

## CHALLENGES IN EVALUATING RELATIONSHIPS BETWEEN QUANTITATIVE DATA (CARBON DIOXIDE) AND QUALITATIVE DATA (SELF-REPORTED VISUAL CHANGES)

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### BACKGROUND

Understanding the nuances in clinical data is critical in developing a successful data analysis plan. Carbon dioxide (CO<sub>2</sub>) data are collected on board the International Space Station (ISS) in a continuous stream. Clinical data on ISS are primarily collected via conversations between individual crewmembers and NASA Flight Surgeons during weekly Private Medical Conferences (PMC). Law, et.al, 2014<sup>1</sup> demonstrated a statistically significant association between weekly average CO<sub>2</sub> levels on ISS and self-reported headaches over the reporting period from March 14, 2001 to May 31, 2012. The purpose of this analysis is to describe the evaluation of a possible association between visual changes and CO<sub>2</sub> levels on ISS and to discuss challenges in developing an appropriate analysis plan.

### METHODS & PRELIMINARY RESULTS

A first analysis was conducted following the same study design as the published work on CO<sub>2</sub> and self-reported headaches<sup>1</sup>; substituting self-reported changes in visual acuity in place of self-reported headaches. The analysis demonstrated no statistically significant association between visual impairment characterized by vision symptoms self-reported during PMCs and ISS average CO<sub>2</sub> levels over ISS missions. Closer review of the PMC records showed that vision outcomes are not well-documented in terms of clinical severity, timing of onset, or timing of resolution, perhaps due to the incipient nature of vision changes. Vision has been monitored in ISS crewmembers, pre- and post-flight, using standard optometry evaluations. In-flight visual assessments were limited early in the ISS program, primarily consisting of self-perceived changes reported by crewmembers. Recently, on-orbit capabilities have greatly improved. Vision data ranges from self-reported post-flight changes in visual acuity, pre- to post-flight changes identified during fundoscopic examination, and in-flight progression measured by advanced on-orbit clinical imaging capabilities at predetermined testing intervals. In contrast, CO<sub>2</sub> data are recorded in a continuous stream over time; however, for the initial analysis this data was categorized into weekly averages.

### FORWARD WORK

Several analyses are planned to investigate the relationship between CO<sub>2</sub> and different outcomes of interest. We will discuss possible ways CO<sub>2</sub> exposure can be characterized based on various types of outcomes, collected using qualitative and quantitative methods.

### REFERENCES

[1] Law *et.al*, (2014) *Journal of Occupational and Environmental Medicine* 56(5):477-483.