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Chapter 7. Challenges in training of military surgeons: experiences from Dutch combat operations in Southern Afghanistan

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ABSTRACT

Background: To improve care for battle casualties, we analyzed the surgical workload during the Dutch deployment to Uruzgan, Afghanistan. This surgical workload was compared with the resident surgical training and the pre-deployment medical specialist program.

Methods: Patient data were analyzed from the trauma registry (2006-2010) at the Dutch Role 2 medical treatment facility (MTF). The case logs of chief residents (n=15) from the general surgery training program in the Netherlands were used as comparison.

Results: The trauma registry query resulted in 2,736 casualties, of which 60% (1,635/2,736) were classified as disease non-battle casualties and 40% (1,101/2,736) as battle casualties. During the study period 1,427 casualties (336 pediatric cases), required 2,319 surgical procedures. Graduating chief residents did an average of 1,444 cases, including 165 laparotomies, 19 major vessel repairs, 28 amputations, and 153 fracture stabilizations during their residency. Residents had limited exposure to injuries requiring a thoracotomy, craniotomy, nephrectomy, IVC repair and external genital trauma.

Conclusions: The injuries treated at the Dutch Role 2 MTF were often severe, exposure to pediatric cases was much higher than reported in other combat hospitals in Iraq and in Afghanistan. The current civilian resident training does not foresee in the minimally required competences of a fully trained military surgeon. The recognition of military surgery as a subspecialty within general (trauma) surgery, with a formal training curriculum, in the Netherlands should be considered. The introduction of a North Atlantic Treaty Organization Military (and Disaster) Surgery standard may attribute to achieve this aim.

BACKGROUND

The battlefield casualties research working group publishes in collaboration with the Ministry of Defense (MOD) data and analyses of armed conflict related medical experiences[1-4]. The International Security Assistance Force (ISAF) is a North Atlantic Treaty Organization (NATO) led security mission in Afghanistan that was authorized by the United Nations Security Council in December 2001. The main purpose of the mission is to train the Afghan National Security Forces and assist Afghanistan in rebuilding key government institution. Since 2002, the Dutch (NL) Armed Forces have been involved in operations in Afghanistan. From August 2006 to August 2010 the Netherlands were lead nation in Uruzgan province, deploying Task Force Uruzgan (TFU). Uruzgan is located in the southern region of the country, having borders with Zabul and Kandahar to the south, Helmand to the southwest, Daykundi to the north, and Ghazni Province to the east. Uruzgan covers an area of 12,640 km^2, with approximately 400,000 inhabitants, who are mostly part of a tribal society.

The main component of TFU was located at Multi National Base Tarin Kowt (MBTK), Afghanistan. It was composed of approximately 1,200 service members and contained a Dutch role 2 Enhanced Medical Treatment Facility (role 2 MTF NL). It was comprised of approximately 50 multinational medical service members. The role 2 MTF NL was configured with two emergency resuscitation tables, one operating room, two ICU beds and fourteen regular nursing beds. Besides the primary aim of treatment of coalition forces at the role 2 MTF NL, the secondary aim was the treatment of Afghan national security forces and local nationals. In the Netherlands, the Institute of Collaboration Defense and Relation Hospitals (IDR) of the Ministry of Defence (MOD) is the central organ responsible for training and deployment of military medical specialists. The content of the pre-deployment work-up program for military surgeons, in the Netherlands (2006-2010) was composed of:

1. A short basic military skills course

2. A one week course with general information about the area of operations

3. Courses:
   a. Mandatory: Advanced Trauma Life support (ATLS®), Battlefield Advanced Trauma Life support (BATLS), Emergency Management of the Severe Burn Course (EMSB®) and Major Incident Medical Management and Support course (MIMMS®)
   b. Since 2008 mandatory: Definitive Surgical Trauma Care (DSTC®) and Polytrauma Rapid Echo/ ultrasound evaluation Program (PREP)
   c. Optional clinical rotation in South Africa for acquaintance with penetrating trauma

In the above mentioned period 17 different Dutch surgeons, most of them (15) being reservists, deployed multiple times (1-3) to MBTK in 2-3 month periods to the role 2 MTF NL. Most NATO countries divide the initial surgical responsibility between a general and an orthopaedic surgeon[5-11]. In the Netherlands both the trauma surgeon and the orthopaedic surgeon focus on skeletal aspects of extremity injuries in elective and acute settings. Soft tissue and visceral trauma are the primary domain of the trauma surgeon in the Netherlands. In the role 2 MTF NL the (trauma) surgeon was the sole surgical medical specialist, treating

severely injured casualties in a combat theatre with limited resources. Other types of specialist surgery were only available in higher echelons, as the key objective at a role 2 MTF is damage control surgery. After initial stabilisation, patients could be evacuated to higher echelons of care (e.g. role 3 MTF at Camp Bastion in Helmand province or at Kandahar Airfield in the province Kandahar). Battle casualties treated at the role 2 MTF NL were dominantly injured by explosions (55%) and gunshot wounds (35%)[1]. The above described (international) military setting, mechanisms of injury and surgical pathology are substantially different from those seen in civilian trauma. In Europe the incidence of penetrating and blast trauma is low[12]. In the Netherlands violence related penetrating injuries were only registered as emergency department admission in 2,519 cases and as cause of death in 92 cases (respectively 16.4/ 100,000 and 0.6/100,000 per inhabitant) in 2011[13,14]. Penetrating trauma accounts for only 5–10 % of all trauma in Europe, compared with 40–50% in the United States of America (US)[15,16]. It is possible that a newly trained military surgeon will deploy soon after completing civilian residency training, and will encounter these complex combat injuries. Regardless of (residency) subspecialisation, all Dutch military general (trauma) surgeons complete their surgical training on civilian patients, because there is no standardized military surgical training program yet. Although numerous studies have described the operative caseload and injury patterns seen in both Iraq and Afghanistan by coalition partners[1,5-11], comparing in-theatre surgical workload with caseloads completed by graduating surgical residents has only been performed by the US military[10,17-19]. The aim of our study was to compare the surgical workload at the role 2 MTF NL in South Afghanistan with the exposure of surgical pathology in civilian surgical training and the pre-deployment medical specialist work up program, in order to identify a possible curriculum modification for the future military surgeon.

METHODS

This study was approved by the MOD and the Institutional Review Board and Medical Ethical Committee of Leiden University, the Netherlands. Basic data collection and verification of the cases treated at the role 2 MTF NL between August 2006 and August 2010 was conducted using the electronic admission database. Missing information was collected from the written patient records. Patient demographics collected included age, divided into children (under 16 years old) and adults. Injuries were subsequently subdivided into two categories; battle casualty (BC) or non-battle injury (NBI). To compare the caseload of the deployed general (trauma) surgeon to caseloads encountered in residency by graduating general surgical residents, we used the electronic admission database of the role MTF NL. These cases were compared with case logs of chief residents (n=15) from the general surgery training program, provided by the national surgical committee in the Netherlands from graduation years 2010 to 2013. Statistical analyses were performed through a computerized software package, using SPSS (Version 20, IBM Corporation, Armonk, New York). The categorical variables were analysed by their absolute and relative frequencies in percentages.

RESULTS

The role 2 MTF NL admission database query in the studied period between August 2006 and August 2010, resulted in 2,736 casualties, of which 60% (1,635/2,736) were classified as disease non-battle casualties and 40% (1,101/2,736) as battle casualties. During the study period 1,427 casualties (24% [336/1,427] pediatric cases), required 2,319 surgical procedures. Sixty six per cent (1,523/2,319) of the surgical procedures were performed on casualties with battle injuries and 34% (796/2,319) on casualties with disease non-battle injuries. In the battle casualty group 80 cases were unknown and 202 required no surgical procedure. In the non-battle casualty group 182 cases were unknown and 845 required no surgical procedure. The breakdown of procedures by anatomical location, was 32% (736/2,319) extremities, 19% (430/2,319) chest-abdomen, 7% (170/2,319) head & neck and 42% (983/2,319) general surgery or debridement on any anatomical location. The full spectrum of surgery as described in table (Table 1) was present. The second and third column displays the percentage of overall surgical procedures in the deployed setting by battle or non-battle injury, and the right column displays mean number of cases completed per resident during the course of their general surgical training in elective and emergency setting (PPR, procedures per resident). The most common surgical procedures performed (by any specialty) were irrigation and debridement of wounds (40%), followed by skeletal fixation (17%) and (exploratory) laparotomy (14%). Graduating chief residents did an average of 1,444 cases during their residency (range 1,188 to 1,682). Residents did an average of 165 laparotomies (mostly in elective setting), 19 major vessel repairs, 28 amputations, and a large number of fracture stabilisation (153 PPR). Residents had limited exposure to injuries requiring a thoracotomy, craniotomy, nephrectomy, IVC repair, external genital trauma and pediatric surgery.

Procedures performed	BC No (%)	NBC No (%)	Total	PPR
Head/neck	131 (8.6)	39 (4.9)	170 (7.3)	19
Thoracotomy	20 (1.3)	2 (0.3)	22 (0.9)	NR
Chest drain	53 (3.5)	8 (1.0)	61 (2.6)	NR
DC laparotomy	121 (7.9)	4 (0.5)	125 (5.4)	165[c]
Laparotomy	69 (4.5)	113 (14.2)	182 (7.8)	[c]
Genitals	11 (0.7)	29 (3.6)	40 (1.7)	7
Major amputation	61 (4.0)	20 (2.5)	81 (3.5)	28[d]
Minor amputation finger/toe	37 (2.4)	8 (1.0)	45 (1.9)	[d]
Large arterial vessel	19 (1.2)	2 (0.3)	21 (0.9)	19
Extremity ORIF	46 (3.0)	115 (14.4)	161 (6.9)	153[e]
External fixation	113 (7.4)	95 (11.9)	208 (9.0)	[e]
MUA	0 (0)	54 (6.8)	54 (2.3)	2
Fasciotomy/escharotomy	59 (3.9)	2 (0.3)	61 (2.6)	NR
DID	633 (41.6)	187 (23.5)	820 (35.4)	NR
DIS	88 (5.8)	17 (2.1)	105 (4.5)	NR
Reconstruction/SSG	62 (4.1)	51 (6.4)	113 (4.9)	NR
Minor general surgery	0 (0)	50 (6.3)	50 (2.2)	NR
Total Procedures	**1,523 (66)[a]**	**796 (34)[b]**	**2,319 (100)**	

Table 1: *Surgical procedures at the Dutch role 2 Medical Treatment Facility Uruzgan, Afghanistan.*

DID indicates debridement, irrigation, and dressing; *DIS:* debridement, irrigation, and splinting; *SSG:* split skin graft; *No:* number; *BC:* battle casualty; *NBC:* non battle casualty; *DC:* damage control; *ORIF:* open reduction internal fixation; *MUA:* manipulation under anaesthesia; *NR:* procedure frequency not captured by resident case log database; *PPR:* procedures per resident.

[a] Total procedures on 819 unique battle casualties, [b] Total procedures on 608 unique non battle casualties, [c] Total laparotomies, [d] Total amputations, [e] Total of operative fracture stabilisations.

DISCUSSION

This study compared the surgical workload of deployed military surgeons with cases completed by civilian surgical residents in order to identify a possible curriculum modification for the future military surgeon. Almost 2,500 surgical procedures were performed at the role 2 MTF NL in the study period (2006-2010). Sixty six per cent of the surgical procedures were performed on casualties with battle injuries and 34% on casualties with disease non-battle injuries. Pediatric cases made up 24% of all surgical cases, which is far higher than the 5% pediatric cases reported in combat hospitals in Iraq[20] and the 15% in Afghanistan[5]. Graduating chief residents did an average of almost 1,500 cases during their residency. Laparotomies and fracture stabilisation were the most performed procedures. Although residents are broadly trained, they had limited resident exposure to injuries, requiring a thoracotomy, craniotomy, nephrectomy, IVC repair, external genital trauma and pediatric (trauma) surgery. The sustained high surgical workload noted in this study (role 2 MTF NL) demonstrates that there is little opportunity to have a gradual introduction to military surgery in order to accommodate any on-deployment learning curve. Ramasamy et al.[5] described the problem sharply. Military surgeons practising in an austere environment encounter multiply injured patients with high-energy transfer fragment, projectile and blast wounds that require an assortment of damage control and definitive operative competences unparalleled in standard civilian practice. Therefore Dutch military surgeons need to be properly trained and equipped to treat the complex casualties they can be confronted with during military operations, with special emphasis on blast & penetrating injuries, damage control surgery and triage.

	Mean	Minimum	Maximum	SD
Fractures[a]	8.5	5	10	1.2
Soft tissue surgery[a]	8.2	6	10	0.9
Burn treatment[a]	8.2	7	10	1.2
Gastro intestinal surgery[a]	8.1	7	10	0.9
Pediatrics[a]	7.1	4	10	1.3
Thorax surgery[a]	6.9	4	10	1.6
Vascular surgery[a]	6.7	4	10	1.3
Plastic (reconstructive) surgery	6.5	5	8	0.9
Urology[b]	5.0	1	8	2.0
Neurosurgery[a]	4.5	1	8	2.3
Obstetrics/Gynecology[b]	4.5	1	8	2.4
Ophthalmic[b]	3.7	1	8	2.3
Maxillofacial surgery[b]	3.5	1	7	1.9

Table 2: *Self-perceived medical expertise of the deployed surgeons at the Dutch role 2 Medical Treatment Facility Uruzgan, Afghanistan**

SD indicates standard deviation, scores are expressed on 10 point scale as mean (1=lowest – 10=highest)
[a] key damage control surgery, [b] key adjuvant (damage control surgery) skills.
* submitted survey.

Parker et al.[21] and Willy et al.[6] compiled a core surgical skills list and proposed a training matrix. We used this matrixes for our proposed damage control surgery training matrix (Table 3). When the relative numbers of procedures performed in each surgical discipline are considered, it must be kept in mind that specialised medical teams (e.g. neurosurgery, maxillofacial surgery, urology and ophthalmology) were only stationed in higher echelons. Therefore, the surgical procedures at the role 2 MTF NL were all performed by a general (trauma) surgeon. After initial stabilization some casualties needed transport to higher echelons of care for definitive treatment. Patients not eligible for referral remained hospitalized in the role 2 MTF NL. From a humanitarian point of view (quality of provided care), it can be argued that a surgical team in a role 2 MTF needs to have the capabilities to perform the full spectrum of surgical procedures, beyond damage control surgery. Taking the wide spectrum of injuries in these high combat hospitals into account, we suggest the need for a broadly trained military surgeon. When this is not possible in the current stream of sub-specialisation, a paired surgeon surgical team (a senior and a junior surgeon with a different specialization) could be considered. Hoencamp et al. (submitted survey) described the self-perceived medical expertise of the general (trauma) surgeons at the role 2 MTF NL (Table 2). This illustrated the challenging task of the deployed surgeons and the discrepancies in self-perceived surgical skills and workload. At the time of their deployment most of the Dutch military surgeons were board-certified for more than five years, but only few of them had combat experience. Only few (junior) specialists had the non-formalized opportunity to do dedicated fellowships in South-Africa. The Dutch armed forces should formalize the training to optimally match the required competences of military surgeons and the curriculum of surgical residents.
Deering et al.[22] reported a decline in surgical skills during military operations. Recent Dutch experiences during the anti-piracy missions with low casualty rates and minimal surgical workload illustrate this dilemma. During NATO mission Ocean Shield and European Union mission Atalanta in the Somali Basin, the Gulf of Aden and the Arabic Sea, there was in total one appendicitis and one tendon repair in a period of 6 months (2013). In a 3 month period (2012), at the German role 3 MTF in Kunduz, Afghanistan, 27 surgical procedures were performed with 90% being NBI orthopedic trauma (personal communication ET). To prevent a decline in surgical skills short deployments should be considered during low-intensity missions with correspondingly reduced surgical workloads, especially for the junior medical specialists. We suggest a staged classification of military surgeons, with a clear differentiation between a senior, junior and trainee medical specialist for different violence spectra. By these means it is possible to match the surgeon to the deployment, with the possibility to upscale or downscale considering the casualty rate, type of injury and workload. Combat operations rarely follow a set pattern; any situation can instantly change, the staged approach does not mean concessions to the required surgical skill set. Tailor-made medical planning should be part of the initial battle planning.

Abdominal and vascular procedures	Thoracic procedures
Aortic cross-clamping during resuscitative laparotomy (thoracic or abdominal)	Thoracic access methods (including rapid emergency thoracotomy)
Simple ligation of any major vessel tear	Closure of penetrating cardiac wounds
Arterial injuries shunted/ligated + fasciotomy/coiling Venous injury ligation or repair Liver laceration packing	Lung haemorrhage control En-masse lobectomy Pulmonary tractotomy
Colonic perforation control	Non-anatomically stapled lung resection
Removal of solid organs (e.g. spleen and kidney) Bladder ruptures catheterized and drained Pancreatic bed leaks multiply drained	En-masse closure of chest wall muscles Repair or drainage of intra-thoracic oesophageal injuries Temporary (patch) closure of thoracic wounds (using an iv fluid bag)
Peritoneal soilage copiously irrigated and contained	Thoracic infection control using early appropriate antibiotics
Abdomen temporarily and/or rapidly closed Visceral compartment syndrome treated with plastic sheet or temporary vacuum packing Abdominal infection control using early appropriate antibiotics	

Table 3: *A suggested damage control surgical skill set.*

CNS indicates central nervous system

Extremity and pelvic procedures	Head, neck and neurosurgical procedures
Unstable pelvic ring fracture-pelvic binding or external fixation / pelvic packing	Surgical control or major head and neck vessels
Junctional zone bleeding control with urinary catheter tamponade	Drainage of cervical oesophageal injuries
Articular fracture stabilisation with bridging external fixator Rapid amputation decision making and performance Fracture reduction with approximate alignment	Surgical airway management including tracheostomy Intercranial bleeding-emergent haemorrhage control Adequate early exposure via a burr hole technique
Soft tissue damage-rapid primary debridement with physiological alignment	Intracranial haematoma evacuation/limitation of contamination
Contamination minimised by high volume fluid lavage Compartment syndrome prevention-wide area Soft tissue coverage temporary dressings	CNS superficial bone/metal fragment removal CNS infection control using early antibiotic therapy fasciotomy of any compartment
Management of burn patients, escharotomy, mesh-graft	
Primary wound management with vacuum drainage packs Femoral fracture control with rapid unilateral frame external fixation or Donway splint Musculoskeletal infection control using early appropriate antibiotics	

Training solutions and continuing training

Although Hoencamp et al.[1] concluded that the deployed surgical teams functioned well under high physical and mental stress in a combat theatre, further optimization is possible. The recognition of Military surgery as a subspecialty within general (trauma) surgery, with a formal curriculum and education & research program, in the Netherlands should be considered. The contents of such a training program should contain at least: 1. essential basic military training; 2. clearly defined courses: e.g. basic courses (ATLS®, BATLS, EMSB® and MIMMS®), damage control surgery courses (e.g. DSTC®, the Emergency War Surgery Course [EWSC®], the French advance course for deployment surgery [Cours Avancé de Chirurgie en Mission Extérieure, CACHIRMEX] and the UK Definitive Surgical Trauma Skills [DSTS®]), adjuvant courses (e.g. pediatric course, neurosurgical course, obstetric course and PREP course); 3. fellowships; 4. junior specialist deployment; 5. formalized continuing training; 6. surgical team training (Crew Resource Management). Military surgery has been appropriately recognised as a subspecialty within general surgery in the United Kingdom (UK) by the Intercollegiate Surgical Curriculum Project and the Defence Medical Services have continued to fund fellowships to overseas trauma centres for military surgeons in the UK[5]. Willy et al.[6] described the German DUO plus model, which entails a specialization in general surgery plus a second specialization, either visceral surgery or trauma/orthopedic surgery. A collaboration in an international military surgical task group or with a larger NATO coalition partner would fit the Dutch Armed Forces, because apart from the medical point of view, the cost of such an extensive surgical training program may outweigh the benefits of a smaller country. There is a strong analogue with disaster medicine and surgery. Collaboration in composing a training matrix for Disaster and Military medicine could possibly be useful, but beyond the scope of this study. Historically, units of the Dutch Armed Forces work in close cooperation with operational units of several international partners (e.g. US, UK, Canada, Germany, Australia, Singapore, France and Belgium). The level of provided care and positive endorsement of these partners, may indicate the quality of care provided by the Dutch military surgeons. Such a medical cooperation could be a solution for future deployments. The recently discussed NATO curriculum by the Military Surgical Expert Team of the Committee of the Chiefs of Military Medical Services are signs of implementing standardization for the NATO military surgeon[23]. Also, the IDR is planning to present a Dutch surgical training program for military surgeons this year (2014). The obligation of the DSTC® and PREP courses are clear signs that standardization for the Dutch military surgeons is being implemented on the course side of the training matrix. An emergency surgery fellowship in a foreign level 1 trauma center with a significant exposure to penetrating trauma could be a next step in the formation of a future pre-deployment workup program. A standardized international fellowship program could improve the NATO coalition integration of the Dutch medical armed forces. To acquire and improve the skills and competences a residency deployment of 4-6 weeks with a senior colleague could be part of this training program. A downfall is the increase of the deployment rate per military surgeon. The proposed continuing program by Willy et al.[6] would perfectly fit the needs. The general plan is a 3-5 month refresher program every 5 years. If they are to preserve the acquired skills, regular practice in those disciplines in which they are not routinely engaged as part of their work will be necessary (e.g. a trauma surgeon will be required to receive training in the disciplines of thoracic, visceral and vascular surgery). To enhance experience with rare injuries live tissue training, cadaver dissections and computer simulations could serve as training tools before deployment[11].

There are certain limitations to our study. First, due to initially missing information there was a relatively long delay in reporting these statistics. Incomplete or missing medical charts may have led to an under-estimation of the performed surgical procedures. Also surgical procedures were often undefined in both the procedures performed at the role 2 MTF NL and in the resident case logs. Some specific areas of resident experience could not be assessed due to limitation of the resident case log, which fails to capture resident experience with specific injuries (or differentiation between trauma and non-trauma). Secondly, only 15 residents were assessed from civilian surgical training in the Netherlands. Additional (personal) follow up training could not be scored. Thirdly, it was not possible to assess objectively the quality of the provided care in respect to clinical outcome, morbidity and mortality. Last, the severity of injuries could not be scored in a consensus-derived global severity scoring system, such as the Abbreviated Injury Scale[24] or the Injury Severity Score[25]. Coalition partners also reported poor population description of data points and poor consistence of pre-hospital data entered into a digital medical registration system[26]. For this reason the US established in 2004 the Joint Theater Trauma Registry (JTTR) as a standardized system of data collection, designed to encompass all echelons of the Medical Support Organization. Recent experiences in Afghanistan, with Australian and Singaporean participation, go even beyond classical NATO borders. To improve future international collaboration, the introduction of an international trauma registry could be a proactive option. This study, to our knowledge, represents the only European comparison of surgical cases seen in the current theater of combat operations to cases completed by surgical residents and pre-deployment surgical work up program.

In conclusion, during recent armed conflicts, like Afghanistan, military surgeons treated many casualties. Exposure to pediatric cases was much higher than reported in other combat hospitals in Iraq and in Afghanistan. The findings at the role 2 MTF NL show that the injuries were often severe and the required surgical procedures sometimes highly demanding. In addition the single surgeon surgical teams were exposed to the full surgical spectrum. It could be argued that the current Dutch standard, of deploying a single surgeon, should be reconsidered, especially because of increasing subspecialisation in surgical training. Considerations about individual skillsets, fatigue, stress, reducing operating times, shared decision making and quality of care contribute to the thought of deploying paired surgical teams with complimentary competences. The recognition of military surgery as a subspecialty within general (trauma) surgery, with a formal training curriculum in the Netherlands should be considered. Further research is necessary to evaluate the psychological impact of being the sole surgeon in a MTF and to assess and validate the proposed curriculum. Tailor-made medical planning should be part of the initial battle planning to effectively face the challenges. The current civilian resident training does not foresee in the minimal required competences of a fully trained military surgeon. Standardized courses, exchange/ fellowship programs, the deployment of surgical residents as part of their medical specialist training, staged classification of military surgeons and the introduction of a NATO military (and disaster) surgery standard may attribute to achieve this aim.

REFERENCES

1. Hoencamp R, Idenburg FJ, Hamming JF, Tan ECTH. Incidence and Epidemiology of Casualties treated at the Dutch role 2 Enhanced Medical Treatment Facility at Multi National Base Tarin Kowt, Afghanistan in the period 2006-2010. World J Surg. 2014;38:1713-8. DOI:10.1007/s00268-014-2462-x.
2. de Kruijff LGM, Mert A, van der Meer F, Huizinga EP, de Wissel MJ, van der Wurff P. Dutch military casualties of the war in Afghanistan-Quality of life and level of participation after rehabilitation. Ned Tijdschr Geneeskd. 2012;155(35):A4233.
3. de Kruijff LGM, van der Krans A, Mert A. Reintegration of Dutch war casualties; what is the impact on family relations and job commitment? Ned Mil Geneeskd Tijdschr. 2012; (65):3.
4. Huizinga E, van der Hem JA, Blokhuis TJ. Repatriation and care of a battle casualty from Uruzgan. Ned Tijdschr Trauma. 2012;20(2):32-35.
5. Ramasamy A, Hinsley DE, Edwards DS, Stewart MP, Midwinter M, Parker PJ. Skill sets and competencies for the modern military surgeon: lessons from UK military operations in Southern Afghanistan. Injury. 2010;41:453-459.
6. Willy C, Hauer T, Huschitt N, Palm HG. "Einsatzchirurgie"-experiences of German military surgeons in Afghanistan. Langenbecks Arch Surg. 2011;396:507-522.
7. Kearney SP, Bluman EM, Lonergan KT, Arrington ED, Ficke JR. Preparedness of orthopaedic surgeons for modern battlefield surgery. Mil Med. 2012;177:1058-1064.
8. Rosenfeld JV. How will we produce the next generation of military surgeons? Re: Skill sets and competencies for the modern military surgeon: lessons from UK military operations in Southern Afghanistan. Injury. 2010;41:435-436.
9. Tyler JA, Ritchie JD, Leas ML, Edwards KD, Eastridge BE, White CE, et al. Combat readiness for the modern military surgeon: data from a decade of combat operations. J Trauma. 2012;73:S64-S70.
10. Tyler JA, Clive KS, White CE, Beekley AC, Blackbourne LH. Current US military operations and implications for military surgical training. J Am Coll Surg. 2010;211:658-62.
11. Bonnet S, Gonzalez F, Poichotte A, Duverger V, Pons F. Lessons learned from the experience of visceral military surgeons in the French role 3 Medical Treatment Facility of Kabul (Afghanistan): an extended skill mix required. Injury. 2012;43(8):1301-6.
12. Gawande A. Casualties of war-military care for the wounded from Iraq and Afghanistan. N Engl J Med. 2004;351:2471-5.
13. Traumazorg in Beeld: Landelijke Traumaregistratie 2007-2011: rapportage Nederland. LNAZ, June 2013.
14. Central Bureau of Statistics of the Netherlands. Causes of death; non-natural deaths. Available athttp://statline.cbs.nl/StatWeb/publication/?DM=SLNL&PA=37683&D1=2-103&D2=0&D3=a&D4=12-15&VW=T. Accessed December 30, 2013.
15. Bruinsma MY, Moors JA. Illegale vuurwapens. Gebruik, bezit en handel in Nederland 2001–2003. Tilburg/Den Haag: IVA Beleidsonderzoek en advies/WODC (Ministerie van justitie); 2005.
16. Van Waes OJF, Van Riet PA, Van Lieshout EMM, Hartog DD. Immediate thoracotomy for penetrating injuries: ten years' experience at a Dutch level I trauma center. Eur J Trauma Emerg Surg. 2012;38:543–551.
17. Fox JP, Tyler JA, Paulick J, et al. Iraq, integrated programs, and training military surgeons. Presented at American College of Surgeons 2008 Clinical Congress, San Francisco, CA. October 2008.

18. Martin MJ, Dubose JJ, Rodriguez C, Dorlac WC, Beilman GJ, Rasmussen TE, et al. "One front and one battle": civilian professional medical support of military surgeons. J Am Coll Surg. 2012;215(3):432-7.
19. Sullivan MC, Sue G, Bucholz E, Yeo H, Bell RH Jr, Roman SA, Sosa JA. Effect of program type on the training experiences of 248 university, community, and US military-based general surgery residencies. J Am Coll Surg. 2012;214(1):53-60.
20. Coppola CP, Leininger BE, Rasmussen TE, Smith DL. Children treated at an expeditionary military hospital in Iraq. Arch Pediatr Adolesc Med. 2006;160: 972–6.
21. Parker PJ. Kosovo 1999. A surgical template for modern conflict. J R Army Med Corps. 2000;146:199–203.
22. Deering SH, Rush RM, Lesperance RN, Roth BJ. Perceived effects of deployments on surgeon and physician skills in the US Army Medical Department. Am J Surg. 2011;201:666-672.
23. NATO COMEDS. http://www.nato.int/cps/en/natolive/topics_49168.htm. Accessed 26 Jan 2014.
24. The Abbreviated Injury Scale (AIS)-1985 Revision. American Association for Automotive Medicine, Des Plaines, IL 60018.
25. Baker SP, O'Neill B, Haddon Jr. W, Long WB. The Injury Severity Score: a method for describing patients with multiple injuries and evaluating emergency care. J Trauma. 1974;14: 187–196.
26. Therien SP, Nesbitt ME, Duran-Stanton AM, Gerhardt RT. Prehospital medical documentation in the Joint Theater Trauma Registry: a retrospective study. J Trauma. 2011;71:S103-S108.