Load Carriage Considerations for Tactical Personnel: Injury risk to performance

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Load Carriage Considerations for Tactical Personnel: Injury risk to performance.

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2019
Australian Tactical Medicine Conference
Brisbane QLD Sep 19 & 20

CONTENT:

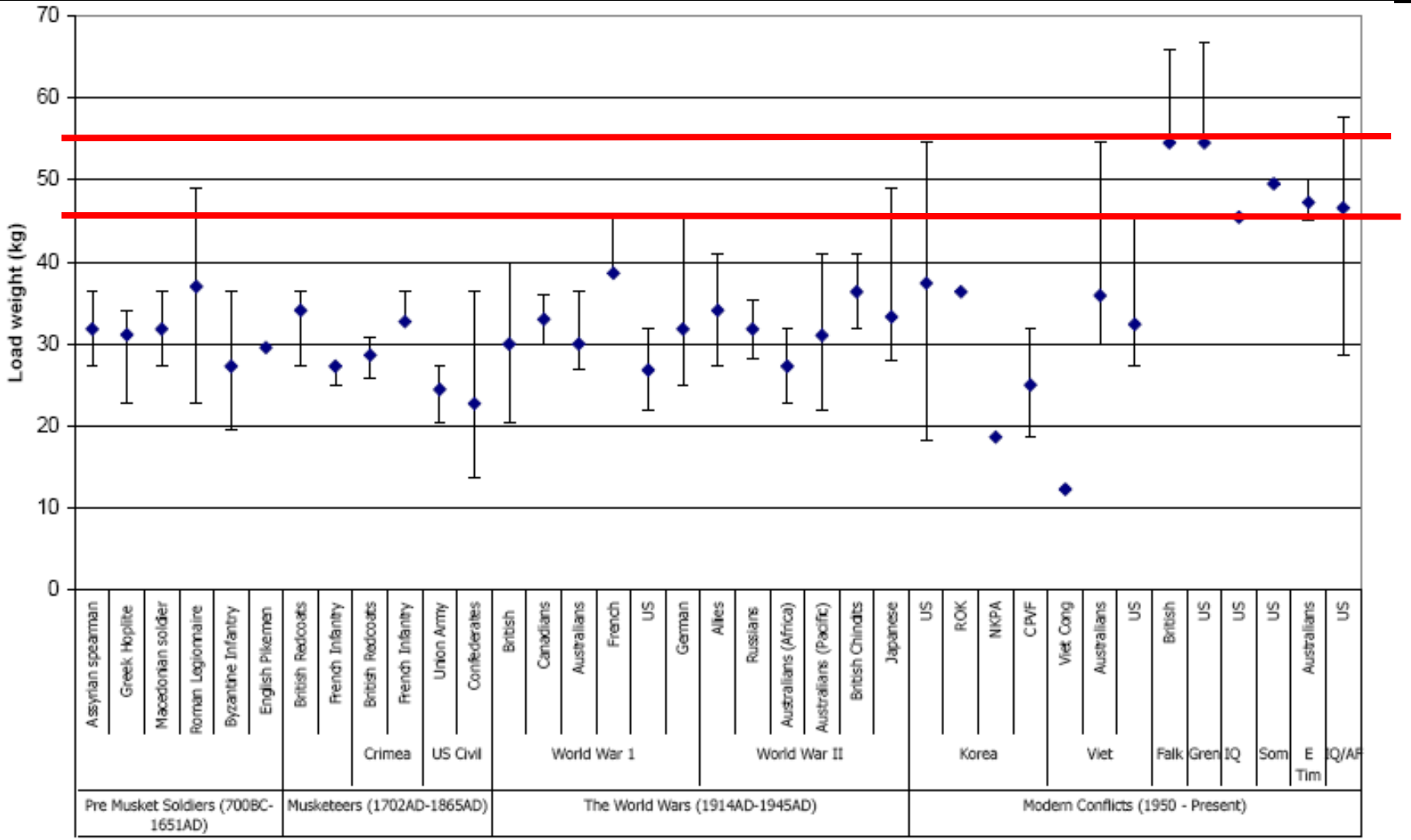
- Load carriage context
- Risks associated with load carriage
- Risk enhancers
- Load carriage conditioning

MILITARY CONTEXT

http://img266.imageshack.us/img266/9808/diggerssmg28.jpg

http://4.bp.blogspot.com/_BZQXUhgZR3A/S9Tzq_w6uOI/AAAAAAAAABE/HGGoRbjiaoU/s1600/vietnam-peter-b.jpg

http://upload.wikimedia.org/wikipedia/commons/5/5a/Australian_soldier_Afghanistan_Aug_2008.jpg



Viet = Vietnam; Falk = Falklands; Gren = Grenada; IQ = Iraq; Som = Somalia; E Tim = East Timor; IQ/AF = Iraq/Afghanistan

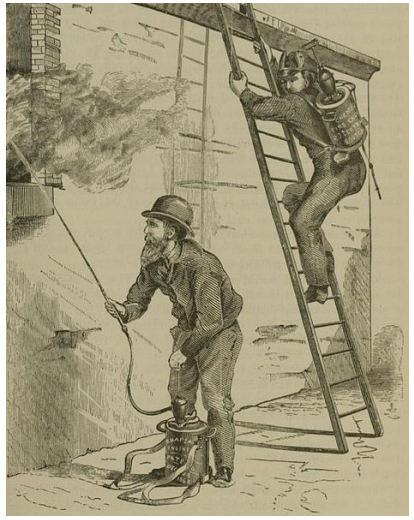
FIREFIGHTER CONTEXT

- Context and scope of practice has changed

1770

http://upload.wikimedia.org/wikipedia/commons/thumb/6/66/Old_firefighters.jpg/220px-Old_firefighters.jpg

1879



http://upload.wikimedia.org/wikipedia/commons/4/43/Vintage_firefighters.jpg

2012

http://www.stacksplace.com/EMS/ffadd1.jpg

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LAW ENFORCEMENT CONTEXT

1890s

http://2.bp.blogspot.com/-xHtSiLRFIMQ/UfewLRnEgAI/AAAAAAAAIpc/54yapn_ibtE/s1600/Curious+Black+&+White+Photographs+of+The+Police+Officers+from+1890–1930+(28).jpg

1970s

http://3.bp.blogspot.com/-HO26ffMhqS4/UiHkEhycroI/AAAAAAAAMR4/qGsg2ryfWKA/s640/Pictures+of+Life+of+the+New+York+Police+Department+in+the+1970's+(7).jpg

2010

http://www.gunblast.com/images/WBell_PoliceHolsterHist/Police-Holster-History-012.jpg

http://images.smh.com.au/2012/12/04/3861588/art-police-uniforms-620x349.jpg

http://images.smh.com.au/2009/03/09/410908/policebelt.jpg

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SAR CONTEXT

http://bloximages.newyork1.vip.townnews.com/estesparknews.com/content/tncms/assets/v3/editorial/d/c7/dc7f6316-1ea7-11e5-a8eb-bb1f7936f02c/5591bc1ee90b6.image.jpg

http://www.medicinec.si/wp-content/uploads/2013/10/imgS1351803309img5092e1ada9b3c.jpg

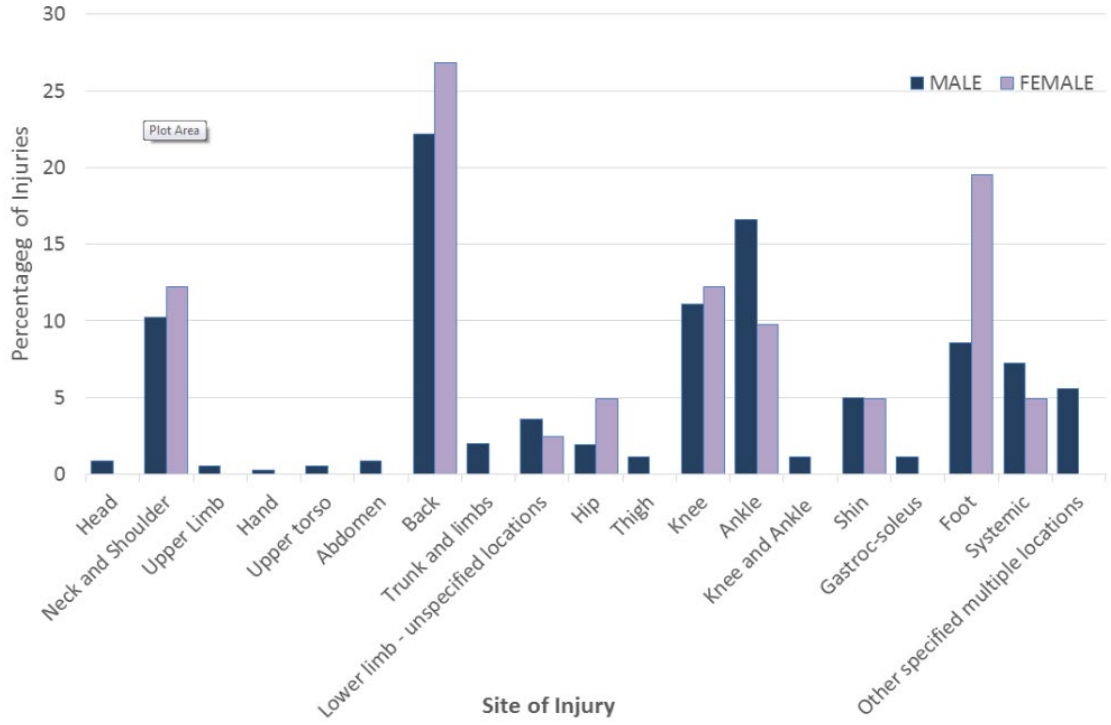
http://www.sandia.gov/news-center/news-releases/2004/images/SAR-map.gif

RISKS ASSOCIATED WITH LOAD CARRIAGE

- Injuries: Associated with a variety of injuries (from skin blistering to muscle, ligament, tendon, bone and nervous system injuries)

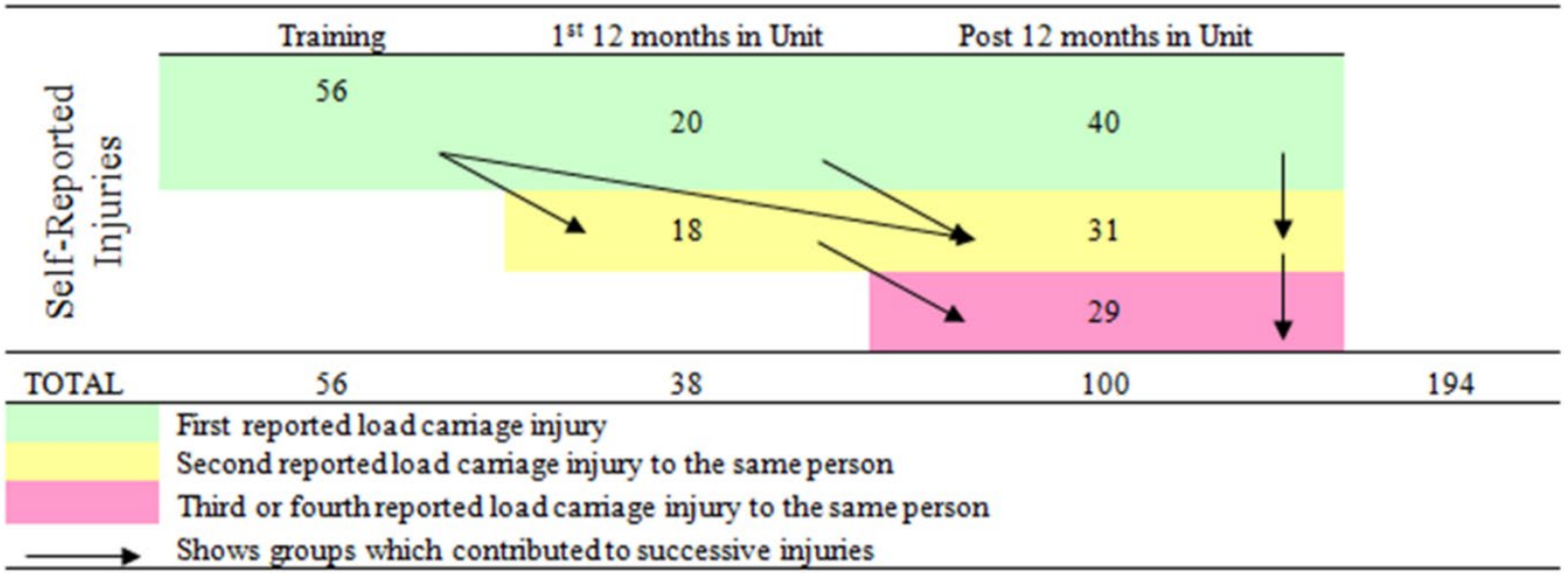
RISKS ASSOCIATED WITH LOAD CARRIAGE

- Some differences may exist between genders



RISKS ASSOCIATED WITH LOAD CARRIAGE

- Once injured – more likely to be reinjured



Orr. R., Pope, R., Coyle, J. & Johnston, V. (2016). Self-reported load carriage injuries in Australian Regular Army soldiers, International Journal of Injury Control and Safety Promotion, pp. 1-9 http://dx.doi.org/10.1080/17457300.2015.1132731

RISKS ASSOCIATED WITH LOAD CARRIAGE

- Decrements in performance:
  - ↓ Mobility
    - Increased risk of trip and fall
    - Decrease in CODS with loads of 10kg

Orr R, Kukić F, Cvorovic A, Koropanovski N, Janković R, Dawes J, and Lockie R. Associations between Fitness Measures and Change of Direction Speeds with and without Occupational Loads in Female Police Officers. International journal of environmental research and public health 16, 2019

RISKS ASSOCIATED WITH LOAD CARRIAGE

- Decrements in performance:
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    - Decrease in CODS
    - Decreased ability to negotiate escape routes

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Table 3 - Mean data ± SD from the dummy drag scenarios with participant loads of under 25% Body Weight and over 25% Body Weight.

		Under 25% BW	Over 25% BW
Dummy drag	10m sprint (sec)	2.48 ± 0.13	2.43 ± 0.20
	10m dummy drag (sec)	6.27 ± 0.73	7.32 ± 0.44
	Total time (sec)	10.75 ± 0.60	09.74 ± 0.60

Carlton, S.D., Carbone, P.D., Stierli, M & Orr, R. (2014). The Impact of Occupational Load Carriage on the Mobility of the Tactical Police Officer. J. Aust. Strength Cond., 22(1), pp. 32-37.

RISK ENHANCING FACTORS

- ↑ in load weight = ↑ in the energy cost of standing, walking (forwards and backwards, up and down stairs) and running
- ↑ in speed of load carriage = ↑ in the energy cost of carrying given load (more than weight)? ↑ *0.5km/h= ↑10kg*

RISK ENHANCING FACTORS

- ↑ in gradient of load carriage = ↑ in the energy cost of carrying given load (more than weight)? ↑ *1%= ↑10kg*

http://mountainenterprise.com/fds/images/story/fs_4764.jpg

RISK ENHANCING FACTORS

- Different terrains types will elicit different energy cost requirements

  (road-light brush-heavy brush-sand)

RISK ENHANCING FACTORS

- Differences in load placement will elicit differences in energy cost.
  - Weight on the feet more costly than the back
  - Thigh more costly that back (0.5kg ↑ cost by 3.5%)
  - Shoulder more costly than back
  - Hands around 2 x more costly than back*

RISK ENHANCING FACTORS

- Soule and Goldman (1969) found the cost of carrying a 7 kg load in the hands to be nearly twice that of carrying the load on the torso.
- Datta and Ramanathan (1971) observed a significantly higher ($p<.05$) cost of load carriage in the hands (mean of 6.96 KCAL/min) than on the back (mean of 5.27 KCAL/min).

RISK ENHANCING FACTORS

- Unilateral v Bilateral Loads in the hand
  - Unilateral hand loading can:
    - increase hip muscle activity to twice that for the same load carried bilaterally (Neumann, Cook, Sholty, & Sobush, 1992),
    - cause gait asymmetry (Zhang, Ye, & Wang, 2010) and
    - potentially increase further energy expenditure (Datta & Ramanathan, 1971).

LOAD CARRIAGE CONDITIONING

- Concept is not new (*Flavius* Vegetius Renatus - *Epitoma rei militaris)*
- Common in military training but in all corps and trades?

Table 1: Descriptive breakdown of participating Unit PT programs.

Program [1]	Length of program (number of sessions)	Number of sessions per type of training[2]				Load carriage training (Type 1) (See footnote 92)		
		1	2	3	4	Freq (per week)	Intensity (minimum to maximum load)	Time (min to max)
A*	6 weeks (12 sessions)	12 100%	0 0%	0 0%	0 0%	2x/1 week	7 kg to 31 kg	40-120 min
B	6 Weeks (18 sessions)	3 17%	1 6%	13 72%	1 6%	1x/2 weeks	15 kg to 20 kg	60 min
C*+	15 weeks (75 sessions)	13 17%	3 4%	43 57%	16 21%	1 per week first 12 weeks	No information	up to 60 min
D*~	11 weeks (33 sessions)	8 24%	9 27 %	10 30%	6 18%	1 per week first 8 weeks	Patrol Order+	up to 60 min
E	10 weeks (49 sessions)	0 0%	10 20 %	28 57%	11 22%	No load carriage PT sessions		
F	10 weeks (42 sessions)	0 0%	9 21 %	19 45%	14 33%	No load carriage PT sessions		
G	8 weeks (31 sessions)	0 0%	8 26 %	18 58%	5 16%	No load carriage PT sessions		
H	6 weeks (18 sessions)	0 0%	0 0%	12 67%	6 33%	No load carriage PT sessions		

*Training for Combat Fitness Assessment
~Included carrying additional stores like ammunition boxes
+No additional load weight provided

Orr R. Soldier load carriage: A risk management approach, in: *School of Health and Rehabilitation Sciences*. Australia: The University of Queensland, 2013

LOAD CARRIAGE CONDITIONING

Research by Orr et al. (2010) and Knapik et al., (2012) recommend:

- F.I.T.T Formula (Frequency, Intensity, Time & Type)
  - F. 7-10 days per load carriage session
  - I. To loads required at the speeds and over the terrains required
  - T. Duration of load carriage operations
  - T. Load carriage preferable, but combined resistance and cardio may be of some benefit

LOAD CARRIAGE CONDITIONING

- Specificity

TAKE HOME MESSAGES

- Load carriage reduces performance and can cause injuries = decreased operational success
- Load carriage is about more than the load weight, terrain type and grade, speed of movement and load position must be taken into account
- To minimise the risk of injury and increase the potential for operational success personnel need to be conditioning to carry load

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