Is Skiing Harmful To Health?

Is high altitude skiing harmful to health? It is an interesting question and we will take a look into the emerging evidence that vigorous exercise in an oxygen and pressure deficient environment at ten thousand feet or above may actually be hazardous to long term human health.

High Altitude Ski Resorts

There are many ski resorts in the USA with peaks in the ten thousand feet range. 10,000 feet is equal to 3,048 meters. The top three highest USA ski resorts are:

1. Breckenridge – Colorado – 2,926 m to 3,914 m (Difference 988 m)
2. Loveland - Colorado – 3,245 m to 3,871 m (Difference 626 m)
3. Telluride – Colorado – 2,659 m to 3,831 m (Difference 1172 m)

This website documents all of the highest USA ski resorts:

http://www.skiresort.info/ski-resorts/north-america/sorted/mountain-altitude/

You will notice that the first 44 ski resorts are at or above ten thousand feet. There are no shortage of high altitude ski resorts in the USA.

Regarding altitude effects on human health, Wikipedia states the following:

At high altitude, 1,500 to 3,500 metres (4,900 to 11,500 ft), the onset of physiological effects of diminished inspiratory oxygen pressure (PiO2) includes decreased exercise performance and increased ventilation (lower arterial partial pressure of carbon dioxide- PCO2). While arterial oxygen transport may be only slightly impaired the arterial oxygen saturation, SaO2, generally stays above 90%. Altitude sickness is common between 2,400 and 4,000m because of the large number of people who ascend rapidly to these altitudes.

At very high altitude, 3,500 to 5,500 metres (11,500 to 18,000 ft), maximum SaO2 falls below 90% as the arterial PO2 falls below 60mmHg. Extreme hypoxemia may occur during exercise, during sleep, and in the presence of high altitude pulmonary edema or other acute lung conditions. Severe altitude illness occurs most commonly in this range.

https://en.wikipedia.org/wiki/Altitude_sickness

Regarding very high altitude exposures, the list shows 17 USA ski resorts are at or above 11,500 feet or 3,500 meters.

People With High Altitude Exposures

What does high altitude do to people? Here are some people who have spent significant time at high altitudes:

- "An avid mountain climber, Konrath is one of less than 300 people who have climbed to the highest point on all seven continents...Konrath appeared to explain a plan to sneak into his ex-wife's house at night and shoot her while their children were asleep in their rooms...Konrath told ABC News' "20/20" in a jailhouse interview." http://abcnews.go.com/US/inside-bizarre-case-indiana-surgeon-accused-plotting-wifes/story?id=33800834
- "Lisa Marie Nowak is an American former naval flight officer and NASA astronaut...Florida prosecutors filed three formal charges against Nowak: (1) attempted kidnapping with intent to inflict bodily harm or terrorize, (2) burglary of a conveyance with a weapon, and (3) battery...Her lawyer stated that she suffered from major depression, obsessive-compulsive disorder, insomnia, and "brief psychotic disorder with marked stressors" at the time of the incident. She was also suffering from Asperger Syndrome" https://en.wikipedia.org/wiki/Lisa_Nowak
- "Kurt "Charlie" Steil...used to run competitively in marathons and ultramarathons, including a grueling race up Pikes Peak (14,115 feet)... About four years ago he was diagnosed with amnesthic mild cognitive impairment, or short-term memory loss, robbing him of his ability to go about his daily life the way he once did. The condition also has caused him to lose some physical strength" https://www.uwstout.edu/news/upload/LT_021715_N_PolingTrail.pdf
- "Steven Magee, Chartered Electrical Engineer, was medically diagnosed with Amnestic Disorder which is characterized by short term memory loss in 2016 at the age of 46. He had worked for five years on the 13,796 feet very high altitude summit of Mauna Kea, Hawaii, USA from 2001 to 2006 and had noticed memory problems developing during the last years that he worked there. The condition has now progressed into a disability." Steven Magee CEng MIET http://environmentalradiation.com/Open%20Letter%20To%20The%20Astronomical%20Community.pdf

Who Are The Most Vulnerable?

- Sea level adapted humans.
- Developing children.
- People with lung issues.
- People with heart issues.
- People with brain issues.
- Older people.

What Do The Professionals Say?

- "It is well documented that high altitude expeditions may elicit alterations in both emotional and cognitive functioning. These changes are likely due to the cumulative effects of hypoxia, high altitude deterioration, physical exhaustion, fluid and electrolyte disturbances, and preexisting psychological morbidity." http://onlinelibrary.wiley.com/doi/10.1111/j.1708-8305.2009.00369.x/full
- "Journeying to these places of high altitude carries significant risk of illness and death." Centre for Altitude Space and Extreme Environment Medicine (CASE Medicine) http://www.case-medicine.co.uk/news_detail.php?article=33
- "Pulmonary Hypertension...Mountain climbers all develop the condition" http://www.mountsinai.org/patient-care/health-library/diseases-and-conditions/pulmonary-hypertension
- “Pulmonary Hypertension - This condition of high blood pressure in the lungs can occur from many causes. Since high blood pressure in the pulmonary vessels is a main mechanism that leads to HAPE, persons with pulmonary hypertension have a much higher risk of developing HAPE and need to consider this risk before coming to altitude.” http://www.altitudemedicine.org/altitude-and-pre-existing-conditions/
- "A high prevalence of patent ductus arteriosus and atrial septal defect was found at the three high altitude sites and the effect of altitude was progressive." http://www.ncbi.nlm.nih.gov/pubmed/3379209
- "ECGs of immigrants to high altitude demonstrate an increase in RV hypertrophy with increased duration of high-altitude residence. Loss of normal circadian rhythm and QTc prolongation have been described in both infants and adults." http://emedicine.medscape.com/article/901668-overview
- "experienced and professional climbers tend to show higher levels of chronic damage, suggesting that high altitude's effects may be cumulative and lasting." http://healthyliving.azcentral.com/high-altitude-effects-mountain-climbers-4931.html
- "Three attributes of a good mountaineer are high pain threshold, bad memory, and ... I forget the third. — Joke in a mountaineering Internet chat room" http://www.scientificamerican.com/article/brain-cells-into-thin-air/
- "Federal Aviation Regulations Sec. 135.89 — Pilot requirements: Use of oxygen.(a) Unpressurized aircraft. Each pilot of an unpressurized aircraft shall use oxygen continuously when flying—(1) At altitudes above 10,000 feet through 12,000 feet MSL for that part of the flight at those altitudes that is of more than 30 minutes duration; and (2) Above 12,000 feet MSL." http://www.risingup.com/fars/info/part135-89-FAR.shtml
- “Climbing experts recommend taking along enough tanks of oxygen to last for several days when traveling above 10,000 feet.” http://my.clevelandclinic.org/health/diseases_conditions/hic-altitude-sickness
- "At altitude above 10,000 ft, a person may fail to adjust to the low level of oxygen" http://www.amperordirect.com/pc/help-pulse-oximeter/z-interpreting-results.html
- "Low Brain Oxygen Ups Alzheimer's Risk" http://www.webmd.com/mental-health/news/20061120/alzheimers-risk-upped-by-low-brain-oxygen
- "you could suffer brain damage by going from sea level to 14,000 feet in a couple days"

http://climbing.about.com/od/mountainclimbing/a/AltitudeStudy.htm

- "Low oxygen levels affect a number of systems in the body" http://www.copdbfrg.org/?page_id=984
- "Dementia from oxygen deprivation is not always treatable, because it usually stems from some form of permanent brain damage. If a person facing low levels of oxygen is restored to adequate levels fast enough, the damage may be minimal or reversible. But if the damage is long-term and causes the onset of dementia, there is little that can be done short of managing the symptoms." https://www.dementia.org/oxygen-deprivation-dementia
- "The effects of UV-B radiation on human skin are varied and widespread. UV-B induces skin cancer by causing mutation in DNA and suppressing certain activities of the immune system...UV-B may also suppress the body's immune response to Herpes simplex virus and to skin lesion development, and may similarly harm the spleen....Common eye problems resulting from over-exposure to UV-B include cataracts, snow blindness, and other ailments, both in humans and animals...Living organisms at high elevations are generally exposed to more solar radiation and with it, more UV-B than organisms at low elevations." http://earthobservatory.nasa.gov/Features/UVB/uvb_radiation2.php

What Does The News Say?

- "BARBARA SMOLEK LIPPIN, a 39-year-old New York City resident and avid skier, cannot wait to put skis to Rocky Mountain snow, but she also knows that for her there is a price to pay for the joys of high-altitude schussbooming: severe headaches, nausea and other effects of acute mountain sickness." http://www.nytimes.com/1992/12/23/news/surprise-for-flu-prone-skiers-it-may-be-mountain-sickness.html?pagewanted=all
- "climbers are advised by medical experts to ascend only 300 meters a day at altitudes over 3,000 meters to give their bodies time to adapt." https://www.ucalgary.ca/utoday/issue/2016-01-27/study-looks-effects-oxygen-depletion-high-altitude-workers-chile
- "But inside the control room at 16,500 feet, my head was splitting. I was out of breath and couldn't tell if my shot was in focus. My cameraman Josh Barajas was struggling too. He asked repeatedly where his memory card was, and repeatedly I told him he'd already put it in the camera. ...My blood oxygen read 83 — that's low. At sea level, I would be in the hospital for a reading of 93." http://www.pbs.org/newshour/updates/reporters-notebook/
- "Lifelong Skiers Show Increased Risk of Developing Heart Arrhythmias" http://fasterskier.com/fsarticle/lifelong-skiers-show-increased-risk-of-developing-heart-arrhythmias/
- "some employees report blacking out or falling asleep at the wheel as they wind their way back down the mountain... some of the body and brain-altering effects of oxygen depletion are causing untold accidents at the observatory... the most significant issue is an employee's ability to undertake the complex tasks necessary for safe work performance — memory, attention and planning....These likely become compromised at altitude because of the lack of oxygen and the inadequate time for the body to adapt" https://www.ucalgary.ca/utoday/issue/2016-01-27/study-looks-effects-oxygen-depletion-high-altitude-workers-chile
- 'we were briefed on high-altitude hazards, such as dehydration, intense solar radiation and

altitude illness, which can lead to life-threatening conditions such as high-altitude pulmonary edema and high-altitude cerebral edema. "There's 40 percent less oxygen up there than you're used to," said Joy Pollard, who works in outreach for the Gemini Observatory. "It'll feel like you've had a cocktail or two … Most people don't get sick, but almost everyone feels something.'" http://www.honolulumagazine.com/Honolulu-Magazine/January-2016/Walk-Inside-the-Controversial-Telescopes-Atop-Mauna-Kea-Starting-This-Month/index.php?cparticle=2&siarticle=1#artanc

- "High altitude makes you stupid." http://www.pbs.org/newshour/updates/reporters-notebook/

What Does The Skiing Community Say?

- "At high elevations everyone is affected by altitude to some degree. At elevations of 8,000 plus ft, your body responds by breathing faster and more deeply, resulting in shortness of breath, especially on exertion. Some people develop mild symptoms of headache, nausea, sleep disruption, and unusual tiredness. Doctors call the symptoms "Acute Mountain Sickness" or AMS." http://www.tampabayskiclub.com/Forms/High_Altitude_Sheet.pdf
- "Even without feeling ill with AMS, the lack of oxygen can have some effect on brain function. This may not be too important when cruising a gentle blue run but possibly highly relevant in a challenging couloir for example. Coupled with all this you should think about dehydration and diminished quality of sleep." https://skiunion.com/features/altitude-skiing.html
- "What you've got, and what you probably didn't prepare for, is most likely altitude sickness (also called acute mountain sickness, AMS). If you live at an altitude under 5,000 feet and you head up to altitudes over 8,000 feet you're highly vulnerable to its effects, especially if you've experienced it before." http://www.coppercolorado.com/winter/blog/outsiders/tracy-greenhalgh/tips-for-skiing-at-high-altitude1
- "Many skiers and mountain climbers experience altitude-induced illnesses, which can range from harmless dizziness to acute and life-threatening edemas." http://www.pbs.org/wgbh/nova/body/high-altitude-body.html
- "But flatlanders can find themselves reeling with nausea on the first couple of days at high elevation ski resorts. The effects of altitude can be severe enough to land some in the emergency room." http://www.onthesnow.com/news/a/106686/how-to-avoid-altitude-sickness-on-high-elevation-ski-trips
- "At high altitude, the sun in the winter is still incredibly strong. This is due to the fact that there is less atmosphere to filter out the ultraviolet rays." http://www.ski.com/blog/5-tips-for-reducing-the-high-altitude-effects-on-your-ski-vacation/
- "The higher the elevation, the harder your body has to work, because air pressure is lower (i.e. there's less oxygen, which is also why it's dehydrating). The body responds by producing more red blood cells to increase circulation. The short answer is, high elevations stress the body." http://gadling.com/2012/11/30/avoiding-altitude-woes-what-to-bring-on-your-next-ski-trip/
- "At high elevations, the atmosphere is thinner and there is less oxygen and less humidity available to you than at sea level. This can result in a number of symptoms such as muscle fatigue, insomnia, mild headaches or slight shortness of breath. Our thin atmosphere filters out

only a minimum of the sun's ultraviolet ("UV") rays and can result in severe sunburn." http://www.visitmammoth.com/high-altitude-tips

- Altitude sickness (Acute Mountain Sickness) is a common health concern for those on a Colorado ski vacation, particularly those who usually reside at sea level. This is not surprising considering that Colorado has the highest average elevation of any of the states. Colorado also has over 50 fourteeners (mountains with peaks higher than 14,000 feet), and the majority of the Colorado ski resorts have a top elevation of greater than 3,000 metres (9,843 feet). http://www.powderhounds.com/USA/Ski-Colorado/Altitude-Sickness.aspx
- "Studies have shown that ski resorts above 8,000 feet pose the highest risk to those who are not acclimated to high elevations. Depending on the elevation that you live at, you may not feel the effects, but for those coming in from sea level it is helpful to keep in mind that at 8,000 feet, oxygen is reduced by 25%." https://skisolitude.com/blog/six-tips-for-staying-healthy-at-altitude

Summary

I hope that you enjoyed this discussion on the potential high altitude health effects on skiers. My advice for sea level adapted humans is to ski at low altitude resorts that are below 4,900 feet until more is known on the subject of how high altitudes affects skiers long term health.

"I stopped snowboarding as I started to recognize symptoms that corresponded with radiation sickness when at high altitude ski resorts."
Steven Magee CENG MIET BEng Hons – Author of Toxic Electricity