PROBABILISTIC MODELING OF DECOMPRESSION SICKNESS (DCS) RISK FOR PIGS IN H_2. A. Fahlman, S.R. Kayar, J. Himm, and P. Tikuisis. Naval Medical Research Center, Bethesda, MD 20889, USA; Carleton U., Ottawa, ON, Canada and DCIEM, Toronto, ON, Canada.

BACKGROUND: We used a probabilistic model to predict DCS outcome in pigs during H_2 dives. The data set included dives for control animals and animals with intestinal injections of H_2 metabolizing microbes.

METHODS: To simulate a H_2 dive, pigs (n=70, 19.5±1.3 kg) were placed in a dry chamber and compressed to 24 atm for 30, 120, 150, 180, or 1175 min. Final chamber gas composition was 86-96% H_2, 6-14% He, 2% O_2, 0-1% N_2. Animals were then decompressed (0.9 atm/min) to 11 atm, and observed for 1 h for symptoms of DCS. We used single exponential kinetics to describe the tissue partial pressures (P_{tis}) of H_2 and He: $P_{tis} = \int (P_{amb} - P_{tis})/\tau \, dt$, where P_{amb} is the ambient pressure. One exponential time constant (τ) was used for both gases. To predict the probability of DCS (pDCS) we used the risk function: $pDCS = 1 - e^{-r}$, where $r = \int (P_{tis}H_2 + P_{tis}He - P_{amb})/P_{amb} \, dt$. To estimate the effect of H_2 metabolism on pDCS in treated animals, we added a term (BUG) corresponding to the total activity injected (mmoles H_2 /min) into the calculation of $P_{tis}H_2 = \int (P_{amb} - BUG - P_{tis}H_2)/\tau \, dt$.

RESULTS: The probabilistic model showed that duration of hyperbaric exposure was positively correlated with increasing DCS incidence. Based on the log-likelihood ratio test, there was a significant improvement in the prediction of pDCS ($P<0.05$) with the inclusion of BUG into the model.

CONCLUSION: The results from the model suggest that pigs in H_2 may be 98% saturated after approximately 120 min. In addition, the model suggests that animals injected with H_2 metabolizing microbes have a decreased pDCS following a simulated H_2 dive. (NMRDC #61153N MR04101.00D-1103).