

Rates of ADHD appear to decrease at higher altitudes

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Children with ADHD find it more difficult to focus and to complete their schoolwork. Credit: public domain image

Recent research has linked the thin air of higher elevations to increased rates of depression and suicide. But a new study shows there's also good news from up in the aspens and pines: The prevalence of attention deficit hyperactivity disorder (ADHD) decreases substantially as altitude



increases.

In Utah, for example, an analysis of information from two national health surveys correlated with the average state elevation of 6,100 feet showed that the rate of diagnosed ADHD cases is about 50 percent of states at sea level. In Salt Lake City, whose elevation is about 4,300 feet, diagnosed ADHD prevalence is approximately 38 percent less than at sea level.

One potential reason for the decreased rate of ADHD, University of Utah researchers believe, is higher levels of dopamine produced as a reaction to hypobaric hypoxia—a condition caused when people breathe air with less oxygen at <u>higher elevations</u>. Decreased dopamine levels are associated with ADHD so when levels of the hormone increase with elevation, the risk for getting the disorder diminishes. There are other potential reasons for the disparities in the rates of the disorder, such as regional inconsistencies in diagnosing ADHD.

The study findings, published in the *Journal of Attention Disorders* online, have important implications for potentially treating ADHD, according to Douglas G. Kondo, M.D., assistant professor of psychiatry and senior author on the study. "Our previous studies of mood disorders and suicide consistently suggest that hypobaric hypoxia associated with altitude may serve as a kind of environmental stressor," Kondo says. "But these results raise the question of whether, in the case of ADHD, altitude may be a protective factor."

Rebekah Huber, a doctoral candidate in educational psychology at the University of Utah, is the first author. Huber works in the research group of Perry F. Renshaw, M.D., Ph.D., M.B.A., a University of Utah professor of psychiatry, USTAR investigator and a co-author on the study.



Huber, Kondo, Renshaw and their colleagues conducted the study with data from two national health surveys and information on average state elevations taken from NASA's Shuttle Radar Topography Mission and the National Geospatial-Intelligence Agency.

The National Survey on Children's Health contacted 91,642 households in 2007 and found that 73,123 children ages 4-17 had been diagnosed with mild, moderate or severe ADHD by a physician or other health care provider. The 2010 National Survey of Children with Special Healthcare Needs contacted 372,689 households and found that 40,242 children in that age range had been diagnosed with full ADHD.

The researchers correlated the number of cases of diagnosed ADHD with average elevations in the lower 48 states and the District of Columbia as reported by the federal agencies to determine rates of ADHD. From this, they derived data on ADHD rates at sea level and above and found that for every 1-foot increase in elevation, the likelihood of being diagnosed with ADHD by a healthcare provider decreases by .001 percent.

The data showed that North Carolina, whose average elevation is 869 feet above sea level, had the highest percentage of children diagnosed with ADHD - 15.6 percent. Delaware, Louisiana and Alabama—all states with an average elevation of less than 1,000 feet—followed closely behind North Carolina with high percentages of ADHD.

Nevada—with an average elevation of 5,517 feet above <u>sea level</u>—had the lowest percentage at 5.6. Utah had one of the lowest rates of ADHD, 6.7 percent. All of the Mountain West states rated well below average for the percentage of children diagnosed with ADHD. The study also took into account other factors—such as birth weight, ethnicity, and sex (males are more likely to have ADHD)— that could affect ADHD diagnoses and influence the rate of the disorder in each state.



This study follows research in which Renshaw and colleagues at the University of Utah and in South Korea showed correlations between increased rates of suicide and depression with higher altitudes.

The decrease in ADHD at elevation doesn't mean people need to start moving to the mountains, according to Renshaw. But the research results do have potential implications for treating the disorder.

"To treat ADHD we very often give someone medication that increases dopamine," he says. "Does this mean we should be increasing medications that target dopamine? Parents or patients might want to take this information to their health care providers to discuss it with them."

Provided by University of Utah Health Sciences

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