Elevation Complication: Implications for Mental Health

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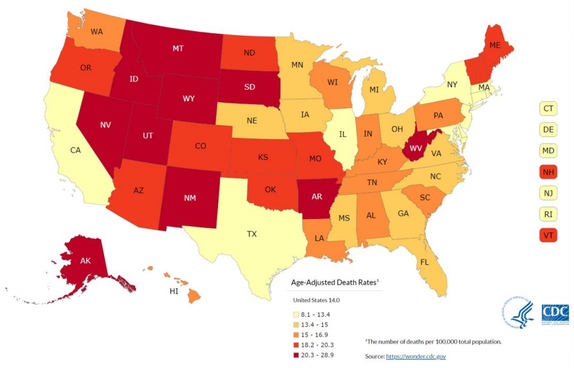
Suicide Mortality by State: 2017



Question:

Are adults (18+) living at high elevation compared to those who live at low elevation at an increased risk for suicide?

Background:

- Suicide plagues global society: nearly 800,000 people die by suicide each year (WHO, 2018)
- Risk factors include history of substance/alcohol abuse, access to lethal means, low population density, and social isolation (CDC, 2018)
- High elevation is defined as greater than 2,000m (6,560 feet) and low elevation as less than 1,000m (3,280 feet)
- The Rocky Mountain, or the "suicide belt" states average 24 deaths per 100,000 compared to the national average of 14 deaths per 100,000
- Hypobaric hypoxia is a condition found at high altitude; it means a decreased oxygen saturation in low pressure environments

Article	Summary	Findings
The possible effect of altitude on regional variation in suicide rates by Charlotte A. Haws, Douglas D. Gray, Deborah A. Yurgelun-Todd, Michelle Moskos, Laurence J. Meyer, Perry F. Renshaw (2009).	Level V retrospective cohort study which reviewed the suicide rates of each state and its highest elevation. Suicide data studied was available from the CDC from the years 1990-1994. The hypothesis refers to an inverse relationship between elevation and oxygen saturation which has potential effect on mood.	The study found that the correlation between the highest altitude of each state and it's subsequent adjusted suicide rate. The western-most states had the highest rate of suicide compared to states in southern, mid-western, and northeastern regions.
Hypoxia-related risk factors for death by suicide in a national clinical sample by Natalie B. Riblet, Daniel J. Gottlieb, Bradley V. Watts, Sarah L. Cornelius, Vincent S. Fan, Xun Shi, Brian Shiner (2019).	Level V retrospective cohort study which discusses the 3 causes of chronic hypoxia which are COPD, smoking, and high altitude and their relations to suicide risk. Studied population of 9 millions veterans at VA hospitals.	Study found that there is a positive correlation between altitude and suicide rates. Specifically, suicide rates increased by 7% per every 500 meter increase in elevation.
Altitude, immigration and suicide rates: a study from Turkey by Salih Selek (2013).	Level V retrospective cohort study that looked at 2 years of police reports of suicide rates in 81 provinces in Turkey to potentially link the country's suicide rates with immigration and altitude.	This study did not find any association between altitude and suicide. It referred to studies in the US and South Korea which show strong association between those variables and suggested that cultural practices in those countries might have an influence on the suicide rates.
Positive association between altitude and suicide in 2584 U.S. counties by Barry Brenner, David Cheng, Sunday Clark, Carlos A. Camargo, Jr (2011).	Level V retrospective cohort study which analyzed suicide data and altitude of 2,584 US counties.	This study discovered a strong positive correlation between altitude and suicide rate in each county. Did not delve into why higher altitude might affect suicide or the body processes that could potentially be affected.
Altitude, gun ownership, rural areas, and suicide by Namkug Kim, Jennie B Mickelson, Barry E. Brenner, Charlotte A. Haws, Deborah A. Yurgelun-Todd, Perry F. Renshaw (2011).	Level V retrospective cohort study compiled elevation data from the National Geospatial Intelligence Agency and suicide and population density data from 490 counties from the CDC WONDER database. The data extracted was collected over the years 1979-1998.	The study concluded that there is a significant positive correlation between age adjusted suicide rates and county elevation. It states that at higher altitude, there is a "mild hypoxic challenge" and hypobaric hypoxia has been associated with mood changes (p. 49).
High altitude remains associated with elevated suicide rates after adjusting for socioeconomic status: A study from South Korea by Jealim Kim, Nari Choi, Yu-Jin Lee, Hyonggin An, Namkug Kim, Ho-Kyoung Yoon, Heon-Jeong Lee (2014).	Level V retrospective cohort study analyzed demographic and socioeconomic information on individuals who died by suicide in South Korea from 1997-2007. The study gathered information such as sex, age, date of death, altitude of different districts in South Korea, and mean income to factor in the socioeconomic status.	This study found a significant positive correlation between the suicide rate and mean altitude of each district in South Korea. In fact, it was determined that the "suicide rate increased by 1.8% for every one meter increase in mean altitude" (p. 493). Additionally, the article discusses the neurochemical effects of living at high altitude.

Results:

Five out of six research articles found a significant positive relationship between high elevation and increased suicide risk

Why?

- Tryptophan hydroxylase is an enzyme that directly affects the synthesis of neurotransmitter serotonin
  - Low concentrations of serotonin is associated with suicide
- In hypoxic conditions, concentration of tryptophan hydroxylase decreases, in turn, decreasing serotonin levels in the brain
  - Altering efficacy of certain antidepressant medications

Nursing Implications:

- Understanding risk factors is key in ensuring the most effective screening takes place
- At risk regions can lobby for more support from local and state governments
- Increases the ability of healthcare providers to provide the best possible care substantiated by evidence
- Some of the articles refer to hypobaric hypoxia and how it affects metabolism and neurochemical synthesis in the body. More research on this subject should be advocated for in order to more fully understand the effects of elevation on the human brain
  - Therapies traditionally used to treat neurochemical changes associated altitude sickness could be repurposed

This work is not original. This is a systematic review of published research conducted by professionals. Guidance was provided by Stephanie Burkholder, professor of NU307: Evidence-Based Practice Research Methods.