# VALIDATION AND EXTENSION OF MAMMILLARY MODELS FOR PREDICTING THE PROBABILITY OF DECOMPRESSION SICKNESS IN SCUBA DIVING

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**BACKGROUND:** Recently Goldman (1), using a restricted calibration dataset, showed that interconnected "competitive parallel" models (2) (hereafter "mammillary models") generally provided significantly greater accuracy than their Haldanian (independent parallel) counterparts. In this study the work in (1) was extended by re-calibrating using a large mixed-profile dataset, and by adding a four-compartment model (4CM) to the two- and three-compartment mammillary models (2CM, 3CM) introduced previously.

**METHODS:** The calibration dataset consisted of 2159 air dives (2/3 recreational low-risk mixed profiles, 1/3 higher-risk square profiles). A dissolved gas phase risk function was used, and the model parameters were determined by calibrating against total DCS incidence rate data using "Maximum Likelihood". Comparisons were made with a two-compartment parallel model (2CP) and the LE1 model (calibrated elsewhere (3)).

**RESULTS:** Using $P(\chi^2)$ for the probability that the calculated $\chi^2$ could have been obtained by chance, $P(\chi^2)$ was: .83, .50, .12, and .0001 for the 2CP, 2CM, 3CM and 4CM models, respectively, for the fit to the calibration dataset. $P(\chi^2)$ was : .026, .73, .040, .0031, and $\cong 0$ for the LE1, 2CP, 2CM, 3CM and 4CM models, respectively, for projections to a low-risk recreational mixed profile dataset. The root-mean-squared deviation (RMSD) relative to the predictions of the Hill Multi-Species Model (4) for very high-risk direct ascents from air saturation was: .12 and .072 for the 3CM and 4CM models, respectively, and $\geq$ .25 for all the other models.

**CONCLUSIONS:** From the accuracy of both their fits to the calibration dataset, and their projections beyond the calibration regime, the 3CM and 4CM models were found to be best. The accuracy and potential usefulness of these mammillary models was thus confirmed.

**REFERENCES:**

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