Load carriage for emergency responders

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Load Carriage for Emergency Responders
CONTENT:

• Load carriage context
• Risks associated with load carriage
• Risk enhancers
• Load carriage conditioning
FIREFIGHTER CONTEXT

- Context and scope of practice has changed

1770


1879


2012

[Image: http://www.stacksplace.com/EMS/ffadd1.jpg]
LAW ENFORCEMENT CONTEXT

1890s

1970s

2010

http://2.bp.blogspot.com/- xHtSiLRFIMQ/UfewLRnEgAI/AAAAAAAAIpc/54yapn_i btE/s1600/Curious+Black+%26+White+Photographs+of+ The+Police+Officers+from+1890–1930+(28).jpg

http://3.bp.blogspot.com/- HC2G6HqGdJk4h8ynxw/AAAAAAAAMR 4/eqGeg2nyWYK/s640/Pictures+of+Life+of+the+ New+York+Police+Department+in+the+1970’s+(7).jpg


LAW ENFORCEMENT CONTEXT


EMS CONTEXT

https://www.ems1.com/ems-advocacy/articles/10-noteworthy-reasons-to-join-and-stay-in-ems-7k7e3xdtb8e7j1mp/
SAR CONTEXT


http://www.medicinec.si/wp-content/uploads/2013/10/img51351803309img5092e1ada9b3c.jpg

http://blowimages.newyork1.vip.townnews.com/estesparknews.com/content/tncms/assets/v3/editorial/d/c7/dc7f6316-1ea7-11e5-a8eb-162179369032/5591bc1ee90b6.image.jpg
SAR CONTEXT

Conolly et al., 2015

- Prolonged hiking with loaded backpack (30–50 lbs), helmet, and harness in mountainous terrain
- Litter loads can be in excess of 100 lbs
- Maintain squat or semi-squat position with around 17% BW load.
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

Comparison of Reported Load Carriage Injuries
Captured By Survey (1999-2010) and By OSCHAR (2009-2010)
RISKS ASSOCIATED WITH LOAD CARRIAGE

• No literature has been found to specially investigate load carriage injuries in SAR. However, **musculoskeletal injuries consisting of sprains, strains, fractures, and dislocations to shoulder, knee, ankle, and fingers** have been reported as injury natures and sites in SAR personnel (Conolly et al., 2015; Iserson, 1989).
RISKS ASSOCIATED WITH LOAD CARRIAGE

• Decrement in performance:
  – ↓ Mobility
    • Increased risk of trip and fall
    • Decreased ability to negotiate escape routes
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
RISK ENHANCING FACTORS

• Different terrains types will elicit different energy cost requirements

(road-light brush-heavy brush-sand)
Differences in load placement will elicit differences in energy cost.

- Weight on the feet more costly than the back
- Thigh more costly than 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

- Knapik et al., 2000
  - Load carriage times were significantly shorter when loads were carried in the hands (81 – 88%; p<.01) when compared to the innovative methods.
**Risk Enhancing Factors**

- Unilateral vs 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 SAR?
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 SAR personnel need to be conditioning to carry load
REFERENCES


REFERENCES


- Neumann DA, Cook TM, Sholty RL, et al. (1992). An electromyographical analysis of hip abductor muscle activity when subjects are carrying load in one or both hands. Physical Therapy, 72(3):207-17
REFERENCES


REFERENCES


