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## **Chapter 9.** Cross-sectional analysis of Dutch repatriated service members from Southern Afghanistan (2003-2014)

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## ABSTRACT

**Background:** A systematic analysis of the complete medical support organization (MSO) of the Dutch Armed Forces regarding repatriated service members from Afghanistan has not been performed so far.

**Methods:** All information was collated in a specifically designed electronic database and gathered from the archive of the Central Military Hospital for all Dutch service members receiving treatment for wounds or diseases sustained in the Afghan theatre from July 2003 till January 2014.

**Results:** Traumatic injuries were the main cause (63%, 141/223) of repatriation, and Improvised Explosive Devices the major (67%, 60/89) mechanism of injury in the battle casualty (BC) group. The mean time between injury and medical evacuation from Afghanistan was 8 days, and this was reduced to 3.6 days in case of polytrauma casualties (ISS>15).

**Conclusions:** Sixty percent of all Dutch medical evacuations from Afghanistan was not directly related to combat operations. The mean time between injury and medical evacuation from Afghanistan is 8 days, which was reduced to 3.6 days in severely injured casualties. Shorter transport intervals might improve morbidity and mortality of casualties, a timeframe of 48-72 hours for receiving definitive treatment seems feasible. Further research is necessary to identify delay factors and possible improvements in the MSO.

## BACKGROUND

The Dutch Armed Forces (DAF) participated in three recent missions in Afghanistan; (1) Operation Enduring Freedom 2001-2011 (OEF), deploying ~ 2,000 service members, (2) International Security Assistance Force 2002-2010 (ISAF), including four years (2006-2010) as lead nation in the province of Uruzgan, deploying ~17,000 Dutch service members (as Task Force Uruzgan [TFU]), and (3) European Police training mission 2011-2014 (EUPOL) in Kunduz, deploying ~1,500 service members. The participations in the Afghan armed conflicts were the first broad scale deployments for the DAF resulting in numerous casualties since the Korean war. All injured service members were first treated in the Dutch Role 2 Medical Treatment Facility (Role 2 MTF) or MTF in Kunduz and when required, the casualties were repatriated to the Central Military Hospital (CMH) and University Medical Center Utrecht (UMCU) in Utrecht, the Netherlands. This joint involvement is a good example of civilian and military collaboration (SDC 1). Many studies focusing on Dutch battle casualties (BCs) have been published, but the disease non-battle injuries (DNBIs) have not been covered in these studies.<sup>1-4</sup> These data however are essential for gaining insight into the impact of casualties on the complete medical support organization (MSO). Interestingly, there is also very limited international literature about this subject.<sup>5-7</sup>

A systematic analysis of the complete MSO regarding repatriated service members has not been performed so far. The primary aim of this study is to assess the volume and type of injuries of all repatriated Dutch service members. The ultimate goal is to further optimize the MSO for future military deployments.

## METHODS

This study was approved by the Ministry of Defense (MOD), the Institutional Review Board and the Medical Ethics Committee of Leiden University, the Netherlands. A 'casualty' in customary military usage means an active duty service member lost to the theatre of operations for medical reasons. The term therefore includes diseases (illnesses) and non-combat/battle injuries (DNBI), as well as combat injuries. BCs were defined as service members being injured as a direct result of hostile action, sustained in combat or sustained going to or coming from a combat mission.<sup>8</sup> Service members who survived their injury until arrival at a MTF were defined as wounded in action (WIA).

All information was collated in a specifically designed electronic database and gathered from the archive of the CMH for all Dutch service members receiving treatment for wounds or diseases sustained in the Afghan theatre from July 2003 till January 2014.

The casualties were divided into five rank groups namely; junior enlisted (E1-E4), senior enlisted (E5-E9), warrant officers (WO1-WO2), junior officers (O1-O3), and senior officers (O4-O10). Medical evacuations included in the analyses were classified by the causes and natures of the precipitating medical conditions (based on information reported in relevant evacuation and medical encounter records). First, all medical conditions that resulted in evacuations were classified as "battle injuries" or "non-battle injuries and illnesses". Evacuations due to non-battle injuries and illnesses were sub-classified into 13 illness/injury categories based on International Classification of Diseases (ICD-9-CM) diagnostic codes reported on records of medical encounters after evacuation.<sup>9</sup> The categorical variables were analyzed by their absolute and relative frequencies in percentages. The association between two categorical variables was calculated by applying the Pearson  $\chi^2$  test. In all cases,  $p < 0.05$  was considered statistically significant. The severity of the injuries in this study was scored according to the Abbreviated Injury Scale (AIS)<sup>10</sup> and the Injury Severity Score (ISS)<sup>11</sup>, and was expressed in mean and range. Statistical analyses were performed using predictive analysis software, SPSS (Version 20, IBM Corporation, Armonk, New York).



*SDC 1: Central Military Hospital and University Medical Center Utrecht, the Netherlands.*

## RESULTS

During the studied period (2003-2014) a total of 223 Dutch service members were repatriated. The vast majority was male (93%, 208/223) with a mean age of 29 years (respectively 25 and 32 years for BCs and DNBI(s)). Sixty percent (134/223) of all medical evacuations were DNBI(s), and these service members were significantly ( $p < 0.05$ ) older than the BCs.

The distribution per unit was as follows; 74.9% (167/223) Army, 11.2% (25/223) Navy, 9.4% (21/223) Air force, 2.7% (6/223) Military Police, and 1.8% (4/223) Civilian Police. When examining the distribution of repatriates by rank group, a significant difference ( $p < 0.05$ ) was noted between the 54.3% (121/223) junior enlisted, 26.0% (58/223) senior enlisted, 2.2% (5/223) warrant officers, 7.2% (16/223) junior officers, and 7.2% (16/223) senior officers, 1.8% (4/223) civilian police and unknown cases 1.3% (3/223). The distribution of repatriates according to the NATO definitions is shown in Table 1. The difference in age, AIS, ISS, period between incident and arrival CMH, number of surgical procedures and total admission time are presented in Table 2 and 3. In Table 3 the trauma injuries (BC N=89, DNBI N=52) and polytrauma patients (ISS>15) are presented. The intensity of treatment (surgical procedures and total admission time) was significantly higher ( $p < 0.05$ ) in the BC group compared to the DNBI group. Twenty one percent (17/80) of the 80 BCs had a blast related tympanic perforation and 18% (14/80) of the BCs had signs of acoustic trauma.

### Repatriation

The mean time between injury and medical evacuation from Afghanistan was 8 days, which reduced to 3.6 days in the severely injured group (ISS>15).

Sixty nine percent (153/223) of the patients were repatriated because of a surgical or orthopedic problem (Table 4). The DNBI group was defined conform the ICD-9-CM in Table 5. Sixty three percent (141/223) of the casualties were repatriated because of a traumatic injury (89 BCs and 52 DNBI(s)). IEDs were the main cause of injury 43% (60/141), as shown in Fig 1. Except for the three casualties repatriated for mental disorders we did not find casualties repatriated because of psychological injury (PI). These three patients were repatriated in 2005 and 2006, the beginning of the Dutch involvement in Afghanistan.

Distribution of repatriates	Frequency	Percentage
BC: WIA STRATEVAC (1 DOW)	89	39.9
DNBI: injuries not related to combat operation	52	23.3
DNBI: medical illness	82	36.8
<b>Total</b>	<b>223</b>	<b>100</b>

**Table 1:** Distribution of repatriates according to NATO definitions.

Abbreviations: BC: battle casualty; WIA: wounded in action; STRATEVAC: strategic evacuation; DOW: died of wounds; DNBI: disease non-battle injury.

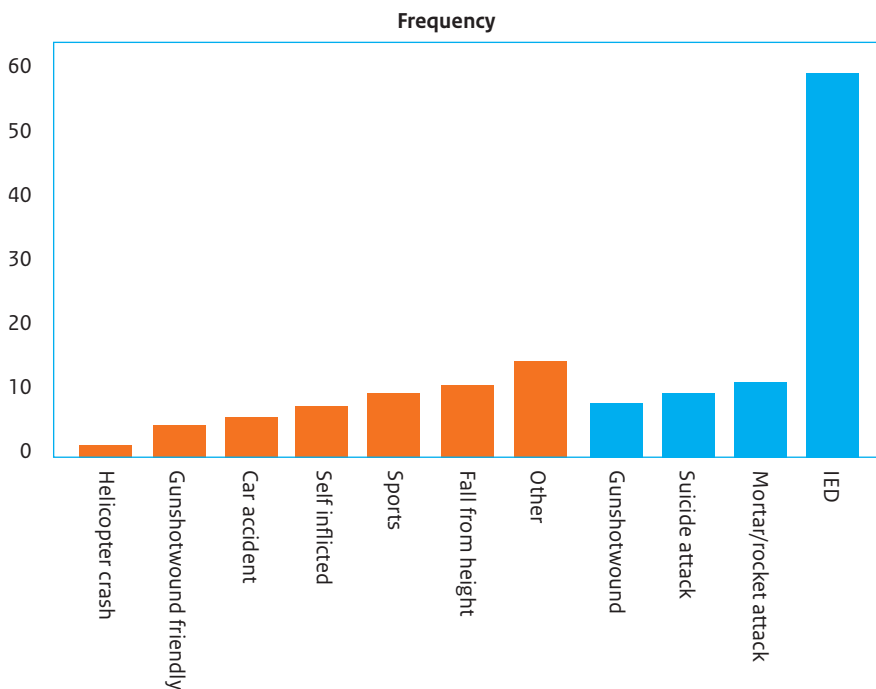
Demographics	BC N=89 (range, SD)	DNBI N=134 (range, SD)	Total N=223 (range, SD)	P value
Age	25 (18-49, 6.3)	32 (18-59, 10.7)	29 (18-59, 9.7)	p<0.05
Highest AIS (mean)	1.53 <sup>a</sup> (0-4, 1.3)	N/A	N/A	N/A
ISS	11.3 (1-43, 9.5)	N/A	N/A	N/A
Period between incident and arrival				
CMH (days)	5.5 (0-62, 8.5)	9.8 (1-132, 14.3)	8.0 (0-132, 12.4)	p<0.05
Surgical procedures (N)	4.2 (0-21, 4.6)	0.7 (0-8, 1.3)	2.1 (0-21, 3.4)	p<0.05
Total admission time (days)	19.1 (0-145, 28.5)	3.3 (0-30, 5.5)	9.7 (0-145, 20.1)	p<0.05

**Table 2:** Demographics of battle casualties and disease non-battle injuries.

Abbreviations: BC: battle casualty; DNBI: disease non-battle injury; N: number; SD: standard deviation; AIS: abbreviated injury severity score; ISS: injury severity score; N/A: not applicable; CMH: Central Military Hospital, Dutch Role 4.

<sup>a</sup> Region: extremity.





**Figure 1:** Cause of injury for the Dutch repatriated casualties.

Abbreviations: IED: improvised explosive device. Left (red) the non-battle injuries, right (blue) the battle injuries.

Demographics	Trauma injury* N=141 (range, SD)	ISS>15 N=26 (range, SD)	P-value
Age	26 (18-59, 7.5)	26 (19-59, 8.8)	0.97
Highest AIS (mean)	1.56 <sup>a</sup> (0-4, 1.2)	1.77 <sup>b</sup> (0-5, 2.0)	0.63
ISS	8.8 (0-43, 8.5)	23.9 (16-43, 7.9)	<0.05
Period between incident and arrival CMH (days)	6.9 (0-62, 9.3)	3.6 (1-10, 2.4)	<0.05
Surgical procedures (N)	3.1 (0-21, 3.9)	6.9 (0-21, 5.7)	<0.05
Total admission time (days)	13.8 (0-145, 24.1)	35.0 (0-145, 38.8)	<0.05

**Table 3:** Demographics of trauma injuries and polytrauma patients.

Abbreviations: SD: standard deviation; ISS: injury severity score; N: number; AIS: abbreviated injury severity score; CMH: Central Military Hospital, Dutch Role 4.

\*Trauma injury group consisted of battle casualties N=89 + injuries not related to combat operation N=52.

<sup>a</sup> Region: extremity; <sup>b</sup> Region: head and neck.

Leading specialism	Frequency	Percentage
Surgery	128	57.4
Internal medicine	17	7.6
Orthopedic surgery	27	12.1
Urology	5	2.2
Plastic surgery	3	1.3
Neurology	16	7.2
Ophthalmology	2	0.9
Cardiology	9	4.0
Psychiatry	3	1.3
Ear, nose and throat	5	2.2
Maxilla facial surgery	2	0.9
Pulmonology	5	2.2
Gynecology	1	0.4
<b>Total</b>	<b>223</b>	<b>100</b>

*Table 4: Repatriated Dutch service members from Afghanistan in the period 2003-2014 divided by leading specialism.*

Diagnostic category (ICD-9-CM)	Frequency	Percentage
Battle injuries*	89	39.9
Genitourinary system (580-629)	7	3.1
Endocrine, nutrition, immunity (240-279)	1	0.4
Respiratory system (460-519)	6	2.7
Circulatory system (390-459)	10	4.5
Skin and subcutaneous tissue (680-709)	1	0.4
Non-battle injuries (800-999)	52	23.3
Digestive system (520-579)	20	9.0
Nervous system (320-389)	16	7.2
Other (V01-V82)	4	1.8
Infectious and parasitic diseases (001-139)	8	3.6
Mental disorders (290-319)	3	1.3
Musculoskeletal system (710-739)	6	2.7
<b>Total</b>	<b>223</b>	<b>100</b>

*Table 5: Diagnostic category (ICD-9-CM) for the Dutch repatriated casualties.*

Abbreviations: ICD-9-CM: International Classification of Diseases, Ninth Revision, Clinical Modification.

\*non specified group of battle injuries

## DISCUSSION

This report is the first systematic analysis of all the repatriated casualties in Afghanistan from the DAF. Traumatic injuries were the main cause (63%, 141/223) of repatriation, and IEDs the major (67%, 60/89) mechanism of injury in the BC group. The mean time between injury and medical evacuation from Afghanistan was 8 days, and this reduced to 3.6 days in the polytrauma casualties (ISS>15). Sixty percent of all medical evacuations were DNBI, and these service members were significantly older than the BCs. In the limited published literature currently available, the percentage DNBI is even higher (76%-86%).<sup>6,9</sup> The introduction of a standard medical exam/ endurance test in the pre-deployment phase could be useful as screening tool in reduction of the DNBI casualty rate. Our efforts should aim for reduction of preventable repatriation by effective pre-deployment tests. The relatively long interval between injury and arrival in the CMH warrants further assessment. An interval between 3.6 and 8 days seems quite long compared to the generally accepted timeline for definitive care and protocols. Although there are no clearly defined timelines, the NATO Allied Joint Medical Support Doctrine AJP 4.10<sup>12</sup> is the capstone document on which the MSO is based, and this protocol only provides rough outlines. Nessen et al.<sup>13</sup> describes a rough timeframe of 48-72 hours for strategic evacuation to the next level of care and out of the combat theater (role 4 MTF) for definitive surgical care. The shortest timeframe currently is 12 hours from the point of injury to arrival in a role 4 MTF.<sup>13</sup> The polytrauma patients in our study arrived with a mean interval of 3.6 days. The appreciation of time in resuscitation and damage control surgery (DCS) of polytrauma patients is a general value. All our efforts should aim for reduction of transport times in the MSO, shorter transport intervals might improve morbidity and mortality of (Dutch) casualties.

There were clear and valid explanations for these relatively long transport intervals. Several factors should be taken into account, when evaluating the Dutch MSO; (1) the Dutch MSO depends on coalition partners regarding transport of (critical ill) casualties. Organizing transport for the severely injured takes time and might result in delay, (2) planned follow-up operations (second and third look) in Afghanistan. The multinational role 3 MTF at Kandahar Airfield (KAF) was mostly used for these type of surgical procedures before evacuation out of theatre. The multinational character of the personnel at the role 3 MTF at KAF and an extra "stop moment" in the medical evacuation, might have influenced the final outcome (e.g. loss of information, language barriers in transfer of information, and again delay in definitive treatment).<sup>15</sup> Interestingly, 22% of the patients who were exposed to a blast event were diagnosed having a tympanic perforation. Another 18% had clear signs of acoustic trauma on audiogram. Harrison et al.<sup>14</sup> described comparable results. During our studied period all repatriated service members involved in a blast event were screened by an ear- nose- and throat (ENT) specialist. The high rate of ear trauma after a blast injury illustrates the need for a robust screening program. Further research is necessary to assess the consequences of blast injuries on the long term (e.g. ENT and PI impact).

There are certain limitations to our study. First, the absence of a standardized system of data collection and the inevitable resulting delay in reporting these statistics. Secondly, there were only a few psychological injuries reported in this study. It is not clear whether these PIs were repatriated without registration in the CMH or that deployed service members developed their psychological injuries (e.g. asked for medical assistance) after returning home. According to NATO definitions PIs are battle injuries, not reporting these injuries results in an underestimation of the total amount of battle injuries. Thirdly, retrospective cohort studies are sensitive to bias and battle casualty definitions significantly affect casualty analysis results. Clearly defining the studied population is necessary to make valid comparisons and draw meaningful conclusions.

In conclusion, sixty percent of all Dutch medical evacuations from Afghanistan were not directly related to combat operations, effective pre-deployment tests could be useful in reduction of preventable repatriation. The mean time between injury and medical evacuation from Afghanistan was 8 days, which was reduced to 3.6 days in severely injured casualties. The appreciation of time in resuscitation and DCS of polytrauma patients is a general value, all our effort should aim for reduction of transport times in the MSO. Shorter transport intervals might improve morbidity and mortality of casualties, a timeframe of 48-72 hours for receiving definitive treatment (in a role 4 MTF [out of theatre]) seems feasible. Further research is necessary to identify delay factors and possible improvements in the MSO.

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