

Evaluation of Paramedics' Handover of Polytrauma Patients to Medical Team in Emergency Department at Suez Canal University Hospital

Bassant Sayed Moussa^{*1}, Alaa Desouky Mohamed², Moamen Mohammed Elsayed³, Ahmed ELSayed Abou-Zeid⁴

¹ Lecturer of emergency medicine, faculty of medicine, Suez canal university*

² Lecturer of emergency medicine, faculty of medicine, Suez canal university

³ Resident of emergency medicine, faculty of medicine, Suez Canal university

⁴ Associate Professor of emergency medicine, faculty of medicine, Suez canal university

Abstract : Background: A slight is identified about how efficiently information is transmitted from paramedics to the medical team at the emergency department (ED). Information about prehospital events and clinical findings can help ensure expedient and appropriate care. Therefore, our study aimed to assess the effectiveness of data transferred between paramedics and trauma team in trauma unit at Suez Canal university hospital.

Aim: The study aimed to evaluate data transferred between paramedics and trauma team in order to improve the outcomes of polytrauma patients attending to emergency department at Suez Canal University hospital by evaluating the handover process. **Methods:** A cross sectional observational study was conducted at the emergency department of Suez Canal University hospital. A validated form was completed to evaluate assessing data transfer and data loss between paramedics and trauma team in trauma unit at Suez Canal university hospital.

Results: Our study included 125 handovers of paramedics delivering polytrauma patients. It was found that all data items handed over by paramedics were the same as documented by physicians on the trauma notification sheet in regarding patients' demographics, mechanism of injury and pattern of injury. On the other hand, paramedics' handovers had significantly missing data in all items of vital signs, procedures, medication given and related medical history compared to physicians' assessments.

Conclusion: Almost all data items handed over by paramedics were deficient compared to physicians' documentation on the trauma notification sheet. Regarding barriers facing paramedics during handover process, most frequent barriers were lack of standardization, lack of training and limitation of resources.

Key words: handover, ambulance, prehospital

Introduction :

The World Health Organization (WHO) identified trauma as any unplanned event caused by an external force that acts quickly and results in physical or mental injury⁽¹⁾.

The term "polytrauma" has been frequently identified in terms of a high Injury Severity Score (ISS) and has been used interchangeably with terms such as "severely injured" or "multiple trauma"⁽²⁾

Trauma is the main cause of mortality and morbidity worldwide. The universal burden of trauma is markedly high with injuries accounting for 10% of all deaths & over 15% of disability-adjusted life years (DALYs)⁽³⁾.

The World Bank and WHO found that until 2020, twenty percent of all the DALYs losses would be a consequence of injuries. Regarding to the burden of diseases and injuries study found that, twenty eight percent of years of life lost (YLL) and the first reason of YLL among the whole causes of death are caused by injuries⁽⁴⁾.

Approximately 16,000 people die because of injuries every day and for each of these mortalities, numerous thousand individuals stay alive with everlastingly disabling injuries. In the United States, trauma-related costs, such as, employer costs, insurance administration costs, medical expenses, property damage and lost wages, exceed \$400 billion yearly⁽⁵⁾.

The dissemination of mortality because of trauma follows a tri-modal distribution. In the early phase, in a fifty percent of the trauma patients, death happens in the first seconds to minutes after the event, and mostly is due to brain stem damage, brain lacerations, cardiac injury, high spinal trauma, aortic rupture and other great vessel injury. Very few of these patients survive. These deaths are salvageable hardly and here lies the significance of health education and preventive measures⁽⁶⁾.

Medical handover from prehospital care to the emergency department (ED) is defined as the transfer of responsibility of the care of one or more patients to another person or team. Handovers are of enormous importance for the subsequent emergency treatment because that treatment necessitates specific expertise, quick decision-making and accurate timing. Furthermore, the handover is serious for the relaying of information, such as details from the emergency scene and interventions that have happened⁽⁷⁾.

The handover of patients from one health care provider to another is recognized as a high-risk activity and carries the potential for loss of important information⁽⁸⁾.

A Slight is known about how efficiently information is transmitted from emergency medical services (EMS) personnel to the clinicians in the ED receiving the patient. Information about prehospital events and clinical findings can help ensure convenient and appropriate care⁽⁹⁾.

Trauma patients are a reasonable subgroup to begin to assess the integrity of information conduction between EMS providers and receiving clinicians, as the trauma literature describes a set of prehospital data points that are known to have an influence on outcome and therefore should be included in the EMS report and known by the receiving team⁽¹⁰⁾.

Patient and methods:

We conducted a cross sectional observational study at emergency department at Suez Canal University hospital. Paramedics delivering polytrauma patients to the ER team were involved. We included all registered paramedics delivering polytrauma patients. We excluded paramedics delivering isolated trauma patients.

Data was collected in Emergency Department Suez Canal University Hospital by the researcher from Paramedics coming with polytrauma patients. An informed consent was taken from the paramedics after a short interview to explain the aim and the procedure of the study. Data was collected through the Trauma/ time critical notification form. Data included patient demographics, mechanism of trauma, signs observed and treatments given in the ambulance. Data included in the Trauma/ time critical notification form (appendix I) was considered the standard data that should be reported by the paramedics. Data reported by each paramedic was documented by the researcher. Then, the collected data was compared to data included in the Trauma/ time critical notification form to assess missing or faulty data. Then, paramedics completed another questionnaire that included potential barriers that hinder effective handover to the medical team at the ED.

Literature did not include a standardized form for barriers affecting the handover process. After translation in an accredited translation center, the pilot study was carried on 20 paramedics who were not included in the study to assess the understandability, clearness, acceptability and meaning of the questionnaire items to the participants. Secondly, two academic members of staff were asked to review the draft questionnaire. After the pilot study, the internal consistency reliability was assessed using Cronbach alpha coefficients for each domain. The coefficient ranges from 0 (lowest reliability) to 1 (highest reliability). Kappa statistic, which also ranges from 0 to 1, was used to measure the test-retest reliability.

Results :

All data items handed over by paramedics were the same as documented by physicians on the trauma notification sheet regarding mechanism and types of injury. The most frequent types of injuries were motor car accidents (51.2%), followed by motorcyclist (30.4 %) then falling from height (13%). the vast majority of the injuries were blunt (95.2%), whereas only 4.8% of the injuries were penetrating (4.8%).

It was found that the most of the data items handed over by paramedics were the same as documented by physicians on the trauma notification sheet regarding site and description of injury. The most frequent types of injuries were fracture of ≥ 2 long bones, spinal injuries and pelvic fractures. Paramedics' handovers had significantly missing data in all items of vital signs compared to physicians' assessments among polytrauma patients especially respiratory rate, temperature and GCS assessment.

Almost all other handovers related to procedures done to trauma patients were deficient in comparison to physician documentation. Regarding frequency of data items related to medications given to trauma patients. It was found that almost all data items handed over by paramedics were deficient compared to physicians' documentation on the trauma notification sheet. It was found that there was a statistically significant difference between handover of the paramedics and physicians' documentations regarding the past medical history and medications patients on ($p < 0.001$).

It was found that the most frequent barriers were lack of standardization (83%), lack of training (68%) and limitation of resources (18%).

Discussion:

Miscommunication during clinical handover contributes to adverse events and it is subsequently targeted to improve patient safety in the hospital setting and in the emergency department (ED)⁽⁸⁾. EDs are chaotic and complex environments which can result in inaccurate or lost information during the handover process⁽¹¹⁾. For these reasons it is imperative that clear, consistent and concise communication between health care providers within the ED is undertaken to minimize the risk of an adverse event occurring⁽¹²⁾.

We observed 125 handovers of paramedics delivering polytrauma patients to the ER team aiming to assess the process of data transfer and the lost data between paramedics and the trauma team.

In the current study we found that all data regarding age, gender, time of injury and arrival and mechanism of trauma handed over by paramedics were the same as documented by physicians on the trauma notification sheet. However, there were missed data regarding age and time of injury of some trauma patients as documented by both paramedics and physicians on the trauma notification sheet that were reported only in 78% of them. These patients might have been brought to the ER with people who did not know them well or these patients were rather unconscious to report these data. These data were also missed in some patients in the observational multisite study of handover in the emergency department by Ehlers *et al.* who found that the age of the patient was reported 339 times (47.0%) at the time of handover and the time of the emergency onset was reported in 272 cases (37.7%). During the observation period in this study, a total of 721 handovers were examined in the three EDs. Of these handovers, 44.5% ($n = 321$) were carried out by emergency physicians (EPs) and 55.5% ($n = 400$) by paramedics. 79.1% ($n = 570$) of the transfers involved non-trauma emergency patients, and 20.9% ($n = 151$) patients after trauma⁽⁷⁾. Similarly, in the audit study by Yegane and colleagues, the phase 1 before training sessions showed under reporting of patients' identification and age being reported only in 10.7% and 34%, respectively⁽¹³⁾.

Mechanism of trauma and injury patterns were perfectly handed over by paramedics and it was found that almost all data items handed over were the same as documented by physicians on the trauma notification sheet with motor car accidents being the most encountered mechanism of trauma. Similarly, in a study assessing the clinical information transfer between EMS staff and emergency medicine assistants during handover of trauma patients by Yegane and colleagues, mechanism of injury was reported in almost all trauma patients represented 88.7% of the cases⁽¹³⁾. Paramedics missed some chest ($n = 16$) and abdomen ($n = 15$) injuries which were later discovered by physicians. Two cases with Tension pneumothorax and two cases with rigid abdomen

were missed from paramedics. Paramedics might have not properly exposed the patients and searched for some hidden injuries. And also no vital signs were recorded for these patients by paramedics.

The number of limb injuries documented by physicians (57 patients) was lower than that reported by paramedics (64 patients). On the other hand, some pelvic injuries were missed by paramedics (7 patients). Those pelvic injuries might have been mistakenly reported as limb injuries as the patient might have been holding or pointing to his limb or seen unable to mobilize this limb.

Paramedics' assessment of trauma patients' vital signs was very defective in our study. Pulse, blood pressure, and O₂ saturation were assessed and reported in only 18%, 6.4%, and 18.4% of trauma patients, respectively. Additionally, temperature and GCS were not reported for any patient. Physicians' assessment was statistically significant different ($p < 0.001$) as they recorded all these vital signs for all patients. This defect may be due to lack of resources, experience or some environmental factors. Similar defect was detected in the study of Ehler and colleagues. In only 44.7% ($n = 289$) of cases was the blood pressure (BP) mentioned in the handover. In 30.6% ($n = 199$) of handovers the heart rate (HR) was verbalized, while the oxygen saturation (SpO₂) was only communicated in 25.6% ($n = 165$) of cases. The respiratory rate was only communicated in 12.8% of handovers. GCS was assessed in only 22.2% of handovers⁽⁷⁾. Yegane et al. found that only 74% of pre-education handovers included assessed vital signs⁽¹³⁾.

Ehler *et al.* noted that the presence of a higher disease severity with pathological vital signs appears to be a trigger for more verbalization at the handover. Conversely, in less critical patients, information regarding the leading medical problem, vital signs, and other information from the patient's medical history may not be considered relevant for the handover⁽⁷⁾.

To date, numerous studies have shown that vital signs, especially respiratory rate, BP, and GCS, have a predictive value for the outcome of critical emergency patients^(14,15). In this context, vital signs play an important role in order to evaluate critical conditions of patients by using scores such as qSOFA⁽¹⁶⁾. Here, a transfer of vital signs is categorically called for, independent of the severity of the illness and the qualification of the person transmitting the data.

In our study, physicians documented usage of cervical collar in all trauma patients while paramedics used it in 72% of cases only ($p < 0.001$). The National Emergency X-Radiography Utilization Group (NEXUS) criteria state that a patient with suspected c-spine injury can be cleared providing the following: no posterior midline cervical spine tenderness is present, no evidence of intoxication is present, the patient has a normal level of alertness, no focal neurologic deficit is present, and the patient does not have a painful distracting injury⁽¹⁷⁾. Similarly, The Canadian C-Spine Rules (CCR) rules out cervical spine injury in low-risk patients, obviating the need for radiography. Patients are low risk provide that there is not age older than 65 years, dangerous mechanism of injury, numbness or tingling present in the extremities⁽¹⁸⁾. Therefore, cervical collar is better used in polytrauma patients as in our sample and it was missing in patients' handover of paramedics.

Airway management was quite deficient in paramedics' handover. Only three cases in which Oropharyngeal/ nasopharyngeal airway was used in comparison to physicians' management who used them in 27(21.6%) patients ($p < 0.001$). Additionally, laryngeal mask airway, endotracheal tube, rapid sequence intubation, and ventilation were not used in polytrauma patients. However, 16 patients required these interventions according to physician documentation. These interventions are advanced and require modest training and experience to master them which might not be available in paramedics. Additionally, paramedics are not allowed to perform any invasive maneuvers to the patients. Paramedics did not obtain IV access in any polytrauma case. According to the ABCDE approach it is required to insert an IV catheter to trauma patients in order to keep the vein patent and prevent difficult cannulation if the patient deteriorates. Additionally, IV fluids are from the basic parts in polytrauma management⁽¹⁹⁾. Similar results were reported by Ehler et al. as he showed that a handover with a complete ABCDE algorithm (Airway, Breathing, Circulation, Disability, environment/Exposure) took place only 31 times (4.3%) and Intravenous (IV) access was mentioned in only 37.2% ($n = 132$) of the cases at handover and had the lowest ratio between performance and handover of all pre-clinically performed measures⁽⁷⁾.

None of the paramedics' handovers included giving emergency medications like potent analgesics or anti-epileptics. However, they were administered later in management of some patients in the ER according to physicians' sheet. Paramedics did not obtain any IV access and that might have been a cause for delay of medications.

Some of drugs used in rapid sequence intubation (RSI) were not available at ED like Suxamethonium and Pancuronium. Also some types of analgesia as inhaled analgesia like Methoxyflurane and strong opioid like Fentanyl were not available to be used. A proper history taking was another defect in paramedics' handover as they reported a significant past history and significant medication history only in 3 cases in comparison to 54 cases in which significant past and medication history were obtained by physicians ($p < 0.001$). In the study of Ehler *et al.*, previous illnesses of the emergency patient were reported at the handover with a frequency of 49.7% (95% CI, 46.0-53.3 / $n = 358$) and the risk factors of the patient in 54.4% (95% CI, 50.7- 58.0 / $n = 392$). The patient's home medication was mentioned in 41.2% (95% CI, 37.6-44.8 / $n = 297$) of the cases. Information on existing allergies was significantly less often reported in 17.0% (95% CI, 14.3-19.8 / $n = 123$) and on the last meal in 3.9% (95% CI, 2.6-5.3 / $n = 28$) of cases⁽⁷⁾. The pre-education handover in the study of Yegane *et al.* involved the patient's past history and home therapy only in 9.3%, 5.3% of patients, respectively⁽¹³⁾. The patient's chronic disease and medication history significantly affect the assessment and the management plan in the ER and this defect is slowing the process of management as all of these questions should be asked again in the ER.

Our observations regarding barriers affecting complete handover by paramedics focused on lack of standardization being the most important factor (83%). Others are lack of training (68%) and limitation of resources (18%). Other barriers were mentioned in the previous literature and addressed in order to improve the process of handover of trauma patients. Yegane et al. found that some information may not always be available at the time of delivering patients or, alternatively, some patients may not be able to communicate fully to provide their own medical history⁽¹³⁾. The distractions, disinterest, not being believed by ED staff (as perceived by paramedics) and amount of eye contact were common across several, mostly qualitative, studies⁽²⁰⁾. Bost et al.

found that differing organisational values and individual factors linked to experience, education and relationships, also impacted on handovers ⁽¹¹⁾.

Medical staff needs knowledge and skills of handover to ensure the safety and effectiveness of patient delivery. This can be through formal teaching sessions and workshops. It is recommended that education of medical staff about the standard handovers should be carried out in the hospital. This is a useful way of promoting learning within hospital. Holding handover training sessions is an excellent opportunity for medical staff in different categories to develop communication, leadership, teamwork, and problem-solving skills.

The clinical audit of Yegane *et al.* showed that patient handover in the ED did not initially follow the ISBAR (Identify, Situation, Background, Assessment, and Recommendation) standard guideline. After providing education as pamphlets and lectures to emergency medical assistant, a high percentage of patient handovers were conducted in accordance with the ISBAR instructions ⁽¹³⁾.

Recall of the paramedic verbal report is found to be worse in severe trauma cases compared with less severe trauma cases. This might be due to prioritizing the patient treatment in the emergency situation. Conflicts between listening and performing practical work at the same time were found to be a general theme reported by all health professionals. This causes lack of active listening ⁽²¹⁾. Another recommendation is that handovers for critically ill patients should be delivered in two phases – with essential information given immediately and thereafter supplementary information, when initial treatment has been undertaken.

This study has the strength of being one of the very few studies which focused on the quality of the process of polytrauma patients' handover. However, there are some limitations. Firstly, it is a single center study and there is a need to conduct a larger multicentre study in order to involve and properly assess different systems. Secondly, much of the processes of handover were done with same paramedics..

Conclusion

Almost all data items handed over by paramedics were deficient compared to physicians' documentation on the trauma notification sheet. Regarding barriers facing paramedics during handover process, most frequent barriers were lack of standardization ,lack of training and limitation of resources.

Recommendations

From the study results we recommend:

1. Medical staff needs knowledge and skills of handover to ensure the safety and effectiveness of patient delivery. This can be through formal teaching sessions and workshops
2. It is recommended that education of medical staff about the standard handovers should be carried out in the hospital. This is a useful way of promoting learning within hospital.
3. Providing education as pamphlets and lectures to emergency medical assistant.
4. Handovers for critically ill patients should be delivered in two phases – with essential information given immediately and thereafter supplementary information, when initial treatment has been undertaken.
5. Written notes should be used by medical staff instead of verbal handover.
6. A standardized form should be available in every ambulance, so paramedics could use it to avoid missing any items .

List of abbreviations

DALYs	disability-adjusted life years
ED	Emergency Department
EMS	Emergency Medical Services
ISS	Injury Severity Score
WHO	World Health Organization
YLL	years of life lost

Declaration:

- -Ethics approval and consent to participate: uploaded as separate file.
- all methods were carried out in accordance with relevant guidelines and regulations.
- all experimental protocols were approved by ethics committee of Faculty of Medicine, Suez Canal University, with Reference: Research 4178#.
- Ethics approval and consent to participate . Approval of authority was obtained
- An informed consent was taken from each patient or from his relatives before taking any data or doing any intervention .
- The consent included :
 - .1Arabic title of the research .
 - .2Aim of the research and brief scientific background .
 - .3We explained the aim of the study in a simple manner to be understood by the common people .
 - .4No harmful maneuvers were used
 - .5Right of the patient to refuse being involved in the research and we confirmed that he would have his usual treatment .
 - .6All data were confidential and were used in this research only .
 - .7Right of the patient or his relatives to withdraw from the study at any time without giving any reason .
 - .8An identified person to whom the patient or his relative could return to any time for any explanations .
 - .9Right of the patient to have a copy from the informed consent .
 - .10All participants were announced by the results of the study .
- Researcher phone number and all possible communicating methods were identified to the participants.
- Consent for publication: not applicable

- Availability of data and materials: All data generated or analysed during this study are included in this published article and supplementary materials section.
- Competing interests: no competing interest
- Funding: no funding resources.
- Authors' contributions :

M.E collected the data

M.E. and B.M. wrote the manuscript.

A.Z and A.D revised the manuscript.

-Acknowledgements:

Dr.Ahmed ELSayed Abou-Zeid

Associate Professor of emergency medicine , faculty of medicine, Suez canal university

Dr. Alaa Desouky Mohamed²

Lecturer of emergency medicine, faculty of medicine, Suez canal university

Moamen Mohammed Elsayed³

Resident of emergency medicine, faculty of medicine ,Suez Canal university

References :

1. Rau, C.-S., Wu, S.-C., Kuo, P.-J., Chen, Y.-C., Chien, P.-C., Hsieh, H.-Y. and Hsieh, C.-H. (2017) 'Polytrauma defined by the new berlin definition: A validation test based on propensity-score matching approach', *International journal of environmental research and public health*, 14(9), p. 1045.
2. Laytin, A. D., Azzazh, A., Girma, B., Debebe, F., Beza, L., Seid, H., Landes, M., Wytmsa, J. and Reynolds, T. A. (2019) 'African Journal of Emergency Medicine Mixed methods process evaluation of pilot implementation of the African Federation for Emergency Medicine trauma data project protocol in Ethiopia', *African Journal of Emergency Medicine*, 9(August 2018), pp. S28–S31. doi: 10.1016/j.afjem.2019.01.009
3. Bener, A., Zirie, M. A., Kim, E.-J., Al Buz, R., Zaza, M., Al-Nufal, M., Basha, B., Hillhouse, E. W. and Riboli, E. (2012) 'Measuring burden of diseases in a rapidly developing economy: state of Qatar', *Global journal of health science*, 5(2), pp. 134–144. doi: 10.5539/gjhs.v5n2p134.
4. Bener, A., Zirie, M. A., Kim, E.-J., Al Buz, R., Zaza, M., Al-Nufal, M., Basha, B., Hillhouse, E. W. and Riboli, E. (2012) 'Measuring burden of diseases in a rapidly developing economy: state of Qatar', *Global journal of health science*, 5(2), pp. 134–144. doi: 10.5539/gjhs.v5n2p134.
5. Sobrino, J. and Shafi, S. (2013) 'Timing and causes of death after injuries', *Proceedings (Baylor University. Medical Center)*, 26(2), pp. 120–123. doi: 10.1080/08998280.2013.11928934.
6. Ehlers, P., Seidel, M., Schacher, S., Pin, M., Fimmers, R., Kogej, M. and Gräff, I. (2021) 'Prospective observational multisite study of handover in the emergency department: Theory versus practice', *Western Journal of Emergency Medicine*, 22(2), pp. 401–409. doi: 10.5811/WESTJEM.2020.9.47836.
7. **Yong, G., Dent, A. W. and Weiland, T. J. (2008)** 'Handover from paramedics: Observations and emergency department clinician perceptions', *EMA - Emergency Medicine Australasia*, 20(2), pp. 149–155. doi: 10.1111/j.1742-6723.2007.01035.x.
8. **Evans, S. M., Murray, A., Patrick, I., Fitzgerald, M., Smith, S. and Cameron, P. (2010)** 'Clinical handover in the trauma setting: A qualitative study of paramedics and trauma team members', *Quality and Safety in Health Care*, 19(6). doi: 10.1136/qshc.2009.039073.
9. Carter, A. J. E., Davis, K. A., Evans, L. V and Cone, D. C. (2009) 'Information loss in emergency medical services handover of trauma patients', *Prehospital Emergency Care*, 13(3), pp. 280–285.
10. Bost, N., Crilly, J., Patterson, E. and Chaboyer, W. (2012) 'Clinical handover of patients arriving by ambulance to a hospital emergency department: A qualitative study', *International Emergency Nursing*, 20(3), pp. 133–141. doi: 10.1016/j.ienj.2011.10.002.
11. Iedema R, Ball C, Daly B, Young J, Green T, Middleton PM, Foster-Curry C, Jones M, Hoy S, Comerford D(2012). Design and trial of a new ambulance-to-emergency department handover protocol: 'IMIST-AMBO'. *BMJ Qual Saf.*21(8):627-33. doi: 10.1136/bmjqs-2011-000766. Epub 2012 May 23. PMID: 22626739.
12. **Yegane, S. A. F., Shahrami, A., Hatamabadi, H. R. and Hosseini-Zijoud, S. M. (2017)** 'Clinical Information Transfer between EMS Staff and Emergency Medicine Assistants during Handover of Trauma Patients', *Prehospital and Disaster Medicine*, 32(5), pp. 541–547. doi: 10.1017/S1049023X17006562.
13. **Barthel, P., Wensel, R., Bauer, A., Müller, A., Wolf, P., Ulm, K., Huster, K. M., Francis, D. P., Malik, M. and Schmidt, G. (2013)** 'Respiratory rate predicts outcome after acute myocardial infarction: a prospective cohort study', *European heart journal*, 34(22), pp. 1644–1650. doi: 10.1093/EURHEARTJ/EHS420.
14. **McNett, M., Amato, S., Gianakis, A., Grimm, D., Philippbar, S. A., Belle, J. and Moran, C. (2014)** 'The FOUR score and GCS as predictors of outcome after traumatic brain injury', *Neurocritical care*, 21(1), pp. 52–57. doi: 10.1007/S12028-013-9947-6.
15. **Park, J. E., Hwang, S. Y., Jo, I. J., Sim, M. S., Cha, W. C., Yoon, H., Kim, T. R., Lee, G. T., Kim, H. S., Sohn, I. and Shin, T. G. (2020)** 'Accuracy of the qSOFA Score and RED Sign in Predicting Critical Care Requirements in Patients with Suspected Infection in the Emergency Department: A Retrospective Observational Study', *Medicina (Kaunas, Lithuania)*, 56(1). doi: 10.3390/MEDICINA56010042.

16. Paykin, G., O'reilly, G., Ackland, H. and Mitra, B. (2018) 'Review article: Nexus criteria to rule out cervical spine injury among older patients: A systematic review', *EMA - Emergency Medicine Australasia*, 30(4), pp. 450–455. doi: 10.1111/1742-6723.12880.
17. Slaar, A., Fockens, M. M., Wang, J., Maas, M., Wilson, D. J., Goslings, J. C., Schep, N. W. L. and van Rijn, R. R. (2017) 'Triage tools for detecting cervical spine injury in pediatric trauma patients', *Cochrane Database of Systematic Reviews*, 2017(12). doi: 10.1002/14651858.CD011686.PUB2/MEDIA/CDSR/CD011686/IMAGE_N/NCDO11686-TST-002.PNG.
18. Thim, T., Krarup, N. H. V., Grove, E. L., Rohde, C. V. and Lofgren, B. (2012b) 'Initial assessment and treatment with the Airway, Breathing, Circulation, Disability, Exposure (ABCDE) approach', *International Journal of General Medicine*, 5, p. 117. doi: 10.2147/IJGM.S28478.
19. Dawson, S., King, L. and Grantham, H. (2013) 'Review article: Improving the hospital clinical handover between paramedics and emergency department staff in the deteriorating patient', *EMA - Emergency Medicine Australasia*, 25(5), pp. 393–405. doi: 10.1111/1742-6723.12120.
20. Jensen, S. M., Lippert, A. and Østergaard, D. (2013) 'Handover of patients: A topical review of ambulance crew to emergency department handover', *Acta Anaesthesiologica Scandinavica*, 57(8), pp. 964–970. doi: 10.1111/aas.12125.

Table 1. comparison between the mechanism of trauma handed over by paramedics and physician documentation

Variables	Handover by paramedics (n = 125)	Physician documentation (n = 125)	p-value
Motor car accident	64 (51.2)	64 (51.2)	1.00
Rollover	38 (30.4)	38 (30.4)	1.00
Ejected	0 (0)	0 (0)	-
Death other occupant	5 (4)	5 (4)	1.00
Pedestrian	5 (4)	5 (4)	1.00
Motorcyclist	38 (30.4)	38 (30.4)	1.00
cyclist	5 (4)	5 (4)	1.00
Fall > 3m	13 (10.4)	13 (10.4)	1.00
Burns	0 (0)	0 (0)	-
Explosion	0 (0)	0 (0)	-
Trapped	0 (0)	0 (0)	-

p-value is based on chi-square test

* statistical significance <0.05

Table 1 shows mechanism of trauma handed over by paramedics. Similarly, it was found that all data items handed over by paramedics were the same as documented by physicians on the trauma notification sheet. The most frequent types of injuries were motor car accidents (51.2%), followed by motorcyclist and rollover (30.4%) then falling from height (13%).

Table 2. Number of data items related to injuries pattern of the trauma patients

Variables	Handover by paramedics (n = 125) n (%)	Physician documentation (n = 125) n (%)	p-value
Pattern of injury	125 (100)	125 (100)	1.00
Penetrating	6 (4.8)	6 (4.8)	

Blunt	119 (95.2)	119 (95.2)	
-------	------------	------------	--

P-value is based on chi-square test.

* statistical significance <0.05

Table 2 shows that the vast majority of the injuries were blunt (95.2%), whereas only 4.8% of the injuries were penetrating (4.8%). All data items handed over by paramedics were the same as documented by physicians on the trauma notification sheet.

Table 3. Number of data items related to injuries site of the trauma patients

Variables	Handover by paramedics (n = 125) n (%)	Physician documentation (n = 125) n (%)	p-value
Injury site			
Limbs	64 (51.2)	57 (45.6)	0.375
Head	102 (81.6)	102 (81.6)	1.00
Chest	12 (9.6)	28 (22.4)	0.046*
Neck	16 (12.8)	19 (15.2)	0.584
Abdomen	12 (9.6)	27 (21.6)	0.008*
Pelvis	4 (3.2)	11 (8.8)	0.062
Axilla	0 (0)	0 (0)	-
Groin	0 (0)	0 (0)	-

p-value is based on chi-square test.

* statistical significance <0.05

Table 3 shows that paramedics' handovers had significantly missing data related to site of injury of polytrauma patients including chest (p= 0.046), and abdomen (p=0.008). On the other hand, all head injuries were handed over the same as physician documentations.

Table 4. Number of data items related to injury description of the trauma patients

Variables	Handover by paramedics (n = 125) n (%)	Physician documentation (n = 125) n (%)	p-value
Injury description			
Fracture of ≥ 2 long bones	64 (51.2)	57 (45.6)	0.375
Tension pneumothorax	0 (0)	2 (1.6)	0.337
Fracture pelvis	4 (3.2)	11 (8.8)	0.062
Crush	3 (2.4)	3 (2.4)	1.00
Spinal	25 (20)	28 (22.4)	0.642

Rigid abdomen	0 (0)	2 (1.6)	0.337
Amputation	3 (2.4)	3 (2.4)	1.00
Burn >20%	0 (0)	0 (0)	-

p-value is based on chi-square test.

* statistical significance <0.05

Table 4 summarizes paramedics' handover related to injury description of trauma patients. It was found that the majority of data items handed over by paramedics were the same as documented by physicians on the trauma notification sheet. The most frequent types of injuries were fracture of ≥ 2 long bones, spinal injuries and pelvic fractures.

Table 5. Number of data items related to vital signs of the trauma patients

Variables	Handover by paramedics (n = 125) n (%)	Physician documentation (n = 125) n (%)	p-value
Pulse	23 (18.4)	125 (100)	<0.001 ^a
blood pressure	8 (6.4)	125 (100)	<0.001 ^a
RR	0 (0)	125 (100)	<0.001 ^b
Temperature	0 (0)	125 (100)	<0.001 ^b
O ₂ Saturation	23 (18.4)	125 (100)	<0.001 ^b
GCS	0 (0)	125 (100)	<0.001 ^b

^a p-value is based on chi-square test.

^b p-value is based on Fisher exact test.

* statistical significance <0.05

Table 5 shows that paramedics' handovers had significantly missing data in all items of vital signs compared to physicians' assessments among polytrauma patients especially respiratory rate, temperature and GCS assessment.

Table 6. Number of data items related to procedures done to trauma patients

Variables	Handover by paramedics (n = 125) n (%)	Physician documentation (n = 125) n (%)	p-value
Procedures done			
Cervical collar	90 (72)	125 (100)	<0.001 ^a
Oropharyngeal/nasopharyngeal airway	3 (2.4)	27 (21.6)	<0.001 ^b
Laryngeal mask airway	0 (0)	0 (0)	-
Endotracheal tube	0 (0)	16 (12.8)	<0.001 ^b

Rapid sequence intubation	0 (0)	16 (12.8)	<0.001* ^b
Ventilation	0 (0)	16 (12.8)	<0.001* ^b
Chest decompression	0 (0)	2 (1.6)	0.561 ^b
IV access	0 (0)	125 (100)	<0.001* ^b
Fluids administration	0 (0)	125 (100)	<0.001* ^b

^a p-value is based on chi-square test.

^b p-value is based on fisher exact test.

* statistical significance <0.05

Table 6 shows that almost all other handovers related to procedures done to trauma patients were deficient in comparison to physician documentation.

Table 7. Number of data items related to medications given to trauma patients

Variables	Handover by paramedics	Physician documentation	p-value
Drugs administration			
Methoxyflurane	0 (0)	0 (0)	-
Maxolon	0 (0)	9 (7.2)	<0.001*
Morphine	0 (0)	6 (4.8)	<0.001*
Midazolam	0 (0)	23 (18.4)	<0.001*
Fentanyl	0 (0)	0 (0)	-
Suxamethonium	0 (0)	0 (0)	-
Pancuronium	0 (0)	0 (0)	-
Adrenaline	0 (0)	3 (2.4)	0.313

^b p-value is based on fisher exact test.

* statistical significance <0.05

Table 7 summarizes frequency of data items related to medications given to trauma patients. It was found that almost all data items handed over by paramedics were deficient compared to physicians' documentation on the trauma notification sheet.

Table 8 Number of data items related to significant information to trauma patients

Variables	Handover by paramedics (n = 125) n (%)	Physician documentation (n = 125) n (%)	p-value
Known allergies	1 (0.8)	3 (2.4)	0.313
Significant past history	3 (2.4)	54 (43.2)	<0.001*
Significant medications	3 (2.4)	54 (43.2)	<0.001*

P-value is based on Fisher exact test.

* statistical significance <0.05

Table 8 summarizes frequency of data items related to significant medical history to trauma patients. It was found that there was a statistically significant difference between handover of the paramedics and physicians' documentations regarding the past medical history and medications patients on ($p < 0.001$).

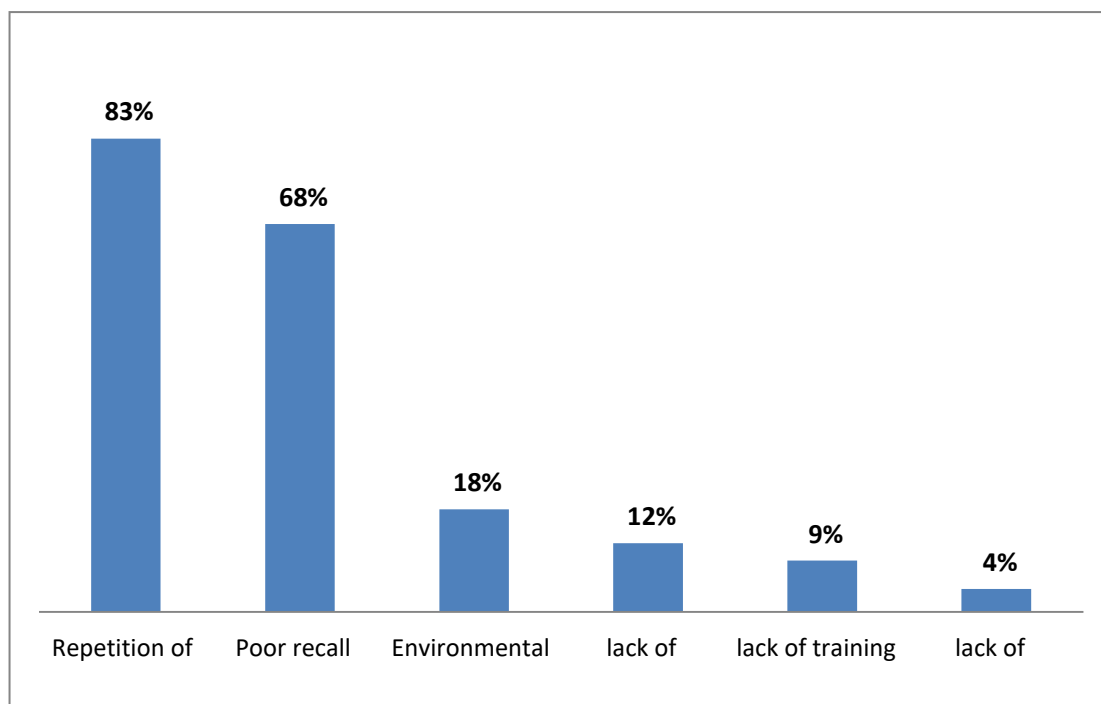


Figure1. Barriers affecting complete handover by paramedics

Figure 1 shows barriers affecting complete handover by paramedics. It was found that the most frequent barriers were lack of standardization (83%), lack of training (68%) and limitation of resources (18%).