cardiopulmonary imaging, submaximal and maximal exercise testing, pulmonary function, cognitive assessment, blood tests, electrocardiogram and questionnaires on mental health and physical function.

Results 113 participants (aged 39±9, 86% male) were recruited; Hospitalised (n=35), community-symptomatic (n=34), community-recovered (n=18) and control (n=26), 159±72 days following acute illness. Hospitalised and community-symptomatic groups were older (p=0.003), with a higher body mass index (p<0.001), and worse mental health (anxiety,p=0.011;depression,p<0.001;post-traumatic stress, p<0.001), fatigue (p<0.001), and quality of life scores (p=0.001), with a mean of 2±2 and 2±1 symptoms, respectively. Hospitalised and community-symptomatic participants also performed less well on sub-maximal (p<0.001) and maximal exercise testing, with hospitalised individuals displaying impaired ventilatory efficiency (p<0.001), less work at the anaerobic threshold and at peak (both p<0.001), and significantly reduced forced vital capacity (p=0.004). Clinically significant abnormal cardiopulmonary imaging findings were present in 6% of hospitalised participants, lower than those seen in other studies. Those who recovered from community-based, mild-moderate COVID-19 had no significant differences from controls on any parameter.

Conclusions Recovered SP who suffered mild-moderate COVID-19 do not differ from an age, sex and job-role matched controls. This is reassuring for the vast majority of individuals who have had acute COVID-19 not requiring hospital management. Individuals who were hospitalised or continue to suffer symptoms may require a specific, comprehensive clinical and occupational assessment prior to a full return to duty.

4 IMPROVEMENTS IN ORTHOSTATIC TOLERANCE WITH PHYSICAL TRAINING ARE AUGMENTED WITH HEAT ACCLIMATION AND ASSOCIATED PLASMA VOLUME EXPANSION; A RANDOMISED CONTROLLED TRIAL

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Background Heat adaptation is protective against heat illness however its role in heat syncope, due to reflex mechanisms, has not been conclusively established. The aim of this study was to evaluate if heat acclimation (HA) was protective against heat syncope and to ascertain underlying physiological mechanisms.

Method 22 (17 males, 5 females) endurance trained cyclists were randomised to either 8 days of mixed active and passive HA (HEAT) or temperate exercise (CONTROL). Prior to, and following, the interventions participants underwent a HUT with graded lower body negative pressure (LBNP) continued until presyncope with measurement of cardiovascular parameters. Heat stress testing was performed to determine physiological and perceptual measures of HA.

Results There was a significant increase in orthostatic tolerance (OT), as measured by HUT/LBNP, in the HEAT group (pre-intervention; 28±9 mins, post-intervention; 40±7 mins) compared to CONTROL (pre-intervention; 30±8 mins, post-intervention; 33±5 mins) (p= 0.0116). Heat acclimation resulted in a significantly reduced peak and mean rectal and skin temperature (p<0.0141), peak heat rate (p<0.0033), thermal comfort (p<0.0411) and rating of perceived exertion (p<0.0251). There was a significantly increased plasma volume in the HEAT group in comparison to CONTROL (p=0.0293).

Conclusions Heat adaptation causes improvements in OT and is likely to be beneficial in patients with heat exacerbated reflex syncope. Heat acclimation mediated PV expansion is the likely predominant physiological mechanism underlying improved OT. These data offer opportunities to improve health and wellbeing of service personnel with economic, logistical and reputational benefits for the UK Armed Forces.

5 A NEW ANIMAL MODEL FOR INFECTED FRACTURE NON-UNION AFTER EXTERNAL FIXATION OF TIBIA WITH REAL-TIME IN-VIVO MONITORING OF INFECTION

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Background Non-union is a well-recognised complication after open fractures. Fifty percent of open extremity trauma returning from military operations developed non-union. Aetiology of non-union is multi- factorial, with infection reported as major contributory factor. The aim of this study was to develop an in-vivo model of infected fracture non-union managed with external fixation which allowed real time in-vivo monitoring of infection to evaluate potential therapeutic strategies.

Method Ten male Wistar rats underwent application of external fixator and midshaft tibia osteotomy. Osteotomy sites were inoculated with bioluminescent Staphylococcus aureus Xen36 (infected group; n=6); or phosphate buffer solution (control group; n=4). Animals were monitored for infection with in-vivo bioluminescent imaging and fracture healing with plain radiographs. Animals were sacrificed at eight weeks. Post-mortem micro-computed tomography (uCT) was used to assess fracture union; in-vivo bioluminescent imaging to assess persistence of Xen36 infection; tissue samples were processed for bacterial colony forming unit counts and histology to assess for fracture healing and infection.

Results Eight animals reached experiment endpoint (infected=5, control=3). All five infected animals demonstrated radiographic non-union on x-ray and uCT. Bioluminescence, at fracture site in infected cohort, peaked at week two and reduced to chronic baseline of 105 photons per second for duration of experiment. At experiment endpoint bioluminescence was confirmed at fracture site and bioluminescent bacteria was cultured from fracture site tissue samples in all of the infected cohort. Two of three control animals demonstrated radiographic non-union, none luminesced, one grew bacteria from tissue samples but was not bioluminescent.

Conclusions This study has developed an infected fracture non-union animal model. Use of bioluminescent bacteria allows for non-invasive and real-time monitoring of infection. This model is more representative of the military casualty than previously reported models and could be used to evaluate therapeutic strategies for prevention and management of infected fracture non-union.