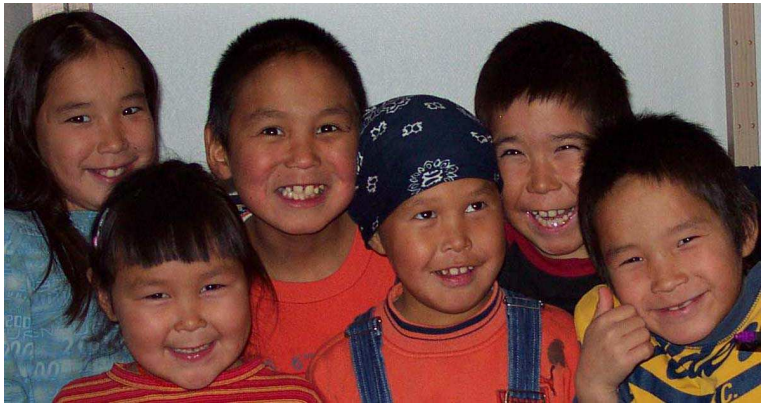
Climate change and infectious disease research in Greenland

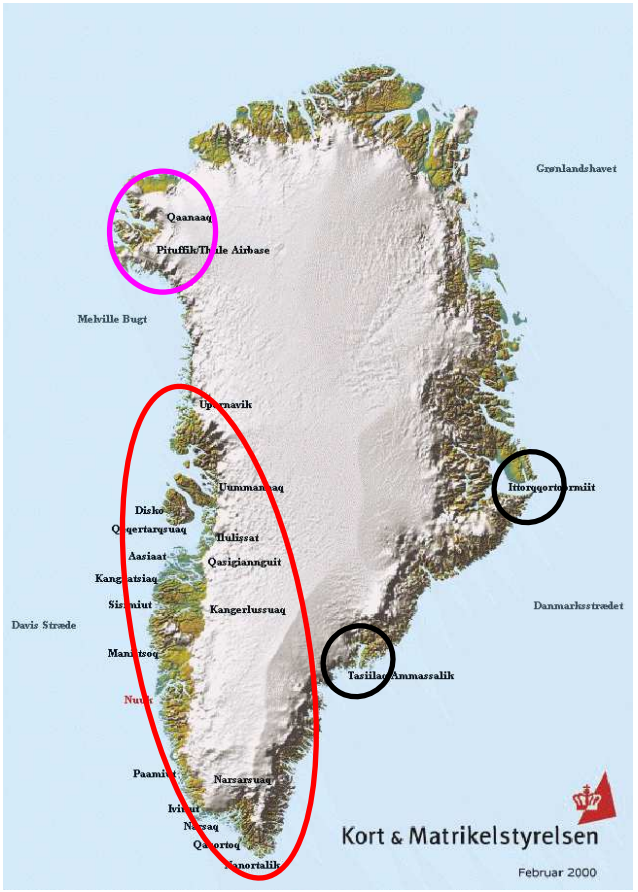
Anders Koch

Statens Serum Institut

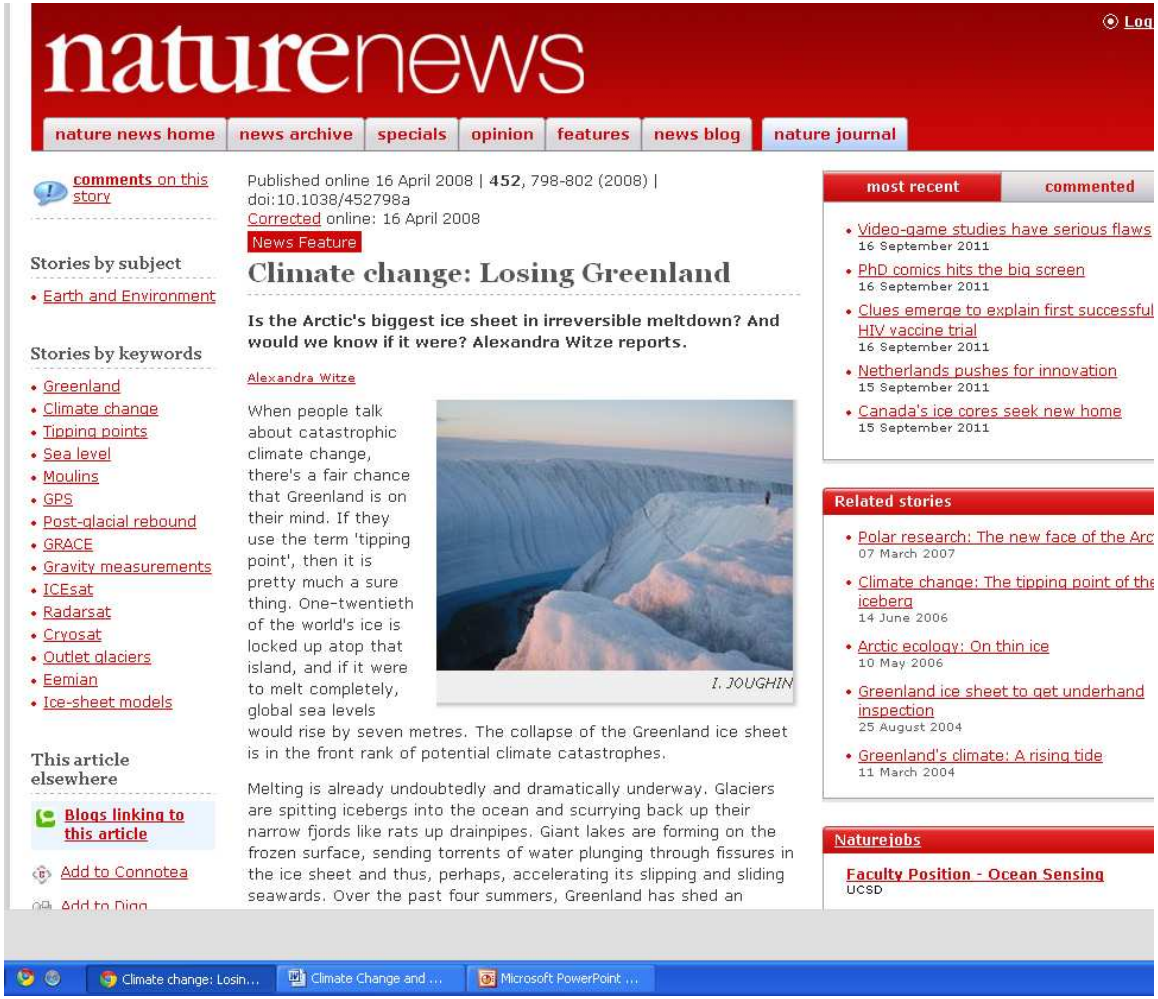


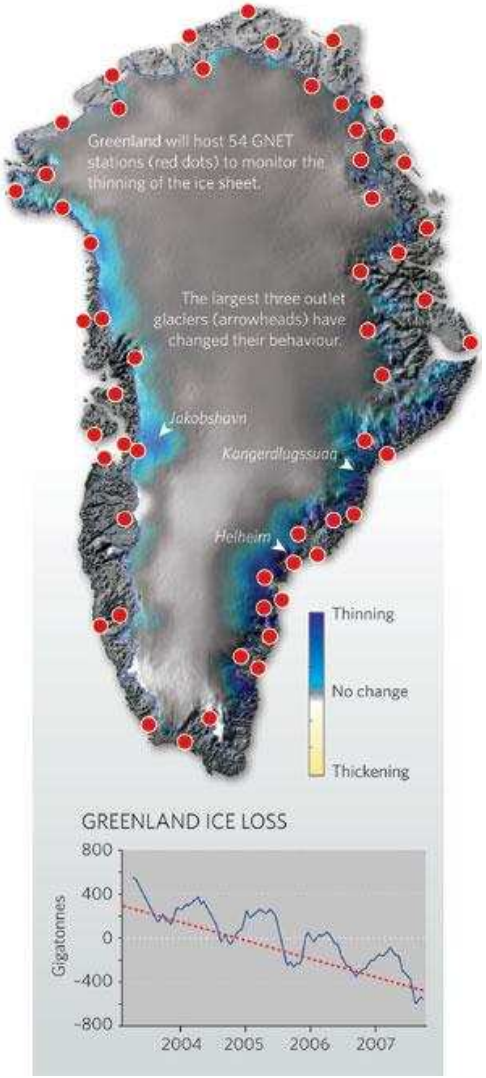
Greenland

- Population 57,000
  - 46,000 Inuits (81%)
  - 11,000 Caucasians (19%)
- Capital Nuuk
  - 15,000 (26%)
- 16 towns
  - 32,000 (56%)
- 60 settlements
  - 10,000 (18%)



Climate changes and Greenland





Research about past changes

Display Settings: Abstract

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Proc Natl Acad Sci U S A. 2011 Jun 14;108(24):9765-9. Epub 2011 May 31.

Abrupt Holocene climate change as an important factor for human migration in West Greenland.

D'Andrea WJ, Huang Y, Fritz SC, Anderson NJ.

Department of Geological Sciences, Brown University, Providence, RI 02912, USA. dandrea@geo.umass.edu

Abstract

West Greenland has had multiple episodes of human colonization and cultural transitions over the past 4,500 y. However, the explanations for these large-scale human migrations are varied, including climatic factors, resistance to adaptation, economic marginalization, mercantile exploration, and hostile neighborhood interactions. Evaluating the potential role of climate change is complicated by the lack of quantitative paleoclimate reconstructions near settlement areas and by the relative stability of Holocene temperature derived from ice cores atop the Greenland ice sheet. Here we present high-resolution records of temperature over the past 5,600 y based on alkenone unsaturation in sediments of two lakes in West Greenland. We find that major temperature changes in the past 4,500 y occurred abruptly (within decades), and were coeval in timing with the archaeological records of settlement and abandonment of the Saqqaq, Dorset, and Norse cultures, which suggests that abrupt temperature changes profoundly impacted human civilization in the region. Temperature variations in West Greenland display an antiphased relationship to temperature changes in Ireland over centennial to millennial timescales, resembling the interannual to multidecadal temperature seesaw associated with the North Atlantic Oscillation.

PMID: 21628586 [PubMed - in process] PMCID: PMC3116382 [Available on 2011/12/14]

Publication Types

LinkOut - more resources

Pubmed search climate change, Greenland and health

Results: 4

Fate and transport of chlormequat in subsurface environments.

1. Juhler RK, Henriksen T, Rosenbom AE, Kjaer J.
Environ Sci Pollut Res Int. 2010 Jul;17(6):1245-56. Epub 2010 Feb 23.
PMID: 20177799 [PubMed - indexed for MEDLINE]
Related citations

Atmospheric monitoring of organic pollutants in the Arctic under the Arctic Monitoring and Assessment Programme (AMAP): 1993-2006.

2. **Hung** H, **Kallenborn** R, **Breivik** K, **Su** Y, Brorström-Lundén E, Olafsdottir K, Thorlacius JM, Leppänen S, Bossi R, Skov H, Manø S, Patton GW, Stern G, Sverko E, Fellin P.
Sci Total Environ. 2010 Jul 1;408(15):2854-73. Epub 2009 Dec 11.
PMID: 20004462 [PubMed - indexed for MEDLINE]
Related citations

Exposure and effects assessment of persistent organohalogen contaminants in arctic wildlife and fish.

3. Letcher RJ, Bustnes JO, Dietz R, Jenssen BM, Jørgensen EH, Sonne C, Verreault J, Vijayan MM, Gabrielsen GW.
Sci Total Environ. 2010 Jul 1;408(15):2995-3043. Epub 2009 Nov 12. Review.
PMID: 19910021 [PubMed - indexed for MEDLINE]
Related citations

An assessment of the toxicological significance of anthropogenic contaminants in Canadian arctic wildlife.

4. Fisk AT, de Wit CA, Wayland M, Kuzyk ZZ, Burgess N, Letcher R, Braune B, Norstrom R, Blum SP, Sandau C, Lie E, Larsen HJ, Skaare JU, Muir DC.
Sci Total Environ. 2005 Dec 1;351-352:57-93. Epub 2005 Sep 12. Review.
PMID: 16154621 [PubMed - indexed for MEDLINE]
Related citations

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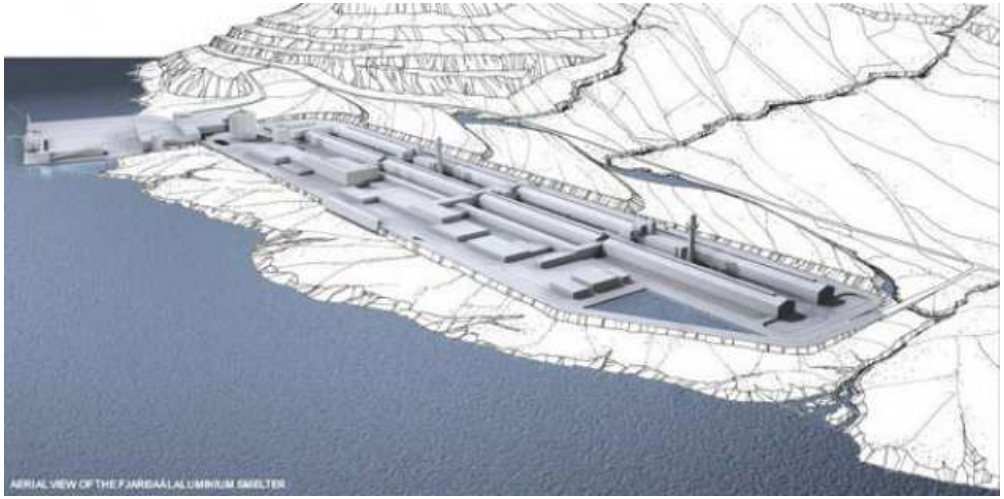
Current research

- Basically none
- *Alcoa aluminium smelter Maniitsoq baseline health study 2009*



What can be done?

- Register based studies
- Specific studies (serum banks)

Register based studies: Denmark (and Greenland) in the lead

EPIDEMIOLOGY

When an Entire Country Is a Cohort

Denmark has gathered more data on its citizens than any other country. Now scientists are pushing to make this vast array of statistics even more useful

For years, any woman who got an abortion had to accept more than the loss of her fetus: For some unknown reason, she also faced an elevated risk for breast cancer. At least that was what several small case-control studies had suggested before Mads Melbye, an epidemiologist at the Statens Serum Institute in Copenhagen, undertook the largest effort ever to explore the link. He and his colleagues obtained records on 400,000 women in Denmark's national Abortion Register, then checked how many of the same women were listed in the Danish Cancer Register. Their foray into the two databases led to a surprising result: As they reported in *The New England Journal of Medicine* in 1997, there appears to be no connection between abortion and breast cancer.

Their success underscores the value of a trove of data the Danish government has accumulated on its citizenry, which today totals about 5 million people. Other Scandinavian countries have created powerful database systems, but Denmark has earned a preeminent reputation for possessing the most complete and interwoven collection of statistics touching on almost every aspect of life. The Danish government has compiled nearly 200 databases, some begun in the 1930s, on everything from medical records to socioeconomic data on jobs and salaries. What makes the databases a plum research tool is the fact that they can all be linked by a 10-digit personal identification number, called the CPR, that follows each Dane from cradle to grave. According to Melbye, "our registers allow for instant, large cohort studies that are impossible in most countries."

Beauty in numbers. These Danish twins starred in a variety show at the turn of the 20th century; now it's their medical records, part of a database, that are in demand.

But Melbye and other scientists think they can extract even more from this data gold mine. They argue that not enough money is being spent on maintaining and expanding existing databases, and they say that red tape is hampering studies that require correlation of health and demographic data. The problem is that, while they have unfettered access to more than 80 medical databases maintained by the Danish hospitals, thei databases overs Denmark is tigl mark won't allo its premises dat cedures for acc unwieldy and e: Statistics De to release data concerns. "Th dence that infc individuals doe stitution," says Last n ter Bi to bre datab can b told S entifi W can y the U. has s twins tive lifest of Sc Kaar tappe whic twins ing more than older, Christe genes about a man longevity by the unmat the Danish Tw The health able for prot smaller studi

Science 2000

- CPR number
- All alive in DK since 1968, Greenland since 1972
- Not available in large, comparative countries (USA, England)

Register sources

- Greenland Hospital Register 1987-
- Notifiable infections in Greenland

Climate sensitive infectious diseases

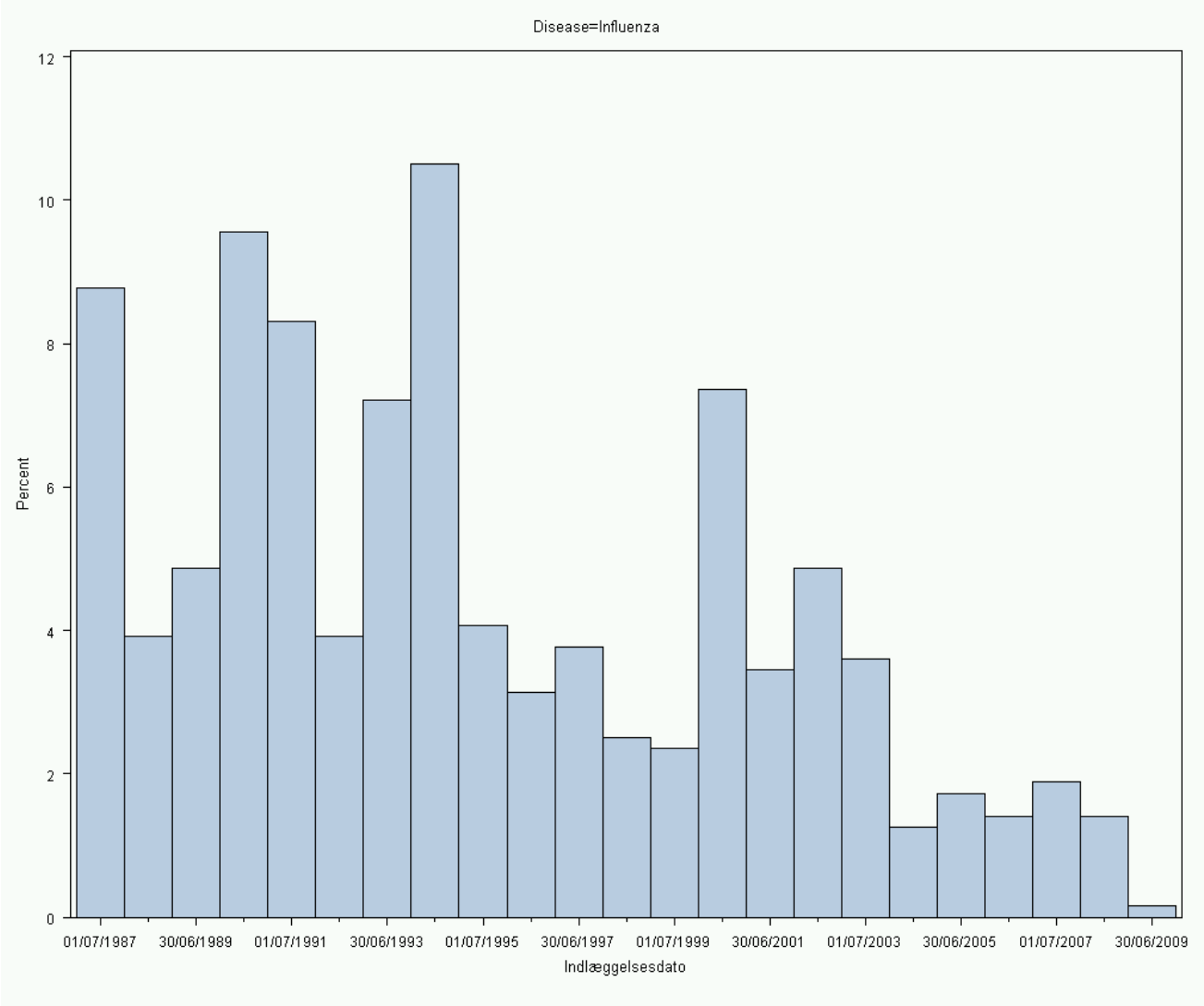
- Syndromic surveillance
  - Respiratory tract infections
  - Diarrheal diseases
  - Skin infections
- Specific infections
  - Influenza
  - Brucella
  - Echinococcus
  - Rabies
  - Toxoplasmosis
  - Trichinella
  - Q fever

Respiratory infections in the Hospital Register

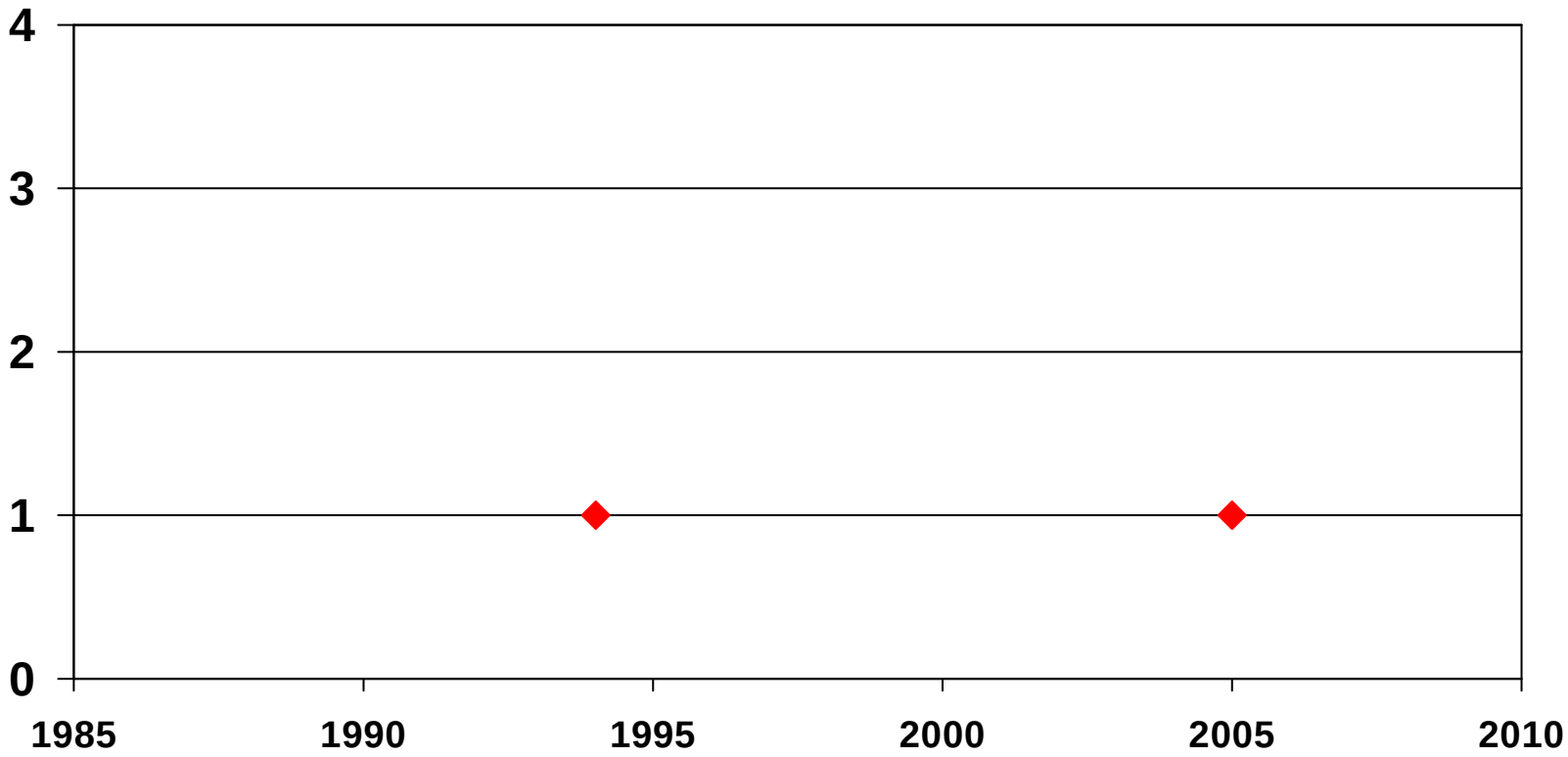
Number of respiratory tract infections and other respiratory related disease hospitalisations registered in the Greenlandic Hospital Register 1987 - 2007 (no. per year per 100.000 in brackets)

			Respiratory tract infections							
	Population		Upper resp. infections		Pneumonia		Influenza		Other resp. diagnoses	
Asiaat	3.413		476	(680)	629	(899)	13	(19)	300	(429)
Ilulissat	4.697		392	(407)	490	(509)	17	(18)	180	(187)
Ittoqqortoormiut	539		77	(697)	254	(2299)	17	(154)	93	(842)
Maniitsoq	3.809		414	(530)	564	(722)	15	(19)	210	(269)
Nanortalik	2.547		186	(356)	383	(734)	58	(111)	111	(213)
Narsag	2.082		212	(497)	286	(670)	14	(33)	75	(176)
Nuuk	13.693		1.479	(527)	1.676	(597)	51	(18)	800	(285)
Paamiut	2.197		217	(482)	282	(626)	34	(75)	85	(189)
Qaanaaq	860		139	(788)	358	(2031)	83	(471)	59	(335)
Qaqortoq	3.487		248	(347)	377	(527)	27	(38)	101	(141)
Qasigiannguit	1.543		172	(544)	238	(752)	14	(44)	189	(598)
Qeqertarsuag	1.110		122	(536)	164	(721)	16	(70)	35	(154)
Sisimiut	5.563		391	(343)	605	(531)	15	(13)	167	(146)
Tasiilaq	2.963		357	(588)	1.251	(2060)	92	(151)	99	(163)
Upernavik	2.777		195	(343)	179	(314)	25	(44)	67	(118)
Uummannaq	2.649		190	(350)	269	(495)	12	(22)	137	(252)
Total	53.929		5.267	(476)	8.005	(724)	503	(45)	2.708	(245)

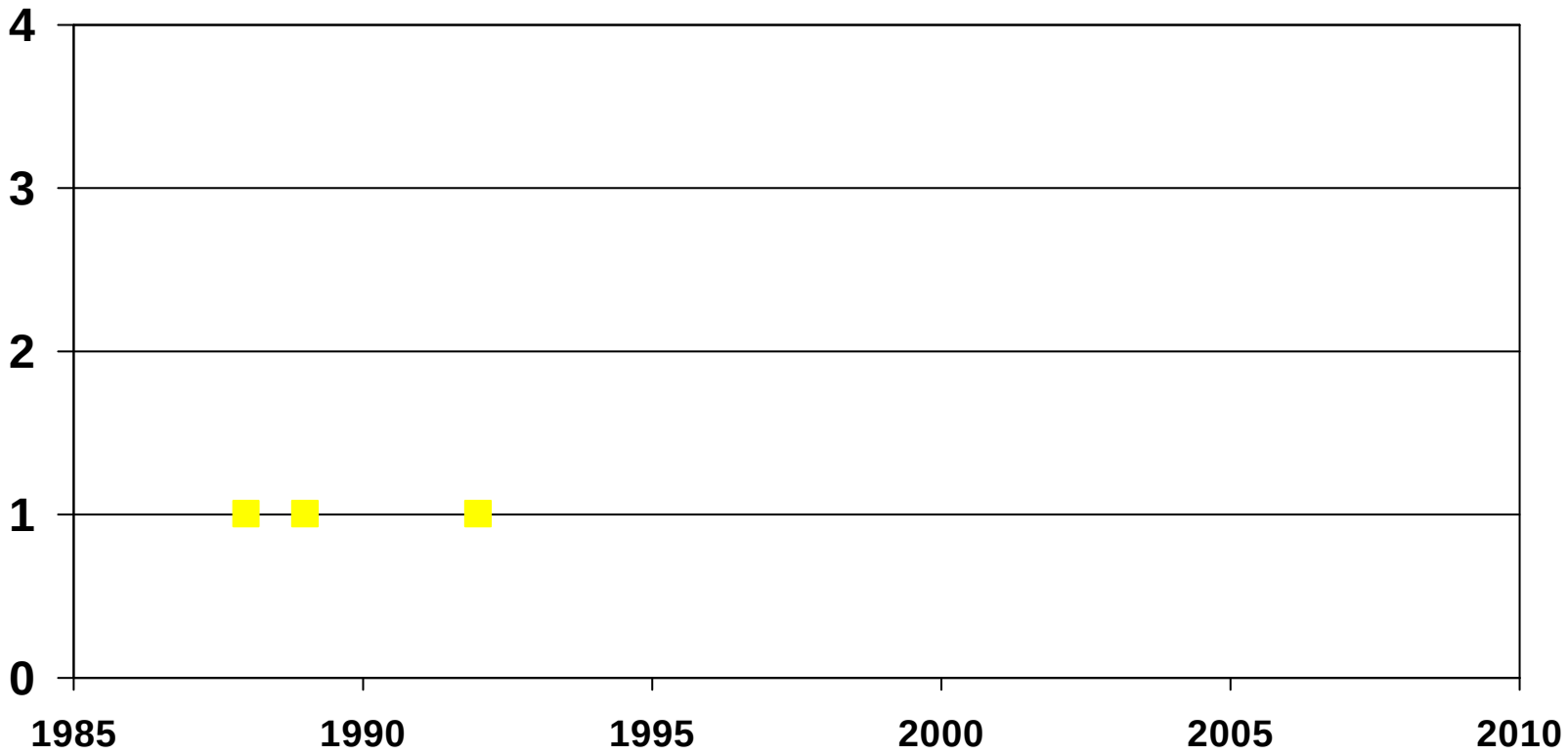
Hospital register: Influenza



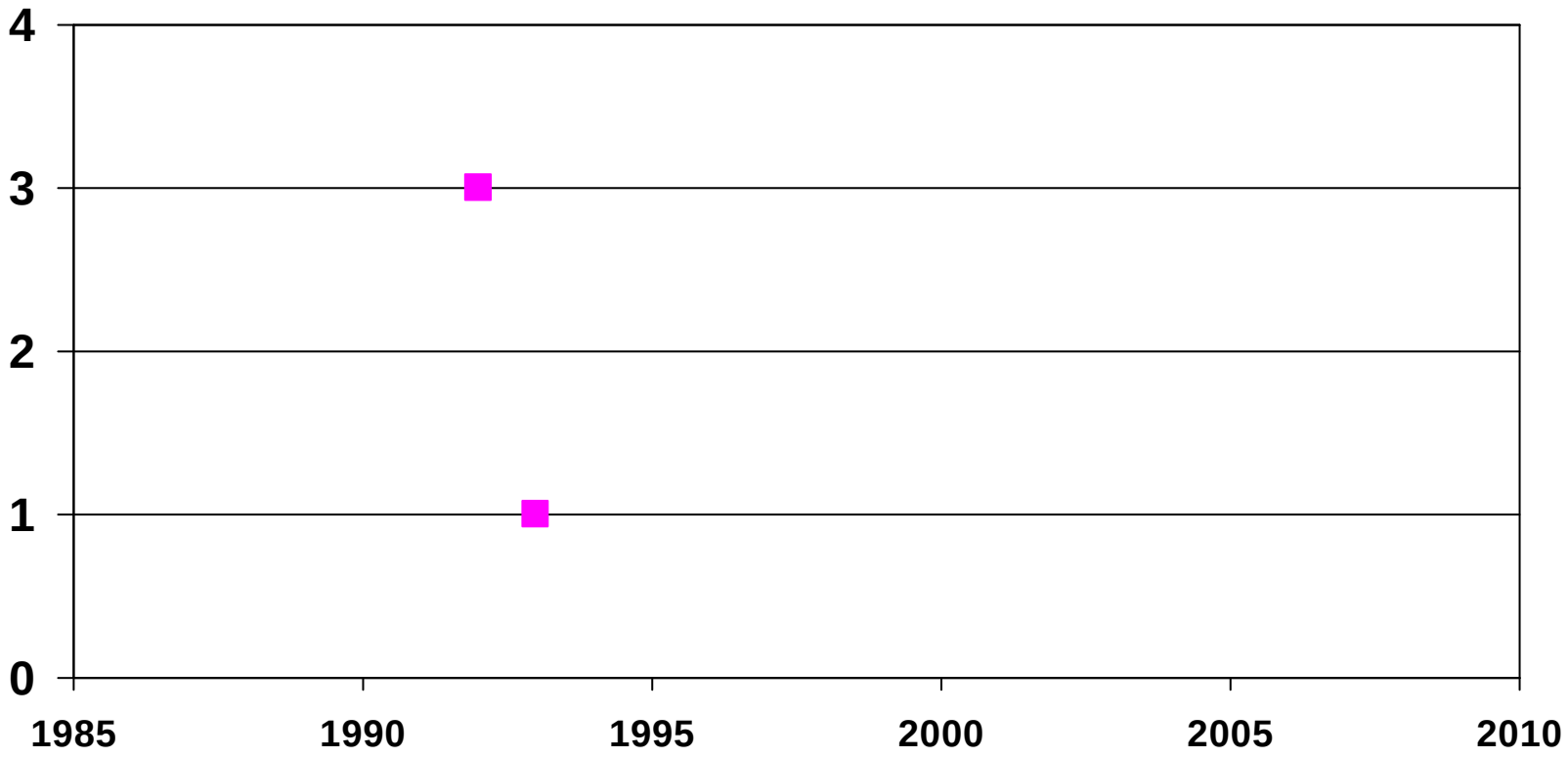
Hospital register: Brucella



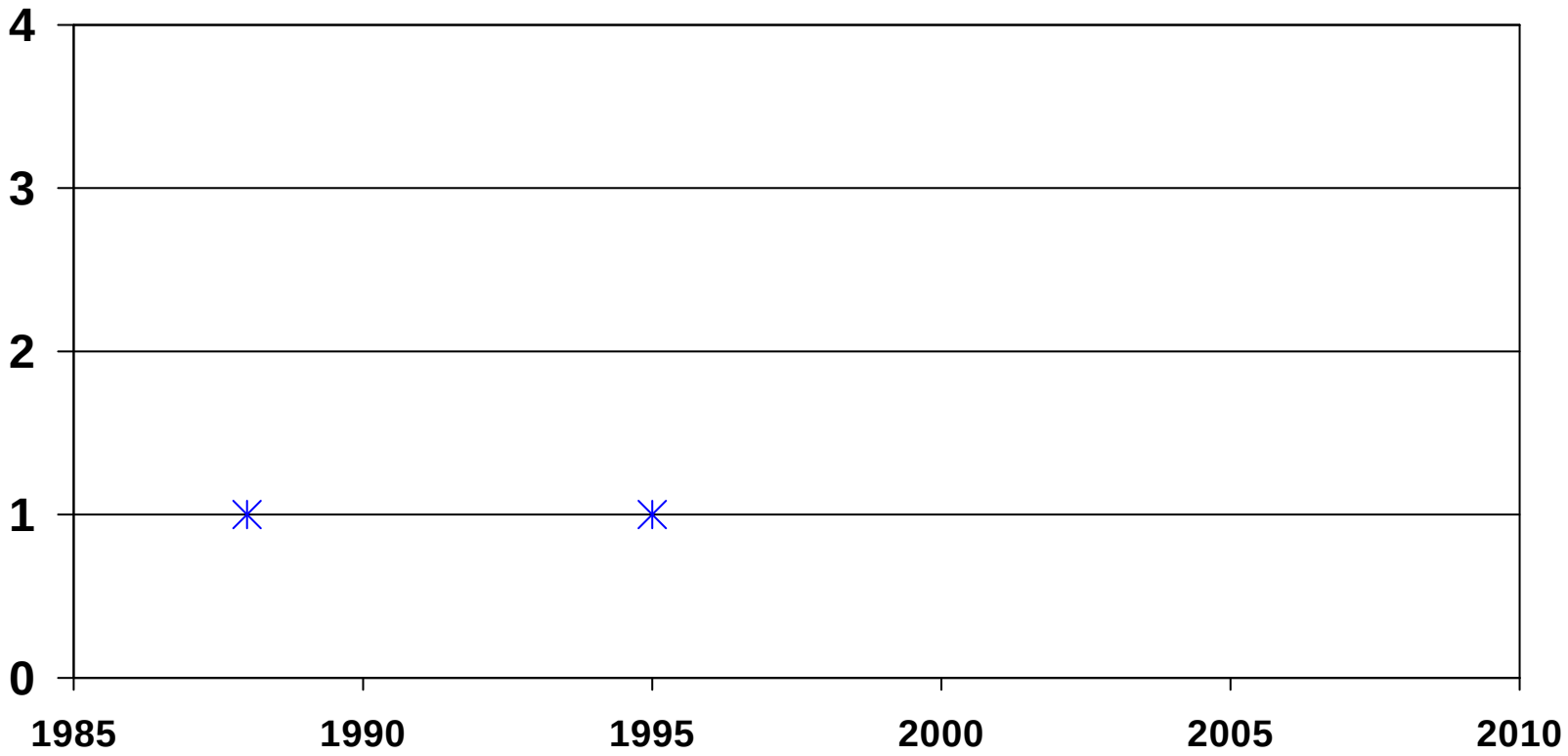
Hospital register: Echinococcus



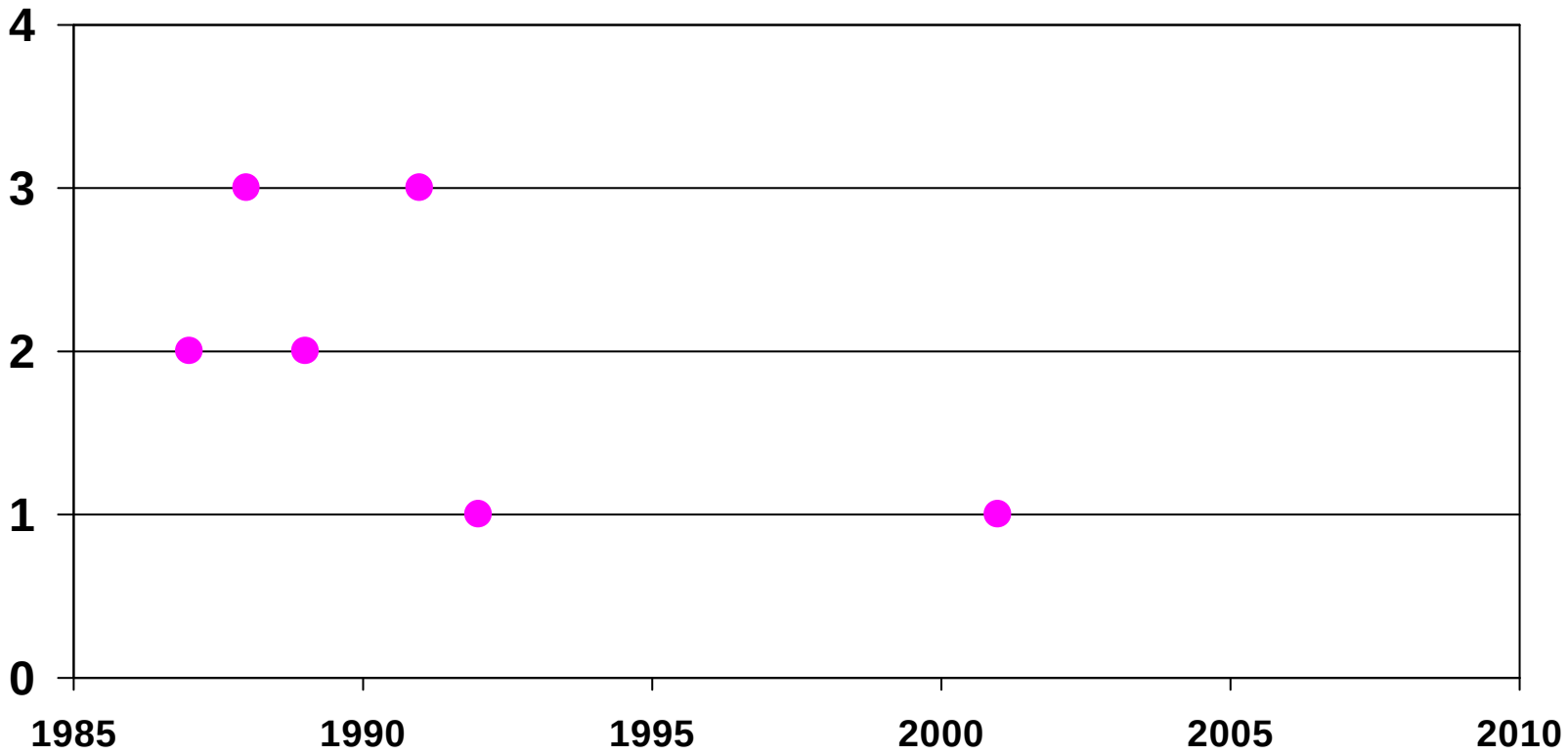
Hospital register: Rabies



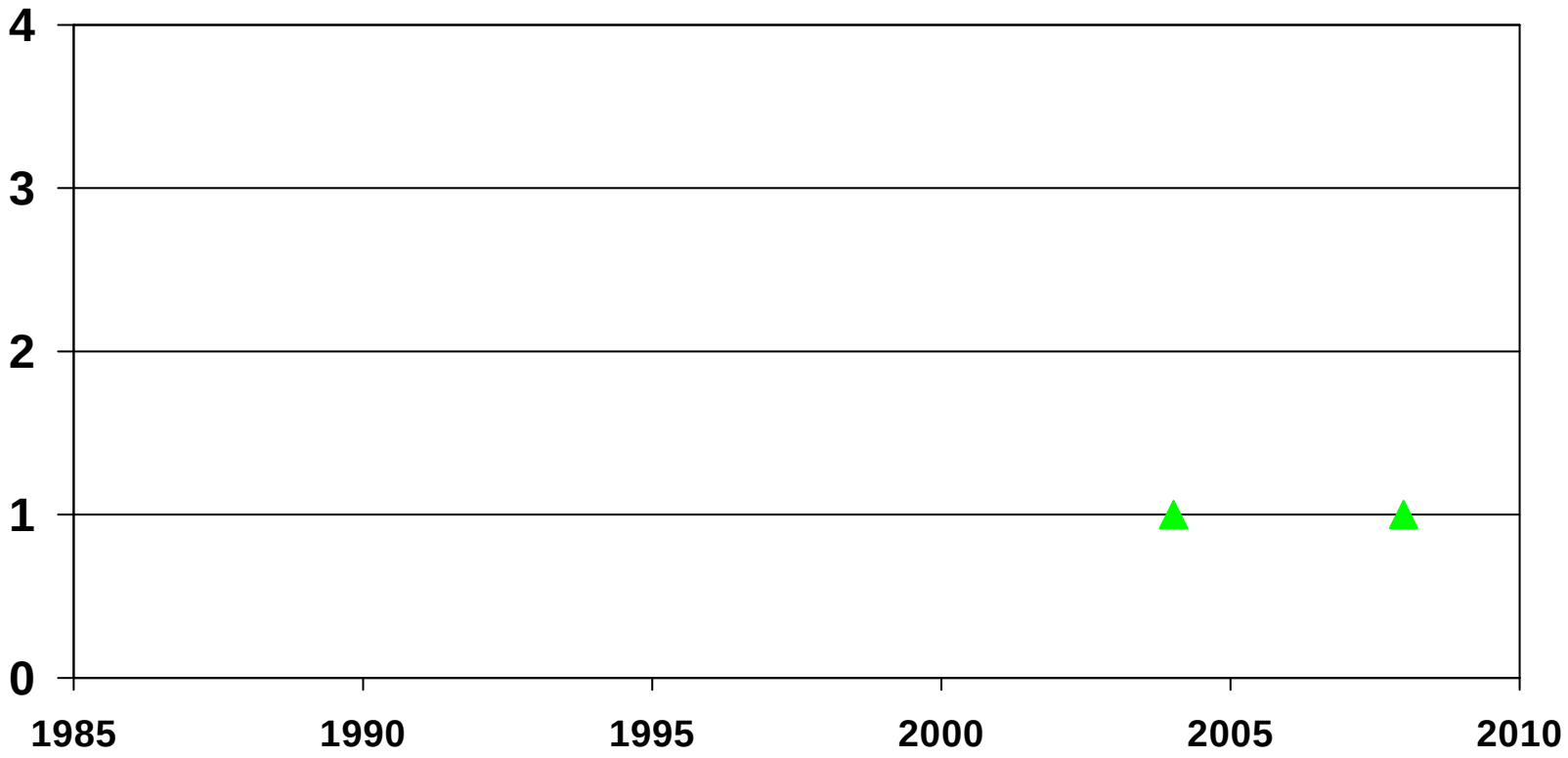
Hospital register: Toxoplasmosis



Hospital register: Trichinellosis



Hospital register: Q fever



Q fever in Greenland

- EID March 2010
- First confirmed case of Q fever in Arctic areas
- Questions validity of previous diagnoses

Q Fever in Greenland

Anders Koch, Claus Bo Svendsen, Jens Jørgen Christensen, Henning Bundgaard, Lars Vindfeld, Claus Bohn Christiansen, Michael Kemp, and Steen Villumsen

We report a patient with Q fever endocarditis in a settlement in eastern Greenland (Isortoq, Ammassalik area). Likely animal sources include sled dogs and seals. Q fever may be underdiagnosed in Arctic areas but may also represent an emerging infection.

Q fever is a zoonosis caused by the small intracellular bacterium *Coxiella burnetii*. Main reservoirs for this bacterium are cattle, goats, and sheep, although a wide range of animals may be infected (*1*,*2*). *C. burnetii* can survive in a spore-like form under harsh conditions (*2*).

In animals, *C. burnetii* infection is often latent; the bacteria may be persistently shed into the environment, especially at the time of giving birth (*2*). In humans, most acute cases result in asymptomatic or mild influenza-like disease; severe disease develops in a few patients. Primary manifestations include pneumonia, hepatitis, and fever of unknown origin.

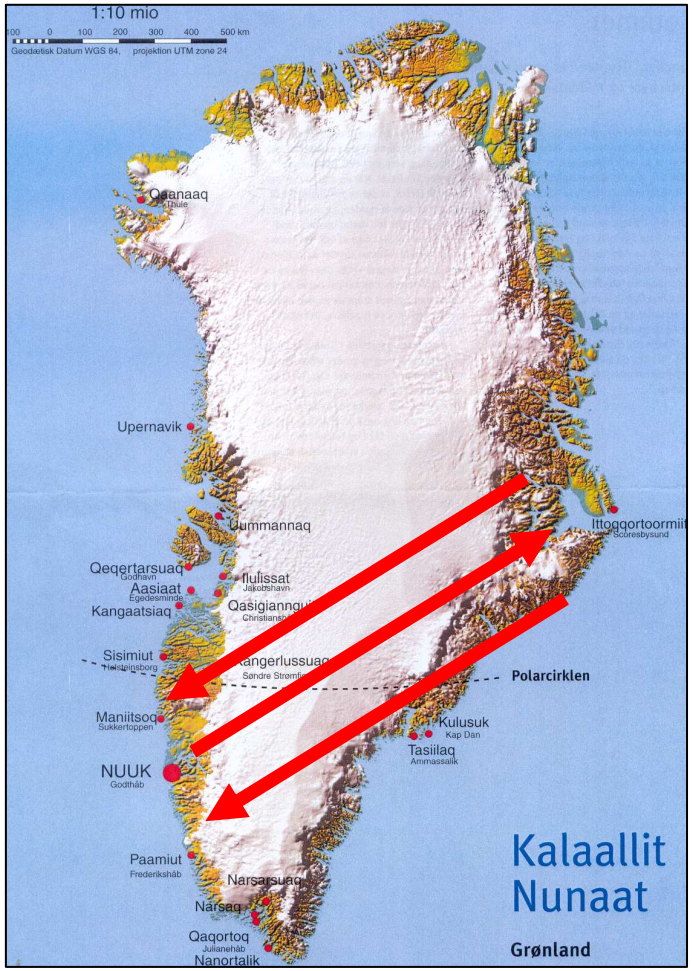
Q fever has been described in >59 countries (*1*) but not in Arctic areas. We report a patient with Q fever in Greenland.

The Patient

The patient, a 40-year-old man, who resided in Greenland all his life, lived in Isortoq (population 100), a small settlement in the Ammassalik area (population 3,000) of eastern Greenland (Figure). He had worked as a hunter and a sanitation worker (garbage collector). The Ammassalik area includes the main town of Tasiilaq and 5 settlements. Isortoq is located on an island off the coast of Greenland. Access is by helicopter, boat during the summer, and dog sleds and snowmobiles during the winter. The main occupation is hunting, especially of seals, which are consumed locally. All other food is imported though Tasiilaq. All imported meat is frozen, and only ultra-high-temperature–pasteurized milk is available. Terrestrial mammals in the area include sled dogs, polar foxes, and a few domesticated cats. Sea mammals include seals and walruses. Polar bears are abundant throughout eastern Greenland; the nearest sheep, horses, and musk oxen are >1,000 km away. There are no cows and goats in Greenland.

Microbiology in Greenland

- Microbiological laboratory only in Nuuk (DIH)
- Confirmation/typing Denmark (RH, SSI)
- Long sample shipping distances
- Harsh shipping conditions
- Long answering time
- Reporting bias



Water quality

- Routine microbiological and physical control of drinking water 4 times per year all towns

Pop. based serum banks in Greenland stored at Statens Serum Institut

• 1979-81	6,500	Children & adults
• 1987	5,600	Adults
• 1996-98	400	Children
• 1998	2,800	Children & adults
• 2000	1,000	Children
• 2004	1,000	Children & adults

Interest, potential collaboration and funding

COP15 CLIMATE GREENLAND

COP15 | Klimaforandringer | Klimaforskning | Udfordringer og muligheder | Klimapolitik

Havet Torsken Vandkraft Indlandsisen Kyoto Grøn IT Solenergi
Landbrug Sejlruter Grønland og klimaet COP15-resultat Fangerne Isbjørn

NEWS | CALENDAR

News from Greenlandic newspapers
News on climate in Greenland and the Arctic

COP16 i Mexico
Følg med på den officielle hjemmeside

Pressemeddelelser på Nanoq.gl
Læs taler og pressemeddelelser fra COP15

Københavner-erklæringen
Verdens ledere blev enige om "Copenhagen Accord" på sidstedagen af COP15.

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Forside » Klimaforskning » Aktører » Klimaforskningscentret i Grønland

Klimaforskningscentret i Grønland

Fredag den 1. maj 2009 åbnede Klimaforskningscentret i Grønland. I spidsen for centret står professor og marinbiolog Søren Rysgaard.

Der er tale om et tværvidenskabeligt forskningscenter forankret på Grønlands Naturinstitut i Nuuk. Centret skal etablere en grundlæggende viden om klimaet i de polare egne og fokusere på effekterne af klimaændringerne i området, herunder vurdere sårbarhed og tilpasning til klimaændringer, samt hvordan de menneskeskabte klimaændringer kan begrænses.

Centret skal hvert år arrangere en international konference om klimaforskning i Grønland.

Aftalen er indgået mellem videnskabsminister Helge Sander og Grønlands tidligere medlem af Naalakkersuisut for forskning Tommy Marø.

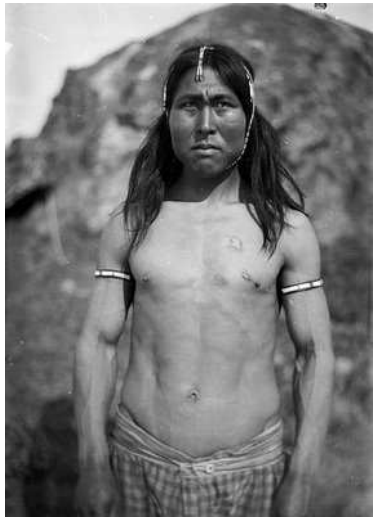
Klimaforskning

- Målestationer
- Iskerneboringer
- Klima og samfund
- Climate Congress
- Beyond Kyoto
- Nuuk Climate Days
- Aktører
  - Grønlands Naturinstitut
  - Asiaq, Grønlands Forundersøgelser

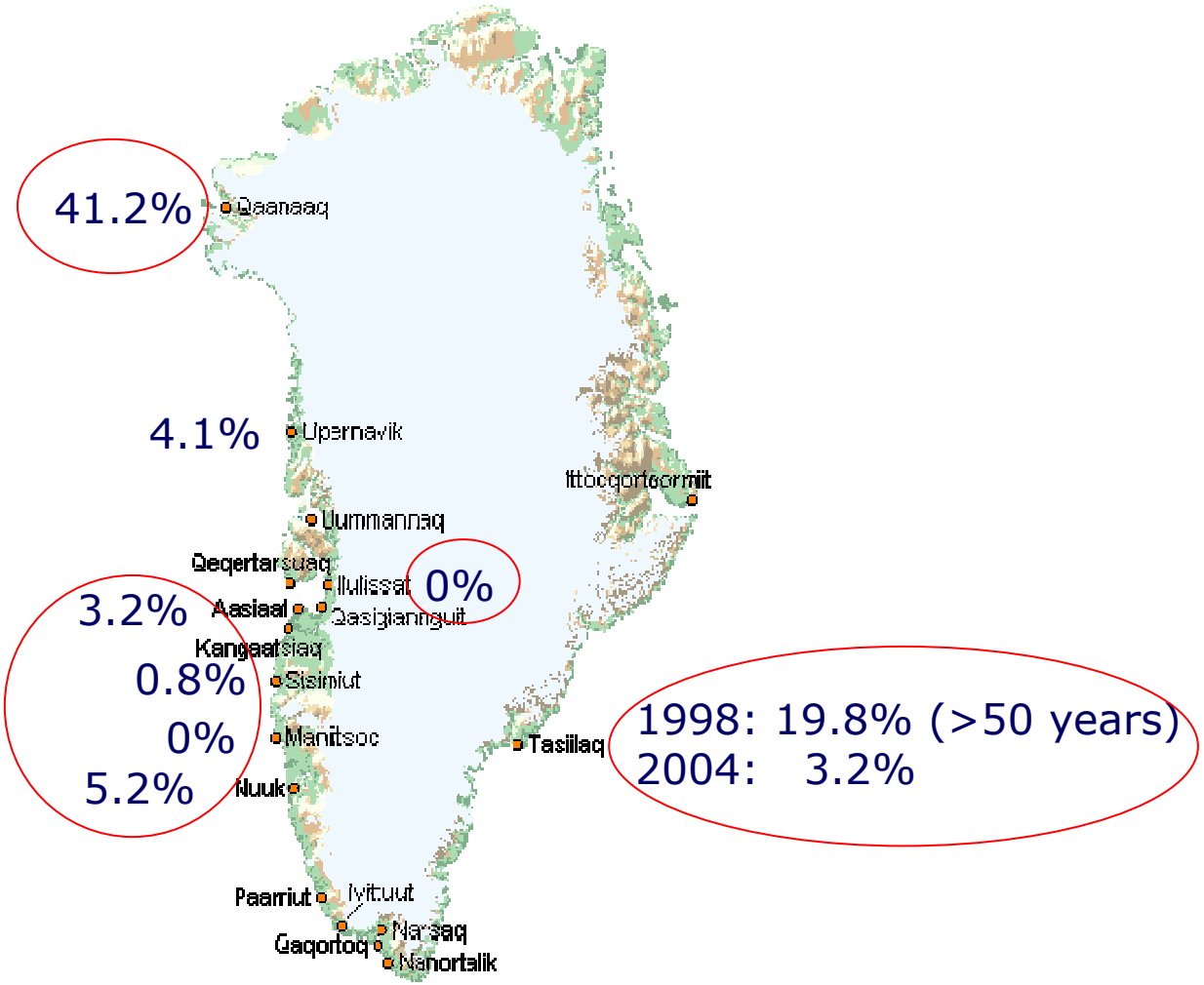
Animal samples

- Meat samples from sea mammals, game, etc. collected all over Grenland and stored in Nuuk

Confounding factors: Temporal trends in Greenland



Trichinella seroprevalence 1998-2004

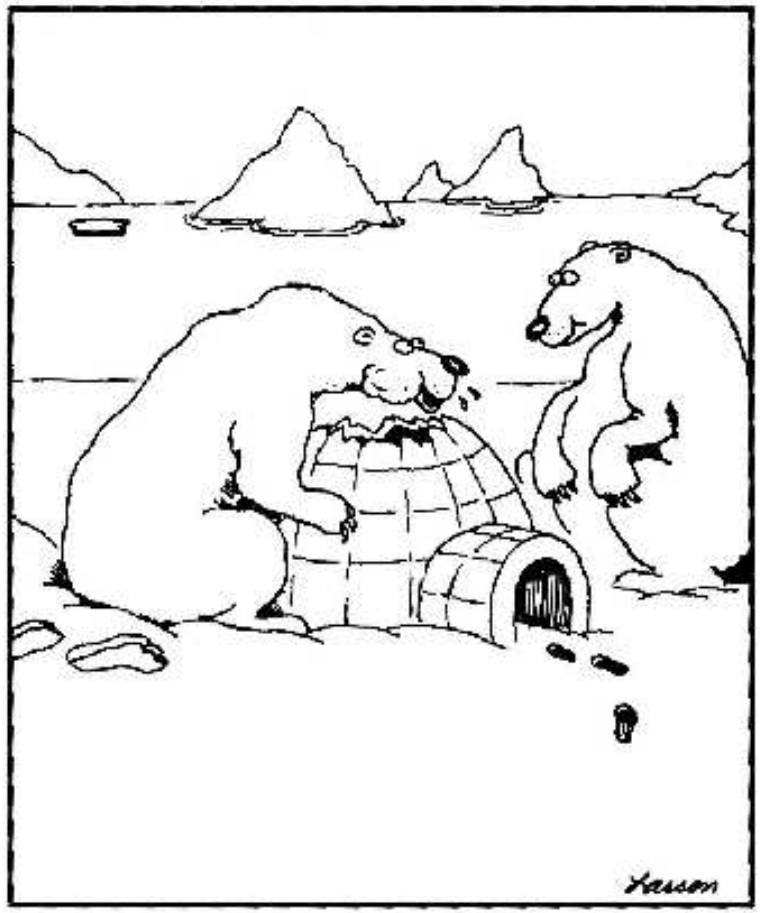


Møller et al. 2004

Conclusions

- Few existing studies on climate changes and health, none on infectious diseases
- Little research currently undertaken
- Register-based information useful for syndromic surveillance, not for rare diseases, needs improvement
- Serum banks dating back to 1979 may be useful for antibody studies
- Other sources of surveillance water and meat samples
- Changing lifestyle confounding factor

Thank you for your attention



"Oh, hey! I just love these things! ... Crunchy on the outside and a chewy center!"