

# Clinical handover from emergency medical services to the trauma team: A gap analysis

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## CLINICIAN'S CAPSULE

### What is known about the topic?

Clinical handover between emergency medical services (EMS) and emergency departments (ED) and/or the trauma team is suboptimal and can compromise patient safety.

### What did this study ask?

What are handover patterns and areas for improvement between EMS and the trauma team at Canada's largest trauma centre?

### What did this study find?

Handover characteristics included a lack of active listening, discordant expectations between team members, and inconsistency in content and structure.

### Why does this study matter to clinicians?

Handover quality improvement in the setting of trauma can reduce critical incidents, optimize team performance, and improve patient care.

**Results:** 79 formal verbal handovers were observed. Information was often missing regarding airway (present 22%), breathing (54%), medications (59%), and allergies (54%). Handover structure lacked consistency beyond the order of identification and mechanism of injury. Of all questions asked, 35% were questioning previously given information. The majority of handovers (61%) involved parallel conversations between team members while EMS was speaking. There was a statistically significant disparity between the self-evaluation of EMS handovers and the perceived quality determined by nurses and trauma team leaders.

**Conclusions:** We have identified the need to standardize handover due to poor information content, a lack of structure and active listening, information repetition, and discordant expectations between team members. These data will guide the development of a co-constructed framework integrating the perspectives of all team members.

## RÉSUMÉ

**Objectifs:** Peu d'études ont porté sur l'évaluation du transfert de responsabilité clinique, ou de soins, des services médicaux d'urgence (SMU) à l'équipe de traumatologie. L'étude visait donc à caractériser les pratiques relatives au transfert de soins afin de cerner les points à améliorer et de déterminer si l'uniformisation du transfert de soins permettrait d'accroître la performance de l'équipe de traumatologie.

**Méthode:** Un observateur formé a procédé à la collecte prospective de données sur une période de 9 semaines, dans un centre de traumatologie de niveau 1, au Canada, selon une répartition aléatoire de l'horaire afin de constituer un échantillon représentatif des transferts de soins. Les données recueillies reposaient sur des critères d'évaluation tels que la durée du transfert de soins, la structure du transfert de soins et la communication de renseignements, ainsi que sur des mesures de processus comme des questions ou des interruptions par l'équipe de traumatologie, et les perceptions du personnel infirmier, des chefs d'équipe de traumatologie et des

## ABSTRACT

**Objectives:** There has been limited evaluation of handover from emergency medical services (EMS) to the trauma team. We sought to characterize these handover practices to identify areas of improvement and determine if handover standardization might be beneficial for trauma team performance.

**Methods:** Data were prospectively collected over a nine-week period by a trained observer at a Canadian level one trauma centre. A randomized scheduled was used to capture a representative breadth of handovers. Data collected included outcome measures such as duration of handover, structure of the handover, and information shared, process measures such as questions and interruptions from the trauma team, and perceptions of the handover from nurses, trauma team leaders and EMS according to a bidirectional Likert scale.

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SMU quant aux transferts de soins, notées sur une échelle de Likert bidirectionnelle.

**Résultats:** Au total, 79 communications verbales de transfert de soins, écoutées attentivement, ont fait l'objet d'observation. Souvent, il manquait des renseignements sur l'état des voies respiratoires (communiqués : 22%), la respiratoire (54%), les médicaments (59%) et les allergies (54%). Au-delà de l'ordre habituel de présentation des renseignements personnels et du type d'accident, les structures de transfert de soins manquaient d'uniformité. Dans l'ensemble, 35% des questions posées concernaient des renseignements déjà fournis. Dans la majorité des cas de transfert de soins (61%), il y avait des conversations parallèles entre les membres d'équipe pendant que les SMU parlaient. Enfin, un écart statistiquement significatif a été relevé entre l'autoévaluation du transfert de

soins par les SMU et la perception de la qualité des communications par le personnel infirmier et les chefs d'équipe de traumatologie.

**Conclusions:** Les résultats de l'étude permettent de confirmer la nécessité d'uniformiser les pratiques relatives au transfert de soins en raison de la piètre qualité des renseignements fournis, du manque de structure et d'écoute active, de la répétition des renseignements et de la divergence de perception, entre les membres d'équipe, quant à la pertinence des renseignements fournis. Les données recueillies serviront de guide dans l'élaboration, en coconstruction, d'un cadre de travail intégrant le point de vue de tous les membres d'équipe.

**Keywords:** Prehospital/EMS, quality improvement, trauma

## INTRODUCTION

Transitions of care between health care providers represent a serious risk to patient safety and are, therefore, important to optimize.<sup>1-4</sup> Emergency medical services (EMS) play a crucial role in the trauma pathway of care, and their involvement usually ends with handover to hospital staff, which entails the transfer of information and accountability from paramedics to the trauma team.<sup>1,5</sup> At the interface of EMS and hospital personnel, clinical handover has been noted to be suboptimal, which can lead to critical incidents, reductions in quality of patient care, and potential litigation.<sup>1-4</sup> Previously identified flaws include a lack of active listening and perceived disinterest from receiving staff.<sup>5-9</sup> These factors can contribute to the information loss that can occur in handover, with studies reporting that up to 30% of information transmitted by EMS is not recorded by the receiving trauma team.<sup>10,11</sup>

Several studies have examined the effects of framework and mnemonic implementation to improve handover and have been met with improvements to handover structure and process.<sup>12,13</sup> In the United States and the United Kingdom, as well as a number of other countries, some studies have examined only the state of handover between EMS and emergency department (ED) staff or the trauma team at their institutions, without applying an intervention, with the purpose of identifying areas for improvement.<sup>6,10,11,14-16</sup> While these studies evaluate either the perceived quality of handover or information loss during this process, there is an overall paucity of research to provide a complete understanding

of the state of EMS handovers, particularly in the setting of trauma. Additionally, few studies have examined discordance in the perceptions of the quality of the handover process across disciplines. In this study, we sought to build on previously published work and provide a Canadian perspective of handover practices in the trauma bay, with the ultimate goal of identifying areas for focused improvement.

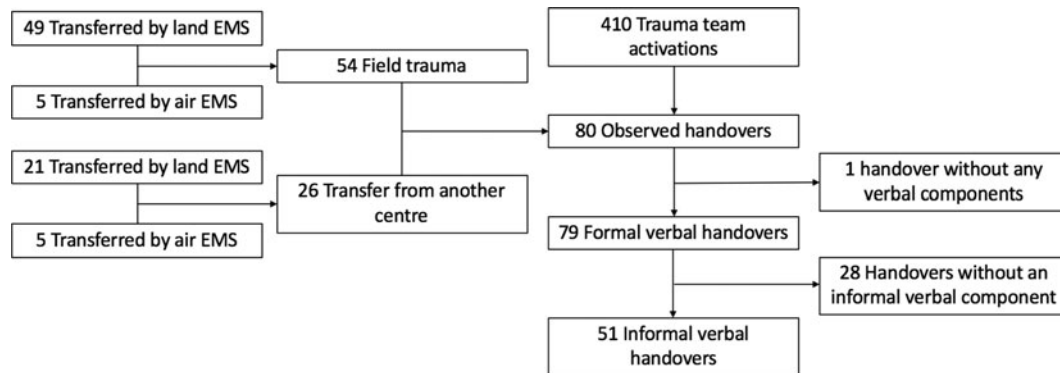
## METHODS

### *Study design and time period*

Following a preliminary review by the hospital Research Ethics Board, our study was deemed exempt from a full review, and did not require board approval, as it was an observational quality improvement study. Data were prospectively collected by a single observer during nine consecutive weeks from June 4, 2018, to August 3, 2018, including an initial one-week pilot period of refining our data extraction form. A randomly generated observation schedule was adhered to, consisting of five 8-hour blocks per week and included mornings, evenings, nights, weekdays, weekends, and holidays, so as to capture a representative breadth of trauma handovers.

### *Study setting and population*

This study was conducted at an adult level one trauma centre in an urban, academic hospital located in Toronto, Ontario, with approximately 2,000 trauma



**Figure 1.** A flowchart of all handovers during the eight-week data collection period.

activations per annum, approximately 50% of which have an Injury Severity Score (ISS) of  $\geq 16$ . The study population consisted of trauma patients aged 16 years or older brought to the hospital via EMS.

### Outcome measures

Our data collection form was based on a standard handover mnemonic known as the IMIST-AMBO framework (I: identification, M: mechanism of injury, I: injuries identified, S: signs and symptoms—including vital signs, T: treatment and trends, A: allergies, M: medications, B: background history, and O: other information), with a minor adjustment to include symptoms in the category of I: injuries identified.<sup>12</sup> Importantly, in this study, EMS were not trained to use this mnemonic and were not mandated to use any mnemonics in general. However, we opted to use the IMIST-AMBO framework as a means of guiding our data collection because of the specificity and breadth of information that is captured and because it was successfully trialled and validated for handovers from EMS to the trauma team in an Australian setting.<sup>12</sup> Our data collection form divided the verbal handover into a formal section (formal handover), consisting of the trauma team pausing to listen to the EMS report, and an informal section (informal handover), consisting of any subsequent verbal interactions between EMS and members of the trauma team as the trauma team continued delivering care to the patient (e.g., EMS moving to the charting nurse and answering questions). Final data collection metrics included: 1) characteristics of the transfer to hospital; 2) patient characteristics; 3) information contained in the handover according to the IMIST-AMBO framework; 4) information related to the process and structure of the handover; 5) the presence of parallel

conversations, defined as ongoing conversations between other members of the trauma team as EMS delivered verbal handover; 6) duration of the formal and informal handover; 7) questions asked to EMS from the trauma team as interruptions and non-interruptions; and 8) a bidirectional Likert scale, distributed to EMS, the charting nurse, and the trauma team leader immediately following the handover. We captured team members' perceptions regarding three categories: amount of information in the handover as it related to clinical decision-making, duration, and structure.

### Data analysis

All statistical tests were conducted using IBM SPSS version 24.0 software (IBM Corp, Armonk, NY). Descriptive statistics were used to calculate handover characteristics and are expressed as means and standard deviations or proportions/percentages. Where relevant, chi-square tests of independence were used to assess for non-random correlations between variables, and Student's *t*-test was used to calculate non-random differences in means. A *p*-value of  $<0.05$  was considered statistically significant in all calculations.

## RESULTS

### Handover flow

Figure 1 demonstrates aggregate handover flow over the data collection period. One patient in extremis was transferred to the trauma bed without any verbal handover. Of the 79 formal handovers, 51 (65%) had a subsequent informal verbal component. Most physical patient

**Table 1. Characteristics of trauma patients and the trauma team**

Trauma population	Demographic feature	Value
Trauma patients	Median age (IQR)	42 (28–61)
	Male sex, <i>n</i> (%)	55 (69%)
	Mean Injury Severity Score (SD)	13.8 (12.3)
	Motor vehicle accident, <i>n</i> (%)	25 (31.3%)
	Fall, <i>n</i> (%)	19 (23.8%)
	Assault, <i>n</i> (%)	13 (16.3%)
	Pedestrian injury, <i>n</i> (%)	7 (8.8%)
	Cyclist injury, <i>n</i> (%)	8 (10.0%)
EMS providers	Other mechanism, <i>n</i> (%)	8 (10.0%)
	Median years of experience (IQR)	7 (4–17)
Trauma charting nurses	Median years of experience (IQR)	6 (4–11)
Trauma team leaders	Median years of experience (IQR)	4 (1–5)

EMS = emergency medical services; IQR = interquartile range; SD = standard deviation.

transfers from the EMS stretcher to the trauma bed occurred before formal handover (77%), 22% occurred during the handover, and one occurred after (1%). [Table 1](#) demonstrates demographic data of trauma patients for which handovers were observed and of the trauma team.

In 61% of formal handovers, there were parallel conversations among other members of the trauma team. Formal handovers with parallel conversations had a greater number of interruptions by team members to ask questions (3.15 v. 1.81, respectively;  $p = 0.001$ ). The presence of parallel conversations in formal handovers was also associated with a greater number of total questions asked (3.58 v. 2.23, respectively;  $p = 0.001$ ). Formal handovers with an associated informal component were significantly longer than those without one (3:19 v. 1:50, respectively;  $p < 0.001$ ).

### Handover content

The most consistently provided information in handovers included identification (99%), injuries identified and/or symptoms (97%), mechanism of injury (96%), and any mention of physical signs (92%) ([Table 2](#)). However, information communicated less frequently included details regarding the background history, including past medical history (present in 75% of handovers), en-route treatment and trends (68%),

medications (59%), and allergies (54%). While examining the sub-categories of identification and physical signs, information was also inconsistent. For example, EMS personnel never identified themselves (0%) and only mentioned the patient's name in 43% of handovers. With respect to the physical signs, information regarding airway status (present in only 22% of handovers) and breathing status (54%) was often lacking. Of the 79 handovers, only 10 (13%) included complete information pertaining to all airway, breathing, circulation, and disability.

### Questions during handover

During formal handovers, there was a mean of 3.05 (standard deviation [SD] 1.95) questions from the trauma team to EMS. Overall, 86% of these questions interrupted the formal handover. During the informal handover, there was a mean of 4.32 (SD 2.75) questions. There were significantly more questions referencing previously provided information in the informal handover compared to the formal handover (58% v. 13%, respectively;  $p < 0.001$ ). Overall, including both the formal and informal handover, there was a mean of 5.84 questions per handover, with 35% of the questions inquiring about information already provided.

In the informal handover, the most common types of questions asked concerned signs (41%), information in the category of "Other" (33%), treatment and trends (27%), the patient's medical background (19%), and injuries and/or symptoms (2%). Concerningly, 15% of questions were requests for the entire handover to be repeated ([Table 2](#)).

### Handover structure

The handover structure was largely inconsistent, as compared with the standard IMIST-AMBO tool ([Table 3](#)). Overall, 85% of handovers began with identification, with 49% of all handovers continuing with the mechanism of injury, and there was little consistency in category order beyond this. There was a dedicated question and answer (Q&A) period in only 28% of formal handovers, which would have involved paramedics explicitly asking the trauma team if they have any questions or providing a period of silence to probe for questions implicitly.

Additionally, the structure was further lacking with regards to the order in which information was presented, with EMS providers returning to a category of information

**Table 2. Information flow of formal and informal handovers by EMS according to the standard items of the IMIST-AMBO tool**

Handover information categories	Number of handovers in which information category was included (%)	Number of handovers in which EMS returned to this category unprompted	Number of handovers in which the information was questioned (%)
I - Identification	78 (99%)	0/78 (0%)	4 (5%)
EMS identification	0 (0%)	N/A	1 (1%)
Patient's Name	34 (43%)	0/34 (0%)	4 (5%)
Patient's Age	69 (87%)	0/69 (0%)	1 (1%)
Patient's Sex	66 (84%)	0/66 (0%)	0 (0%)
M - Mechanism of injury	76 (96%)	2/76 (3%)	15 (19%)
I - Injuries and/or symptoms	77 (97%)	55/77 (71%)	17 (22%)
S - Signs	73 (92%)	22/73 (30%)	32 (41%)
A: Airway status	17 (22%)	1/17 (6%)	0 (0%)
B: Breathing status	43 (54%)	4/43 (9%)	3 (4%)
C: Circulation status	62 (78%)	7/62 (11%)	6 (8%)
D: Disability status	58 (73%)	14/58 (24%)	6 (8%)
T - Treatment and trends	54 (68%)	10/54 (19%)	21 (27%)
A - Allergies	43 (54%)	3/43 (7%)	8 (10%)
M - Medications	47 (59%)	1/47 (2%)	10 (13%)
B - Background	59 (75%)	8/59 (14%)	15 (19%)
O - Other (e.g., scene, advanced directives, etc., as relevant)	64 (81%)	28/64 (44%)	26 (33%)

EMS = emergency medical services; N/A = not available.

\*Categories with sub-categories (e.g., identification, signs) were marked as being present if any sub-categories were present (e.g., patient's name, A: airway status).

**Table 3. Distribution of handover structure according to the standard IMIST-AMBO tool features**

Handover structure features	Number of handovers with feature
Introduction first	67 (85%)
Introduction, leading to mechanism of injury	39 (49%)
Introduction, leading to mechanism of injury, leading to injuries/symptoms	20 (25%)
Introduction, leading to mechanism of injury, leading to injuries/symptoms, leading to signs	10 (13%)
Introduction, leading to mechanism of injury, leading to injuries/symptoms, leading to signs, leading to treatment and trends	1 (1%)
Signs: Airway, leading to breathing, leading to circulation, leading to disability	0 (0%)

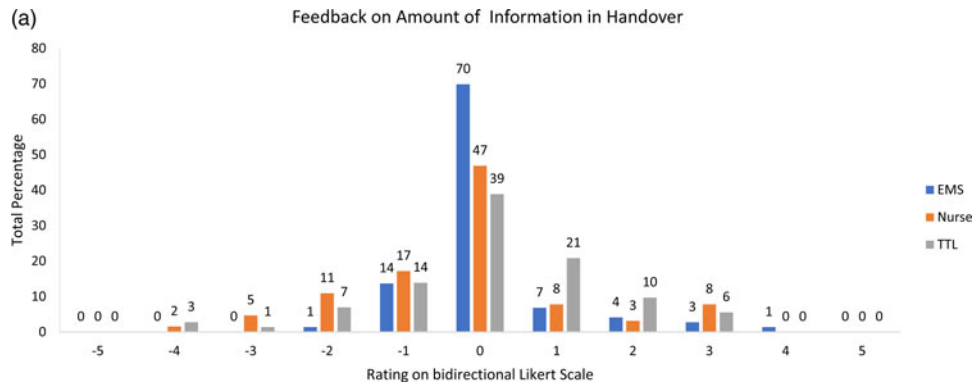
unprompted in 84% of cases. The median number of categories to which EMS returned was two (minimum 0, maximum 6), with categories of information repetition delineated in [Table 2](#).

**Perceptions of EMS-trauma handover**

Information regarding team perceptions of handover information, duration, and structure was collected from nurses (survey response rate: 62/79, 78%), EMS (71/79, 90%), and trauma team leaders (survey response rate: 71/79, 90%) and are presented in [Figure 2a-c](#). When ratings on the bidirectional Likert scale were reduced to ideal (a score of 0) and non-ideal ratings (a score of -5 to -1, or +1 to +5), differences between ratings among providers were statistically significant for ratings of information, duration, and structure ( $p < 0.05$ ), with EMS being most content with their handovers and trauma team leaders the most critical. For example, 77% of EMS thought that the structure of their handover was ideal, as compared with 47% of nurses and 38% of trauma team leaders. This trend persisted across information and duration of the handover.

**DISCUSSION**

Clinical handover has often been flagged as a process susceptible to communication failures and adverse events



**Figure 2a.** Distribution of EMS, nurse, and trauma team leader perceptions on the amount of information provided by EMS during handover, with -5 representing “too little,” 0 representing “ideal,” and 5 representing “too much.”

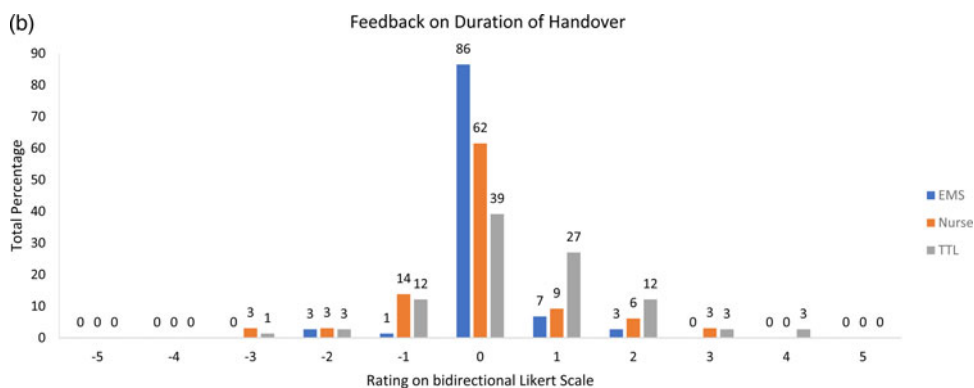
in various settings.<sup>10,13,14,17,18</sup> In the setting of trauma, high patient acuity, overcrowding, and the time-sensitive nature of communicating patient information can paradoxically increase the risk that information is misinterpreted or not properly delivered.<sup>14,19,20</sup> Using the IMIST-AMBO framework as a reference, we have identified key areas for improvement to increase team performance and improve patient care and safety.

EMS providers were most consistent (>90%) in delivering key information that impacts patient outcomes, including patient identification, mechanism of injury, injuries identified and/or symptoms, and any mention of signs.<sup>10</sup> However, other important information that might impact patient outcomes, such as airway status, breathing status, circulation, and disability, were inconsistently transmitted, demonstrating a need for improvement of handover content.<sup>10</sup>

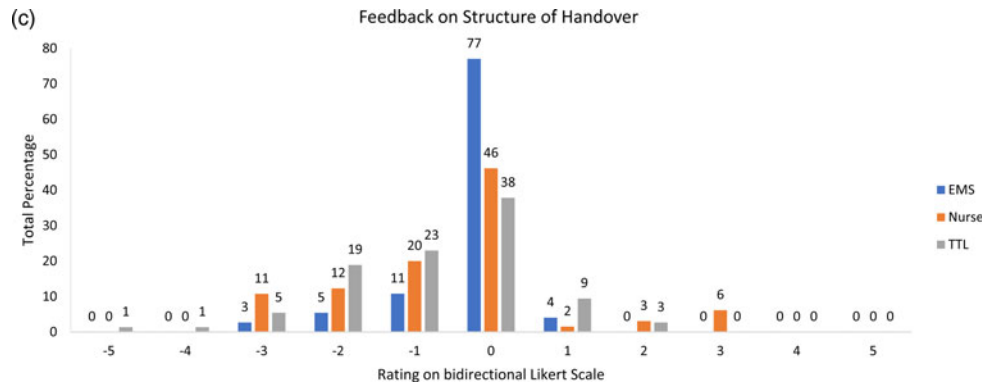
A lack of active listening and the general repetition of information have been identified as two pertinent modifiable factors that frustrate EMS providers.<sup>6,7,9,14</sup> In our study, the high proportion of handovers with parallel

conversations and a large degree of questioning already provided information suggest inadequate active listening. The presence of parallel conversations was also associated with an increased number of questions as interruptions. One possible explanation for this is that parallel conversations increase the need for interrupting questions to keep the team and handover on track, as parallel conversations make it difficult to hear or focus on the handover. Changing environmental behaviour and cultivating a culture that encourages active listening during these handovers may have the potential to reduce parallel conversations and repetition of information.

In the formal handover, only 28% of handovers had a dedicated Q&A period. The lack of dedicated blocks of time to ask questions explains why the vast majority of questions during the formal handover period were framed as interruptions. One qualitative study noted that trauma team members became dismissive of paramedics when they “rambled on” about information that might not have been critical to transmit.<sup>15</sup> It may be possible that there is a mismatch between the



**Figure 2b.** Distribution of EMS, nurse, and trauma team leader perceptions on the duration of the EMS handover, with -5 representing “too short,” 0 representing “ideal,” and 5 representing “too long.”



**Figure 2c.** Distribution of EMS, nurse, and trauma team leader perceptions on the structure of the EMS handover with -5 representing “structure lacking”; 0 representing “ideal”; and 5 representing “structured, but too complex.”

information that the EMS deems important and the information that the trauma team requires, resulting in the high frequency of interrupting questions during the formal handover. This hypothesis is strengthened with our survey results that demonstrate the difference in perception of handover quality (information, duration, and structure) among team members. Setting clear expectations about information content may improve the succinctness of EMS handovers and reduce the number of interrupting questions from the trauma team. Additionally, establishing the expectation that there will be a dedicated Q&A period during the formal report and ensuring that the trauma team knows this and will anticipate it could also reduce the number of interruptions.

Taken together, our data and analysis demonstrate that there is ample impetus for change. Standardization of the handover process has been associated with a shorter duration of handover and improved satisfaction and would mitigate potential latent safety threats.<sup>12,13,21</sup> However, adequate training and education are required to ensure that the handover process and structure yield improvement.<sup>22</sup> The literature has also shown that EMS feel that they receive insufficient training on handover and would appreciate more.<sup>6,23</sup>

A diversity of frameworks and mnemonics exist to standardize handover.<sup>18,24</sup> In interdisciplinary settings, it has been suggested that more prescriptive and specific frameworks (such as IMIST-AMBO) be used in place of frameworks in which the content of the handover is determined predominantly by the provider (such as SBAR: situation, background, assessment, and recommendations). The handover between EMS and receiving staff represents an intersection of two organizational cultures, which may not share the same nomenclature,

or values.<sup>25</sup> Implementing a “shared mental model,” developed with input from both EMS and receiving staff, may be valuable in navigating challenges that arise from the merging of two organizational cultures, educational backgrounds, and heterogeneous practices during patient handover.<sup>26</sup> This could occur through a co-constructed handover model, limiting interruptions during handover and asking clarifying questions at the end of handover.<sup>25</sup> Providing a shared mental model in the form of a standardized framework for handover may allow for the facilitation of shared understanding and enhance team performance.<sup>26,27</sup>

We have provided a comprehensive analysis of the state of handovers between EMS and trauma teams through an examination of the handover content, duration, and structure, handover processes, and perceptions of the handover according to various disciplines. Our adherence to a randomly generated schedule allowed us to capture handover data from a representative breadth of handovers.

Our study had several limitations. First, those involved in the handover may have been performing better than usual, given the possibility that they knew they were being observed. As such, our data may not represent true handover trends in an unobserved environment. Additionally, only a single observer was recording information about the handover. Observation conducted in duplicate may have yielded more robust data and reduced bias introduced by only a sole observer. Third, our data collection occurred in real time. Several other studies evaluating handover have done so using audio- or video-recording, allowing them to capture a greater breadth of information and permitting data abstracters to review data retrospectively to ensure accuracy.<sup>12,13,28</sup>

## CONCLUSION

Several categories of information were inconsistently communicated during handover, with significant repetition of information and a lack of active listening. Handover structure was largely inconsistent, and there may be a misalignment of handover expectations among EMS, nurses, and trauma team leaders. These findings point to the potential benefits that may result from standardizing handover. Doing so optimally requires the co-construction of a shared mental model with input from EMS, nurses, trauma team leaders, and other key stakeholders.

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