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Interhospital Transfers: Managing Competing Priorities while Ensuring Patient Safety

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Abstract

Interhospital patient transfers (IPTs) are highly complex logistical undertakings, involving a multitude of interdependent procedures, critical steps and a degree of unpredictability. Beginning with interfacility communication and patient acceptance agreement, a cascade of numerous handoffs takes place, ultimately culminating in safe arrival of the patient at the receiving facility. Due to the complexity of the IPT process, significant potential for critical errors and adverse patient safety (PS) outcomes exists. To minimize any associated risks, key PS considerations include checklists, handoffs, vehicle/aircraft safety, distance of travel, crew training, team factors, and many other critical components. Detailed knowledge of factors that may influence the risk of errors or adverse events is critical to optimizing both PS and clinical outcomes.

Keywords: interfacility patient transfer, interhospital patient transfer, medical transportation, patient safety, patient transfers, transitions of care

1. Clinical vignette

A young male patient is involved in a head-on motor vehicle collision resulting in heavy vehicle damage with steering wheel deformity. After prolonged extrication, the patient is evaluated by emergency medical services (EMS) personnel, who determine that he is stable for ground transfer and subsequently bring him to a nearby community hospital. Upon further evaluation, the patient is found to have blunt cardiac injury, multiple rib fractures, and bilateral pulmonary contusions. At this point, the treating physician at the community hospital determines that transfer to a higher level of care is required. He promptly contacts a nearby trauma center that has the required expertise to effectively manage this patient's injuries.

A dialog between the community physician and the trauma surgeon from the destination facility is initiated. The receiving trauma surgeon approves the transfer but is in the midst of an acute trauma evaluation and cannot receive a full report on the patient's condition or injuries. The community physician, having received approval for transport, begins the process of moving the patient to the trauma center without any further discussions with the receiving surgeon. Because the patient was hemodynamically stable throughout his evaluation, basic life support (BLS) was determined to be sufficient to transport the patient to the receiving facility, approximately 40 minutes away by ground. The patient is then placed on a BLS ambulance, and the transfer commences. En route, the patient starts to deteriorate with clinical signs of cardiogenic shock, most likely secondary to blunt cardiac injury. Within their scope of practice, BLS personnel attempt to provide care for the patient, but eventually he becomes pulseless, requiring cardiopulmonary resuscitation (CPR). After 10 minutes of CPR, the patient arrives at the trauma center. At this time, the surprised receiving trauma team begins large-scale resuscitative efforts. Because the patient was transported with only a handful of printed pages from the medical record, the receiving team frantically scrambles to accumulate relevant clinical information from the sending hospital. After approximately 20 additional minutes of cardiopulmonary resuscitation, the patient dies. What were the contributing factors to this tragic outcome? How could similar occurrences be prevented in the future?

2. Discussion

Interhospital patient transfer (IPT), a special case within the transitions of care (TOC) domain, is one of the most complicated and high-risk procedures in terms of coordination and patient safety (PS) [1–3]. Interhospital transfer is a type of interfacility transfer (IFT) defined as a transfer following assessment and stabilization at one healthcare facility with movement of the patient to another facility (e.g., clinic to hospital, hospital to inpatient rehabilitation, hospital to long-term care, or hospital to hospital, etc.) [4–6]. In this chapter we will focus primarily on hospital-to-hospital transfers. As in many other areas of PS, communication plays a critical role in ensuring effective and uneventful IPT [3]. Teamwork and attention to detail are important components of each and every IPT, regardless of how simple or “routine” the process may appear to be [7, 8].

The hypothetical case presented in this chapter's clinical vignette describes, and exemplifies, common failure modes encountered in the current system of IPT, with focus on inadequate communication and incomplete understanding of patient condition(s) leading to inappropriate transport-level triage, ultimately resulting in preventable loss of life. The communication between the transferring and accepting physician was deficient, characterized by an unstructured handoff, lack of follow-up, and errors in clinical judgment that led to decreased awareness of risk. Again, the consequence of the above events was the patient's death. More specifically, the lack of planning and incomplete understanding of the circumstances by the community hospital physician, coupled with lack of effective communication from the receiving trauma surgeon, contributed to the request for inadequate resources (both in terms of equipment and trained

personnel) during patient transport. The choice of ground transportation may have been satisfactory for short-distance transfers (e.g., <10–15 miles), but in the case of a projected 40-minute travel time, the choice of air transportation may have been more optimal [9]. Regardless of the modality chosen, the level of crew training (e.g., BLS versus advanced life support or ALS) was equally critical to the current patient's condition.

The capacity for IPTs within our healthcare system will likely grow with the progressive regionalization of care and the associated concentration of specialty medical and surgical expertise at regional referral centers [10–12]. The subsequent discussion will touch upon the many potential interventions that should be considered to reduce the overall risk associated with IPT. The authors will discuss checklist use, handoffs, medication safety, provider-to-provider communication, nursing communication, timely transfer of medical record and imaging information, crew training, team collaboration, critical supplies, as well as safety of the vehicles or aircraft involved in the transfer process.

3. Interfacility patient transfers: basic facts and indications

Each year, >500,000 IPTs take place in the United States [13]. One of the main indications for an IPT is the requirement for additional resources not available at the referring hospital in order to provide an adequate level of patient care and expertise [2, 14, 15]. Specific reasons may include the need for medical subspecialty (e.g., neurosurgery or transplantation) coverage, lack of the required level of nursing care (e.g., intensive care, trauma care, or epilepsy monitoring), or lack of equipment necessary to provide acceptable standard-of-care management (e.g., imaging or interventional capability) [16–20].

For instance, a patient presenting to a small community hospital with signs of an acute myocardial infarction may require an emergent percutaneous coronary intervention which likely will be unavailable at this particular facility [21]. As a result, based on acuity, this patient would then need to be urgently transferred to a tertiary hospital that can provide the required interventional procedure and any subsequent definitive care. While the transfer to such tertiary facility would allow this patient to undergo the optimal therapeutic management, the very presence of a myocardial infarction, even if successfully temporized, may increase the risk of IPT. Hypothetically, the patient's condition could deteriorate, and he or she could develop a cardiac arrhythmia and become unstable en route to the receiving facility, or the much needed intervention could be delayed because of the transfer [22]. In both circumstances, any risk(s) associated with transferring the patient should be carefully considered in the context of potential benefits of percutaneous coronary revascularization [23]. In the end, each IPT must be well justified, with the patient standing to gain from the presence of procedural, technical, or knowledge assets that are unavailable at the original hospital [2, 23]. Accurate assessment of the current patient condition (**Table 1**) is the most important initial step when determining both the need for transfer and the level of care required during IPT.

Patient acuity level	Patient characteristics
Stable, with no risk of deterioration	Routine vital signs, IV line placement, supplemental oxygen administration [level 1]
Stable, with low risk of decline	Level 1 + need for active IV infusion and/or IV medications, pulse oximetry monitoring, personalized care with advanced assessment skills [level 2]
Stable, with moderate risk of decline	Level 2 + EKG/telemetry, cardiac and/or other life-sustaining medications and measures [level 3]
Stable, with high risk of decline	Level 3 + advanced airway or intubation, mechanical ventilatory support/management, vasoactive drips [level 4]
Unstable, with clinical deterioration	Level 4 + unable to achieve sustained hemodynamic stability; actively deteriorating clinical picture; ongoing requirement for invasive monitoring and/or procedures [level 5]

EKG, electrocardiography; IV, intravenous.

Table 1. Patient acuity level definitions.

4. Overview of guidelines for patient transfer

As stated previously, each and every IPT needs to be assessed carefully from the standpoint of potential risks, benefits, and alternatives. Physicians at both the transferring and receiving hospitals must be aware of the patient’s up-to-date clinical status and any specific management requirements [2]. The logistics of medical direction should be determined prior to the initiation of the transfer process [24]. In brief, the responsibility for ongoing care of the patient being transferred rests with the designated “medical director” for the duration of the IPT. This supervising provider may be the transferring physician, the medical director of the transporting service, or the accepting physician. At times, a shared responsibility model that has been agreed upon by all supervising parties can be employed [24].

Given the complexities involved (**Figures 1** and **2**), great care must go into choosing which patients need to be transferred and how they should be transported [2]. Significant amount of customization may be required, with patient safety and hemodynamic stability being among top priorities throughout the entire process. Each patient should be transported under the care of specially trained healthcare professionals, which can include physicians, nurses, advanced life support (ALS)-trained or basic life support (BLS)-trained personnel, respiratory therapists, and others as required, in order to ensure that the transfer is safe and that continuity of care occurs seamlessly both during the IPT and after the arrival at the destination facility [25, 26].

The situation becomes more complicated when various practical aspects of the patient transfer process come into play, both in terms of IPT appropriateness and safety. As stated earlier in this chapter, patients should be transferred only when the facility where they are currently being treated does not have the expertise, equipment, or other accommodations necessary for the patient to receive the appropriate-level care [27–30]. Regardless of the exact scenario, the goal should always be to stabilize the patient prior to transport in an effort to maximize the likelihood of uneventful interfacility transit, timely arrival, and smooth care transition at the receiving institution [18, 31]. During the transfer, constant communication between the medical command and the transporting vehicle/aircraft should be taking place [32], especially given the

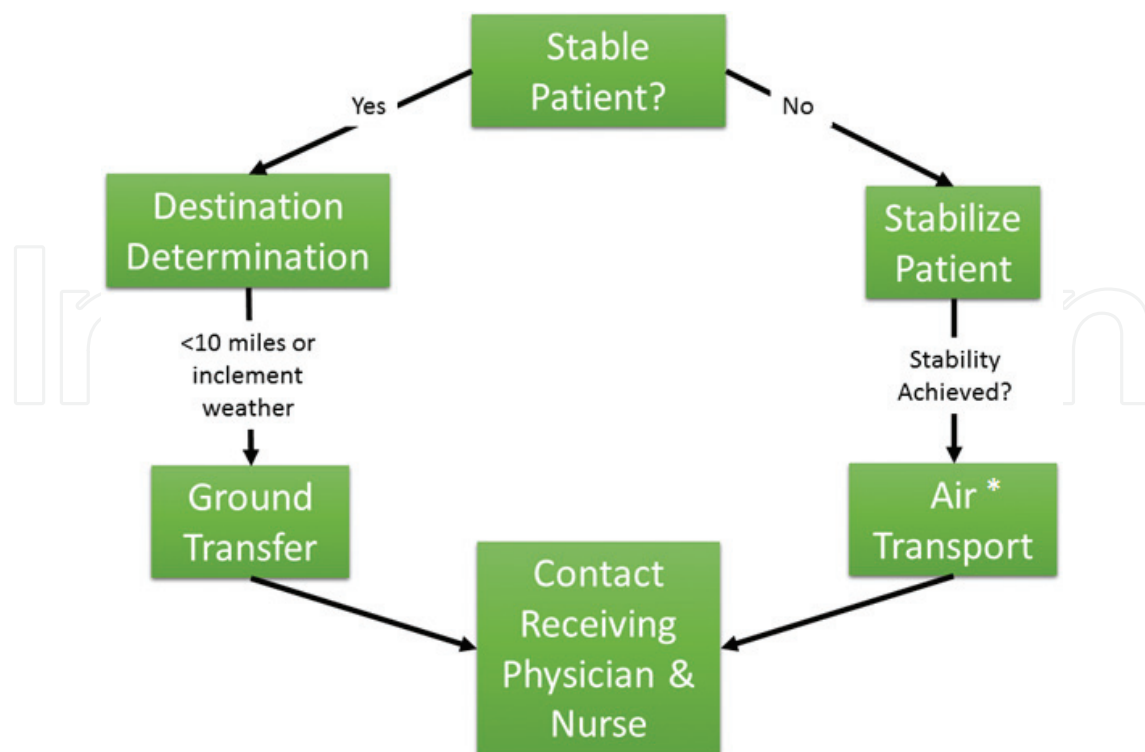


Figure 1. Clinical assessment of the patient in the context of interfacility transfer. The overall process begins with the assessment of patient stability, with subsequent determinations of the transportation modality (ground versus air transport). At all times, communication lines should be open between the referring and receiving facilities; *The ultimate choice of air versus ground transfer should be made after considering patient acuity and weather conditions.

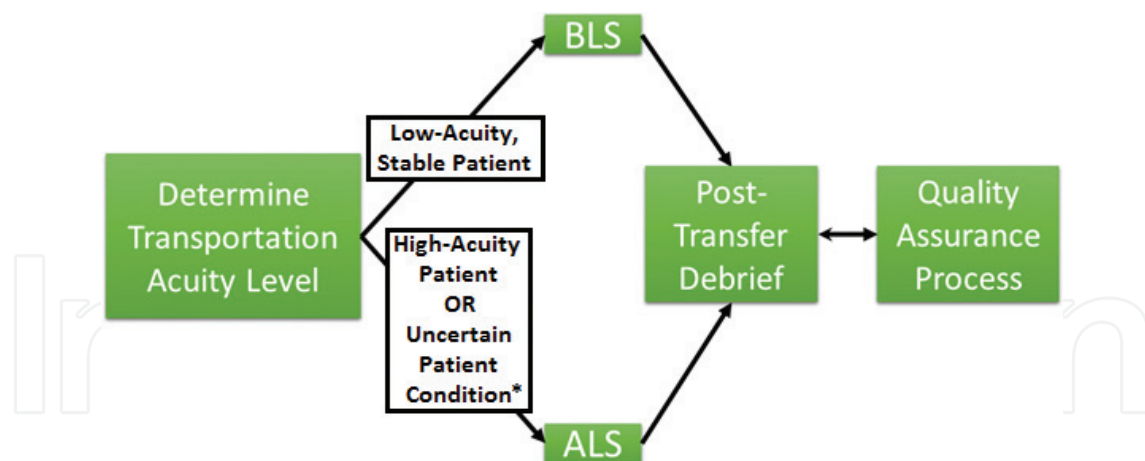


Figure 2. Simplified decision-making algorithm outlining the process of determining whether to use basic (BLS) or advanced (ALS) life support. Post-transfer debriefings and continuous quality assurance are critical to ensuring that safe and effective transfer services continue to operate; *When patient condition is not known, over-triage is preferred to under-triage.

evolving capabilities for continued remote patient monitoring [33]. Consistent with the above principles, if a patient is sufficiently stable to undergo IPT, the sooner the transport process begins, the sooner the necessary (e.g., definitive) interventions can take place. If the patient's baseline status is stable, and the need for transfer is triggered by the requirement for specialty

treatment or the higher level of care, then they can be transported within a reasonable time frame that is convenient for both the transferring and receiving facilities. In such cases, multivariable consideration should include the assessment of need, the overall urgency, current bed capacity at the receiving institution, and the availability of transportation resources.

5. Medical oversight during patient transfer: the role of the medical director

The role of the “medical director” is complex and requires detailed knowledge of IPT-related regulations, which can differ from state to state or region to region. The most important legal framework pertaining to interfacility transfers is the Emergency Medical Treatment and Labor Act (EMTALA) of 1986. It is a federal law whose primary purpose is to ensure that patients with emergency medical conditions are appropriately screened and treated at U.S. Medicare-participating facilities, regardless of a patient’s financial or insurance status and/or their national origin, race, creed, or color [34, 35].

EMTALA automatically applies when an individual presents to a department that is specifically equipped and staffed for the initial evaluation and treatment of outpatients with emergency medical conditions, such as emergency departments. EMTALA also governs how these patients are transferred from one hospital to another and applies specifically to unstable patients. An unstable patient cannot be transferred unless (1) a physician certifies that the medical benefits of transfer outweigh any associated risks or (2) a patient makes a transfer request in writing after being informed of EMTALA and the risks of transfer [34, 35].

EMTALA dictates that the referring physician is the responsible individual for the care of the patient during transfer, although the accepting physician may provide direction/advice [2, 36, 37]. The transferring hospital is obligated to treat and stabilize the patient within its capabilities until the IPT process commences. This mandate serves to minimize interfacility transit risks by optimizing patient condition prior to transfer. The referring facility must also provide copies of medical records, confirm that the receiving institution has space and qualified personnel to treat the condition and has accepted the transfer, and ensure that the IPT can be safely facilitated using qualified personnel and appropriate medical equipment. Conversely, the receiving hospital is obliged under EMTALA to accept an appropriate transfer of a patient who requires specialized care if the hospital has the capacity and corresponding capabilities and facilities to treat the individual. It is critically important for providers to clearly understand the EMTALA framework, not only from the standpoint of patient safety but also from the perspective of level of care and health coverage considerations. All EMTALA violations are considered to be very serious and may lead to substantial penalties, up to and including large civil fines (e.g., for both physicians and hospitals), lawsuits, and potential exclusion from federal and state medical reimbursement programs including Medicare and Medicaid [34, 38].

Consequently, medical direction is of utmost importance throughout the entire IPT process [2]. Logistically, this form of patient oversight can take a number of different forms. Most commonly utilized is the model where the referring physician provides online/on-scene direction.

While a patient is in transport, medical oversight can be maintained by the referring or accepting physician as well as the medical director of the transporting agency or the medical director's specialty care proxy. The latter may require that the medical director consults specialist providers with highly specific area(s) of expertise. Due to the broad range of tasks and responsibilities, the selection process for medical transport program director should ensure that suitable candidates demonstrate sufficient knowledge and skills across numerous domains, as outlined by the National Association of EMS Physicians [39].

In addition to direct oversight of patient transports, the responsibilities of EMS medical director also include activities such as personnel training and education as well as the development of pertinent protocols and procedures. Finally, medical directors are also tasked with reviewing IPT documentation records to determine the appropriateness of care and to verify that sufficient quality of services is being maintained. Regularly scheduled reviews of EMS performance, including quality improvement and compliance oversight, ensure that operations can continue at desired levels of safety and efficiency [40]. Formal education consisting of structured curricula offered at local/regional levels should be encouraged and supported, with the goal of disseminating and reinforcing fundamental knowledge and skills related to the provision of high-quality, safe, and effective emergency medical services. Less formal education often takes place as well, focusing on practical aspects of daily EMS operations, especially at the individual/team level. As outlined elsewhere throughout the *Vignettes in Patient Safety*, it is critical that personnel participating in IPTs are able to report any safety concerns in an anonymous and fair manner, without fear of being judged or punished for doing so.

6. Communication

The first step in the process of IPT is the initiation of proper communication channel(s) between the two institutions involved. The transferring physician should gather clinical information necessary for an orderly handoff and then initiate the transfer request by contacting the hospital department tasked with such procedures. This organizational functionality is often termed "patient transfer center," "patient placement center," or "patient referral center" and will reach out to an analogous department at the receiving institution. The staff at each institution's "transfer center" then contacts key stakeholders (e.g., referring and accepting physician, bedside nurses, etc.) so that the receiving physician is fully aware of the patient's condition and any other information pertinent to the situation in order to determine the appropriateness of the proposed transfer, assess patient suitability for transfer in the context of available clinical data, allocate appropriate level-of-care resources (e.g., ICU bed, operating room), and finalize the decision on transfer modality (e.g., ground versus air transport) [41, 42]. Not only is it necessary for the referring and accepting physicians to be in close contact and discuss the transfer and any potential challenges, but it is also critical for the nurses from the receiving and transferring facilities to communicate details of care pertaining to the patient [43, 44]. This helps facilitate a smooth transition and minimizes any ITP-related disruptions. Lack of communication is a major, preventable source of medical error and is especially prevalent when the care teams are from two different facilities [41, 44]. While distance, distractions,

incongruent treatment goals/plans, uncertainty of timing, and contrasting information sources are all barriers to continuity of care, standardized medical handoffs can help reduce situational and informational confusion, reduce medical errors, and hopefully result in better and safer patient care [2]. Although the authors of this chapter do not advocate for any specific approach to transfer-related communication, the reader is encouraged to consistently employ one of the many previously described systems of handover (**Table 2**).

In addition, patients should be transferred with readily available medical records, laboratory results, radiologic studies, and any other important documents needed to make optimal treatment decisions [41]. Whenever electronic access to patient record is feasible, the referring facility should enable appropriate viewing rights for authorized provider(s) at the receiving

ISBAR:

- Identity—patient’s identification, including current location, clinical care team, etc.
- Situation—current clinical problem, including signs, symptoms, and stability
- Background—pertinent medical history elements, including hospital length of stay, past medical and surgical history, and medication use (past and current)
- Assessment and action—current diagnosis and clinical impression, followed by specific description of clinical interventions and plan(s)
- Recommendation—communication regarding potential future treatment(s), diagnostic workup, clinical evaluation(s), and any other clinically relevant plan(s)

POET-PC:

- Preparation—exchange of basic information, including staff introductions and the general description of the patient and his/her condition
- Organization—the use of established format for standardized information exchange. Personnel is empowered to ask questions and clarify information
- Environmental awareness—ensuring that required equipment is functioning. Safety checklists are followed to verify and cross-check any environment-related variables that may influence patient condition and/or safety (e.g., intravenous medication administration)
- Transfer of responsibility and accountability—formal communication takes place regarding transfer of clinical responsibilities, including formal change in accountability for direct patient care (and safety)
- Patient and caregiver involvement—active participation of both the patient and his/her caregiver(s) is encouraged, whenever possible and/or applicable

SBAR:

- Situation—how is the patient doing at the time of communication?
- Background—pertinent demographic and clinical information, including patient identification, medical/social history, medications/allergies, and any intervention(s)
- Assessment—brief outline of the patient’s current condition, acute medical problem(s), and prognostic information, with any associated management plan(s)
- Recommendations—discussion of potential future course, including associated diagnostic and therapeutic input/suggestions

SOAP:

- Subjective—recorded patient complaints, symptoms, and other nonobjective data
 - Objective—details including vital signs, clinical signs, physical examination, and other objective data
 - Assessment—summative evaluation of the patient’s overall condition, incorporating pertinent diagnostic, and physical exam findings
 - Plan—specific clinical step(s) based on the most recent assessment, including diagnostic and therapeutic recommendations
-

Table 2. Commonly used standardized systems of handover. Compiled and modified from Aslanidis et al. [78], Chaboyer [79] and Abraham et al. [80]. Queensland Government: Clinical handover at the bedside checklist [81].

facility. Otherwise, all available records should either be copied or printed and sent with the patient to avoid critical information gaps at the receiving institution [2]. If laboratory results or other critical documents are not available when a patient is ready for transfer, then the referring facility must alert the receiving facility of any outstanding documentation and ensure timely and accurate transmission (including direct communication) of required information.

It is critical to emphasize the importance of family communication that should occur in parallel to the interfacility dialog. Not infrequently, this important task becomes lost among the plethora of clinical information exchanged during IPTs. The healthcare team must manage expectations of the family, including the real possibility—despite all safety measures—of patient clinical decompensation during the transfer process. An important component of the dialog involving the patient's loved ones is to establish good rapport and an open conversation between the receiving facility and the family who may not be familiar with the staff and/or capabilities of the destination hospital. It also allows both the transferring and receiving facility to better understand family expectations (e.g., goals of care) and to establish an effective platform for any follow-up inquiries [45]. The additional allocation of time and effort that is devoted to informing the patient's loved ones far outweighs the risk of any associated delays [46].

Finally, providers from each facility should consider discussing the necessity of obtaining additional imaging and/or laboratory tests prior to and while awaiting transfer to another hospital. However, it is important to keep in mind that while these results may help facilitate treatment management at the receiving facility, delaying transfer because of additional diagnostic studies may inadvertently result in increased morbidity and mortality.

7. Determining air versus ground transport

There has been a great deal of research and discussion surrounding the benefits and limitations of utilizing ground emergency medical transport (GEMT) versus helicopter emergency medical services (HEMS) during IPTs [47, 48]. Some studies have suggested that there is little difference between GEMT and HEMS during optimal conditions and that there is no measurable benefit in outcomes such as disability, health status, or healthcare utilization [48–50].

For GEMT, the estimated number of annual dispatches in the United States exceeds 10–20 million, giving a glimpse of the enormity and the complexity of the EMS system [51]. According to the National Highway Traffic Safety Administration (NHTSA), the mean estimated number of motor vehicle crashes involving an ambulance stands at approximately 4,500 per year [52]. For HEMS, it is estimated that more than 400,000 patients are transported each year by aeromedical means [53, 54]. While HEMS accidents have decreased in recent years, there is still an incident rate between 0.56 and 0.73 per 10,000 missions, with fatal accidents occurring at a rate of 0.04–0.23 per 10,000 missions [9, 55]. Factors that may contribute to HEMS flight safety include weather conditions, crew training and experience, technical equipment maintenance, as well as the time of day during the conduct of the mission [9, 56, 57]. For both GEMT and HEMS agencies, it is critical to ensure the safety of patients being transported,

to reduce the risk of injury or death to occupants of the medical transport platform (e.g., ambulance or aircraft), and to avoid any injuries/casualties or losses involving other vehicles, aircraft, people, or property.

In terms of modality selection, ground transport is generally faster when travel distances are less than 10 miles using simultaneous dispatch as the reference point, or the cutoff mark of 45 miles in the setting of nonsimultaneous dispatch [9, 58]. Generally speaking, GEMT vehicles are more readily available than air transport platforms (e.g., helicopter or fixed-wing aircraft). For IPTs involving longer distances (and greater amount of ground travel time), aeromedical transportation may be faster and more effective [49]. Others suggested that air transportation should be considered when the expected duration of ground travel exceeds 30 minutes [59, 60].

When determining which type of transport to utilize and under which circumstances, it is imperative to consider each patient's unique situation, as well as any limitations of the facilities involved. In addition to patient stability, travel distance, and time-based considerations outlined in the previous paragraphs, it is also important to account for weather conditions, time of day, as well as the availability and distance of landing facilities from both the referring and receiving facilities [61, 62]. For example, if a receiving hospital utilizes a local airport as a waypoint for HEMS transfers, the additional transit time from the airport to the destination should be examined and compared to a GEMT alternative that may take the patient "from door to door" in equal or lesser amount of time. Additional factors to be considered should include transport priority/acuity, relative cost, resource availability, and the clinical justification (e.g., the determination of medical necessity of the transport) [63, 64]. If a patient is clinically stable, does not require any time-critical interventions, and is expected to remain stable, the more precious resource of air transport may be unnecessary and should be reserved for scenarios involving greater acuity of illness that better justify more expedient transfer [61, 62, 64].

8. Advanced life support (ALS) versus basic life support (BLS): determining the level of care and patient needs

Ensuring appropriate match between EMT personnel skills, knowledge, and the available equipment and infrastructure is the cornerstone of safe and effective IPT. It should be noted, in accordance with the NHTSA EMS guidelines, that the transferring provider should "err on the side of caution" and secure resources for transport that may ultimately exceed needs while at the same time anticipating a patient's possible deterioration [65].

In addition to ensuring that appropriate safety protocols (including vehicle-related, equipment-related, and provider-related considerations) are in place [25], IPTs demand a unique set of provider skills compared to other types of healthcare settings. The aforementioned guidelines organize patient need levels into three tiers: (a) basic life support (BLS, **Table 3**), (b) advanced life support (ALS, **Table 4**), and (c) critical care transport (CCT, **Table 5**) [66–69]. The Centers for Medicare and Medicaid Services (CMS) defines yet another level of care known as the specialty care transport (SCT), which involves the transfer of a critically ill or injured patient that requires

Basic Life Support (BLS): Knowledge and Skills

- Appropriate radio and communication technology
- Transport equipment, logistics & related technologies
- Patient records & other documentation
- Patient is secured for optimal safety and accessibility
- Medical oversight & physician orders
- Level of care determination prior to transport

Table 3. Basic life support (BLS): minimal transportation requirement which includes equipment, basic medical knowledge base, and personnel skill set that will be necessary to safely transport a patient who is stable.

Advanced Life Support (ALS): Knowledge and Skills

- Basic Life Support skills PLUS:
 - Ventilatory mechanical support / management
 - Ability to administer broad range of medications, with pharmacology education at the level of DOT EMT Paramedical National Standard Curriculum
 - Advanced knowledge of vasoactive and antiarrhythmic drugs
 - Proficiency in circulatory management and support

Table 4. Advances life support (ALS): basic life support PLUS more advanced equipment, greater depth of medical/pharmacy/resuscitation knowledge, and broader technical personnel skill set in order to safely transport a patient who may be stable, but is at risk of clinical deterioration. ECG, electrocardiogram; DOT EMT, Department of Transportation Emergency Medical Technician.

knowledge and skill beyond that of the EMT and paramedic [70]. It is applicable when a patient's condition is such that it requires a provider in a specific specialty area (e.g., critical care nurse, emergency physician, orthopedic surgeon) to safely and adequately transport the patient.

The next and very important question to be answered is when to use ALS versus BLS. As outlined previously, triaging patients to the appropriate level of transport requires accurate matching of provider skills, ambulance crew composition (e.g., paramedics, EMTs, nurses, physicians, and respiratory therapists), equipment availability, and the implementation of pertinent patient care protocols. In addition to the general principles and fundamental considerations, the level of care and crew training must also be in compliance with local and state laws and guidelines [71–74].

The main difference between ALS and BLS transports is the ability to provide care at increasing levels of patient acuity [75]. Therefore, the key triage decision that drives the use of ALS

Critical Care Transport: Knowledge and Skills

- Basic + Advanced Life Support skills PLUS:

- Advanced ventilatory management

- Ability to administer complex IV medication regimens, with pharmacology education at the level of DOT EMT Paramedical National Standard Curriculum

- Advanced use of vasoactive and antiarrhythmic drugs

- Proficiency in circulatory management and support

- Familiarity with a variety of critical care procedures, including the use of advanced intravenous and extracorporeal devices

Table 5. Critical care transport (CCT): basic and advances life support PLUS specialized skills in the areas of medical/pharmacy/resuscitation, including familiarity with advanced critical care devices (e.g., extracorporeal support, various intravenous devices) to safely transport a patient who may be in stable of guarded condition, but may face imminent life-threatening decline. DOT EMT, Department of Transportation Emergency Medical Technician; IV, intravenous.

over BLS is the status of the patient. If the patient is considered to be more acutely ill and might require advanced interventions (e.g., ACLS protocol) during the transfer, then ALS is recommended. If, however, a patient is stable and is expected to remain stable, and the acuity is such that he or she will likely not require additional support while in transit, then BLS would be most appropriate option. No matter the level of training of the transport team, it is recommended that the transferring physician be available to communicate with them (see the previous section on medical command). This serves to ensure that any complications which may arise during the IPT can be identified and addressed immediately, thus optimizing the overall patient safety equation during transport. **Figure 3** demonstrates major possible risks

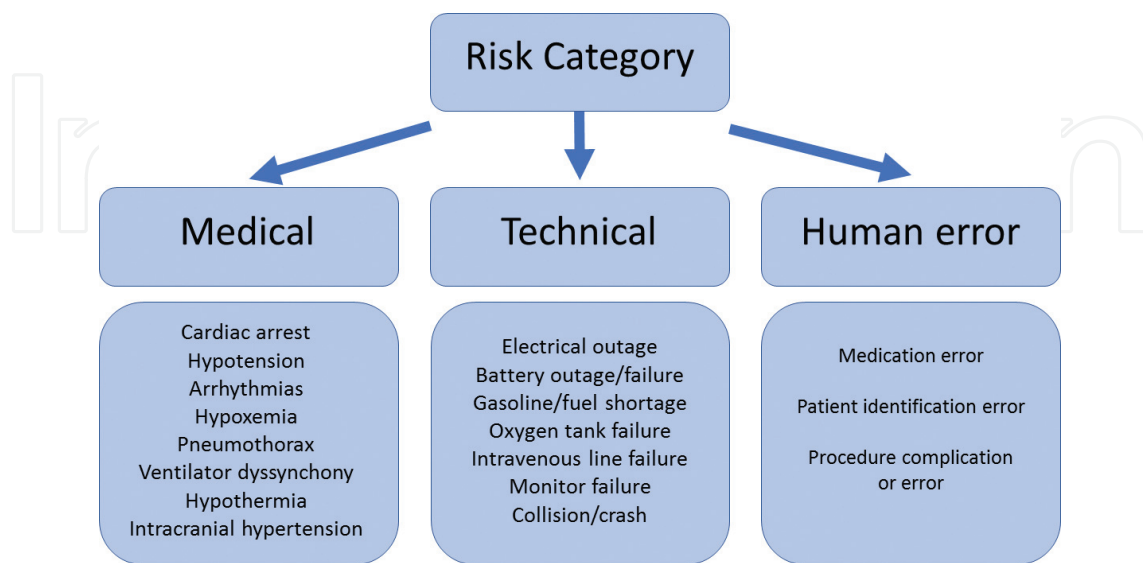


Figure 3. Potential risks associated with interfacility transfers, listed by category.

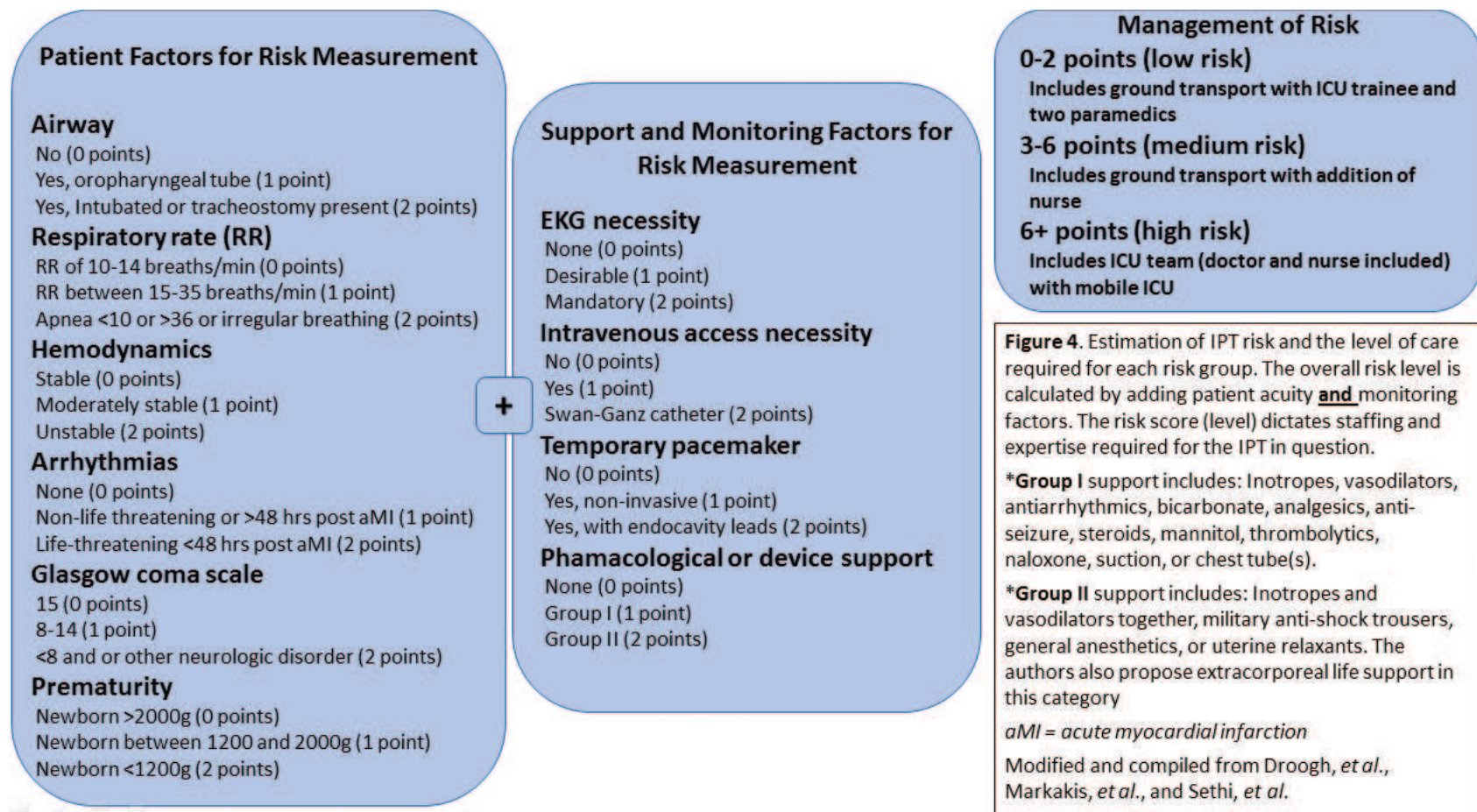


Figure 4. Estimation of IPT risk and the level of care required for the corresponding physiologic acuity. The overall risk level is calculated by adding patient acuity and monitoring intensity as main co-factors. The risk score (level) dictates staffing and expertise required for the IPT in question. *Group I support includes inotropes, vasodilators, antiarrhythmics, bicarbonate, analgesics, antiepileptic agents, steroids, mannitol, thrombolytics, naloxone, suction equipment, or chest tube(s). *Group II support includes inotropes and vasodilators together, military antishock trousers, general anesthetics, or uterine relaxants. The authors also propose extracorporeal life support in this category. Legend: aMI, acute myocardial infarction; EKG, electrocardiogram. Modified and compiled from Droogh et al. [77], Markakis et al. [76], and Sethi and Subramanian [4].

associated with IPTs, and **Figure 4** summarizes the IPT risk assessment process, highlighting the multitude of interdependent factors that may contribute (alone or in various combinations) to the occurrence of adverse events during interfacility patient transport [4, 76, 77].

In certain uncommon cases, a physician may be asked or required to travel with the patient to the receiving facility. Special care must be taken that a physician in this situation be compliant with any and all regulations regarding out-of-hospital privileges, medical command, and liability coverage, as these may all vary from state to state. Although some institutions may routinely use physicians as part of the transport team, most do not. Consequently, care must be taken to avoid any medicolegal pitfalls.

9. Conclusion

Interhospital patient transport (IPT) represents a critical process that involves multiple providers, intersecting communication lines, and large volume of exchanged information. Because of its complexity, IPT is inherently associated with significant risks to the patient being transported, from the potential for clinical deterioration to the possibility of a medication error. The decision to transport the patient is just as important as the determination of the level of care (e.g., ALS, BLS, CCT) during the transfer process. Patients should only be transferred when the clinical benefit(s) outweigh any risk(s), resulting in the patient being able to receive procedural, technical, or cognitive assets that are unavailable at the referring hospital. Appropriate oversight during IPT is critical and is provided through the use of medical command protocols. Lastly, HEMS versus GEMT should be decided carefully based on patient acuity, the distance between facilities, weather conditions, and a number of other important considerations. As with any healthcare endeavor, the most vital considerations during IPT should be the safety and well-being of the patient.

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References

- [1] Manias E et al. Communicating about the management of medications as patients move across transition points of care: An observation and interview study. *Journal of Evaluation in Clinical Practice*. 2016;**22**(5):635-643
- [2] Warren J et al. Guidelines for the inter-and intrahospital transport of critically ill patients. *Critical Care Medicine*. 2004;**32**(1):256-262
- [3] Ong M-S, Biomed E M, Coiera E. A systematic review of failures in handoff communication during intrahospital transfers. *The Joint Commission Journal on Quality and Patient Safety*. 2011;**37**(6):274-AP8
- [4] Sethi D, Subramanian S. When place and time matter: How to conduct safe inter-hospital transfer of patients. *Saudi Journal of Anaesthesia*. 2014;**8**(1):104
- [5] Myers KL. The Use of Patient-Preferred Music to Improve Patient Experience during Interfacility Ambulance Transport. The Florida State University; 2013
- [6] Orr RA et al. Pediatric specialized transport teams are associated with improved outcomes. *Pediatrics*. 2009;**124**(1):40-48
- [7] Nakayama DK et al. Quality improvement and patient care checklists in intrahospital transfers involving pediatric surgery patients. *Journal of Pediatric Surgery*. 2012;**47**(1): 112-118
- [8] Martin T. Transporting the adult critically ill patient. *Surgery (Oxford)*. 2012;**30**(5):219-224
- [9] Hon HH et al. Injury and fatality risks in aeromedical transport: Focus on prevention. *The Journal of Surgical Research*. 2016;**204**(2):297-303
- [10] Jurkovich GJ. Regionalized health care and the trauma system model. *Journal of the American College of Surgeons*. 2012;**215**(1):1-11
- [11] Chance GW. Regionalized care established by neonatal intensive care units. *Pediatric Annals*. 1995;**24**(10):519-528
- [12] Kahn JM et al. Potential value of regionalized intensive care for mechanically ventilated medical patients. *American Journal of Respiratory and Critical Care Medicine*. 2008;**177**(3): 285-291
- [13] Newton SM, Fralic M. Interhospital transfer Center model: Components, themes, and design elements. *Air Medical Journal*. 2015;**34**(4):207-212
- [14] Day S et al. Pediatric interhospital critical care transport: Consensus of a national leadership conference. *Pediatrics*. 1991;**88**(4):696-704
- [15] Bosk EA, Veinot T, Iwashyna TJ. Which patients, and where: A qualitative study of patient transfers from community hospitals. *Medical Care*. 2011;**49**(6):592

- [16] Whiteley S, Macartney I, Mark J, Barratt HS, Binks R. (2011) Guidelines for the transport of the critically ill adult (3rd Edition 2011). London: Intensive Care Society.
- [17] Golestanian E et al. Effect of interhospital transfer on resource utilization and outcomes at a tertiary care referral center. *Critical Care Medicine*. 2007;**35**(6):1470-1476
- [18] Martin GD et al. Prospective analysis of rural interhospital transfer of injured patients to a referral trauma center. *Journal of Trauma and Acute Care Surgery*. 1990;**30**(8):1014-1020
- [19] Kaplan L, Walsh D, Burney RE. Emergency aeromedical transport of patients with acute myocardial infarction. *Annals of Emergency Medicine*. 1987;**16**(1):55-57
- [20] Cowley RA et al. An economical and proved helicopter program for transporting the emergency critically ill and injured patient in Maryland. *Journal of Trauma and Acute Care Surgery*. 1973;**13**(12):1029-1038
- [21] van Diepen S et al. Transfer times and outcomes in patients with ST-segment-elevation myocardial infarction undergoing Interhospital transfer for primary percutaneous coronary intervention. *Circulation: Cardiovascular Quality and Outcomes*. 2012;**5**(4):437-444
- [22] Chakrabarti A et al. Time-to-reperfusion in patients undergoing Interhospital transfer for primary percutaneous coronary intervention in the US. *Journal of the American College of Cardiology*. 2008;**51**(25):2442-2443
- [23] Moon J, Kalra P, Coats A. DANAMI-2: Is Primary Angioplasty Superior to Thrombolysis in Acute MI when the Patient has to be Transferred to an Invasive Centre? *International Journal of Cardiology*. 2002;**85**(2-3):199-201
- [24] Shelton SL et al. Medical direction of interfacility transports. *Prehospital Emergency Care*. 2000;**4**(4):361-364
- [25] Sikka V et al. The 2017 International Joint Working Group white paper by INDUSEM, The Emergency Medicine Association and The Academic College of Emergency Experts on establishing standardized regulations, operational mechanisms, and accreditation pathways for education and care provided by the prehospital emergency medical service systems in India. *Journal of Emergencies, Trauma, and Shock*. 2017;**10**(3):154
- [26] Bruce K, Suserud BO. The handover process and triage of ambulance-borne patients: The experiences of emergency nurses. *Nursing in Critical Care*. 2005;**10**(4):201-209
- [27] Iwashyna TJ, Kahn JM. Regionalization of Critical Care. In: Scales D, Rubenfeld G. (eds) *The Organization of Critical Care. Respiratory Medicine*, vol 18. New York: Humana Press; 2014. pp. 217-233
- [28] Rhodes M, Smith S, Boorse D. Pediatric trauma patients in an 'adult' trauma center. *Journal of Trauma and Acute Care Surgery*. 1993;**35**(3):384-393
- [29] Williams MR, Oz MC. Indications and patient selection for mechanical ventricular assistance. *The Annals of Thoracic Surgery*. 2001;**71**(3):S86-S91

- [30] Nallamothu BK et al. Times to treatment in transfer patients undergoing primary percutaneous coronary intervention in the United States. *Circulation*. 2005;**111**(6):761-767
- [31] Olson CM et al. Stabilization of patients prior to interhospital transfer. *The American Journal of Emergency Medicine*. 1987;**5**(1):33-39
- [32] Fan IR. A Collaborative Video-conferencing System for Improving Care during Neonatal Transport. Boston, Massachusetts: Massachusetts Institute of Technology. 2009
- [33] Lin Y-H et al. A wireless PDA-based physiological monitoring system for patient transport. *IEEE Transactions on Information Technology in Biomedicine*. 2004;**8**(4):439-447
- [34] Department_of_Health_and_Human_Services. Medicare Program; Emergency Medical Treatment and Labor Act (EMTALA): Applicability to Hospital Inpatients and Hospitals With Specialized Capabilities. 2012. Available from: <https://www.gpo.gov/fdsys/pkg/FR-2012-02-02/pdf/2012-2287.pdf>. [September 19, 2017]
- [35] CMS. Emergency Medical Treatment & Labor Act (EMTALA). 2017; Available from: <https://www.cms.gov/Regulations-and-Guidance/Legislation/EMTALA/index.html?redirect=/EMTALA/> [September 19, 2017]
- [36] Woodward GA. Legal issues in pediatric interfacility transport. *Clinical Pediatric Emergency Medicine*. 2003;**4**(4):256-264
- [37] Robinson DJ. The Emergency Medical Treatment and Active Labor Act (EMTALA) and psychiatric patients in the emergency department. In: Leslie S. Zun & Lara G. Chepenik, editors. *Behavioral Emergencies for the Emergency Physician*. Cambridge, UK: Cambridge University Press (2013). pp. 320-324
- [38] Lee T. An EMTALA primer: the impact of changes in the emergency medicine landscape on EMTALA compliance and enforcement. *Annals of health law/Loyola University Chicago, School of Law, Institute for Health Law*. 2003;**13**(1):145-178
- [39] Eljaiek LF, Norton R, Carmona R. Medical director for air medical transport programs. *Prehospital and Disaster Medicine*. 1995;**10**(4):283-284
- [40] Administration NHTS. Guide for interfacility patient transfer. Vol. 810. Washington, DC: DOT HS; 2006. p. 599
- [41] Herrigel DJ et al. Interhospital transfer handoff practices among US tertiary care centers: A descriptive survey. *Journal of Hospital Medicine*. 2016;**11**(6):413-417
- [42] Brooks S et al. The physician decision-making process in transferring nursing home patients to the hospital. *Archives of Internal Medicine*. 1994;**154**(8):902-908
- [43] Leonard M, Graham S, Bonacum D. The human factor: The critical importance of effective teamwork and communication in providing safe care. *Quality & Safety in Health Care*. 2004;**13**(1):i85-i90
- [44] Boockvar KS et al. Prescribing discrepancies likely to cause adverse drug events after patient transfer. *Quality and Safety in Health Care*. 2009;**18**(1):32-36

- [45] Rosenthal JL et al. Familial caregiver and physician perceptions of the family-physician interactions during Interfacility transfers. *Hospital Pediatrics*. 2017;**7**(6):344-351
- [46] Macnab AJ et al. The cost of family-oriented communication before air medical inter-facility transport. *Air Medical Journal*. 2001;**20**(4):20-22
- [47] Galvagno SM Jr et al. Helicopter Emergency Medical Services for Adults with Major Trauma. *Cochrane Database Syst Rev*. 2015;**15**(12):CD009228
- [48] Bulger EM et al. Impact of prehospital mode of transport after severe injury: A multicenter evaluation from the resuscitation outcomes consortium. *The Journal of Trauma and Acute Care Surgery*. 2012;**72**(3):567
- [49] Moens D et al. Air versus ground transport of patients with acute myocardial infarction: Experience in a rural-based helicopter medical service. *European Journal of Emergency Medicine*. 2015;**22**(4):273-278
- [50] Greenberg SE et al. Ankle fractures and modality of hospital transport at a single level 1 trauma Center: Does transport by helicopter or ground ambulance influence the incidence of complications? *The Journal of Foot and Ankle Surgery*. 2015;**54**(5):826-829
- [51] Magazine, F. The 2016 National Run Survey Part 2 (PDF). 2017. Available from: <http://www.firehouse.com/document/12345284/2016-national-run-survey-part-2-pdf> [September 9, 2017]
- [52] NHTSA. The National Highway Traffic Safety Administration and Ground Ambulance Crashes. 2014. Available from: <https://www.naemt.org/Files/HealthSafety/2014%20NHTSA%20Ground%20Amulance%20Crash%20Data.pdf> [September 9, 2017]
- [53] Wheeler R, von Recklinghausen FM, Brozen R. Blood administration in helicopter emergency medical services patients associated with hypothermia. *Air Medical Journal*. 2013;**32**(1):47-51
- [54] Brown BS et al. Helicopter EMS transport outcomes literature: Annotated review of articles published 2007–2011. *Emergency Medicine International*. 2012;**2012**:876703
- [55] Chesters A, Grieve PH, Hodgetts TJ. A 26-year comparative review of United Kingdom helicopter emergency medical services crashes and serious incidents. *Journal of Trauma and Acute Care Surgery*. 2014;**76**(4):1055-1060
- [56] Stawicki SP, Hoey BA, Portner M. Evidence tables: Summary of aeromedical incidents (2003-2012). *OPUS*. 2013;**12**:3-15
- [57] Anagnostakos JP et al. Evidence tables: Summary of aeromedical incidents (2013-2014). *OPUS*. 2014;**8**:9-16
- [58] Diaz MA, Hendey GW, Bivins HG. When is the helicopter faster? A comparison of helicopter and ground ambulance transport times. *Journal of Trauma and Acute Care Surgery*. 2005;**58**(1):148-153
- [59] Thomson DP, Thomas SH. Guidelines for air medical dispatch. *Prehospital Emergency Care*. 2003;**7**(2):265-271

- [60] Talving P et al. Helicopter evacuation of trauma victims in Los Angeles: Does it improve survival? *World Journal of Surgery*. 2009;**33**(11):2469
- [61] Burney R, Fischer R. Ground versus air transport of trauma victims: Medical and logistical considerations. *Annals of Emergency Medicine*. 1986;**15**(12):1491
- [62] Englesbe M, Merion R. The riskiest job in medicine: Transplant surgeons and organ procurement travel. *American Journal of Transplantation*. 2009;**9**(10):2406-2415
- [63] Mehra A. Air ambulance services in India. *Journal of Postgraduate Medicine*. 2000;**46**(4):314
- [64] Phillips M et al. Helicopter transport effectiveness of patients for primary percutaneous coronary intervention. *Air Medical Journal*. 2013;**32**(3):144-152
- [65] Olmstead T. Improving Austin-Travis County Emergency Medical Services Integration with Local Healthcare Networks. Austin, Texas, USA: PRP 182. LBJ School of Public Affairs; 2015
- [66] Liberman M, Mulder D, Sampalis J. Advanced or basic life support for trauma: Meta-analysis and critical review of the literature. *Journal of Trauma and Acute Care Surgery*. 2000;**49**(4):584-599
- [67] Cayten CG, Murphy JG, Stahl WM. Basic life support versus advanced life support for injured patients with an injury severity score of 10 or more. *Journal of Trauma and Acute Care Surgery*. 1993;**35**(3):460-467
- [68] Williams KA, Sullivan FM. Critical care transport. *RI Medical Journal*. 2013;**96**(12):39-43
- [69] American Academy of Orthopaedic Surgeons & American College of Emergency Physicians. Critical Care Transport. 2017. Sudbury, Massachusetts: Jones & Bartlett Learning
- [70] El Sayed M, Tamim H, Mann NC. Description of procedures performed on patients by emergency medical services during mass casualty incidents in the United States. *The American Journal of Emergency Medicine*. 2015;**33**(8):1030-1036
- [71] American Academy of Orthopaedic Surgeons. Emergency Care and Transportation of the Sick and Injured. Sudbury, Massachusetts: Jones & Bartlett Learning; 2014
- [72] Holleran RS. ASTNA Patient Transport-E-Book: Principles and Practice. St. Louis, Missouri: Elsevier Health Sciences; 2009
- [73] Sachs GM. Officer's Guide to Fire Service EMS. Saddle Brook, New Jersey: PennWell Books; 1999
- [74] Thorley TM. Prehospital Nursing in Maryland-Legal Considerations. Air Force Inst of Tech Wright-Patterson AFB OH; 1991
- [75] Palumbo L et al. Performance of a system to determine EMS dispatch priorities. *The American Journal of Emergency Medicine*. 1996;**14**(4):388-390
- [76] Markakis C et al. Evaluation of a risk score for interhospital transport of critically ill patients. *Emergency Medicine Journal*. 2006;**23**(4):313-317

- [77] Droogh JM et al. Transferring the critically ill patient: Are we there yet? *Critical Care*. 2015;**19**(1):62
- [78] Aslanidis T, Kontos A, Chytas I, Peftoulidou MG. ICU handover procedure: The Greek perspective. *International Journal of Research in Medical Sciences*. 2017;**2**(1):321-327
- [79] Chaboyer W, McMurray A, Wallis M, Chang HY. Standard operating protocol for implementing bedside handover in nursing. *Journal of Nursing Management*. 2008;**7**:29-36
- [80] Abraham J, Kannampallil TG, Almoosa KF, Patel B, Patel VL. Comparative evaluation of the content and structure of communication using two handoff tools: Implications for patient safety. *Journal of Critical Care*. 2014;**29**(2):311-e1
- [81] https://www.health.qld.gov.au/__data/assets/pdf_file/0028/429067/ch-checklist.pdf
[Accessed: November 24, 2017]