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2022

TRANSITION OUTCOMES OF ARMED FORCES PERSONNEL WITH BATTLEFIELD INJURIES

A SUMMARY OF THE LITERATURE

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Glossary of terms

ABI	Acquired Brain Injury, i.e., brain damage caused by events after birth
ADL	Barthel Activities of Daily Living, an ordinal scale that measures functional independence in the domains of personal care and mobility
HRQOL	Health-Related Quality of Life, a multi-dimensional concept that includes domains related to physical, mental, emotional, and social functioning
IADL	Lawton Instrumental Activities of Daily Living, assessing a person's ability to perform tasks such as using a telephone, doing laundry, and handling finances
IED	Improvised Explosive Device
ISS	Injury Severity Score, an established medical measure to assess severity of an injury or injuries; a score of over 15 is defined as major trauma
MLKI	Multi-Ligament Knee Injury
mTBI	Mild Traumatic Brain Injury
NISS	New Injury Severity Score, a measure similar to ISS based on scores of each of the patient's three most severe injuries regardless of the body region in which they occur
OEF	Operation Enduring Freedom, the US military operation in Afghanistan 2001-2014
OIF	Operation Iraqi Freedom, the US military operation in Iraq 2003-2011
PEB	Physical Evaluation Board, a board within each US military service which determines whether military personnel with medical conditions are able to perform their military duties and, if not, determines their eligibility for disability benefits and compensation
PTSD	Post-Traumatic Stress Disorder
RTD	Return To Duty, i.e., returning to continue a career in the Armed Forces following injury
SF-36	The Short Form-36 Health Survey, a 36-item, patient-reported survey of health in eight sections covering physical and mental health, and functioning in physical, emotional and social roles
TBI	Traumatic Brain Injury
TDRL	Temporary Disability Retirement List of US military personnel found to be unfit for military duty by reason of disability but whose conditions have not stabilised sufficiently for a permanent disability rating

Executive summary

This review provides a summary of academic studies into employment and well-being outcomes of military personnel who have received battlefield injuries. These articles were systematically identified, but only a small number of papers (13) fulfilled requirements for inclusion; in a large part this was because studies often focus on either health conditions or deployment periods, rather than specifically identifying personnel with battlefield injuries.

We found that return to duty rates were lower for those who underwent amputation subsequent to battlefield injury. Similarly, employment rates for those who left the Armed Forces were generally high but lower for those with major amputations and/or additional physical health needs. Well-being measures were largely similar to uninjured comparator groups, with some evidence that physical well-being is unaffected but mental well-being suffers as a result of battlefield injury; however, the evidence for this is somewhat sparse.

Overall, evidence on this topic was limited. However, studies currently underway, in particular the ADVANCE study, will be able to provide more complete evidence on this topic in a UK context.

Introduction and aims of this review

The purpose of this review was to collate and examine the existing literature on the transition outcomes of military personnel who have sustained physical battlefield injuries. This review arises from the ADVANCE - INVEST study. The ADVANCE (Armed Services Trauma Rehabilitation Outcome) study investigates the long-term physical and psychosocial outcomes of UK Armed Forces battlefield casualties deployed to Afghanistan between 2003 and 2014. The ADVANCE-INVEST (Injured Veterans' Experiences of Transition) study is a subsidiary of the ADVANCE study; a long-term project which investigates the transitional experiences and outcomes of battlefield casualties who have transitioned military to civilian life, comparing them with other transitioning personnel.

This review explored return to duty rates (RTD); employment outcomes; and wellbeing outcomes related to transition, such as independence and social functioning and well-being. This review focused specifically on the outcomes of battlefield casualties as opposed to those (ex-) Service personnel who were wounded, injured, or became sick as a result of non-operational events (including deployment related activities which were not combat-related).

Terms and definitions

- The authors used the term “ex-Service personnel” to refer to military personnel who have served in but left the UK Armed Forces, following the standard UK definition. However, some authors used the term “veteran” in their articles, relating to their local definitions of ‘veteran’, and hence this term may be used when discussing those specific findings.
- Instead of the acronyms “OIF/OEF”, which are commonly used in US literature to denote the US military operations “Operation Iraqi Freedom” in Iraq (2003-2010) and “Operation Enduring Freedom” in Afghanistan (2001-2014), the authors refer to these events as “deployments to Iraq and/or Afghanistan” to be inclusive of all parties active in those deployments.
- The term “well-being” is used to describe an individual’s experience of their life and a comparison of life circumstances with social norms.

Methods

Full methods are found in Appendix 1; in brief, several academic databases were searched for articles on transition outcomes (e.g., “employment”, “civilian work” and “transition”) of military personnel with battlefield injuries. Data were extracted (see Appendix 2 for the full data table) and studies were quality assessed independently by the authors.

Results

1821 potential articles were identified, of which 13 fulfilled inclusion criteria specific to transition outcomes of interest (RTD, employment and well-being) for battlefield-injured Armed Forces personnel. Most studies covered the conflicts in Iraq and Afghanistan post-2001 and the majority of studies were on US or UK populations. Many studies were given a quality assessment of “fair”; few studies qualified as “good” as, partly due to the highly specific population and its needs, studies rarely included control/comparison groups, had smaller sample sizes, contained limited statistical analyses and few followed participants up over time.

Evidence on these topics was largely restricted to three outcomes: RTD, post-discharge employment rates and well-being. Relatively few studies focused specifically on battlefield injured populations; most studies concentrated on groups selected based on health condition (particularly traumatic brain injury (TBI), spinal injury, and Post-Traumatic Stress Disorder (PTSD)); some papers studied injured

personnel but not specifically those who had battlefield injuries. Those studies which were not specifically related to battlefield injury were excluded.

Return to duty

“Return to duty” is a term which refers to the process of an injured Service person returning to Service duty post-injury. Six of the papers reported RTD rates; the key findings are featured below (Table 1).

Authors and year of publication	Sample	Relevant outcomes measured	Findings
	Conflict		
	Comparison group(s)		
Armstrong, A.J., et al., 2018 [1]	165 US ex-Service personnel with a major amputation (92% of which were service-connected)	RTD, employment	92% did not return to active duty (79% due to their disability). Of the whole sample, 39% were employed, 35% unemployed and 26% retired
	Iraq/Afghanistan		
	None		
	Afghanistan		
	General population		
Barrow, A.E., A.J. Sheean, and T.C., 2017 [2]	46 US military service members with MLKI sustained during combat activity	RTD, use of ambulator assistive device	41% RTD; nine individuals required assistive device
	Iraq/Afghanistan		
	None		
Eskridge, S.L., et al., 2013 [3]	1656 US Service personnel with combat blast-related mTBI	Injury severity, mTBI, Type of discharge	11% disability discharge, 36% non-disability discharge, 52% no recorded discharge. Injury severity (but not acute mTBI symptoms) associated with disability discharge
	Iraq		
	None		
Ramasamy, A., et al., 2008 [4]	53 IED casualties from hostile action in Iraq Jan-Oct 2006, either killed in action (KIA) or presented to British Military Field Hospital (casualties KIA were included in the study). 47 were coalition forces (39 UK, 3 US, 5 Danish) five were foreign civilians and one was local civilian	Survival, NISS, RTD	12 killed or died of wounds (23%); 41 (77%) surviving casualties; 20 (49%) underwent surgery. At 18 months follow up, of 14 out of 22 evacuated personnel were members of the UK Armed Forces, all but one had returned to duty
	Iraq		
	None		

Laughlin, M.D., et al., 2017 [5]	1417 US service members injured by gunshot 2005-2009	Separation from service	40% medically separated in time period under study
	Iraq/Afghanistan		
	None		
Rivera, J.C. and B.T. Corona, 2016 [6]	33 combat wounded US service members with known muscle injuries	Whether additional time for recovery via placement on TDRL improves RTD, disability rating from muscle condition	15 were medically retired by first evaluation. 18 were placed in TDRL prior to final retirement. None improved muscle condition. Concluded that additional recovery time did not improve physical evaluations for muscle conditions
	Not specified		
	None		

Table 1. Key findings - return to duty

Return to duty rates were generally low for those who received amputations following battlefield injury. Of 165 US ex-Service personnel who experienced major amputation as a result of deploying to Iraq or Afghanistan, 151 (92%¹) did not return to active duty (time from injury was 2-10 years); 118 (79%) of whom reported that this was due to their disability[1]. Return to duty rates regarding combat-related multi-ligament knee injuries (MLKI) in US Service personnel were higher than for those with a major amputation, 41%[2] and 8%[1] respectively.

In a study of 34 UK military neurorehabilitation patients with combat-related brain injuries from deployment to Iraq or Afghanistan, 11 (32%) returned to military duties[7]. Return to duty rates were higher for mTBI relative to other battlefield neurological injuries in a sample of 1656 US Service personnel who experienced combat blast-related acute mTBI in the Iraq conflict[7]. In this study 11% received a disability discharge, 36% received a non-disability discharge and 52% had no recorded discharge, implying RTD[3]. Injury severity was associated with discharge outcomes and was predictive of disability discharge[3].

Other types of battlefield injury resulted in differing rates of RTD. A study of Service personnel² injured by improved explosive devices (IEDs) in Iraq found that of 41 surviving casualties, 19 were deemed fit to return to the theatre of operations and 22 were aeromedically evacuated out of Iraq after assessment and treatment in a field hospital. At 18 months follow up, of the 14 out of 22 evacuated personnel who were members of the UK Armed Forces, all but one had returned to duty³[4]. A study of combat-related gunshot injury found relatively high rates of RTD: while 40% of 1417 cases were medically discharged as a result of proceedings of a Physical Evaluation Board (PEB), 36% of cases were able to complete another deployment after their gunshot injury[5]. Of 33 US Service personnel with volumetric muscle loss (the traumatic or surgical loss of skeletal muscle with resultant functional impairment), 15 (45%) were medically retired at their first Army Physical Evaluation Board (PEB)[6]. The remaining 18 (55%) were placed on the Temporary Disability Retirement List (TDRL) prior to their final medical retirement; of these, seven (38%) were issued a more disabling rating at their final

¹ Percentages have been rounded to the nearest whole number.

² 53 casualties formed the cohort of this study – 47 were coalition forces (39 UK, 3 US, 5 Danish), five were foreign civilians and one was a local civilian. Twelve of these casualties were either killed or died of their wounds, leaving 41 surviving casualties.

³ Eight personnel were not followed up because they were not members of the UK Armed Forces (3 US and 5 Danish).

evaluation than at their initial evaluations. This study was notable for finding that additional recovery time did not improve PEB outcomes.

Post-discharge employment

Three papers reported rates of employment post-discharge – the key findings are featured below (Table 2).

Authors and year of publication	Sample	Relevant outcomes measured	Findings
	Conflict		
	Comparison group(s)		
Armstrong, A.J., et al., 2018 [1]	165 US ex-Service personnel with a major amputation (92% of which were service-connected)	RTD, employment	92% did not return to active duty (79% due to their disability). Of the whole sample, 39% were employed, 35% unemployed and 26% retired
	Iraq/Afghanistan		
	None		
Bahadur et al., 2016 [7]	34 UK military neurorehabilitation patients with operational/combat brain injury	Functional outcomes	At 4 months post discharge, 47% fully independent, 41% independent in own home but some assistance required, 79% returned to work; 93% of unsurvivable ISS capable of or returned to work
	Iraq/Afghanistan		
	None		
Ebrahimzadeh, Rajabi, 2017 [8]	27 Iranian veteran foot/ankle amputees from war wounds	Employment, treatment for psychological conditions	48% employed post-amputation; 74% reported treatment for psychological conditions
	Iran-Iraq		
	None		

Table 2. Key findings – post-discharge employment

Only 39% of 165 US ex-Service personnel who had sustained a major amputation (92% of which were service-connected) reported being employed; 35% reported being unemployed, and 26% indicated they were retired despite the fact that only 11% were over 45 years of age[1]. Ex-Service personnel who experienced less pain had more prosthetic usage, were more likely to be employed, more engaged in social and community activities and had a better overall perception of being an amputee [1]. A 48% employment rate was reported in a sample of 27 Iranian soldiers who had foot/ankle amputations[8].

High rates of employment were seen in those whose injuries had been labelled “unsurvivable” on the Injury Severity Score (ISS). Seventy-nine percent of UK ex-Service personnel who deployed to Iraq or Afghanistan returned to full- or part-time work four months post-discharge from neurorehabilitation from injuries that had been due to IEDs, gunshot wounds, penetrating wounds or due to blunt trauma or combined injury[7]. The authors suggested that ISS at the point of injury does not reflect the eventual outcome and should not be used to predict employability, quality of life or long-term prognosis[7].

Well-being, independence and social functioning

Five papers reported outcomes related to well-being, independence and social functioning. The key findings are featured below (Table 3).

Authors and year of publication	Sample	Relevant outcomes measured	Findings
	Conflict		
	Comparison group(s)		
Siddharthan, 2012 [9]	75 US ex-Service personnel with mild/moderate combat-related TBI receiving telerehabilitation (and not in employment), 81% of whom had comorbid PTSD	Functional Independence Measure, Functional Assessment Measure, Patient Competency Rating Scale	Functional capabilities stabilised over time, but deficiencies in cognition, psychosocial adjustment, and integration into society pose challenges. Comorbid PTSD worsens employment and social integration
	Iraq/Afghanistan		
	mTBI patients were compared with those with comorbid PTSD		
Bahadur et al., 2016 [7]	34 UK military neurorehabilitation patients with operational/combat brain injury	Functional outcomes	At 4 months post discharge, 47% fully independent, 41% independent in own home but some assistance required, 79% returned to work; 93% of unsurvivable ISS capable of or returned to work
	Iraq/Afghanistan		
	None		
Taghipour et al., 2009 [10]	141 male Iranian ex-Service personnel who sustained lower extremity amputation, either battlefield or after transport to behind-the-line hospitals due to war-related injury	HRQoL (SF-36)	Poor physical HRQOL associated with transfemoral amputation, phantom movement, low back pain, lower Barthel Index. Poor mental HRQOL associated with lower education, articular pain of sound leg, employment, receiving disability
	Iran-Iraq		
	None		
Allami et al., 2017 [11]	1079 Iranian ex-Service personnel with ankle-foot injuries	Quality of life (SF-36)	Ex-Service personnel with ankle-foot injuries had critically poor health-related quality of life and score significantly worse on all eight measures of the SF-36 (physical functioning; role physical; bodily pain; general health; vitality; social functioning; role emotional; and mental health) than
	Iran-Iraq		
	Bilateral lower limb veteran amputees and general Iranian population		

			general population and amputees
Dharm-Datta, S., et al., 2011 [12]	52 UK combat amputees	RTD, Functional Activity Assessment, SF-36	44 continued to serve (33 returned to work), 8 medical discharges. SF-36 physical component summary improved with rehabilitation, but mental component summary did not (though mental component scores were already similar to norms)
	Afghanistan		
	General population		

Table 3. Key findings – well-being, independence and social functioning

Two studies (one US and one UK) identified that battlefield injuries may give rise to difficulties in independence and social functioning. One study involved 75 US ex-Service personnel who had deployed to Iraq/Afghanistan, sustained mild or moderate combat-related TBI, and received telerehabilitation[9]. This study found that, while functional capabilities stabilised over time, deficiencies in cognition, psychosocial adjustment and integration into society posed problems. It was also found that comorbid PTSD worsened employment and social integration outcomes. In the study of 34 UK military neurorehabilitation patients with a combat-related brain injury from the conflict in Afghanistan, it was found that around half (47%) were fully independent four months post-discharge from the rehabilitation centre; while 41% were independent in their home but needed some assistance[7]. Overall, 88% of those in this study were able to care for themselves in their homes.

General well-being may also be affected by type of battlefield injury. A large study of 1079 Iranian ex-Service personnel showed that ex-Service personnel with foot/ankle injuries (an injury that is considered to cause many serious secondary problems for a lifetime) had worse quality of life assessments than both the general Iranian population and bilateral lower limb amputees[11]. The main predicting factors for lower levels of mental health well-being were sustaining additional injuries, a history of hospitalisation, higher levels of dependency when performing activities of daily living (ADLs and IADLs) and unemployment[11]. Similarly, in a study of 52 UK combat amputees, it was found that the Physical Component Summary of the Short-Form-36 Health Survey (SF-36) well-being measure improved with rehabilitation but the Mental Component Summary did not[12]. This suggests that, while physical well-being shows good recovery after battlefield injury, mental health and well-being needs are not always being met. This may be related to independence and employment. In a study of the long-term health-related quality of life (HRQOL) of 141 male Iranian ex-Service personnel who sustained lower extremity amputations (transtibial, transfemoral and knee disarticulation) in the Iraq-Iran War, it was found that low scores on the mental health dimension of HRQOL were associated with employment status and receiving disability allowance[10].

A qualitative study identified a number of key themes regarding well-being, specifically “experiencing different identities” and “discontinuity in rehabilitation”[13]. The former involved shifting between identities of disabled person, wounded veteran, and athlete in different contexts, the latter the frustration of negotiating civilian mindsets in rehabilitation and lack of coordination between healthcare providers. These findings underline the challenges faced by battlefield casualties, on both well-being and administrative levels, due to their specific health support needs.

Thus, the overall evidence is complex, and while overall battlefield injury negatively affects well-being it may be that different injury profiles may give rise to different physical and mental needs.

Conclusions

This review found that the evidence regarding transition outcomes for battlefield casualties is, at the current time, fairly limited. Relatively few outcomes are investigated, primarily RTD and employment. Those studies which exist are generally small in size, limited in depth, and lacking in comparisons or follow-up of participants.

This review found that RTD rates varied by injury type, generally being lower for those with amputations and severe injury. Employment rates after leaving Service are generally high but are also lower for certain specific injuries e.g., major amputations and penetrating head injuries. There were some studies which identified either lower mental or physical well-being in relation to specific injury types. In the future, more research utilising direct comparisons between injury types is needed to understand these implications more fully. Those with complex needs are more likely to encounter difficulties and make more use of health services. The ADVANCE study hopes to examine the impact of different injury types and the impact of complex presentations.

Many gaps in the literature were identified by this review. Few studies had control or comparison groups. Studies were largely retrospective (understandably, as it is difficult to perform prospective studies as battlefield injured personnel have more immediate priorities than collecting research data). Transition outcomes are generally only examined at a basic level; for example, quantitative studies on employment did not consider work suitability, sustainability, or satisfaction. Qualitative studies focused on changing identities but rarely examine adaptation to other aspects of transition. There was little research on work sector, or ongoing disability for those who do not return to work and no papers on pay, financial hardship, or homelessness following battlefield injury. We hope to address these limitations with rich data on transition outcomes that will be collected over multiple phases of the ADVANCE study.

Overall, this review demonstrates that there is a dearth of evidence on this topic. It is hoped that this will be rectified in the future, in particular from the ADVANCE cohort study of UK battlefield injured personnel. This cohort is longitudinal, contains a comparison group of equivalent non-injured personnel, and has a sub-study specifically to investigate transition outcomes. It is hoped that the evidence regarding socioeconomic outcomes of battlefield injury, provided here from disparate studies on specific groups, will become clearer as the ADVANCE study allows a broad approach to answer the questions raised by the existing literature.

Appendix 1: Systematic review method

Study selection

Inclusion and exclusion criteria for studies included in this review were as follows:

- Published in English;
- Primary research on the group or cohort level; case studies, editorials, letters etc. were excluded;
- Source of trauma must be combat; deployment to a conflict area was not sufficient for inclusion, as ill health arising from deployment is frequently due to disease or non-battle injury;
- As a consequence of modern era conflicts, there were medical advances in the treatment of battlefield casualties, as such, we have excluded studies on participants from the Vietnam conflict and earlier and have included all eligible studies on all subsequent conflicts.

Search strategy

To perform the search, the Ovid academic database tool was utilised to simultaneously search the following databases: MEDLINE, Embase, Global Health APA PsycInfo, and Social Policy and Practice. The search was performed on 13/04/2021 and repeated on 20/07/2022. The search terms utilised are listed in Table 1; terms within each column were connected by “OR” statements, and these columns were then connected by “AND” statements to identify all papers which included transition outcomes for military populations with battlefield and traumatic injuries.

Table 1 Systematic search terms

Population	Intervention	Outcome
Military	Trauma	Employment
Veterans	Traumatic	Unemployment
Combat	Trauma-related	Homeless*
Servicemen	Amput*	Transition
Iraq	Traumatic injury	Retirement
Afghanistan	Wounded	“civilian work”
Army	Wounding	“financial hardship”
Armed Services	Warfare	Reemploy*
Marines	Battlefield	Underemployment
Infantry	Blast injuries	“economic outcomes”
Armed Forces		Accomm*

The initial search and deduplication were performed by HB. Resulting citations were downloaded to EndNote software version X8. After automatic and manual deduplication, 1821 potential papers remained. HB and AV then screened titles and abstracts of these potential papers to identify all relevant studies. Full texts of these papers were obtained and screened by HB and AV, after which a final set of 13 papers were selected as fulfilling the requirements of the review (see Figure 1 below; this Figure represents the original search at 13/04/2021, the secondary search at 20/07/2022 did not reveal any new literature). Disagreements were discussed and settled by HB and AV. Data were then systematically extracted from these papers by HB (see Appendix 2 below for the extracted data).

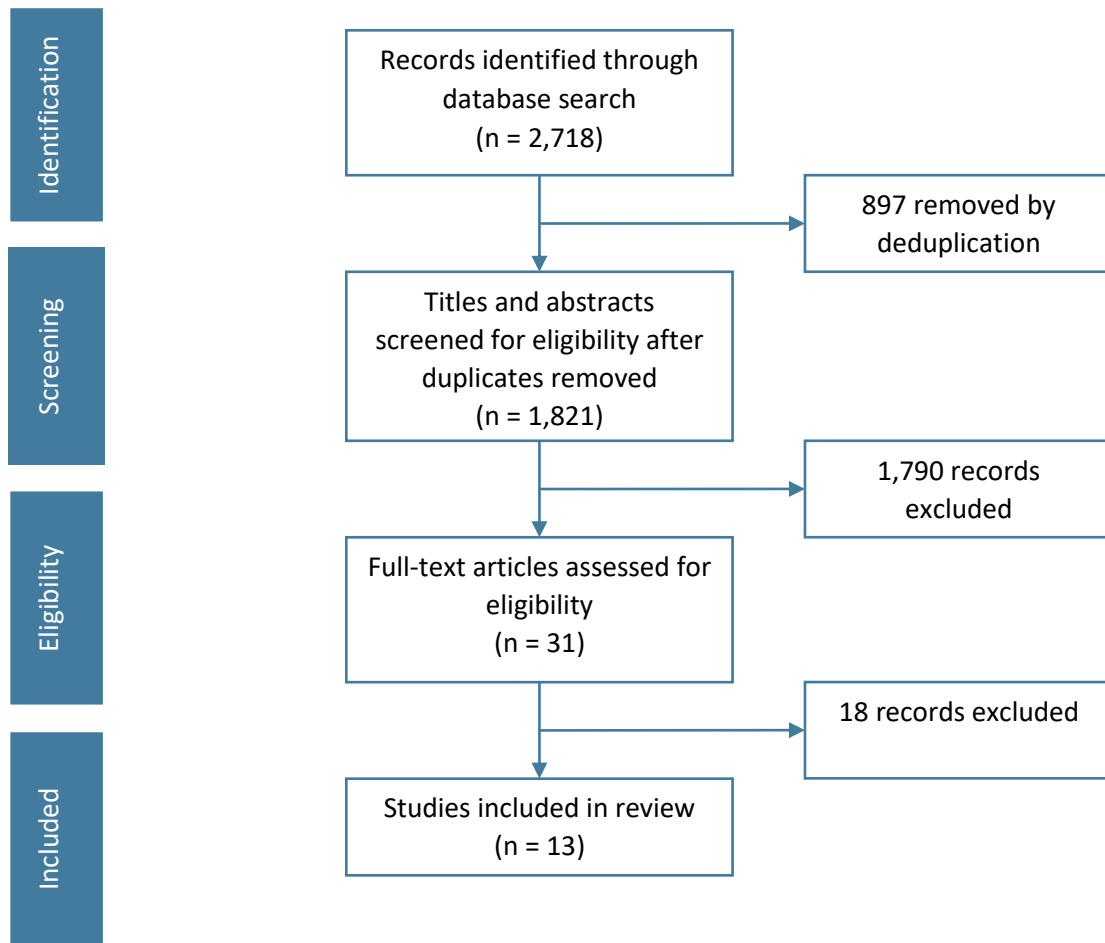


Figure 1 Search strategy flow chart

Additionally, we also examined potential sources of grey literature from repositories of research commissioned by military charities who provide services to injured ex-Service personnel (e.g., Forces in Mind Trust, BLESMA and Help for Heroes). No additional literature was found which fulfilled the inclusion and exclusion criteria.

Quality Assessment

Study quality was then assessed by HB and AV separately, using the Critical Appraisal Skills Programme Qualitative Checklist[14] to assess the quality of qualitative studies and the National Institute of Health Quality Assessment Tool for Observational Cohort and Cross-Section Studies[15] to assess quantitative studies. Quality assessments are found in Appendix 3 below. Almost all studies were judged to be of “fair” quality. Studies on this topic were frequently held back by lack of control or comparison groups, lack of blinding by participants and/or assessors⁴, small sample sizes, limited statistical analysis, and lack of follow-up. Otherwise, most studies were well-conducted and reported given such limitations, which are often difficult to overcome in this population.

⁴ In most cases the outcomes assessors were either (explicitly or implicitly) clinicians attending to the sample as patients, or outcomes were self-reported. In either of these cases, we treated outcomes assessors as not being blind to exposure status of participants.

Appendix 2: Data extracted from studies identified

Authors	Year of publication	Sample	Conflict	Comparison group(s)	Relevant outcomes measured	Findings
Allami et al.[11]	2017	1079 Iranian ex-Service personnel with ankle-foot injuries	Iran-Iraq	Bilateral lower limb veteran amputees and general Iranian population	Quality of life (SF-36)	Ex-Service personnel with ankle-foot injuries had critically poor health-related quality of life and score significantly worse on all eight measures of the SF-36 (physical functioning; role physical; bodily pain; general health; vitality; social functioning; role emotional; and mental health) than general population and amputees
Armstrong et al.[1]	2018	165 US ex-Service personnel with a major amputation (92% of which were service-connected)	Iraq/Afghanistan	None	RTD, employment	92% did not return to active duty (79% due to their disability). Of the whole sample, 39% were employed, 35% unemployed and 26% retired

Bahadur et al.[7]	2016	34 UK military neurorehabilitation patients with operational/combat brain injury	Iraq/Afghanistan	None	Functional outcomes	At 4 months post discharge, 47% fully independent, 41% independent in own home but some assistance required, 79% returned to work; 93% of unsurvivable ISS capable of or returned to work
Barrow et al.[2]	2017	46 US military service members with MLKI sustained during combat activity	Iraq/Afghanistan	None	RTD, use of ambulator assistive device	41% RTD; nine individuals required assistive device
Christensen et al.[13]	2018	Six qualitative interviews with lower limb Danish amputees identified through a register of wounded ex-Service personnel in Denmark	Iraq/Afghanistan	None (qualitative analysis)	None (qualitative analysis)	Two main themes identified: "experiencing different identities" and "experiencing discontinuity in rehabilitation"
Dharm-Datta et al.[12]	2011	52 UK combat amputees	Afghanistan	General population	RTD, Functional Activity Assessment, SF-36	44 continued to serve (33 returned to work), 8 medical discharges. SF-36 physical component summary improved with rehabilitation, but mental component summary did not (though mental

						component scores were already similar to norms)
Ebrahimzadeh, Rajabi[8]	2007	27 Iranian veteran foot/ankle amputees from war wounds	Iran-Iraq War	None	Employment, treatment for psychological conditions	48% employed post-amputation; 74% reported treatment for psychological conditions
Eskridge et al.[3]	2013	1656 US Service personnel with combat blast-related mTBI	Iraq War	None	Injury severity, mTBI, Type of discharge	11% disability discharge, 36% non-disability discharge, 52% no recorded discharge. Injury severity (but not acute mTBI symptoms) associated with disability discharge
Laughlin et al.[5]	2017	1417 US service members injured by gunshot 2005-2009	Iraq/Afghanistan	None	Separation from service	40% medically separated in time period under study
Ramasamy et al.[4]	2008	53 IED casualties from hostile action in Iraq Jan-Oct 2006, either killed in action (KIA) or presented to British Military Field Hospital (casualties KIA were included in the study). 47 were coalition forces (39 UK, 3 US, 5 Danish) five were foreign civilians and one was local civilian	Iraq	None	Survival, NISS, RTD	12 killed or died of wounds (23%); 41 (77%) surviving casualties; 20 (49%) underwent surgery. At 18 months follow up, of 14 out of 22 evacuated personnel were members of the UK Armed Forces, all

						but one had returned to duty
Rivera, Corona[6]	2016	33 combat wounded US service members with known muscle injuries	Not specified	None	Whether additional time for recovery via placement on TDRL improves RTD, disability rating from muscle condition	15 were medically retired by first evaluation. 18 were placed in TDRL prior to final retirement. None improved muscle condition. Concluded that additional recovery time did not improve physical evaluations for muscle conditions
Siddharthan[9]	2012	75 US ex-Service personnel with mild/moderate combat-related TBI receiving telerehabilitation (and not in employment), 81% of whom had comorbid PTSD	Iraq/Afghanistan	mTBI patients were compared with those with comorbid PTSD	Functional Independence Measure, Functional Assessment Measure, Patient Competency Rating Scale	Functional capabilities stabilised over time, but deficiencies in cognition, psychosocial adjustment, and integration into society pose challenges. Comorbid PTSD worsens employment and social integration
Taghipour et al.[10]	2009	141 male Iranian ex-Service personnel who sustained lower extremity amputation, either battlefield or after transport to	Iran-Iraq	None	HRQoL (SF-36)	Poor physical HRQOL associated with transfemoral amputation,

		behind-the-line hospitals due to war-related injury				phantom movement, low back pain, lower Barthel Index. Poor mental HRQOL associated with lower education, articular pain of sound leg, employment, receiving disability
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Appendix 3: Study quality assessment

Quantitative studies

Authors

	Objective clearly stated	Study population clearly specified	Participation rate >=50%	Recruitment from similar populations, eligibility criteria uniformly applied	Sample size justification	Exposures measured prior to outcomes	Timeframe sufficient between exposure and outcome	Appropriate levels of exposure examined	Exposure measures appropriate and implemented consistently	Exposures assessed more than once over time	Outcome measures appropriate and implemented consistently	Outcome assessors blind to exposure status of participants	Loss to follow-up <=20%	Key confounders measured and adjusted	Overall rating (good, fair, poor)
Allami[11]	Y	Y	NR	Y	N	N	N	Y	Y	N	Y	N	NA	Y	F
Armstrong[1]	Y	Y	N	Y	N	Y	NR	Y	Y	N	Y	N	NA	Y	F
Bahadur[7]	Y	Y	Y	Y	N	Y	N	Y	Y	N	Y	N	NA	NA	P
Barrow[2]	Y	Y	NA	Y	N	Y	Y	Y	Y	N	Y	N	NA	N	F
Dharm-Datta[12]	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	N	NA	N	F
Ebrahimzadeh[8]	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	N	NA	N	F
Eskridge[3]	Y	Y	Y	Y	N	Y	Y	NA	Y	N	Y	N	NA	N	F
Laughlin[5]	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	N	NA	N	F
Ramasamy[4]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	NA	N	F
Rivera[6]	Y	Y	Y	Y	N	Y	Y	NA	Y	NA	Y	NR	NA	N	F
Siddharthan[9]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	NR	N	N	F
Taghipour[10]	Y	Y	Y	N	N	Y	Y	NA	Y	N	Y	NR	NA	Y	F

Qualitative studies

Authors	Aims clearly stated	Qualitative methodology appropriate	Design appropriate to address aims	Recruitment strategy appropriate to aims	Data collected in a way that addressed research issue	Relationship between researcher and participants considered	Ethical issues considered	Analysis sufficiently rigorous	Clear statement of findings	Value of research	Overall rating (good, fair, poor)
Christensen[13]	Y	Y	Y	Y	Y	NR	Y	Y	Y	G	F

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