Published in final edited form as:

Arch Phys Med Rehabil. 2018 April ; 99(4): 776–777. doi:10.1016/j.apmr.2018.01.001.

Response to Letter to the Editor regarding the manuscript “Effects of Respiratory Training on Heart Rate Variability and Baroreflex Sensitivity in Individuals with Chronic Spinal Cord Injury”¹

Bonnie E. Legg Ditterline, PhD^{a,b}, Sevda C. Aslan, PhD^b, David C. Randall, PhD^c, Susan J. Harkema, PhD^{a,b}, Camilo Castillo, MD^b, and Alexander V. Ovechkin, MD, PhD^{a,b}

^aDepartment of Physiology, University of Louisville, Louisville, KY, USA

^bDepartment of Neurological Surgery, University of Louisville, Louisville, KY, USA

^cDepartment of Physiology, University of Kentucky, Lexington, KY, USA

Dear Dr. Chan

We would like to thank you for the opportunity to respond to the issues raised in the Letter. We would also like to express our appreciation to Dr. West and Mr. Gee for the interest in our work.

The objective of the reported study was to investigate if our original reciprocal respiratory training approach, already reported to be effective in improving blood pressure regulation in individuals with SCI-induced orthostatic hypotension², can affect baroreflex function which is often deconditioned in the general SCI population. Study groups intentionally included participants with different levels and severity of injury with a variety of respiratory-cardiovascular functional states. Since respiratory motor function was not the primary point of interest, maximum airway pressure values were not reported, but will be when we address specific mechanisms related to respiratory motor control in future publications.

As acknowledged, the sample of participants in the intervention and control groups was functionally heterogeneous, with a variety of levels and severity of injury. That is why, in order to control for variability within groups, a multivariate linear regression model was used to test for significance. A simple Student's t-test is not appropriate in this case. The role played by level and severity of injury on changes in pulmonary function, baroreflex, and heart rate variability outcomes after training was elucidated in Table 3.

It is correct that only a few individuals in our sample exhibited orthostatic intolerance at baseline and it was not significantly changed after training. However, orthostatic intolerance is not the only marker of cardiovascular dysfunction.

We appreciate the recognition that “the data provided speaks to a fascinating area of research on the interaction of the cardiovascular and respiratory systems following SCI”. Indeed, impaired baroreflex and decreased heart rate variability are predictors for future cardiac events^{3,4}. We found significant improvement to baroreflex sensitivity and heart rate

variability induced by respiratory training. Therefore, these findings suggest respiratory training is a promising direction in respiratory-cardiovascular rehabilitation for patients with chronic SCI.

References

1. Legg Ditterline BE, Aslan SC, Randall DC, Harkema SJ, Castillo C, Ovechkin AV. Effects of Respiratory Training on Heart Rate Variability and Baroreflex Sensitivity in Individuals With Chronic Spinal Cord Injury. *Arch Phys Med Rehabil*. 2017
2. Aslan SC, Randall DC, Krassioukov AV, Phillips A, Ovechkin AV. Respiratory Training Improves Blood Pressure Regulation in Individuals With Chronic Spinal Cord Injury. *Arch Phys Med Rehabil*. 2016; 97(6):964–73. [PubMed: 26718236]
3. Stein PK, Barzilay JI. Relationship of abnormal heart rate turbulence and elevated CRP to cardiac mortality in low, intermediate, and high-risk older adults. *J Cardiovasc Electrophysiol*. 2011; 22(2): 122–7. [PubMed: 21134026]
4. Tsuji H, Larson MG, Venditti FJ Jr, Manders ES, Evans JC, Feldman CL, et al. Impact of reduced heart rate variability on risk for cardiac events. The Framingham Heart Study. *Circulation*. 1996; 94(11):2850–5. [PubMed: 8941112]