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# Automated Clinical Decision Support for Triage and Monitoring of Military Casualties: A Modified Delphi Consensus Study

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## Introduction

- Triage is a crucial component in the initial management of patients during mass casualty incidents where severity of injuries and need for immediate medical care must be addressed.
- MASCAL triage strategies under challenging conditions require effective decision making and patient evaluation for optimal outcomes.
- Automated technologies have the potential to alleviate cognitive demands, improve decision making, and aid in evacuation planning.
- To characterize triage decision making in MASCAL scenarios, we conducted a modified Delphi consensus study amongst expert panelists to identify key information and priorities for developing automated clinical decision support systems.

## Objectives

1. Understand the roles of triage in MASCAL and explain the importance of triage.
2. Identify key parameters for automated triage decision making.
3. Evaluate challenges for automating triage processes for future clinical decision support systems.

## Methods

- This study conformed to the Guidance on Conducting and Reporting Delphie Studies (CREDES).
- We formed a panel of triage specialists experienced in both civilian and military-specific triage. Three rounds of survey were conducted with statements and questions.
- After each round, we conducted a virtual working group meeting to clarify any statements and address concerns.
- Adjusted, tiered consensus were minimal agreement (50%-69%), moderate agreement (70-79%), and high agreement (80-100%). No consensus were those with less than 50% agreement.

## Results

| Participants | Number (n) |
|---|---|
| Total Participants in the Study | 12 |
| Completed Surveys | 12 |
| **Clinical Category** | |
| Physician | 9 |
| Nurse | 2 |
| Medic/ Paramedic/ Corpman | 1 |
| Other (Dentist, PA, CRNA, etc.) | 0 |

| Demographic Questions | Responses % (n) |
|---|---|
| Expertise Level | Expert 42% (5)<br>Proficient 42% (5)<br>Competent 16% (2) |
| Participated in MASCAL Triage? | Yes 67% (8)<br>No 33% (4) |
| Have you received triage training? | Yes 92% (11)<br>No 8% (1) |

Figure 1: Years of Triage Experience.

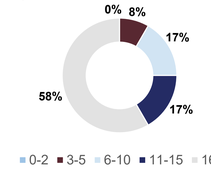



Figure 2: Participant Years Since Last Triage Experience.

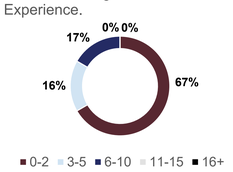



Figure 3: Environment of Last Triage Experience.

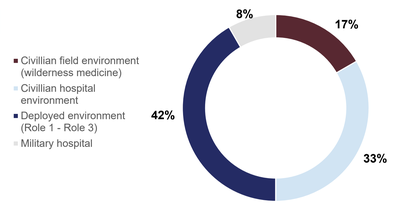
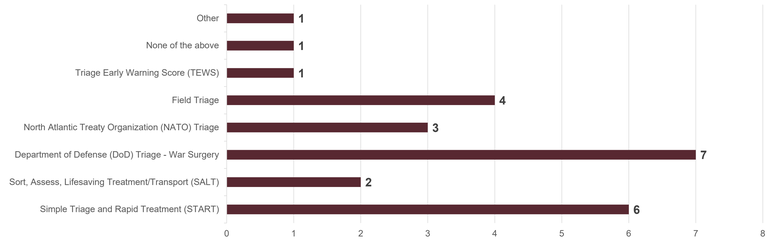
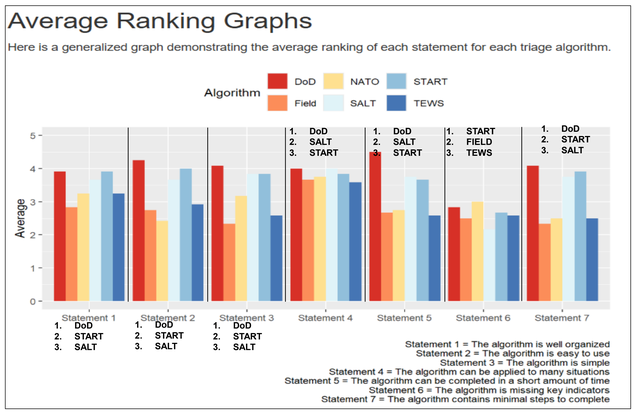



Figure 4: Which triage methods have the participants used?




| Ranking Preference | Well resourced triage environment | MASCAL triage environment |
|---|---|---|
| **1 (Most Preferred)** | **START** | **DoD** |
| 2 | NATO | START |
| 3 | DoD | SALT |
| 4 | Field | NATO |
| **5 (Least Preferred)** | **SALT** | **Field** |

## Results: Triage CDS Interface

| Statement | Consensus | Level of Consensus Agreement |
|---|---|---|
| **Heart Rate** | 91% (n=10) | **High Agreement** |
| **Blood Pressure** | 64% (n=7) | **Minimal agreement** |
| Systolic Blood Pressure | 27% (n=3) | No consensus |
| Mean Arterial Pressure (MAP) | 9% (n=1) | No consensus |
| **Respiratory Rate (RR)** | 64% (n=7) | **Minimal agreement** |
| GCS | 27% (n=3) | No consensus |
| AVPU | 18% (n=2) | No consensus |
| **SpO2** | 91% (n=10) | **High Agreement** |
| Dosage Weight | 9% (n=1) | No consensus |
| Triage Category | 9% (n=1) | No consensus |

| Statement | Consensus | Level of Consensus Agreement |
|---|---|---|
| Compensatory Reserve Mechanism (CRM) | 27% (n=3) | No consensus |
| Triage Early Warning Score (TEWS) | 9% (n=1) | No consensus |
| Modified Early Warning Score (MEWS) | 18% (n=2) | No consensus |
| Hold time (post-injury timer) | 18% (n=2) | No consensus |
| **Tourniquet Time** | **73% (n=8)** | **Moderate Agreement** |
| Resource requirements by injury type | 18% (n=2) | No consensus |
| Shock Index | 33% (n=4) | No consensus |
| Medication Administration (time) | 18% (n=2) | No consensus |

## Conclusion

We established consensus on the most salient data parameters necessary for triage and how they can be implemented in an automated CDS system.

Limitations for full automation included consensus on manual checks such as patient response to shake and shout.

## Future Work

1. Development and validation of triage algorithm for automated systems.
2. Testing and validation of triage algorithm for future triage system.
3. Data flow of patient information into central medical command for rapid decision making.

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Regulatory: This study was conducted under a protocol reviewed and approved by the US Army Medical Research and Development Command Institutional Review Board and in accordance with the approved protocol H-25-012X.

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