The effects of temperature on human health

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Photo: Ilpo Okkonen

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Effects of heat and cold exposure on human health

- Unpleasant sensations
- Decreased performance
- Symptoms
- Morbidity
- Injuries
- Mortality

Hassi & Ikäheimo Suomen Lääkärilehti 2014
Why study extreme temperatures and health?

- Climate warming, but also more extreme weather events
  - Substantial in the Arctic environment
- Increased morbidity and mortality
- Need to identify vulnerable population groups
- The adverse health effects are often preventable with relatively simple measures
- Awareness, early warning systems and management models
  - Improved functional and working ability
  - Reduced health care costs
  - A higher share of cold- and heat-related mortality can be prevented
Symptoms in cold and hot environments
Asthma and allergic rhinitis increase respiratory symptoms in cold weather among young adults

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Asthma control and cold weather-related respiratory symptoms

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Respiratory symptoms and cold

• Among young adults (20-27 yrs) those with asthma, and especially those with coexisting allergic rhinitis, experience substantially more cold temperature-related respiratory symptoms (25-50%) than healthy young peers.\textsuperscript{Hyrkäs et al. 2014}

• Subjects whose asthma is poorly controlled are more prone to experience cold weather-related respiratory symptoms.

• Even a slight worsening of asthma control increases symptom prevalences.\textsuperscript{Hyrkäs et al. 2016}
Heat-related thermal sensation, comfort and symptoms in a northern population: the National FINRISK 2007 study

Simo Näyhä¹,²,³, Hannu Rintamäki³,⁴, Gavin Donaldson⁵, Juhani Hassi¹,², Pekka Jousilahti⁶, Tiina Laatikainen⁶,⁷,⁸, Jouni J. K. Jaakkola¹,²,⁹, Tiina M. Ikkäheimo¹,²
Heat-related symptoms at the population level

• An environment considered comfortable is at 22°C
• Heat is tolerated less with ageing

Heat-related cardiorespiratory symptoms at the population level: FINRISK 2007

Näyhä et al. 2016
Cold exposure and morbidity
Cold temperature and low humidity are associated with increased occurrence of respiratory tract infections

Tiina M. Mäkinen a,b,*, Raija Juvonen b,c, Jari Jokelainen a,d, Terttu H. Harju e, Ari Peitso b, Aini Bloigu f, Sylvi Silvennoinen-Kassin e, Maija Leinonen f, Juhani Hassi a,h

http://www.ehjournal.net/content/13/1/22

Decline in temperature and humidity increases the occurrence of influenza in cold climate

Kari Jaakkola 1,9, Annika Saukkoriipi 2, Jari Jokelainen 3,4, Raija Juvonen 5, Jaana Kauppila 6, Olli Vainio 6,7, Thedi Ziegler 8, Esa Rönkkö 8, Jouni JK Jaakkola 3,9,10,11, Tiina M Ikaheimo 3,9,11* and the KIAS-Study Group
Respiratory infections and cold

Photo: Ilpo Okkonen
• 1°C decrease in temperature and 0.5 g decrease per m³ in AH increased the estimated risk of influenza A and B by 11% [OR 1.11 (1.03 to 1.20)] and 58% [OR 1.58 (1.28 to 1.96)], respectively
Central Aortic Blood Pressure of Hypertensive Men During Short-Term Cold Exposure

Heidi Hintsala,1 Arno Kandelberg,1 Karl-Heinz Herzig,2,3 Hannu Rintamäki,2,4 Matti Mäntysaari,5 Aino Rantala,1 Riitta Antikainen,5,6 Sirkka Keinänen-Kiukaanniemi,5,7 Jouni J. K. Jaakkola,1,5 and Tiina M. Ikäheimo1,5

Am J Hypertension 2014

Cardiac Repolarization and Autonomic Regulation during Short-Term Cold Exposure in Hypertensive Men: An Experimental Study

Heidi Hintsala1,2, Tuomas V. Kenttä2,3, Mikko Tulppo4,13, Antti Kiviniemi4, Heikki V. Huikuri2,3, Matti Mäntysaari5, Sirkka Keinänen-Kiukaanniemi5,6, Risto Bloigu7, Karl-Heinz Herzig8,9, Riitta Antikainen2,5,10, Hannu Rintamäki8,11, Jouni J. K. Jaakkola1,2,5,12, Tiina M. Ikäheimo1,2,5∗

PlosOne 2014
Blood pressure and cold: effects of hypertension

- Permanently higher BP in winter
- Acute increase in cold
- Corresponding increase in BP in hypertensive and controls

Hintsala et al. 2014 Am J Hypert
Is cold and exercise safe for persons with coronary artery disease?

- Both cold and exercise stimulate cardiovascular function
- Is there an additional risk for persons whose cardiac oxygen supply is lower?
Extreme temperatures and mortality
Temperature and mortality in Finland

- Minimum mortality in Finland at +12 °C (2000-2005)
- In Finland the excess mortality related to heat is 100-200 and to cold 2000-3000 persons/year
- The majority of deaths occur at -15 - -5 °C

Daily mean temperature (1961-97)

Näyhä Duodecim 2005
Näyhä Int J Circumpolar Health 2007
Heat spells and mortality in Finland during the 21st century

- Increase in daily mortality by 21% during a heat spells
- Vulnerable groups:
  - 75-years old
  - Women
  - Those with cardiovascular, respiratory, mental or neural diseases
  - Persons living in institutions

Kollanus & Lanki Duodecim 2014
Cold spells are associated with increased mortality (ca. 11%) in populations around the world.

People with cardiovascular or respiratory diseases and the elderly are more prone to cold spells.

A change in temperature might contribute to the effects of cold spells and mortality.
Sudden cardiac deaths and cold

- Sudden cardiac death (SCD) is the leading cause of death, representing 50-60% of all cardiovascular deaths. The association between a cold spell and SCD is not known
- 4,032 consecutive cases of SCD (1998-2012, FINGESTURE-study) from the Province of Oulu, the largest available database on autopsy-verified SCD in the world
- Linked with:
  - 51 years of weather data (minimum, mean, and maximum daily temperatures, Finnish Meteorological Institute)
  - Home coordinates of the cases at the time of death (Population Register Centre)
  - Home coordinates of each case over the study years (Geographical Information System)
- Preliminary results suggest that a cold spell increases the risk of SCD

Ryti et al.
Refugees and their adaptation to change in environment and climate
Future research needs

- Identification of vulnerable populations
- Understanding causality
- Effectiveness of increasing awareness
- Efficacy of adaptation measures