Assessing risk of zoonoses exposure during UK- based military training

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ABSTRACT

A cohort of 336 infantry recruits underwent paired serological testing for vector-borne infections during military training. No seroconversions were observed for Coxiella burnetii; however, 3.2% seroconverted for leptospirosis. These findings reinforce the known risk of vector-borne disease exposure during training and highlight the ongoing need for robust Force Health Protection measures, including awareness and mitigation strategies.

INTRODUCTION

❖During training and deployment military personnel are often within rural or remote environments, spending a large amount of time outdoors in close contact with both vectors and animals. These exposures could pose a risk of zoonotic and vector-borne disease to military personnel.

❖Studies on international deployments of military personnel, including from the UK, have found evidence of transmission of zoonotic and vector-borne diseases. The level of military exposure and pathogens they are exposed to varies depending on the countries and environments of deployment [1, 2].

❖Previous serosurveillance studies of exposure to zoonotic and vector-borne diseases have focused on internationally deployed soldiers. As such, there is a gap in the knowledge of the risk of zoonoses and vector-borne diseases among troops training in the UK.

AIM

Assess seroconversion and sero-prevalence rates for the causative agents of Q-fever, leptospirosis, tick-borne encephalitis (TBE), rickettsial fever and hantavirus disease among troops undergoing basic infantry training in the UK.

METHODS

❖Participants were recruited from one UK-based infantry training centre, with participants drawn from military recruits within the UK, nationals of the Commonwealth nations, and Gurkha troops from Nepal.

❖The UK-based training period was between six to nine months.

❖Participants completed a post training questionnaire, indicating whether they were exposed to animals, insect bites, freshwater, and whether they experienced illness. International travel history during training was recorded.

❖Blood samples were collected on base (Figure 1) and processed at the UKHSA Porton laboratories (Figure 2). Interpretation was performed by biomedical and clinical scientists (e.g., Following guidelines such as for Q-fever testing (Figure 3). Serological assays used are listed in table 1.

Table 1: ELISA and IFA diagnostic kits used in testing pre and post training samples

Pathogen	Test Kit used in Pre- and post-training testing
Rickettsia	*Rickettsia* IFA IgM (IF0100M), *Focus Diagnostics*
Rickettsia	*Rickettsia* IFA IgG (IF0100G), *Focus Diagnostics*
Coxiella burnetii	*Coxiella burnetii* IgM Phase II ELISA Kit (ESR1312M), *Verion/Serion*
Coxiella burnetii	*Coxiella burnetii* IgG Phase II ELISA Kit (ESR1312G), *Verion/Serion*
TBEV	Anti-TBE Virus ELISA 2.0 (IgG) (EI 2661-9601 G) *Euroimmun*
Leptospira	LEPTOSPIRA IgM ELISA (2PE10), PanBio
Hanta virus	Hantavirus Mosaic 1 types IFA Hantaan (HTNV), Sin Nombre, (SNV), Puumala (PUUV), Dobrava (DOBV), Seoul (SEOV), Saaremaa (SAAV) (FI 278h-1010-1 G), *Euroimmun*

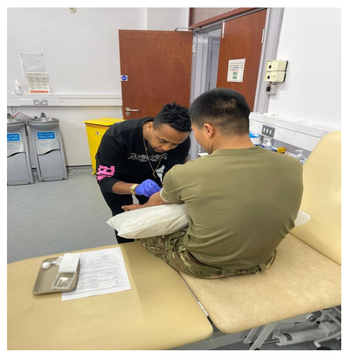


Figure 1: Consenting participant donating blood during sampling session

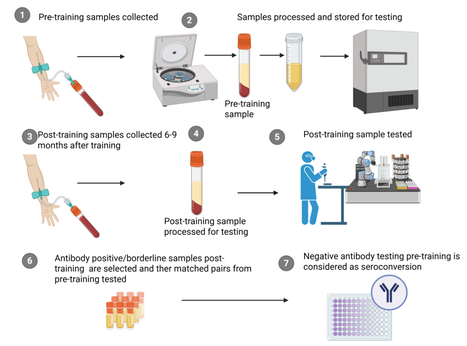


Figure 2: Overview of process flow in pre-and post-sampling sessions and testing.

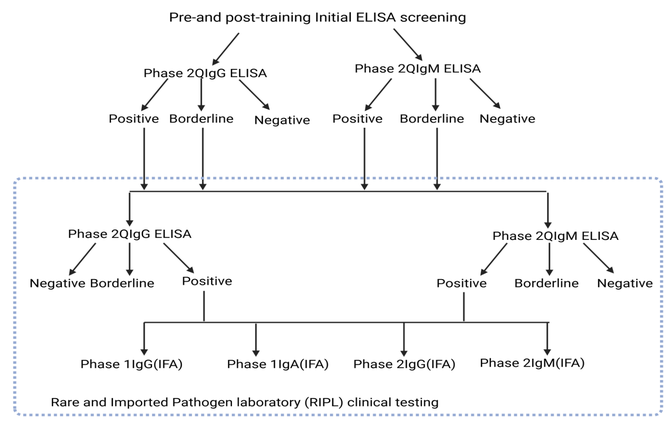


Figure 3: Q fever screening and clinical laboratory testing flow

RESULTS

❖336 individuals were recruited with matched pairs of pre-and post-training samples.

❖One participant seroconverted during training against two different hantavirus serotypes: *Hantaan* and *Sin Nombre*.

❖11 participants showed evidence of seroconversion against *Leptospira* during training, which was the highest rate of seroconversion among the pathogens tested.

❖Seven participants showed evidence of seroconversion against *Rickettsia.*

❖No participant showed evidence of seroconversion against *Coxiella burnetti* during training

❖The Gurkha regiment accounted for 74.4% (67 participants) of positive TBEV complex antibody post-training. Of 90 samples positive in the TBEV serology assay, the majority were positive beforehand so could not be attributed to training exposure.

❖Four participants (1.19%) who were seropositive against TBEV complex antigens post-training were negative in pre-training testing, suggesting seroconversion during training. 3 out of the 4 seroconversions were among the Gurkha troops.

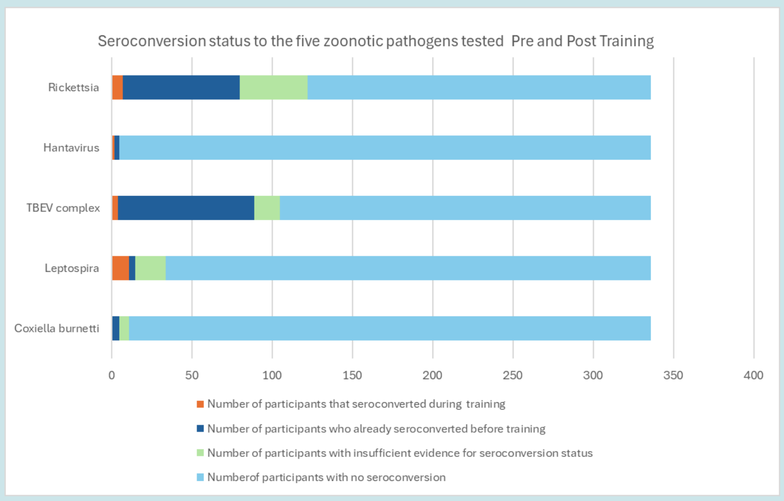
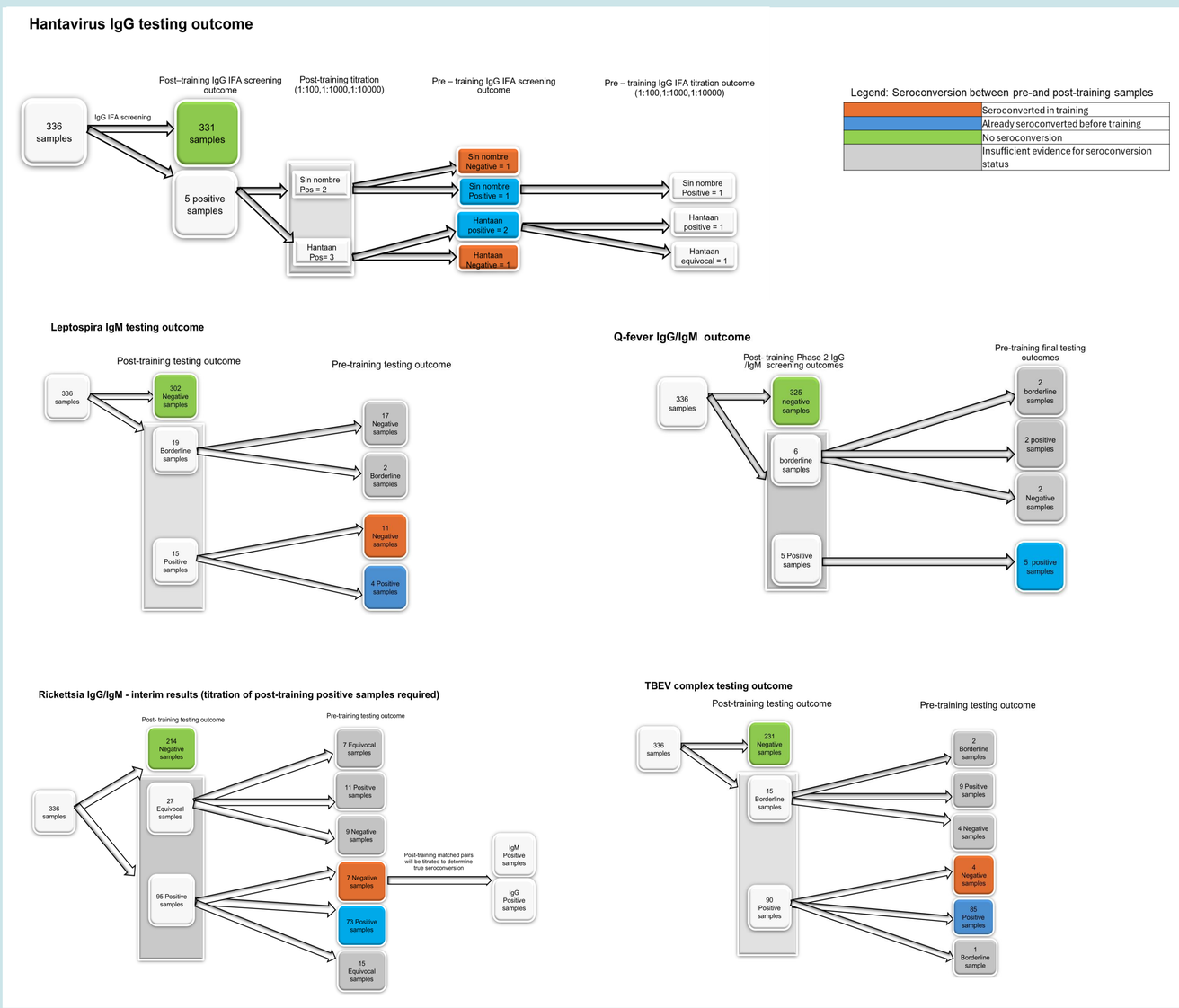


Figure 4: Result of antibody testing showing seroconversion status of participants to the five zoonotic pathogens tested



DISCUSSION AND CONCLUSIONS

❖ 6 serotypes of hantavirus were tested using immunofluorescence assay (IFA) and indicated seroconversion in the Hantaan and Sin Nombre serotypes in one participant who had travelled to Greece during the training period. Two pathogenic hantaviruses are dominantly present in Greece: Dobrava virus and Puumala virus [3]. The hantavirus reactivity may likely be non-specific as distinct patterns of cross-reactivity is usually seen in hantavirus serology due to the serotypes sharing common antigenic sites. Broad antibody responses from antibodies generated from one hantavirus serotype can bind other hantavirus serotypes leading to a cross-reactive signal in IFA.

❖TBEV complex seroconversion observed at 1.19% of the study population may be attributed to possible exposure to tick bites during training or due to a recent exposure prior to commencing training. Participants received Yellow Fever vaccination at their exit medical assessment, ruling out the chances of flavivirus cross-reactivity due to vaccination.

❖Seroconversion to the causative agent of Leptospirosis observed at 3.27% suggests military recruits in training may be exposed while undertaking activities in waterbodies or soil contaminated with infected rodents' urine. Questionnaire data that assesses the risk exposure will be analysed. Military personnel could also be at higher risk of leptospirosis due to activities such as adventure races predisposing them to a possible infection. A systematic review of leptospirosis among military personnel indicated 15 out of 88 leptospirosis cases among French troops occurred in continental France while the remaining were reported during overseas travels [4]. A case of leptospirosis was reported in a soldier who returned to the UK from Borneo in 2016 [5]. While risk is higher in tropical regions of the world, outbreaks have been described among British soldiers operating in the temperate war zones [6].

❖There was no seroconversion observed for Coxiella burnetti, the causative agent for Q-fever during training. However, pre-training screening indicated 5 positive results (Figure 3). Confirmatory testing was conducted by RIPL to meet the diagnostic criteria for Q-fever positive samples. The positive samples in our study did not meet these criteria and were reported as not clinically significant positives and participants therefore will not receive any medical follow-up.

❖7 (2.1%) study participants seroconverted to Rickettsia suggesting exposure may have occurred while undergoing training. The post-training samples of this cohort will be further titrated to confirm that they are true positives alongside obtaining the titer of IgG and IgM antibodies. Questionnaire data will be analysed to determine exposure to tick bites and fleas while undergoing training in dense forests and other similar habitats that may be tick infested. Low-level serological reactivity is seen routinely and can often be attributable to non-specific reactivity in samples, and this is commonly seen in rickettsial serology. As autochthonous rickettsial infection is not recognized in the UK, a non-specific antibody reactivity may have occurred, and further investigation is required.

❖In conclusion, vector-borne and zoonotic diseases are known to exist in the UK and so it is unsurprising that activities such as military training, which involves an element of field training, might increase the risk of exposure to infection. The results underline the importance of Defence continuing to raise awareness of force health protection risks so that appropriate mitigations can be put in place. Serosurveillance studies of this nature can also inform future surveillance studies in other populations that could be at risk of emerging zoonoses and vector-borne diseases in the UK.

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