






ORIGINAL ARTICLE

# Implementation of prehospital handover in the emergency department: a proposed novel SRCA checklist in Saudi Arabia

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## ABSTRACT

**Background:** Maintaining effective clinical handover between prehospital services and emergency departments (EDs) is crucial to recognizing critical cases, guiding proper management, and determining final outcomes.

**Methods:** This is a single-center cross-sectional study that was conducted between October 15, 2021, and July 30, 2022, in a tertiary care center in Riyadh, Saudi Arabia. A novel handover tool [the Saudi Red Crescent Authority (SRCA) checklist] was developed, and eight emergency medicine consultants checked its validity. It contains 4 domains and 12 items and is based on previously validated tools after an extensive literature review and experts' opinions. The primary outcome of this study was to validate the newly developed tool aimed at assessing the quality of handover skills between prehospital medical care providers and EDs. The tool's reliability was examined using Cronbach's alpha method, while factor analysis with varimax rotation was used to examine the construct validity.

**Results:** Our study sample included 147 handovers. Almost 50% of the observed handovers adhered to 7 out of 12 checklist criteria for assessing the handover quality. The chief complaint and associated symptoms were reported in 94.56% ( $n = 139$ ) of cases, and verbalizing the airway-breathing-circulation-disability-exposure was seen in 75% ( $n = 111$ ) of cases. Providing recommendations to the receiving hospital by prehospital medical care providers was the lowest reported element at 4% ( $n = 6$ ). The Cronbach's alpha for the checklist was 0.73.

**Conclusion:** This study highlights the gaps in knowledge and skills in the prehospital phase of clinical handover. The proposed SRCA checklist includes a comprehensive approach for prehospital medical care providers to properly relay scene-related events and essential aspects of patients' conditions to guide proper management.

**Keywords:** Clinical handover, prehospital service, emergency departments, handover tool quality of handover skills.

## Introduction

Maintaining effective clinical handover between prehospital services and emergency departments (EDs) is crucial to recognizing critical cases, guiding proper management, and determining final outcomes. Patient handover is defined as "a situation where the professional responsibility for some or all aspects of a patient's diagnosis, treatment, or care is transferred to another person on a temporary or permanent basis" [1,2]. Handover at the prehospital medical care provider/ED

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interface is a potentially critical episode in the patient care journey, as a lack of structured communication procedures can adversely affect patient care, management provided, and eventually patient outcomes [3,4].

Multiple prospective observational studies confirmed that the handover process in the ED had a remarkable inconsistency in the transfer of information that calls for a unified tool accompanied by proper training, education, and constant quality checks [5]. Moreover, standardizing the elements and items checked during handover between staff within the institution or patients received from other entities would improve information content, reduce data loss, and eventually guide a safe transition of care and maintain favorable outcomes [6]. The Introduction, Situation, Background, Assessment, and Recommendation framework, endorsed by the World Health Organization, is an excellent example of the provision of a standardized approach to communication that can be used in various healthcare environments. The Saudi Red Crescent Authority (SRCA) is the national provider of prehospital services in Saudi Arabia. It has 507 emergency medical services (EMS) stations, an estimated 1,449 ambulances and service vehicles, and about 5,548 paramedics and emergency medical technicians. This study was conducted in King Saud Medical City (KSMC), which is a tertiary trauma center affiliated with the Ministry of Health and located in Riyadh, Saudi Arabia. KSMC receives more emergency cases than other hospitals and has a bed capacity of 1,400 with more than 8,000 employees. This study aims to assess and evaluate the quality and communication of handover skills between prehospital medical care providers and EDs using a novel handover tool (the SRCA checklist).

## Methods

This single-centre cross-sectional study was conducted between October 15, 2021, and July 30, 2022, in a tertiary care centre in Riyadh, Saudi Arabia. To check the face validity, the tool was piloted among 25 participants. On the other hand, eight board-certified emergency medicine consultants checked the tool's validity. The SRCA checklist contained 4 domains and 12 items and was based on previously validated tools [2,7,8]. SRCA stands for S: Say (say your name and affiliation as a healthcare practitioner; say patient age, gender, nationality, and comorbidities); R: En route events (name events at the incidence scene, recall the mechanism of injury at the incidence scene, and tell the scene duration); C: Chief complain (describe chief complaint, clinical symptoms, identity, past medical, past surgical, medication intake, social history (Hx); and A: Assessment and actions [list vital signs values, electrical cardiograph (ECG) interpretation, allergies Hx, glucose-check levels, pain score, examine for "airway-breathing-circulation-disability-exposure (ABCDE)," tell the provisional diagnosis, state action and interventions provided, and name further recommendations]. All handover cases delivered by SRCA prehospital medical care providers to KSMC ED during morning, evening, or night shifts were included, and no cases were excluded. The data were entered into electronic sheets by two expert data

collectors, and the primary investigator reviewed any discrepancies. Data were kept secure by a two-verification system, and access was granted only to primary data collectors. The main outcome of this study was to validate the newly developed tool aimed at assessing the quality of handover skills between prehospital medical care providers and EDs.

Convenience sampling was used due to time and resource constraints. The minimum sample size was estimated to be 143 participants based on  $\alpha = 0.05$ ,  $\beta = 0.2$ , medium effect size (Cohen's  $w = 0.3$ ), and a power of 0.8. The internal consistency of the newly developed tool was examined using Cronbach's alpha method. On the other hand, construct validity was examined using principal component analysis with varimax rotation. Factors with eigenvalues of one or more were extracted. Descriptive statistics using the mean, standard deviation, frequencies, and percentages were conducted to present the checklist items' responses. Pearson's correlation coefficient was used to explore the correlations between the different items of the newly developed handover checklist. All statistical analyses were conducted using SAS® version 9.4 (SAS® Institute, Cary, NC).

## Results

One hundred and forty-seven participants were observed, and their performance during the handover process was documented. Participants' adherence to the 12-item checklist is presented in Table 1. In our study, only 54% ( $n = 80$ ) of the participants introduced themselves by name and affiliation. Patient identification data such as patient age, gender, nationality, and comorbidities were reported in 68% ( $n = 100$ ). Events at the scene and mechanism of injury were reported in 66.67% ( $n = 98$ ) and 55.1%, respectively. Chief complaint and associated symptoms were 94.56% ( $n = 139$ ). Nevertheless, we described past medical history, surgical history, and social history in 31.29% ( $n = 46$ ). We found that vital signs, ECG interpretation, and allergy history were verbalized in 40% ( $n = 59$ ) of cases, while verbalizing ABCDE was seen in 75% ( $n = 111$ ) of cases. Also, we found that the actions and interventions provided by the EMS during transfers were reported in 36.73% ( $n = 54$ ). Moreover, we found that providing recommendations to the receiving hospital was the lowest reported element in the current study at 4% ( $n = 6$ ). The newly developed 12-item checklist demonstrated good internal consistency with a Cronbach's alpha of 0.73, and the item's total correlation, as well as the tool's Cronbach's alpha if one of the items was deleted, are shown in Table 3. Four factors were extracted, and their items' loadings on each extracted factor are shown in Table 4. Correlation between the checklist items was presented as Pearson correlation coefficients and  $p$  value in Table 2.

## Discussion

The journey to ideal prehospital medical services is concluded by a proper clinical handover to the receiving healthcare facility. Important messages that could influence and direct patients' diagnosis, management, or even final outcomes are delivered during that period. Gaps

**Table 1.** Participants' adherence to the handover protocol checklist.

Item	Adherent, N (%)	Non-adherent, N (%)	Number of responses, N (%)
Say your name and affiliation as a healthcare practitioner	80 (54.20)	67 (45.58)	147 (100)
Check the patient's age, gender, nationality, and comorbidities	100 (68.03)	47 (31.97)	147 (100)
Inquire about what happened at the scene	98 (66.67)	49 (33.33)	147 (100)
Report or recall the mechanism of injury	81 (55.10)	66 (44.90)	147 (100)
Tell or report the scene duration	52 (35.37)	95 (64.63)	147 (100)
Describe the chief complaint and clinical symptoms	139 (94.56)	8 (5.44)	147 (100)
Identify and report the patient's past medical, surgical, prescription medications, and social history	46 (31.29)	101 (68.71)	147 (100)
List all vital signs, ECG interpretation, allergy history, glucose levels, and pain scores	59 (40.14)	88 (59.86)	147 (100)
Check for ABCDE	111 (75.51)	36 (24.49)	147 (100)
Report provisional diagnosis	82 (55.78)	65 (44.22)	147 (100)
Report all actions and interventions provided	54 (36.73)	93 (63.27)	147 (100)
Provide further recommendations	6 (4.08)	141 (95.92)	147 (100)

**Table 2.** Correlations between the checklist items.

Item		1	2	3	4	5	6	7	8	9	10	11	12
1	Pearson correlation	1	0.603	0.512	0.355	0.191	0.202	0.117	-0.115	0.558	0.285	0.244	0.119
	p-value	–	<0.0001	<0.0001	<0.0001	0.020	0.014	0.159	0.167	<0.0001	0.0005	0.0029	0.149
	N	147	147	147	147	147	147	147	147	147	147	147	147
2	Pearson correlation	0.603	1	0.258	0.290	0.172	0.286	0.179	0.026	0.525	0.212	0.280	0.141
	p-value	<0.0001	–	0.0016	0.0004	0.038	0.0005	0.029	0.757	<0.0001	0.0099	0.0006	0.0875
	N	147	147	147	147	147	147	147	147	147	147	147	147
3	Pearson correlation	0.512	0.258	1	0.464	0.252	0.085	0.042	-0.098	0.369	0.387	0.1497	0.1459
	p-value	<0.0001	0.0016	–	<0.0001	0.0021	0.307	0.618	0.237	<0.0001	<0.0001	0.0704	0.078
	N	147	147	147	147	147	147	147	147	147	147	147	147
4	Pearson correlation	0.355	0.290	0.464	1	0.410	0.085	0.049	-0.126	0.345	0.325	0.1204	0.117
	p-value	<0.0001	0.0004	<0.0001	–	<0.0001	0.3066	0.5576	0.1288	<0.0001	<0.0001	0.1462	0.1579
	N	147	147	147	147	147	147	147	147	147	147	147	147
5	Pearson correlation	0.191	0.172	0.252	0.410	1	0.115	0.268	0.091	0.057	0.315	0.027	0.135
	p-value	0.0202	0.0377	0.0021	<0.0001	–	0.1663	0.0010	0.2739	0.489	0.0001	0.750	0.1030
	N	147	147	147	147	147	147	147	147	147	147	147	147
6	Pearson correlation	0.202	0.287	0.085	0.085	0.115	1	0.097	0.135	0.282	0.088	0.121	0.049
	p-value	0.0142	0.0005	0.307	0.3066	0.1663	–	0.241	0.1024	0.0005	0.2875	0.1457	0.5517
	N	147	147	147	147	147	147	147	147	147	147	147	147
7	Pearson correlation	0.117	0.179	0.042	0.049	0.269	0.097	1	0.285	0.043	0.099	0.125	0.157
	p-value	0.1588	0.0296	0.618	0.5576	0.0010	0.241	–	0.0005	0.6037	0.2344	0.1319	0.0570
	N	147	147	147	147	147	147	147	147	147	147	147	147
8	Pearson correlation	-0.115	0.026	-0.098	-0.126	0.091	0.135	0.285	1	-0.082	0.0025	0.066	0.182
	p-value	0.1673	0.757	0.2370	0.1288	0.2739	0.1024	0.0005	–	0.321	0.976	0.4202	0.0275
	N	147	147	147	147	147	147	147	147	147	147	147	147
9	Pearson correlation	0.559	0.525	0.369	0.345	0.057	0.282	0.043	-0.082	1	0.130	0.368	0.038
	p-value	<0.0001	<0.0001	<0.0001	<0.0001	0.489	0.0005	0.604	0.3215	–	0.1165	<0.0001	0.6518
	N	147	147	147	147	147	147	147	147	147	147	147	147
10	Pearson correlation	0.285	0.211	0.387	0.325	0.315	0.088	0.098	0.002	0.130	1	0.139	0.184
	p-value	0.0005	0.0099	<0.0001	<0.0001	0.0001	0.2875	0.2344	0.9763	0.1165	–	0.0941	0.0260
	N	147	147	147	147	147	147	147	147	147	147	147	147
11	Pearson correlation	0.244	0.280	0.149	0.120	0.027	0.121	0.125	0.067	0.368	0.139	1	0.199
	p-value	0.0029	0.0006	0.0704	0.1462	0.7500	0.1457	0.132	0.4202	<0.0001	0.0941	–	0.0155
	N	147	147	147	147	147	147	147	147	147	147	147	147
12	Pearson correlation	0.119	0.141	0.146	0.118	0.135	0.049	0.157	0.182	0.038	0.184	0.199	1
	p-value	0.1485	0.0875	0.0779	0.1579	0.1030	0.5517	0.0570	0.0275	0.6518	0.0260	0.0155	–
	N	147	147	147	147	147	147	147	147	147	147	147	147

**Table 3.** Item analysis of handover protocol checklist.

	Mean ± SD	Item-total correlation	Cronbach's alpha if item removed
Say your name and affiliation as a healthcare practitioner	0.54 ± 0.49	0.566	0.70
Check patient age, gender, nationalities, and comorbidities	0.68 ± 0.46	0.546	0.69
Report the events at the scene	0.66 ± 0.47	0.465	0.70
Report or recall the mechanism of injury	0.55 ± 0.49	0.439	0.70
Tell or report the scene duration	0.35 ± 0.47	0.362	0.72
Describe the chief complaint and clinical symptoms	0.94 ± 0.22	0.271	0.73
Identify and report the patient's past medical, surgical, prescription medications, and social history	0.31 ± 0.46	0.255	0.73
List all vital signs, ECG interpretation, allergy history, glucose levels, and pain scores	0.40 ± 0.49	0.06	0.75
Check for ABCDE	0.75 ± 0.43	0.478	0.70
Report provisional diagnosis	0.55 ± 0.49	0.387	0.71
Report all actions and interventions provided	0.36 ± 0.48	0.325	0.72
Provide further recommendations	0.041 ± 0.19	0.257	0.73
Total	6.17 ± 2.69		

**Table 4.** Factor analysis of the handover protocol checklist (Varimax rotation method).

Item	Factor-1	Factor-2	Factor-3	Factor-4
%variance explained	33.2	30.1	20.6	16.12
Say your name and affiliation as a healthcare practitioner	0.707	0.394	-0.089	0.113
Check the patient's age, gender, nationalities, and comorbidities	0.754	0.191	0.142	0.102
Report the events at the scene	0.321	0.659	-0.184	0.154
Report or recall the mechanism of injury	0.256	0.728	-0.087	-0.023
Tell or report the scene duration	-0.016	0.701	0.407	-0.156
Describe the chief complaint and clinical symptoms	0.557	-0.049	0.406	-0.256
Identify and report the patient's past medical, surgical, prescription medications, and social history	0.084	0.149	0.698	0.091
List all vital signs, ECG interpretation, allergy history, glucose levels, and pain scores	-0.062	-0.147	0.737	0.192
Check for ABCDE	0.819	0.136	-0.121	0.111
Report provisional diagnosis	0.055	0.665	0.058	0.211
Report all actions and interventions provided	0.439	-0.054	0.033	0.634
Provide further recommendations	-0.057	0.207	0.241	0.738

in knowledge, skills, and even staff training are evident in these environments globally. This study presented a novel tool (the SRCA checklist) with a comprehensive framework and essential elements to standardize the handover process for prehospital services and be of clinical importance. To the best of our knowledge, this is the first study to assess the quality of communication between prehospital providers and the receiving hospitals in the Middle East. Out of the 147 handovers reviewed, several remarkable findings in communication were noted during the transfer of care. Almost half of the participants introduced themselves by name and affiliation. Although this type of information might not directly impact clinical outcomes, it reflects the provider's professionalism and enhances awareness among the receiving party.

Patient identification data such as age, gender, nationalities, and comorbidities were reported in nearly 68% of cases. The patient's name was not on the proposed checklist, as this item can be unknown in many emergencies and is considered an identifier that could breach patients' privacy, according to the local. In Canada, a prospective observational study conducted to assess the

handover of EMS personnel for trauma cases found that around 85% of the patient's age and gender were reported after the transfer. However, none of the EMS personnel introduced themselves during the handover period [9]. Furthermore, a multisite study reported that the gender and age of the patient were verbalized in 95.6% and 47.0% of emergency cases, respectively [5,9].

EMS personnel described the scene of an incident 66% of the time and elaborated on the mechanism of injury in 55% of emergency cases. Such detailed information is essential and known to only a few, including EMS personnel responding to the incident in the field. In addition, it can estimate the severity of the condition and guide toward potential injuries that are not readily identifiable or visible. Previous studies reported higher rates of reporting these variables, emphasizing their significance [5,9]. In this study, scene duration hints at the seriousness of an incident and efforts provided in extrication or management, with a comparable reporting rate with previous studies [9].

There was a high percentage of reporting chief complaints and the associated symptoms compared with a low percentage of reporting past medical history, surgical history, and social history, similar to previous results [5,6]. Knowing the initial complaint would direct history taking and differential diagnosis and is clinically helpful; however, most handovers miss other valuable components, including past medical and surgical history, which could be of added value due to the need for a standardized framework. Vital signs, ECG interpretation, and allergy history were verbalized in 40% of cases, while ABCDE was verbalized in 75% of cases, lower than the international standard [10,11]. These variables are dynamic and crucial to the status of the patient. Knowing abnormal vital signs, various ECG changes, allergies, and ABCDE status would lead to proper actions being taken promptly by the emergency team.

Prehospital interventions provided by the EMS team could be lifesaving, and knowing such data will prevent duplication of orders in the ED and adverse consequences. Unfortunately, only in 36% of cases did the prehospital medical care providers report such intervention, calling for more educational programs to improve this aspect. The provision of recommendations to the receiving hospital was the lowest reported element during handover in the current study, at 4% compared to others [10]. Sharing knowledge and experience between prehospital medical care providers and emergency staff personnel would improve the outcomes of critical cases.

Proposing a standardized well-structured handover tool between the prehospital and hospital settings seems reasonable. Sending clear, organized messages should have diagnostic, prognostic, and management value for patient care. This study discusses a novel (the SRCA checklist) with carefully selected elements in a rational order. This process is new to the EMS community in Saudi Arabia, and its implications would require constant training and dedicated education programs. Furthermore, capturing feedback from the receiving party is essential to guide further improvements and ensure the quality of medical care. Nevertheless, further research is recommended to assess the generalizability of this tool, analyze communication gaps, and explore best educational practices to improve handover skills. We encourage prehospital leaders and policymakers to address the importance of handover and measure its performance as an indicator of the quality of care.

Several limitations in our study are acknowledged. First, this is a single-center study, and there is a possibility of repetitive handovers by the same prehospital team during the observation period due to the small sample size and short duration. Second, while assessing the checklist, it is possible in the busy, noisy ED triage that some of the reported data were not captured or documented accurately. Third, we should have studied EMS personnel's educational background or years of experience, as such factors might affect the quality of communication.

## Conclusion

This study highlights the gaps in knowledge and skills in the prehospital phase of clinical handover. The proposed SRCA checklist includes a comprehensive approach for prehospital medical care providers to properly relay scene-related events and essential aspects of patients' conditions to guide proper management. Adopting such tools should be considered by policymakers as a standard to improve the quality of medical care between the prehospital and hospital phases.

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## List of Abbreviations

ABCDE	Airway-breathing-circulation-disability-exposure
ECG	Electrical cardiograph
ED	Emergency department
EMS	Emergency medical services
Hx	History
KSMC	King Saud Medical City
SRCA	Saudi Red Crescent Authority

## Conflict of interest

All study authors stated that no conflict of interest in this study.

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The authors stated that there is no funding for this study.

## Consent to participate

Obtained written consent from all participants.

## Ethical approval

The study was approved by the Medical Ethics Committee of King Saud Medical City, Ref #.H1RI-26-SEP21-01, date of IRB approval 14/10/2021.

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