Landmark Everest experiment shows low-oxygen environments lead to cognitive decline

March 28 2017, by George Wigmore

Credit: Marta Wave from Pexels

Exposure to low oxygen environments, or hypoxia, can have significant consequences for our brain and body, according to a new study led by researchers from City, University of London and UCL (University

College London).

The research, which is published in the journal *PLOS ONE*, found that although individuals' responses varied when at altitude, cognitive decline was seen in nearly all tasks.

In particular, it was seen that tasks associated with verbal ability/language; learning; and executive functions, which help us plan, organise and focus, were significantly affected. Those looking at memory and coordination were also impacted.

Furthermore, age was also significantly associated with cognitive decline at altitude and with delayed recovery upon return to more normal oxygen levels in Kathmandu, with the greatest decline seen in older adults. This suggests that cognitive recovery from low oxygen may take longer in older people.

As a result the study, which is the largest to investigate the impacts of environmental hypoxia on cognitive ability, could have significant implications for health care, as such hypoxic states are seen following surgery or due to particular health conditions.

To investigate the impact of such conditions, 198 participants were recruited from the general public as part of the Caudwell Extreme Everest Medical Research Expedition between February and June 2007.

Participants received a series of neuropsychological tests assessing memory, language, attention, and executive function using standardised and commonly used tests in clinical and research settings. These were administered at sea level in London, 3,500m at Namche Bazaar in Nepal, and at 5,300m at Everest Base Camp. Tests were also conducted upon return to 1,300m in Kathmandu. This group was compared with a control group.

The researchers found that cognitive declines were evident in the group on all tasks at Everest Base Camp, which was the highest point of ascent, but that it was greatest in executive function, complex attention, and verbal skills. It was also seen that while cognitive performance improved on descent from Everest Base Camp to Kathmandu (1,300m), it remained impaired when compared to pre-trek levels and even to those recorded at greater altitude (Namche at 3,500m) on ascent. As a result, the researchers found that return to lower altitude does not immediately restore the cognitive effects of exposure to hypoxia.

Professor Stanton Newman, Dean of the School of Health Sciences at City, University of London and senior author on the paper, said:

"By taking otherwise healthy individuals to Everest Base Camp our study has provided insight into how low oxygen environments impact on the human brain and body. We found that in particular, such environments lead to significant cognitive decline, with recovery taking longer with age. As hypoxia did not have the same effect on everyone – some were more prone to neurocognitive decline than others – we hope this study will give further insight into how we can respond to hypoxia-related cognitive impairment in clinical settings, particularly in older patients, in order to guide therapy and thereby minimise the magnitude and duration of impairment."

More information: Konstadina Griva et al. Caudwell Xtreme Everest: A prospective study of the effects of environmental hypoxia on cognitive functioning, *PLOS ONE* (2017). DOI: 10.1371/journal.pone.0174277

Provided by City University London