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Analysis of an American College of Surgeons Committee on Trauma (ACS-COT) Approved Pilot Project: Increasing Provider Communication During Interhospital Transfer

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ABSTRACT

The American College of Surgeons Committee on Trauma requires physician-to-physician communication prior to interhospital transfer. This requirement can be difficult to achieve in high-volume trauma centers. This pilot project utilizes trauma advanced practice providers (APPs) as the primary communicator, in lieu of the trauma surgeon, prior to interhospital transfer. The hypothesis suggests that APPs can provide safe recommendations and accurately triage patients for the highest level trauma alert. From January to April 2018, a total of 1,145 patients were transferred to a Level I or Level II trauma center. All interhospital trauma transfers were dispatched through a designated transfer center APP (TCAPP). Descriptive statistics were used to describe the frequency of core TCAPP recommendations, including reversal agents for anticoagulants, antibiotics for open fractures, direct admission criteria, administration of blood products, and triaging to the highest level of trauma activation. TCAPP triage accuracy was analyzed and reported as percentages. Percentages are compared between independent groups using a chi-square test. Prior to implementation of the TCAPP role, provider-to-provider communication occurred in less than 1% of interhospital transfers; TCAPP-to-provider communication occurred 92% of the time ($p < .001$). During the study period, the TCAPP made 398 care-related recommendations. Three (<1%) TCAPP recommendations were deemed inappropriate. The TCAPP (89.7%) and physician (89.9%) triage accuracy was not significantly different ($p = .43$). Interhospital transfer communication and recommendations can be performed safely and accurately by a trauma trained APP.

Key Words

Interhospital transfer, Provider-to-provider communication, Trauma advanced practice provider

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Severely injured patients often require the resources and specialized care found at tertiary referral centers (Garwe et al., 2019). The recommendation of interhospital transfer for trauma patients has been associated with decreased mortality (Garwe et al., 2019; Martinez et al., 2017). The transition-of-care period or "patient handoff" is a time of information degradation and patient safety risk (CRICO Strategies, 2015). The Joint Commission (2017) has identified patient handoffs as a high-risk time correlating with sentinel events. Because of the nature of often hazardous trauma scenes, multisystem injuries, and complex evaluations, trauma patients present a transition-of-care challenge.

Few studies have focused their efforts on interhospital trauma transfer processes or their clinical outcomes (Usher et al., 2016). According to Usher et al. (2016), transfer documentation is frequently absent, with a 58.3% completeness rate. A similar study conducted by Lewis,

Schoenfeld, and Landry (2018) revealed that the lack of imperative documentation in transfer packets leads to repeat imaging, unnecessary testing, and an increase in emergency department length of stay. In an attempt to mitigate this problem, the American College of Surgeons Committee on Trauma (ACS-COT) (2014) requires physician-to-physician communication prior to all interhospital transfers (Criteria Deficiency [CD] 4-1). At high-volume trauma centers, the trauma surgeon is often multitasking, encumbered, and unable to provide direct communication with the referring provider. CD 4-1 was recently cited as a weakness for the Level II facility. This resulted in the development of a process utilizing advance practice providers (APPs), in lieu of the trauma surgeon, to perform interhospital provider-to-provider communication and meet the ACS-COT requirement.

Advanced practice providers are established in most trauma centers, proven to provide safe and effective care (Christmas et al., 2005; Gillard et al., 2011; Holliday, Samanta, Budinger, Hardway, & Bethea, 2017). In fact, utilization of trauma trained APPs in the care of injured patients has been endorsed by the Eastern Association for the Surgery of Trauma and Society of Trauma Nurses (Messing et al., 2017). The purpose of this project was to address the added communication responsibility for our trauma surgeons, developing a process in which all interhospital transfer communication was conducted by trauma trained APPs. The hypothesis suggests that trauma trained APPs (1) can be utilized to meet the ACS-COT criteria, (2) can provide safe recommendations to the transferring provider, and (3) can accurately triage interhospital transfers for the highest level trauma alert.

METHODS

This is a descriptive, before-and-after study of a process improvement initiative implemented to address the ACS-COT CD 4-1. We began utilizing trauma trained APPs as the primary communicator on all interhospital transfers on January 2, 2018. The study period was conducted through April 2018 and includes the analysis of 1,145 interhospital transfers. This process improvement initiative was approved by the systems institutional review board, which governs research activities at both institutions; it was also approved by the American College of Surgeons Verification Review Committee (ACS-VRC).

To secure project approval from the ACS-VRC, the Level II Trauma Medical Director sent a written request to the ACS-VRC Chair. The inquiry provided a project overview and requested the ACS-VRC grant a waiver of the requirement that the receiving trauma physician speak directly with the referring provider. The project proposed the capability of the trauma APP to satisfy the provider-to-provider communication requirement. The ACS-VRC discussed the matter at a subsequent meeting, and the medical director was notified by the VRC Chair of the pilot project's approval.

The project was a collaborative effort between a Level I and Level II trauma center at a large nonacademic, nonprofit health care system in central Ohio. Both locations serve as tertiary trauma centers and cumulatively receive an estimated 3,700 interhospital transfers annually; the combined annual volume is approximately 11,000 patients. Each center varies in its trauma surgeon staffing requirements; both centers do participate in acute care surgery coverage, have established APP programs, and utilize emergency medicine and surgical resident staff in varying capacities. Trauma APPs are required to complete an onboarding process that includes lectures, procedural didactics, physician evaluation, Advanced Trauma Life Support, and the Fundamentals of Critical Care Support courses. The APP daily responsibilities include trauma activation response, daily management of critical and noncritical care patients, various procedural activities, as well as all outpatient follow-ups.

To provide 24-hr coverage, this project required five additional full-time APPs. The additional staffing was distributed between our Level I (three APPs) and Level II centers (two APPs). Transfer center responsibilities are placed on a call rotation. Interhospital trauma transfers entering either facility are dispatched through a centralized transfer center. The transfer center then facilitates communication between the on-call transfer center APP (TCAPP) and the referring provider. The TCAPP carries a phone that is dedicated to communication with the transfer center and referring providers. The APP must have at least 1 year of experience as a trauma provider to fulfill this role.

The primary outcome was compliancy with the ACS-COT criteria for provider-to-provider communication on all interhospital transfers utilizing the TCAPP. Secondary outcomes include TCAPP care-related recommendations and the TCAPPs triage accuracy for the highest level alert. For consistency the pilot project began with an emphasis on specific TCAPP recommendations; initial recommendations were based upon frequently encountered transferred injuries. We also intended the TCAPP recommendations to improve hospital throughput by increasing the number of direct admissions. The TCAPPs received additional education around the following core recommendations: (1) reversal agents for anticoagulant (AC) medications, (2) antibiotics for open fractures, (3) direct admission criteria, (4) administration of blood products for hemorrhagic shock, and (5) identifying the need for the highest level of activation (HLOA). Table 1 shares a brief summary of the focused TCAPP guidelines. The TCAPP notifies the emergency department of its activation if the patient meets criteria for the HLOA. The emergency department physician then makes the final

TABLE 1 TCAPP Recommendation Guidelines

TCAPP Recommendation	Brief Guideline Summary
Reversal agents for AC medications	• An intracranial hemorrhage has been confirmed on head CT and the patient is prescribed an AC medication • Appropriate reversal agents should be considered and administered as soon as possible; also consider early notification/consultation of the neurosurgical team
Antibiotic administration for open fractures	• Orthopedic injuries: Patients with open fractures should receive intravenous antibiotics within 60 min of presentation • Mandible fractures: Any fracture that crosses the dentition or external tissue is an open fracture and should receive antibiotic coverage
Direct admission	• Patients referred by a verified trauma center with respiratory and hemodynamic stability can be considered for direct admission
Administration of blood products	• For patients with active hemorrhage and/or hemorrhagic shock consider the recommendation of hemorrhage control measures and blood product transfusion in lieu of high-volume crystalloid infusion
Triaging to the highest level alert	Category 1 criteria • Traumatic cardiac arrest (blunt or penetrating) • Gunshot and penetrating injuries to the head, neck, torso, or extremities proximal to the elbow/knee • Drowning • Any sign of current or impending respiratory compromise • Hemodynamic instability (systolic blood pressure <90) • Glasgow Coma Score <9 with mechanism attributed to trauma • Deterioration of the previously stable patient • Transfer requiring ongoing resuscitation to maintain vital signs (crystalloid or blood products) • Paralysis or suspected spinal cord injury • Maxillofacial/neck injury with potential airway compromise • Pulseless, crushed, degloved, amputated, or mangled extremity proximal to the elbow and knee (concern for vascular compromise) • Tourniquet in place

Note. AC = anticoagulant; CT = computed tomography; TCAPP = transfer center advanced practice provider.

activation recommendation once alerted by the transport agency or upon the patient's arrival to the emergency department. If at any time the opinion of a trauma surgeon is requested by the referring provider and/or the TCAPP, a trauma surgeon is connected to the call by the transfer center. The TCAPP process is highlighted in Figure 1.

Trauma transfers were then retrospectively reviewed by designated APPs at each trauma center via electronic medical record, in order to determine whether direct provider-to-provider communication occurred. Furthermore, TCAPP recommendations were inspected for appropriateness according to established clinical guidelines. Patients with an injury severity score (ISS) of more than 14 or any patient who received the HLOA was also reviewed. The TCAPP activation recommendations were compared with the level of alert called by the emergency department physician. Unusual or inappropriate recommendations and/or activations were further reviewed by two designated trauma surgeons.

Upon completion of the interhospital transfer chart reviews, 4 months of data were retrospectively queried from the institutions trauma database; 896 charts were reviewed from October to November 2017. The key elements queried from previous interhospital transfers included demographic data, time to antibiotic administration in the setting of open fractures, and the administration of AC reversal agents in the setting of intracranial hemorrhage. The goal of comparison was to identify whether the TCAPP recommendations were improving the timeliness in delivery of these interventions.

Descriptive statistics comprise the bulk of the results. Categorical or dichotomous variables are reported as counts and percentages. For continuous variables, means and standard deviations are presented. Percentages are compared between independent groups using a chi-square test. The standard $p < .05$ is used to determine statistical significance.

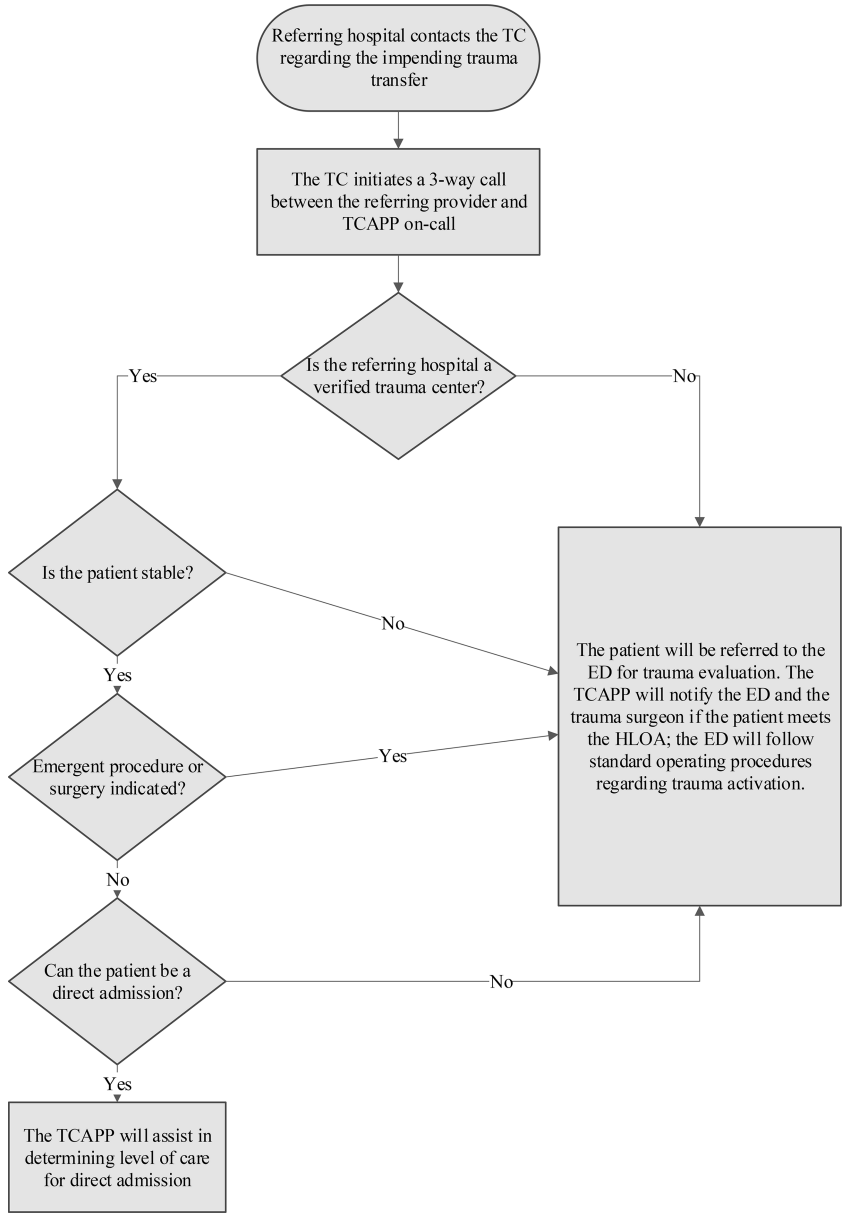

Figure 1. TCAPP process guideline. ED = emergency department; HLOA = highest level of activation; TC = trauma center; TCAPP = transfer center advanced practice provider.

RESULTS

Demographics

From January to April 2018, a total of 1,145 patients were transferred to Level I (n = 799) or Level II (n = 346) trauma center based upon the referring provider request. The majority of patients in the cohort were female (57.5%), with a mean age of 54.3 years and an ISS of 8.5. Length of stay was the only demographic or injury-related data point significantly different post-TCAPP implementation (p = .08). Further demographic and injury-related data are described in Table 2.

Provider-to-Provider Communication

The pilot project witnessed a stark increase in compliance with ACS-COT criteria 4-1. Prior to TCAPP implementation, direct communication occurred in less than 1% of interhospital transfers compared with 92% post-TCAPP implementation ($p < .001$). The TCAPP did not require trauma surgeon consultation during the study period, nor was it documented as requested by the referring provider.

TCAPP Recommendations

The TCAPPs made 398 recommendations including antibiotics (n = 46; 11%), reversal agents for AC (n = 23; 5%),

TABLE 2 Demographic and Injury-Related Data

	Pre-TCAPP Implementation	Post-TCAPP Implementation
Interhospital transfers, Level I, *n* (%)	671 (74.9)	799 (69.8)
Interhospital transfers, Level II, *n* (%)	225 (25.1)	346 (30.2)
ISS, mean (*SD*)	8.5 (7.1)	8.5 (7.2)
LOS, mean (*SD*)	4.4 (5.9)	4.0 (4.5)
Age, mean (*SD*)	55.1 (22.8)	54.3 (22.4)
Male, *n* (%)	501 (55.9)	487 (42.5)
Female, *n* (%)	395 (44.1)	658 (57.5)
Caucasian, *n* (%)	833 (93.0)	1,046 (91.3)
African American, *n* (%)	47 (5.2)	67 (5.9)
Other, *n* (%)	16 (1.8)	32 (2.8)

Note. ISS = injury severity score; LOS = length of stay; TCAPP = designated transfer center advanced practice provider. There was no statistical difference between groups for age, ISS, or racial background; p = .08 for hospital LOS.

direct admissions (n = 3; 0.7%), blood product administration (n = 5; 1%), HLOA (n = 114; 29%), and various other miscellaneous recommendations (n = 207; 52%) (Figure 2). Figure 3 details the miscellaneous TCAPP recommendations.

Further analysis of pre- and postimplementation data shows that patients prescribed AC medication and diagnosed with an intracranial hemorrhage were more likely to receive reversal agents (n = 29; 59%; 95% CI [2.0, 11.0]). In turn, patients with open fractures were also more likely to receive antibiotic therapy after TCAPP implementation (n = 29; 38%; 95% CI [1.2, 6.1]). These findings are presented in Figure 4. Only three (<1%) TCAPP recommendations were deemed inappropriate: tranexamic acid administration outside the recommended time frame, recommendation to reapply a backboard, and antihypertensive administration for intracranial hemorrhage resulting in transient hypotension.

Triage Accuracy

The TCAPP (89.7%) and emergency physician (89.9%) triage accuracy was not significantly different (p = .43).

DISCUSSION

The results of this process improvement project support the utilization of the TCAPP as an innovative approach to ACS-COT CD 4-1 compliancy. Prior to implementation, provider-to-provider communication occurred with a frequency of less than 1% on all interhospital trauma transfers. To complicate this already low compliancy, both locations have experienced a large increase in trauma volume and the trauma surgeons have been assigned additional responsibilities (i.e., acute care surgery, difficult airway teams, etc.).

By inserting the TCAPP into the transfer process, compliancy with the ACS-COT requirement increased to 92% and also alleviated the additional responsibility from the trauma surgeon. Although there is no measure of proof, subjectively the trauma team feels that communication of the care received at referring hospitals has improved. The project did experience an unexpected barrier; even with a TCAPP dedicated to interhospital transfer communication, we were unable to participate in 8% of transfer calls. Missed calls were attributed to the TCAPP receiving multiple calls at once or the transfer center failing to engage the TCAPP in transfer communication (as determined by the call-waiting feature and closed-loop feedback with the transfer center). To date, there is no evidence in the literature utilizing trauma APPs in this capacity.

The results also support the ability of the TCAPP to make safe recommendations and improve the timeliness of care. The TCAPP provided 398 recommendations to referring providers. Patients were 4.8 times more likely to receive AC reversal agents in the setting of intracranial hemorrhage and 2.8 times more likely to receive

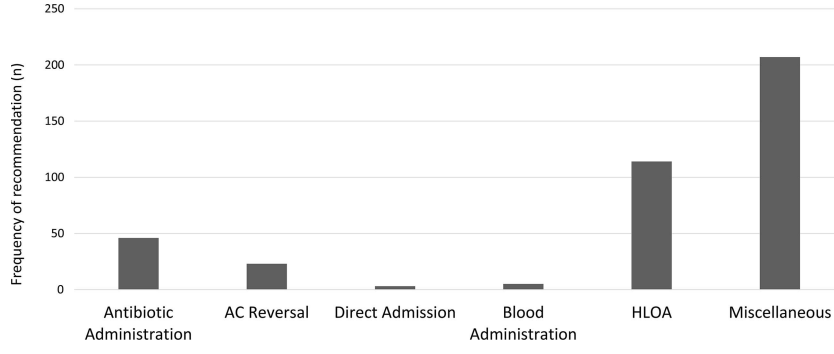

Figure 2. TCAPP core recommendations. AC = anticoagulant; HLOA = highest level trauma alert; TCAPP = transfer center advanced practice provider.

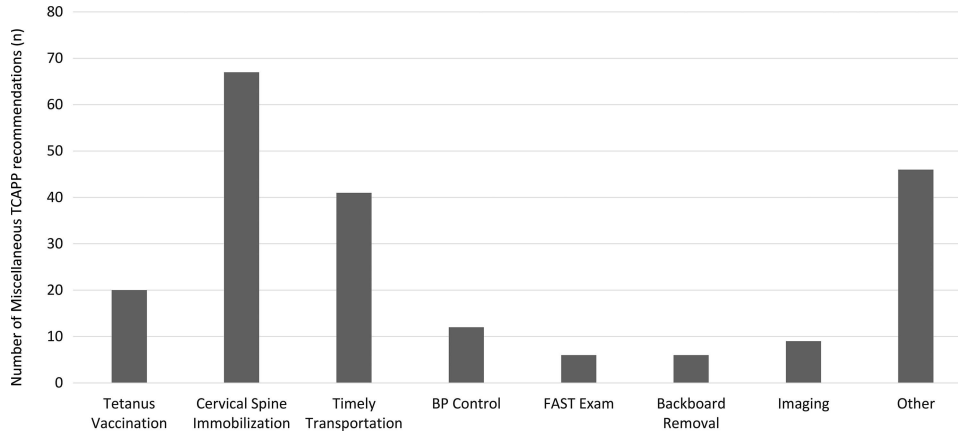

Figure 3. Miscellaneous TCAPP recommendations. BP= blood pressure; FAST= focused assessment with sonography in trauma; TCAPP = transfer center advanced practice provider.

antibiotics for open fracture after TCAPP implementation. These recommendations improved the timeliness in the provision of these interventions, as the agents were administered prior to transfer. Less than 1% of the recommendations were deemed inappropriate or unusual; none of them were associated with long-term adverse events.

By utilizing the TCAPP as the tertiary provider during interhospital communication, the APPs were able to use their knowledge of trauma care to provide multiple other miscellaneous recommendations. For example, recommendations included holding aspirin administration for chest pain in the setting of thoracic trauma, splinting of extremities prior to transfer, intravenous access, and various others. The resultant miscellaneous recommendations are likely due to the clinical acumen of the APPs and a result of the collaborative effort between the referring and tertiary providers.

Future utilization of the TCAPP has been considered for process improvement, to include coordinating outpatient follow-up to prevent unnecessary transfers, determining the most appropriate transportation modes, and improving estimated time of arrival. Like other Level II facilities, the trauma surgeons take call from home. Early notification of trauma transfers that meet the HLOA, with an accurate estimated time of arrival, would be useful for the Level II surgeons who are not in house. The process attempted to improve throughput by prompting the TCAPP to directly admit patients who had been evaluated at a trauma center; only 0.7% were direct admissions. This is likely due to a limited number of patients transferred from trauma centers.

Limitations

This process improvement project has limitations. The study lacked a power analysis. It was conducted at hospitals within the same system in central Ohio; there are limitations in its generalizability to other institutions. Our TCAPPs recommended the HLOA and notified the emergency department. The actual activation was up to the discretion of the emergency department physician. Because of the HLOA recommendation coming from a member of the trauma service, the emergency department physician may have felt obligated to follow the TCAPP

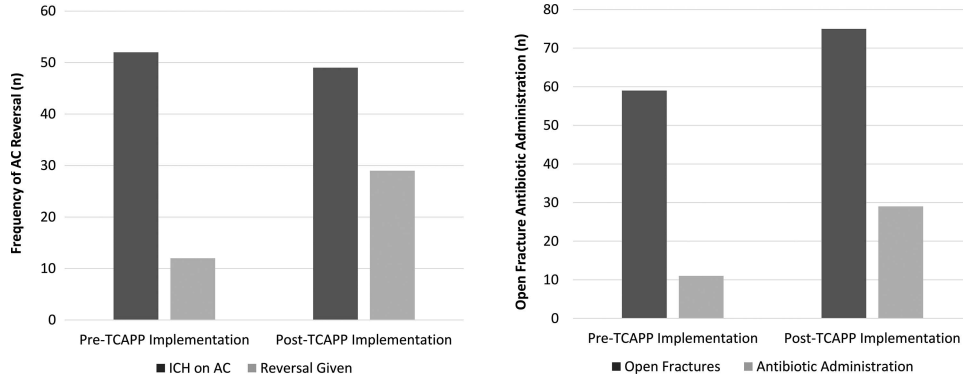

Figure 4. Post-TCAPP guideline-driven intervention results.AC = anticoagulant;ICH = intracranial hemorrhage;TCAPP = trauma center advanced practice provider. *p = .0002 when comparing AC reversal pre- and post-TCAPP implementation; p = .012 when comparing antibiotic administration pre- and post-TCAPP implementation.

recommendation. We only reviewed data during a 4-month period; ongoing data collection to further evaluate TCAPP recommendations and outcomes would support the safety of this project. The TCAPP made many recommendations; however, we are unable to associate the recommendations with improved outcomes; post-interhospital trauma transfer outcomes are an area of recommended future research. The outreach coordinator did attempt to obtain feedback from referring providers regarding satisfaction with TCAPP communication; few surveys were returned and the results were neutral.

CONCLUSION

Communication between providers on interhospital transfer is required by the ACS-COT. Ensuring provider-to-provider communication on all interhospital transfers can be challenging for a single trauma surgeon. To meet the ACS-COT CD 4-1 requirement, a trauma trained APP can be both an effective and safe alternative to the trauma surgeon.

KEY POINTS

- Compliancy with ACS-COT CD 4-1, which requires provider-to-provider communication prior to all interhospital transfers, can be difficult for a busy trauma surgeon.
- Advanced practice providers can be a safe and effective alternative to the trauma surgeon in meeting compliancy with ACS-COT CD 4-1.
- Utilizing trauma trained APPs can improve the timeliness of guideline-driven interventions prior to interhospital transfer.

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