IDRiM Virtual Workshop
for Interactive Discussions between
Senior and Early-Career Scientists
23-24 September 2020 | Online Workshop
FOR A SAFER WORLD

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[Abstract No.] 05006

[Abstract Title]

A warming climate may reduce health risks of hypoxia on the Qinghai-Tibetan Plateau

[Abstract]

Each year, approximately 100 million people worldwide visit high altitude regions (2500 m and more above sea level). The consequent health risks caused by hypoxia have attracted wide attention. Previous studies suggested that while barometric pressure and oxygen partial pressure significantly decrease with rising altitude, relative oxygen concentration (ROC) remains constant. In this study, we conducted field investigations on the Qinghai-Tibetan Plateau (QTP) and found that the ROC varied under different air temperature and vegetation conditions. One sample t-test showed that the ROC from three different years were significantly different from the suggested constant value of 20.946% (2017, $n = 65$, $p < 0.001$, 95% CI (confidence interval): 21.03-21.14%; 2018, $n = 80$, $p < 0.001$, 95% CI: 20.15-20.22%; 2019, $n = 166$, $p < 0.001$, 95% CI: 20.27-20.33%). The spatio-temporal variabilities of air temperature and fractional vegetation cover (FVC) contributed more than altitude to changes in ROC in the region. The relative contributions of altitude, FVC and air temperature to the ROC were 44.81%, 16.56% and 38.63%, respectively

(n = 193, $p < 0.001$). The mean ROC of summer (n = 53) was 0.31% higher than that of winter (n = 53) in the Qilian Mountains, northwest of the QTP, which led to an absolute oxygen concentration difference of 2.81g/m3, which decreased the summer chronic mountain sickness rate by 2.60-2.74% compared to winter. During the period 1990-2018, even though the medical care conditions of the populations of Tibet and Qinghai lagged behind the nation's average, the life expectancy of the two provinces rose considerably, and the gap with the national average has gradually shortened from 8.44 to 5.14 years. A warming climate and promoted vegetation could lead to rising ROC, which could have beneficial effects on the increase in life expectancy on the QTP. Under a warming climate, the air temperature and fractional vegetation cover may continue to increase in the foreseeable future, which may further decrease the population health risks of hypoxia. Our results not only first demonstrated the effects of climate and vegetation conditions to the ROC, but also provide new perspectives for high altitude medicine and suggestions for climate change mitigation for these regions.

[Keywords]

Health risks of hypoxia; Relative oxygen concentration; Life expectancy; Air temperature; Fractional vegetation cover; Global warming; Qinghai-Tibetan Plateau