Two Years. *Acad Emerg Med*. 2003;10(8):867-871. doi:10.1111/j.1553-2712.2003.tb00630.x
47. Dent B, Kendall RJ, Boyle AA, Atkinson PRT. Emergency ultrasound of the abdominal aorta by UK emergency physicians: A prospective cohort study. *Emerg Med J*. 2007;24(8):547-549. doi:10.1136/emj.2007.048405
48. Kuhn M, Bonnin RLL, Davey MJ, Rowland JL, Langlois SLP. Emergency department ultrasound scanning for abdominal aortic aneurysm: Accessible, accurate, and advantageous. *Ann Emerg Med*. 2000;36(3):219-223. doi:10.1067/mem.2000.108616
49. Summers SM, Scruggs W, Menchine MD, et al. A prospective evaluation of emergency department bedside ultrasonography for the detection of acute cholecystitis. *Ann Emerg Med*. 2010;56(2):114-122. doi:10.1016/j.annemergmed.2010.01.014
50. Kendall JL, Shimp RJ. Performance and Interpretation of Focused Right Upper Quadrant Ultrasound By Emergency Physicians. *J Emerg Med*. 2001;21(1):7-13.
51. Scruggs W, Fox JC, Potts B, et al. Accuracy of ED Bedside Ultrasound for Identification of gallstones: retrospective analysis of 575 studies. *West J Emerg Med*. 2008;9(1):1-5. <http://www.ncbi.nlm.nih.gov/pubmed/19561694><http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC2672232>
52. Jang T, Docherty M, Aubin C, Polites G. Resident-performed Compression Ultrasonography for the Detection of Proximal Deep Vein Thrombosis: Fast and Accurate. *Acad Emerg Med*. 2004;11(3):319-322. doi:10.1197/j.aem.2003.09.020
53. Jacoby J, Cesta M, Axelband J, Melanson S, Heller M, Reed J. Can emergency medicine

- residents detect acute deep venous thrombosis with a limited, two-site ultrasound examination? *J Emerg Med.* 2007;32(2):197-200. doi:10.1016/j.jemermed.2006.06.008
54. Blaivas M, Lambert MJ, Hardwood RA, Wood JP, Konicki J. Lower-extremity Doppler for Deep Venous Thrombosis—Can Emergency Physicians Be Accurate and Fast? *Acad Emerg Med.* 2000;7:120-126.
  55. Kline JA, O'Malley PM, Tayal VS, Snead GR, Mitchell AM. Emergency Clinician-Performed Compression Ultrasonography for Deep Venous Thrombosis of the Lower Extremity. *Ann Emerg Med.* 2008;52(4):437-445. doi:10.1016/j.annemergmed.2008.05.023
  56. Gaspari RJ, Horst K. Emergency ultrasound and urinalysis in the evaluation of flank pain. *Acad Emerg Med.* 2005;12(12):1180-1184. doi:10.1197/j.aem.2005.06.023
  57. Holdgate A, Chan T. How Accurate Are Emergency Clinicians at Interpreting Noncontrast Computed Tomography for Suspected Renal Colic? *Acad Emerg Med.* 2003;10(4):315-319. doi:10.1111/j.1553-2712.2003.tb01342.x
  58. Rodgers JD, Heegaard WG, Plummer D, Hicks J, Clinton J, Sterner S. Emergency department right upper quadrant ultrasound is associated with a reduced time to diagnosis and treatment of ruptured ectopic pregnancies. *Acad Emerg Med.* 2001;8(4):331-336. doi:10.1111/j.1553-2712.2001.tb02110.x
  59. Ünlüer EE, Yavaş Ö, Eroğlu O, Yılmaz C, Akarca FK. Ultrasonography by emergency medicine and radiology residents for the diagnosis of small bowel obstruction. *Eur J Emerg Med.* 2010;17(5):260-264. doi:10.1097/MEJ.0b013e328336c736
  60. Blaivas M, Sierzenski P, Lambert M. Emergency evaluation of patients presenting with acute scrotum using bedside ultrasonography. *Acad Emerg Med.* 2001;8(1):90-93. doi:10.1111/j.1553-2712.2001.tb00563.x
  61. Bailey C, Carnell J, Vahidnia F, et al. Accuracy of emergency physicians using ultrasound measurement of crown-rump length to estimate gestational age in pregnant females. *Am J Emerg Med.* 2012;30(8):1627-1629. doi:10.1016/j.ajem.2011.12.002
  62. Knaut AL, Kendall JL, Patten R, Ray C. Ultrasonographic measurement of aortic diameter by emergency physicians approximates results obtained by computed tomography. *J Emerg Med.* 2005;28(2):119-126. doi:10.1016/j.jemermed.2004.07.013
  63. Tsui CL, Fung HT, Chung KL, Kam CW. Focused abdominal sonography for trauma in the emergency department for blunt abdominal trauma. *Int J Emerg Med.* 2008;1(3):183-187. doi:10.1007/s12245-008-0050-2
  64. Moore CL, Rose GA, Tayal VS, Sullivan M, Arrowood JA, Kline JA. Determination of Left Ventricular Function by Emergency Physician Echocardiography of Hypotensive Patients. *Acad Emerg Med.* 2002;9(3):186-193. doi:10.1111/j.1553-2712.2011.01196.x
  65. Al-Reesi A, Stiell IG, Al-Zadjali N, Cwinn AA. Comparison of CT head interpretation between emergency physicians and neuroradiologists. *Eur J Emerg Med.* 2010;17(5):280-282. doi:10.1097/MEJ.0b013e32833483ed
  66. Trzeciak S, Erickson T, Bunney EB, Sloan EP. Variation in patient management based on ECG interpretation by emergency medicine and internal medicine residents. *Am J Emerg Med.* 2002;20(3):188-195. doi:10.1053/ajem.2002.32628
  67. Brady WJ, Perron AD, Chan T. Electrocardiographic ST-segment elevation: Correct identification of acute myocardial infarction (AMI) and non-AMI syndromes by emergency physicians. *Acad Emerg Med.* 2001;8(4):349-360.

68. Zink BJ. The Biology of Emergency Medicine: What Have 30 Years Meant for Rosen's Original Concepts? *Acad Emerg Med*. 2011;18:301-304. doi:10.1111/j.1553-2712.2011.01011.x
69. Cameron PA. International emergency medicine: Past and future. *Emerg Med Australas*. 2014;26(1):50-55. doi:10.1111/1742-6723.12181
70. Stroobants J, Arafat R, Leach R, et al. Cooperation in emergency medicine in Europe: the bright side of the medal. *Eur J Emerg Med*. 2018;25:1-2. doi:10.1097/MEJ.0000000000000521
71. Antman EM. The Specialty of Emergency Medicine : Needed Now More Than Ever Before. *Ann Emerg Med*. Published online 2008:317-319. doi:10.1016/j.annemergmed.2008.07.025
72. Peralta PG, Sinon JB. Emergency Medicine in the Philippines. *Ann Emerg Med*. 1995;26(December):743-745.
73. Drummond A. Is this really the right time for an identity crisis? *Can J Emerg Med*. 2008;10(4):321-322.
74. De Robertis E, Tomins P, Knape H. Anaesthesiologists in emergency medicine: The desirable manpower. *Eur J Anaesthesiol*. 2010;27(3):223-225. doi:10.1097/EJA.0b013e32832d3d66
75. Topol EJ. Cardiology and Emergency Medicine: United We Stand, Divided We Fall. *Ann Emerg Med*. 2002;39(2):164-167. doi:10.1067/mem.2002.121469
76. Ting J. Collaborative research between emergency medicine and physicians. *Intern Med J*. 2018;48(4):379-381. doi:10.1111/imj.13749
77. Kraft PL, Newman S, Hanson D, Anderson W, Bastani A. Emergency Physician Discretion to Activate the Cardiac Catheterization Team Decreases Door-to-Balloon Time for Acute ST-Elevation Myocardial Infarction. *Ann Emerg Med*. 2007;50(5):520-526. doi:10.1016/j.annemergmed.2007.03.013
78. Singer AJ, Shembekar A, Visram F, et al. Emergency Department Activation of an Interventional Cardiology Team Reduces Door-to-Balloon Times in ST-Segment-Elevation Myocardial Infarction. *Ann Emerg Med*. 2007;50(5):538-544. doi:10.1016/j.annemergmed.2007.06.480
79. Council of the European Society for Emergency. Manifesto for Emergency Medicine in Europe. *Eur J Emerg Med*. 1998;5(4):389-390.
80. Winter R. Acute medical emergencies: the physician's role. *Hosp Med*. 2001;62(1). doi:194.066.072.104 on
81. Morris SC. Emergency medicine and global health policy: history and next steps. *J Glob Health*. 2016;6(2):1-4. doi:10.7189/jogh.06.020304
82. Rotenstein LS, Torre M, Ramos MA, et al. Prevalence of burnout among physicians. A systematic review. *J Am Med Assoc*. 2018;320(11):1131-1150. doi:10.1001/jama.2018.12777
83. Bragard I, Dupuis G, Fleet R. Quality of work life , burnout , and stress in emergency department physicians : a qualitative review. *Eur J Emerg Med* 2015. 2015;(22):227-234. doi:10.1097/MEJ.0000000000000194
84. Shanafelt TD, Boone S, Tan L, et al. Burnout and satisfaction with work-life balance among US physicians relative to the general US population. *Arch Intern Med*. 2012;172(18):1377-1385. doi:10.1001/archinternmed.2012.3199

85. Pek JH, Lim SH, Ho HF, et al. Emergency medicine as a specialty in Asia. *Acute Med Surg*. 2016;3(2):65-73. doi:10.1002/ams2.154
86. Lee YK, Lee CC, Chen CC, Wong CH, Su YC. High risk of “failure” among emergency physicians compared with other specialists: A nationwide cohort study. *Emerg Med J*. 2013;30(8):620-622. doi:10.1136/emered-2012-201440
87. Tabrizi S, Nejati A, Nedjat S, Aghili SM. Specialist Physicians’ Attitude towards Emergency Medicine; a Semi-Structured Qualitative Study. *Emergency*. 2018;6(1):1-5.
88. Philippon A, Nguyen A, Raynal P, et al. Weaker compressions after night shift ? The WeCAN manikin study. *Emerg Med J*. Published online 2016:65-67. doi:10.1097/MEJ.0000000000000284
89. Charbonneau V, Kwok E, Boyle L, Stiell IG. Impact of emergency department surge and end of shift on patient workup and treatment prior to referral to internal medicine: a health records review. *Emerg Med J*. 2018;35(5):309-315. doi:10.1136/emered-2017-207149
90. Graham CA. Emergency physicians under pressure – are we sustainable? *Eur J Emerg Med*. 2014;21:245. doi:10.1097/MEJ.0000000000000177
91. Madsen M, Kiuru S, Castrèn M, Kurland L. The level of evidence for emergency department performance indicators : systematic review. *Eur J Emerg Med*. 2015;22:298-305. doi:10.1097/MEJ.0000000000000279
92. To A, Care M. Emergency Medicine in Bosnia and Herzegovina. *Ann Emerg Med*. 1997;30:527-530.
93. HOPE. *Emergency Care : A HOPE Survey.*; 2015. [http://www.hope.be/05eventsandpublications/docpublications/101\\_emergency\\_care/101\\_HOPE\\_Emergency\\_care\\_October\\_2015.pdf](http://www.hope.be/05eventsandpublications/docpublications/101_emergency_care/101_HOPE_Emergency_care_October_2015.pdf)
94. Hashemi B, Baratloo A, Rahmati F, Forouzanfar MM, Motamedi M, Safari S. Emergency Department Performance Indexes Before and After Establishment of Emergency Medicine. *Emergency*. 2013;1(1):20-23. doi:10.22037/emergency.v1i1.5343
95. CAEP, ACMU. THE CANADIAN ASSOCIATION OF EMERGENCY PHYSICIANS CALLS FOR COMPLETE ED DATA REPORTING AND ACCOUNTABILITY FROM HEALTH REGIONS. Published online 2017:3343.
96. American College of Emergency Physicians. *The Role and Value of Emergency Medicine - An Information Paper.*; 2017. [https://www.acep.org/globalassets/uploads/uploaded-files/acep/clinical-and-practice-management/resources/administration/empc\\_vemp\\_0430\\_0117.pdf](https://www.acep.org/globalassets/uploads/uploaded-files/acep/clinical-and-practice-management/resources/administration/empc_vemp_0430_0117.pdf)
97. Koenig BO, Ross MA, Jackson RE. An emergency department observation unit protocol for acute-onset atrial fibrillation is feasible. *Ann Emerg Med*. 2002;39(4):374-381. doi:10.1067/mem.2002.122785
98. Decker WW, Smars PA, Vaidyanathan L, et al. A Prospective, Randomized Trial of an Emergency Department Observation Unit for Acute Onset Atrial Fibrillation. *Ann Emerg Med*. 2008;52(4):322-328. doi:10.1016/j.annemergmed.2007.12.015
99. Ramos P, Paiva JA. Dedication increases productivity: an analysis of the implementation of a dedicated medical team in the emergency department. *Int J Emerg Med*. 2017;10(1). doi:10.1186/s12245-017-0136-9
100. Sasson C, Wiler JL, Haukoos JS, et al. The changing landscape of America’s health care system and the value of emergency medicine. *Acad Emerg Med*. 2012;19(10):1204-

1211. doi:10.1111/j.1553-2712.2012.1446.x
101. Buck DL, Osterland T, Schmidt TA, Rasmussen SW. Quality assessment of an Emergency Department. *Scand J Trauma Resusc Emerg Med*. 2012;19(2):2012. doi:10.1186/1757-7241-19-S2-P42
  102. Arnold JL, Dickinson G, Tsai MC, Han D. A survey of emergency medicine in 36 countries. *Can J Emerg Med*. 2001;3(2):109-118. doi:10.1017/S1481803500005340
  103. Hallas P, Folkestad L, Pedersen DB, Brabrand M. How many years does it take to establish a specialty in emergency medicine? *Scand J Trauma Resusc Emerg Med*. 2015;23(1):7241. doi:10.1186/1757-7241-23-S1-A50
  104. Turkey IS. Countries Recognize Emergency Medicine as a Specialty. International Emergency Medicine Education Project. Accessed January 12, 2019. <https://iem-student.org/2019/05/13/countries-recognize-emergency-medicine/>
  105. Razzak JA, Kellermann AL. Emergency medical care in developing countries: Is it worthwhile? *Bull World Health Organ*. 2002;80(11):900-905. doi:10.1590/S0042-96862002001100011
  106. Handel DA, Hedges JR. Improving Rural Access to Emergency Physicians. *Acad Emerg Med*. 2007;14(6):562-565. doi:10.1197/j.aem.2007.02.025
  107. Reid C, Habig K, Hsu R, Coombes S. Emergency medicine in South Africa – time to catch up. *South African Med J*. 2012;102(11):836. doi:10.7196/SAMJ.5913
  108. Ciotto GR. *Introduction to Disaster Medicine*. 2nd ed. Elsevier Inc.; 2016. doi:10.1016/B978-0-323-28665-7.00001-7
  109. Definition of Emergency Medicine. *Ann Emerg Med*. 2016;68(1):142-143. doi:10.1016/j.annemergmed.2016.04.040
  110. Taylor SF, Gerhardt RT, Simpson MP. An association between Emergency Medicine residencies and improved trauma patient outcome. *J Emerg Med*. 2005;29(2):123-127. doi:10.1016/j.jemermed.2005.01.014
  111. Semplicini A, Benetton V, Macchini L, et al. Intravenous thrombolysis in the emergency department for the treatment of acute ischaemic stroke. *Emerg Med J*. 2008;25(7):403-406. doi:10.1136/emj.2007.053033
  112. Nguyen HB, Rivers EP, Havstad S, et al. Critical Care in the Emergency Department: A Physiologic Assessment and Outcome Evaluation. *Acad Emerg Med*. 2000;7:1354-1361.
  113. Hirshon JM, Morris DM. Emergency Medicine and the Health of the Public: The Critical Role of Emergency Departments in US Public Health. *Emerg Med Clin North Am*. 2006;24:815-819. doi:10.1016/j.emc.2006.06.012
  114. Krasnoff M, Moscati R. Domestic violence screening and referral can be effective. *Ann Emerg Med*. 2002;40(5):485-492. doi:10.1067/mem.2002.128872
  115. James TL, Aschkenasy M, Eliseo LJ, Olshaker J, Mehta SD. Response to Hepatitis A Epidemic: Emergency Department Collaboration with Public Health Commission. *J Emerg Med*. 2009;36(4):412-416. doi:10.1016/j.jemermed.2007.10.001
  116. Coates WC, Yarris LM, Clarke SO, et al. Research Pioneers in Emergency Medicine—Reflections on Their Paths to Success and Advice to Aspiring Researchers: A Qualitative Study. *Ann Emerg Med*. 2019;73(6):555-564. doi:10.1016/j.annemergmed.2018.10.033
  117. Yates DW, Gray AJ. Emergency medicine research: How far have we come and where are we heading? *Emerg Med J*. 2018;35(3):149-151. doi:10.1136/emj-2017-

118. Langhan TS. Emergency medicine certification in Canada. *CJEM*. 2008;10(4):322-323.
119. Sawe HR, Akomeah A, Mfinanga JA, Runyon MS, Noste E. Emergency medicine residency training in Africa: overview of curriculum. *BMC Med Educ*. 2019;19(1):294. doi:10.1186/s12909-019-1729-1
120. Brichko L, Forbes J, Humphrey K. Evidence-based medicine: The significance of research literacy in emergency medicine training. *Emerg Med Australas*. Published online 2017. doi:10.1111/1742-6723.12889
121. Thomas T. Can Academic Emergency Medicine Influence the Growth of Emergency Medicine Globally? *Soc Acad Emergmed*. Published online 2007:449-450. doi:10.1197/j.aem.2007.03.1345
122. Wiler JL, Beck D, Asplin BR, et al. Episodes of Care : Is Emergency Medicine Ready ? *Ann Emerg Med*. 2012;59(5):351-357. doi:10.1016/j.annemergmed.2011.08.020
123. Sauter TC, Hautz WE, Hostettler S, et al. Interprofessional and interdisciplinary simulation-based training leads to safe sedation procedures in the emergency department. *Scand J Trauma Resusc Emerg Med*. Published online 2016:1-8. doi:10.1186/s13049-016-0291-7
124. Weiner SG, Ban KM, Sanchez LD, et al. A comparison between the efficacy of lectures given by emergency and non-emergency physicians in an international emergency medicine educational intervention. *Intern Emerg Med*. 2006;1(1):67-71. doi:10.1007/BF02934725
125. Chew M, Wilhelms D, Sjo F. Emergency medicine is about collaboration, not monopolisation. *Eur J Anaesthesiol*. 2018;35:231-232. doi:10.1097/EJA.0000000000000755
126. Li Y, Guo S, Xu S. Emergency medicine in China: current situation and its future development. *Am J Emerg Med*. 2012;30:2075-2077. doi:10.1016/j.ajem.2012.07.011
127. Schilling UM. Cost awareness among Swedish physicians working at the emergency department. *Eur J Emerg Med*. 2009;16(3):131-134. doi:10.1097/MEJ.0b013e32831cf605
128. Graham CA. Emergency medicine : this is what we do. *Eur J Emerg Med*. 2016;23:1. doi:10.1097/MEJ.0000000000000363

TABLES

Table 1 - PRISMA 2009 Flow Diagramo of Methods and Matherials

