

## Letters to the Editor

### Dive computer profile analyses

Dear Editor,

We were very interested to read the recent article by Sayer et al on the analysis of dive computer profiles and calculation of nitrogen loading indices for divers with decompression illness (DCI).<sup>1</sup> We found the concept of using nitrogen loading to quantify the necessary duration of recompression therapy to be a novel idea.

We believe, however, that their methodology and analysis created several biases that may have prematurely led to the rejection of their hypothesis. The first issue is that there were no criteria or a case definition for the diagnosis of DCI used in the study. This issue is encountered in many studies involving DCI, and allows for the inclusion of an unknown number of false-positive cases. False-positive cases (i.e., non-cases of decompression sickness) are not likely to respond to recompression therapy and therefore may receive multiple treatments. Since most dives are exposures with low nitrogen loading, most of the non-cases will also have low nitrogen loading, and therefore a systematic error in favour of the null hypothesis has been introduced. Currently, there is no universally accepted case definition for the diagnosis of decompression sickness (DCS) or arterial gas embolism (AGE). A set of criteria for the diagnosis of DCS and AGE was recently presented in Tokyo, Japan.<sup>2</sup> The use of an objective, validated, highly specific case definition for DCS would largely eliminate the false positives from the data set and reduce the bias in favour of the null hypothesis.

Another bias that may have contributed to the authors' failure to validate their hypothesis was that they did not consider the effects of time to treatment. Patients with prolonged delays between symptom onset and initial treatment have a lower likelihood for rapid recovery. These patients may also require multiple recompression treatments. As stated previously, these cases (like most of the cases in the series) will likely have a low nitrogen load. Yet despite this low calculated nitrogen burden, these patients would likely receive more recompression treatments, thus again creating a systematic bias in favour of the null hypothesis.

Finally, we feel an additional bias is introduced because patients with DCS and AGE were grouped together in the study. The authors use the term decompression illness (i.e., DCS and AGE) to describe their cases. However, AGE is not related to nitrogen loading. As AGE cases can require multiple recompression treatments, once again, this creates a systematic bias favouring the null hypothesis.

We were disappointed to read the authors' conclusions that their model did not perform as expected. However, it still seems their hypothesis has significant merit and may have

been rejected prematurely. Perhaps by applying a validated, highly specific case definition of DCS, eliminating cases of AGE, and setting a cut off for time to treatment, results may be obtained that support the authors' original hypothesis. We feel the principles of the authors' hypothesis are sound, and would be excited to see additional work in this area.

### References

- 1 Sayer MDJ, Cook EJ, Wilson CM, Barrington J. Analysing dive-computer profile integrations from incidents of suspected and actual decompression illness using cumulative nitrogen loading. *SPUMS J.* 2005; 35: 59-66.
- 2 Grover I, Reed W, Neuman T. Criteria for diagnosis of decompression illness (SANDHOG). Lecture and article presented at the US and Japan Joint Conference on Diving and Aerospace Medicine, October 2004. Article not yet published.

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### Key words

Decompression illness, computers diving, nitrogen, models, treatment, letters (to the Editor)

### Reply:

Dear Editor,

I welcome the opportunity to respond to the very valid and reasoned issues raised by Medak et al in relation to the recent study on analysing the dive computer profiles from divers with actual or suspected decompression sickness.<sup>1</sup>

Although the study started with the premise that cumulative nitrogen loading from the incident and preceding dives could have influenced the type and/or duration of subsequent treatments, it became very obvious that this would not be possible for a number of reasons that I detail below. Therefore, the real value of the study is that it presented a methodology for comparing multi-level computer-controlled dive profiles with empirically-tested square-wave decompression tables. It is clear that this is of value only where the incidents are occurring as a result of a series of repetitive 'incident-free' dives, where it may be difficult for the treating physician to demonstrate to the patient the possible reasons for the eventual treatment or