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The role of physician-staffed ambulances: the outcome of a pilot study

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ABSTRACT

Objective: To evaluate the outcome of physician-staffed ambulances in a pilot study.**Methods:** All physician-staffed ambulance missions conducted in Gothenburg, Sweden, in 2013 were retrospectively reviewed and evaluated for the type of missions and the need of a physician.**Results:** Out of 1381 physician-staffed missions, 511 were cancelled or managed by telephone. Around 239 (17%) missions required active intervention, of which only one was considered directly life-saving.**Conclusions:** Most of the missions neither required the interventional skills of a physician, nor could they be performed at distance. However, the added medical value of physicians was found to be in other prehospital situations, such as critical decision-making, staff education and research.

1. Introduction

The use of physician-staffed ambulances differs greatly in different countries. Several Swedish county councils and regions have established physician-staffed ambulances to bring higher medical competence closer to the patients in order to improve the outcome of emergencies. Physicians, often specialized in anaesthesia and intensive care, accompany an ambulance or an emergency vehicle and are dispatched to cases that are anticipated to be in need of a physician's evaluation. However, due to unmeasurable outcomes, this type of service has been ceased in some areas and instead phone assisted medical support by a physician has been offered^[1,2].

According to the Swedish Department of Healthcare and Welfare (SOSFS 2009:10), there should be at least one licensed health care staff in each ambulance. Therefore, in Sweden, ambulances have generally been staffed with nurses specialized in prehospital care and physicians have been mainly used in helicopters and a few specialized ambulances^[3-5]. Other countries use "paramedics", who have a shorter, more focused and specialized education^[6]. Both categories have a limited competency compared to a

physician, with nurses having a wider medical knowledge than paramedics^[7,8]. Unfortunately, due to national differences (organizational, economical and geographical), it is difficult to compare these various systems. Few studies have evaluated the medical benefit of physicians, *vs.* other prehospital staff, in pre-hospital setting and in existing literature the focus has mainly been on helicopter ambulances, major trauma^[9,10], cardiac arrest^[11-13] and prehospital intubation^[14].

There are also few studies comparing basic life support (BLS) with advanced life support (ALS). In the former healthcare staffs are not qualified or authorized to intervene medically and follow the code of "scoop and run", while in ALS, staffs have some qualifications to "stay and play". Surprisingly, besides older reviews and some published expert opinions^[15-18], there is not enough scientific evidence to support ALS code in prehospital trauma^[15-24], cardiac and respiratory conditions^[25-32]. Consequently, the need for higher competence than BLS in these cases has been questioned.

There are near one million inhabitants in greater Gothenburg, which is the second largest city in Sweden. It has six hospitals of which 4 have emergency departments. There are over 40 ambulances running 24/7. A fully equipped medical ambulance established in 2008 and initially staffed with a nurse, specialized in prehospital care or anesthesiology, has recently been staffed by both

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a physician and a nurse to run weekdays (08:00 to 18:00). The unit is to be dispatched based on a priority scale; Priority 1 (very urgent), Priority 2 (urgent, high priority), Priority 3 (transport, non-urgent) and Priority 4 (non-medical treatment/care)^[33]. It was tasked to a) offer qualified evaluation of patients with complicated and ambiguous clinical presentation and involved physicians were supposed, b) to take part in staff education, c) developing projects and d) follow up of severe cases. Compared to ordinary ambulances that focus on potentially life-threatening cases, this unit was supposed to be sent to patients with clear life-threatening conditions (limited cases) after solid call criteria. The initial alerting criteria have been modified during the years, but yet been focused on critical cases or injuries (Table 1).

Table 1

Dispatching criteria for physician-staffed ambulances.

Dispatching criteria
Severe allergic reaction
Severe dyspnoea and suspected foreign body
Severe burn in child < 12 years
Drowning
Diving accident
Unconscious patient without breathing
Ongoing or ended delivery with ill baby
High energy trauma, fall > 3 m, entrapment
Trauma, suspected severe head, abdominal, thoracic or pelvic injuries
Trauma, penetrating head, neck, thorax or pelvis
Severe trauma or disease in children < 12 years
If – other ambulances request a physician
Prehospital command and control in complicated or long-lasting incidents (Telephone consultation)

The aim of this study was to scientifically evaluate the outcome of this unit's medical mission during a one year

period (2013).

2. Materials and methods

All ambulance missions conducted in the Region Västra Götaland are recorded in a registry "AmbuLink" (Web 3.0) [33]. This registry shows particular statistics on missions: time, addresses, personal data, given treatment and responsible unit/hospital^[34]. All missions conducted by "the physician-staffed ambulance" were studied between January 1st 2013 and December 31st 2013. All data were retrospectively retrieved, accumulated, reviewed and analyzed by the first author. The focus has been on patients who have been left in place or been treated at home. Other information accumulated for analysis were age, gender, cause of contact, priority set on dispatching and triage on arrival at the scene by ambulance crews. Data have also been accumulated for patients, in whom a physician's presence could be anticipated to be of more value, such as airway block, cardiac arrest, major trauma and unconscious/seriously ill child (<18 years). All assignments for other ambulances in the same period have also been analyzed. The data from both groups were matched according to age, gender, and priority setting at dispatching.

Relevant literature search was conducted using available libraries at the Sahlgrenska University Hospital and all electronically accessible journals, PubMed and Google Scholar. Following keywords: "emergency medical technician", "emergency physician", "prehospital physician", "ground-based ambulances", "ambulances with and without physicians", were used. All journals published after 2000 in English or Scandinavian languages

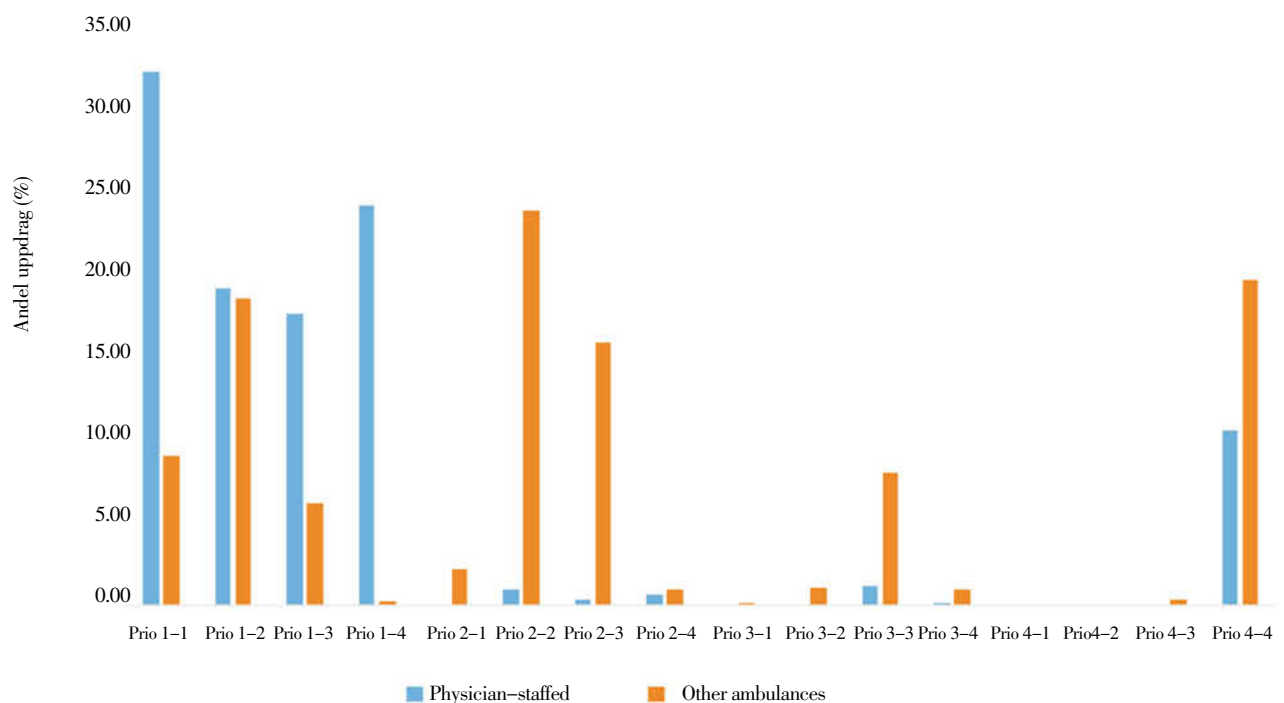


Figure 1. The priorities made at dispatch center vs. on site by ambulance crew.

were reviewed by first author. Papers dealing with physician-staffed helicopters and those with no comparison between staff categories were excluded.

3. Results

There were 1381 registered missions for the physician-staffed ambulance (A) vs. 83696 for ambulances staffed with nurses (B). There were 52% men (48% women) in Group A vs. 46% (54% women) in Group B, respectively. The average age of patients in Group A was 45.6 years (men 45, women 47) with median age of 52 years, vs. 62.8 years (men 61, women 64.5) with median 76 years in Group B. Priority pattern at dispatching differed considerably between the two groups (Figure 1) with higher priority in Group A. In the physician-staffed ambulance (Group A), priority 4 missions were phone consultations, automatically encoded as a low priority (Table 1).

A large proportion of the total number of physician-staffed missions was assistance to other ambulances, followed by cancelled missions. The latter includes cases in which the first ambulance on site declared no need for a physician. Few patients were transported between hospitals. No calls/missions have been excluded in the review, with the exception of cases with incomplete data. In 140 calls/missions, the victims were children (<18 years). However, only 14 cases were proven to be in need of a physician. All 14 cases were transported to the hospital with medical attendance. Twenty-four patients could be left at home with or without treatment (Table 2).

Table 2
Various types of alarms for physician-staffed ambulances.

Alarms	Number	Percentage (%)
Total number of alarms	1381	100.00
Assisting other ambulances	511	37.00
Cancelled missions	329	23.82
To emergency department	132	9.56
Telephone consultations	120	8.69
Treatment on the scene –	111	8.04
Traffic accident (command and control)	81	5.87
Missions without patients	62	4.49
Treatment and delivery	24	1.74
Fire alarm	5	0.36
Patient transfer	5	0.36
Patient not available	1	0.07

In around 14% of cases physicians were consulted to make a decision to leave a patient at home, or to decide an out of guideline treatment such as advanced treatment at home for a cancer patient or a child and decision to stop cardiac resuscitation. Other situations were rather administrative conditions, which were basically not emergencies or could have been done from a remote place *e.g.* death confirmation/certification (Table 3). Literature review gave 201 hits, of which 34 relevant studies were chosen by first author (see method for exclusion criteria).

Table 3

Actions/measures performed by physician-staffed ambulances.

Measures	Number	Percentage (%)
Total number of actions/measures	239	100.00
Left at home/scene/other reasons	54	22.59
Declaration of death	42	17.57
Other treatment (medication, assessment)	40	16.74
Resuscitation termination	26	10.88
Other intubation (intoxication, trauma, severe dyspnoea)	22	9.21
Cardiac arrest (intubation + CPR)	21	8.79
Compulsory psychiatric care assessment	12	5.02
Advanced pain treatment	9	3.77
Telephone consultation	7	2.93
Palliative care at home	4	1.67
Command and control in major incidents	1	0.42
Direct life-saving measures (extraction of foreign body)	1	0.42

4. Discussion

The purpose of this study was to scientifically evaluate the outcome of the physician's staffed ambulances during a one-year period in prehospital environment in Gothenburg, Sweden, including dispatching criteria utilized by dispatching center.

The main goal with a physician-staffed ambulance was to bring high competence closer to the patients and prevent unnecessary transportation to hospital. One such situation in which high experience and interventional ability of a physician may be needed is airway block^[34–37]. In 23 cases of airway block (cardiac arrest excluded) in this study, only one was in need of life-saving intervention by a physician. In other cases, airways could be managed by specialist nurses^[8]. In cardiac arrest, utilization of a laryngeal mask is a routine measure for all nurses and if needed *e.g.* laryngeal mask dysfunction, specialized nurses can also intubate a patient without involvement of any physician.

In this study, nearly 20% of cases with cardiac arrest were intubated^[34,35]. The decision of abandoning cardiovascular resuscitation has traditionally been given to physicians. However, having guidelines and the possibility of medical support in decision-making for nurses, the presence of a physician may not technically be necessary. However, a physician may be needed to facilitate such decision-making and indicate a more professional approach in front of the relatives^[13].

Several studies have failed to demonstrate any benefits with advanced medical intervention on scene in severe trauma cases^[36–46]. In this study we found severe traumas in few cases, both with and without head injuries. Some were declared dead on the scene and only one trauma patient was intubated (declared dead later in the emergency room). The outcome in this study is in accordance with earlier studies.

One group of patients, who may need a physician, are seriously ill children^[27,38–40]. In this study, several cases could be managed on the scene or left at home, with or

without treatment. The presence of a physician in these cases may not only reduce the anxiety of parents, but also facilitate advanced treatment, which normally is not given by nurses.

In this report, the physician-staffed ambulance was used to confirm death outside the hospital and/or conduct a psychiatric evaluation of persons in need of psychiatric care (23% of cases). Although these interventions are not emergencies and can be performed by other specialties (e.g. primary healthcare physicians), they may shorten patient's evaluation time and free available resources for other patients. In another word primary healthcare physicians who are already occupied with patients during day-time may continue working with their ordinary patients.

The results of this study shows that using the given criteria and under current circumstances in Sweden, interventional skills of a physician may not be needed in an emergency ambulance staffed with experienced and specialized nurses. However, their presence will facilitate decision-making in other areas such as ethical and strategic issues. Physicians' impact in educating other staffs, strategic and technical development and research has not been highlighted in this study, but is probably as important as their medical support in management of severe cases^[47,48]. In this perspective the criteria used for dispatching a physician-staffed ambulance in Gothenburg should be revised to increase physician availability to much larger patient cohorts. In such revision following questions may be dealt with: can an anesthesiologist be substituted with an emergency physician? Can new medical interventional strategies such as femoral nerve block for suspected hip fracture, advanced pain relief for various conditions and assessment of the thoracic and abdominal pain in young, statistically sound patients, be implemented?^[3,11,31,49]. Re-defining the tasks and aims and obtaining desired knowledge and resources would possibly be needed to redistribute patients from hospitals to primary care centers. New criteria may also facilitate less discrepancy in triage between that conducted by dispatch center through a telephone call and ambulance crews on scene and consequently result in less cancelled missions and better selection of patients^[33].

The financial aspects of a physician-staffed ambulance has not been analyzed in this study. However, evaluation of patients at scene, not only reduces the suffering of patients, but also prevents a long waiting time at the hospitals and consequent over-crowding of emergency departments. Direct lifesaving efforts are difficult to measure economically. The same applies to the supportive assistance of physicians on the scene and in administrative cases. More research is needed in this large but relatively unexplored area^[47,48].

One limitation of this study is the lack of the comparison between ordinary ambulances (around the clock) with physician-staffed ambulances (limited working time), since accident statistics can be suspected to be a little different at night while the incidence of many other diseases would be similar. Furthermore, there has not been any comparison between the two groups of ordinary and physician's staffed ambulances with regard to number of patients left at home. Finally, the search for literature in other languages than Scandinavian and English, was limited.

Conflict of interest statement

The authors report no conflict of interest.

References

- [1] Roudsari BS, Nathens AB, Cameron P, Civil I, Gruen RL, Koepsell TD, et al. International comparison of prehospital trauma care systems. *Injury* 2007; **38**: 993–1000.
- [2] Roudsari BS, Nathens AB, Arreola-Risa C, Cameron P, Civil L, Grigoriou G, et al. Emergency Medical Service (EMS) systems in developed and developing countries. *Injury* 2007; **38**: 1001–1013.
- [3] Krüger AJ, Skogvoll E, Castrén M, Kurola J, Lossius HM, The ScanDoc Phase 1a Study Group. Scandinavian pre-hospital physician-manned Emergency Medical Services—same concept across borders? *Resuscitation* 2010; **81**: 427–433.
- [4] Langhelle A, Lossius HM, Silfvast T, Björnsson HM, Lippert FK, Ersson A, et al. International EMS Systems: the Nordic countries. *Resuscitation* 2004; **61**: 9–21.
- [5] National Highway Traffic Safety Administration. National Emergency Medical Services Education Standards—Paramedic Instructional Guidelines. Washington, D.C.: National Highway Traffic Safety Administration. [Online] available from: <http://www.ems.gov/pdf/811077e.pdf> [Accessed on 17th January, 2015]
- [6] Timmermann A, Russo S, Hollman M. Paramedic versus emergency physician emergency medical service: role of the anesthesiologist and the European versus the Anglo-American concept. *Curr Opin Anesthesiol* 2008; **21**: 222–227.
- [7] Schuppen H, Bierens J. Understanding the prehospital physician controversy. Step 1: comparing competencies of ambulance nurses and prehospital physicians. *Eur J Emerg Med* 2011; **18**: 322–327.
- [8] Osterwalder J. Mortality of blunt polytrauma: a comparison between emergency physicians and emergency medical technicians—prospective cohort study at a level 1 hospital in Eastern Switzerland. *J Trauma* 2003; **55**: 355–361.
- [9] Bartolomeo S, Sanson G, Nardi G, Scian F, Michelutto V, Lattuada L. Effects of 2 patterns of prehospital care on the outcome of patients with severe head injury. *Arch Surg* 2001; **136**: 1293–1300.
- [10] Botker M, Bakke S, Christensen E. A systematic review of controlled studies: do physicians increase survival with prehospital treatment? *Scand J Trauma Resusc Emerg Med* 2009; **17**: 12.
- [11] Hagihara A, Hasegawa M, Abe T, Nagata T, Nabeshima Y. Physician presence in an ambulance car is associated with increased survival in out-of-hospital cardiac arrest: a prospective cohort analysis. *PLoS One* 2014; doi: 10.1371/journal.pone.0084424.
- [12] Estner H, Günzel C, Ndrepepa G, William F, Blaumeiser D, Rupprecht B, et al. Outcome after out-of-hospital cardiac arrest in a physician-staffed emergency medical system according to the Utstein style. *Am Heart J* 2007; **153**: 792–799.
- [13] Olasveengen T, Lund-Kordahl I, Steen P, Sunde K. Out-of-hospital advanced life support with or without a physician: effects on quality of CPR and outcome. *Resuscitation* 2009; **80**: 1248–1252.
- [14] Wirtz DD, Ortiz C, Newman DH, Zhitomirsky I. Unrecognized

- misplacement of endotracheal tubes by ground prehospital providers. *Prehosp Emerg Care* 2007; **11**: 213–218.
- [15] Lieberman M, Mulder D, Sampalis J. Advanced or basic life support for trauma: meta-analysis and critical review of the literature. *J Trauma* 2000; **49**: 584–599.
- [16] Lieberman M, Bahman S, Roudsari. Prehospital trauma care: what do we really know? *Curr Opin Crit Care* 2007; **13**: 691–696.
- [17] Lee A, Garner A, Fearnside M, Harrison K. Level of prehospital care and risk of mortality in patients with and without severe blunt head injury. *Injury* 2003; **34**: 815–819.
- [18] Seamon MJ, Fisher CA, Gaughan J, Lloyd M, Bradley KM, Santora TA. Prehospital procedures before emergency department thoracotomy: “scoop and run” saves lives. *J Trauma* 2007; **63**: 113–120.
- [19] Eckstein M, Chan L, Schneir A, Palmer R. Effect of prehospital advances life support on outcomes of major trauma patients. *J Trauma* 2000; **48**: 643–648.
- [20] Liberman M, Mulder D, Lavoie A, Denis R, Sampalis JS. Multicenter canadian study of prehospital trauma care. *Ann Surg* 2003; **237**: 153–160.
- [21] Stiell I, Nesbitt L, Pickett W, Munkley D, Spaite DW, Chim JB, et al. The OPALS Major Trauma Study: impact of advanced life-support on survival and morbidity. *CMAJ* 2008; **178**(9): 1141–1152.
- [22] Sethi DD, Kwan I, Kelly AM, Roberts IG, Bunn F. Advanced trauma life support training for ambulance crews. *Cochrane Database Syst Rev* 2001; doi: 10.1002/14651858.CD003109.pub2.
- [23] Aydin S, Overwater E, Saltzherr T, Jin P, van Exter P, Ponsen KJ, et al. The association of mobile medical team involvement on on-scene times and mortality in trauma patients. *J Trauma* 2010; **69**: 589–594.
- [24] Smith R, Conn A. Prehospital care—scoop and run or stay and play? *Injury* 2009; **40** Suppl 4: 23–26.
- [25] Ma M, Chiang W, Ko P, Huang J, Lin CH, Wang HC, et al. Outcomes from out-of-hospital cardiac arrest in Metropolitan Taipei: does an advanced life support service make a difference? *Resuscitation* 2007; **74**: 461–469.
- [26] Stiell I, Wells G, Field B, Spaite D, Nesbitt LP, De Maio VJ, et al. Advanced cardiac life support in out-of-hospital cardiac arrest. *N Engl J Med* 2004; **351**: 647–656.
- [27] Pitetti R, Glustein J, Bhende M. Prehospital care and outcome of pediatric out-of-hospital cardiac arrest. *Prehosp Emerg Care* 2002; **6**: 283–290.
- [28] Stiell I, Spaite D, Field B, Nesbitt L, Munkley D, Maloney J, et al. Advanced life support for out-of-hospital respiratory distress. *N Eng J Med* 2007; **356**: 2156–2164.
- [29] Ryyänänen OP, Lirola T, Reitala J, Pälve H, Malmivaara A. Is advanced life support better than basic life support in prehospital care? A systematic review. *Scand J Trauma Resusc Emerg Med* 2010; **18**: 62.
- [30] Isenberg D, Bisell R. Does advanced life support provide benefits to patients? A literature review. *Prehosp Disast Med* 2005; **20**(4): 265–270.
- [31] Christensen EF, Melchiorson H, Kilsmark J, Foldspang A, Sogaard J. Anesthesiologists in prehospital care make a difference to certain groups of patients. *Acta Anaesthesiol Scand* 2003; **47**: 146–152.
- [32] Lossius H, Soreide E, Hotvedt R, Hapnes S, Eielsen OV, Førde OH, et al. Prehospital advanced life support provided by specially trained physicians: is there a benefit in terms of life years gained? *Acta Anaesthesiol Scand* 2002; **46**: 771–778.
- [33] Khorram-Manesh A, Lennquist Montán K, Hedelin A, Kihlgren M, Örtengren P. Prehospital triage, discrepancy in priority-setting between emergency medical dispatch centre and ambulance crews. *Eur J Trauma Emerg Surg* 2010; **37**: 73–78.
- [34] Strote J, Roth R, Cone D. Prehospital endotracheal intubation: the controversy continues. *Am J Emerg Med* 2009; **27**: 1142–1147.
- [35] Ummenhofer W, Scheidegger D. Role of physician in prehospital management of trauma: European perspective. *Curr Opin Crit Care* 2002; **8**: 559–565.
- [36] Al-Thani H, El-Meynar A, Latifi R. Prehospital versus emergency room intubation of trauma patients in qatar: a 2-year observational study. *N Am J Med Sci* 2014; **6**(1): 12–18.
- [37] Lossius HM, Roislien J, Lockey D. Patient safety in pre-hospital emergency tracheal intubation: a comprehensive meta-analysis of the intubation success rates of EMS providers. *Crit Care* 2012; **16**(1): R24.
- [38] DiRusso S, Sullivan T, Risucci D. Intubation of pediatric trauma patients in the field: predictor of negative outcome despite risk stratification. *J Trauma* 2005; **59**: 84–91.
- [39] Gausche M, Lewis R, Stratton S. Effect of out-of-hospital pediatric endotracheal intubation on survival and neurological outcome. *JAMA* 2000; **283**: 783–790.
- [40] Eich C, Roessler M, Nemeth M. Characteristics and outcome of prehospital paediatric intubation attended by anaesthesia-trained emergency physicians. *Resuscitation* 2009; **80**: 1371–1377.
- [41] Davis D, Peay J, Sise M. The impact of prehospital endotracheal intubation on outcome in moderate to severe traumatic brain injury. *J Trauma* 2005; **58**: 933–939.
- [42] Murray J, Demetriades D, Berne T. Prehospital intubation in patients with severe head injury. *J Trauma* 2000; **49**: 1065–1070.
- [43] Wang H, Peitzman A, Cassidy L. Out-of-hospital endotracheal intubation and outcome after traumatic brain injury. *Ann Emerg Med* 2004; **44**: 439–450.
- [44] Sen A, Nichani R. Prehospital endotracheal intubation in adult major trauma patients with head injury. *Emerg Med J* 2005; **22**: 887–892.
- [45] Bochicchio G, Ilahi O, Joshi M. Endotracheal intubation in the field does not improve outcome in trauma patients who present without an acutely lethal traumatic brain injury. *J Trauma* 2003; **54**: 307–311.
- [46] Tuma M, El-Menyar A, Abdelrahman H, Al-Thani H, Zarour A, Parchani A, et al. Prehospital intubation in patients with isolated severe traumatic brain injury: a 4-year observational study. *Crit Care Res Pract* 2014; doi: 10.1155/2014/135986.
- [47] Fevang E, Lockey D, Thompson J, Lossius H. The top five research priorities in physician-provided prehospital critical care: a consensus report from a European research collaboration. *Scand J Trauma Resusc Emerg Med* 2011; **19**: 57.
- [48] Osterwalder JJ. Insufficient quality of research on prehospital medical emergency care—where are the major problems and solutions? *Swiss Med Wkly* 2004; **134**: 389–394.
- [49] Bounes V, Concina F, Lecoules N, Olivier M, Lauque D, Ducassé JL. [Physician staffed ambulances are better for patient’s analgesia on arrival at the emergency department]. *Ann Fr Anesth Reanim* 2010; **29**(10): 699–703. French.