

## Carcinogenesis

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MD PhD

## What about?

- Global burden of cancer
- Breast cancer: causes and prevention

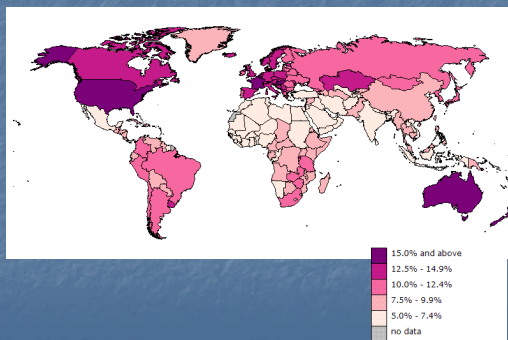
## Getting Cancer

- Most common cancers involve epithelial tissue
- Rapid increase with age
- Most types occur more often in men than in women
- Developing countries: younger population, with less frequent cancer and earlier age at diagnosis

## Getting Cancer

- Risk of developing cancer:
  - USA: 17% before age 65; 27% before age 75
  - Oman: 6% before age 65; 10% before age 75

Cancer risk: The probability of developing cancer before age 65 (2002)



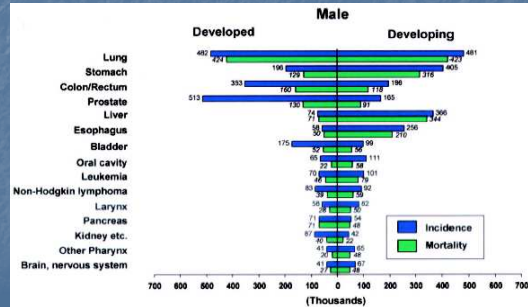
## Major Cancer Types in males

- Developed Countries
- Developing Countries

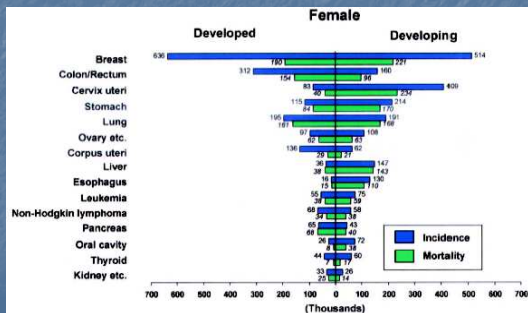
## Major Cancer Types in females

- Developed Countries
- Developing Countries

## Worldwide estimated number of new cases and deaths, in men (2002)



## Worldwide estimated number of new cases and deaths, in women (2002)



## Five leading cancer types for incident cases (in thousands), Worldwide (2002) and UK (2005)

Males Worldwide UK

Females Worldwide UK



## Five leading cancer types for deceased cases (in thousands), Worldwide (2002) and UK (2006)

**Males**

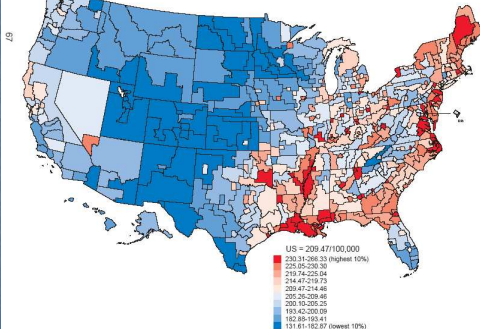
Worldwide	UK
Lung (848)	Lung (20)
Stomach (446)	Prostate (10)
Liver (417)	Colorectal (8)
Colorectal (278)	Oesophageal (5)
Oesophageal (261)	Pancreas (4)

**Females**

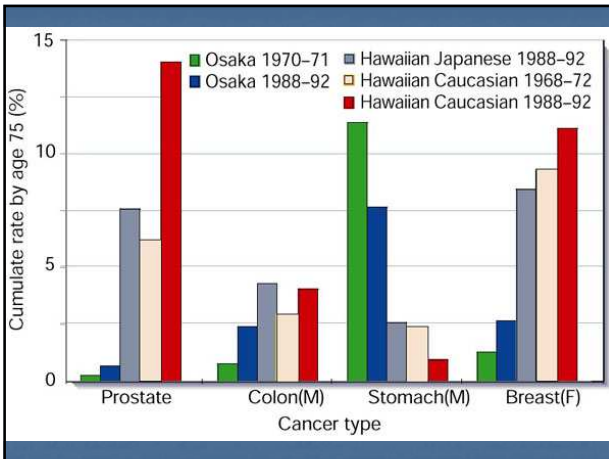
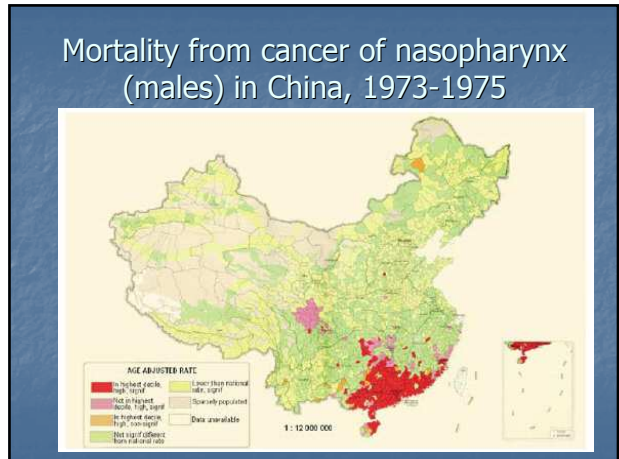
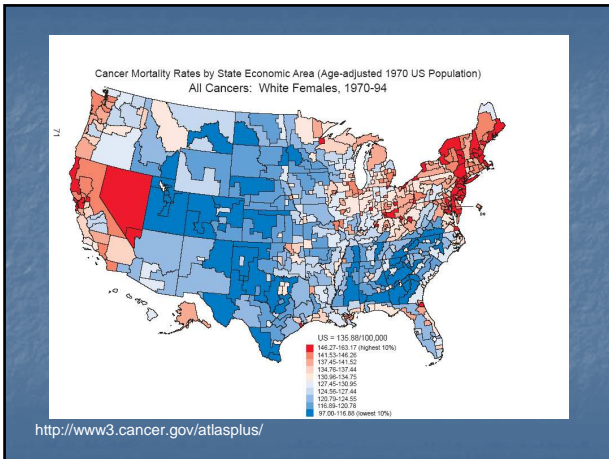
Worldwide	UK
Breast (410)	Lung (15)
Lung (330)	Breast (12)
Cervix uteri (273)	Colorectal (7)
Stomach (254)	Ovary (4)
Colorectal (250)	Pancreas (4)



Cancer Mortality Rates by State Economic Area (Age-adjusted 1970 US Population)  
All Cancers: White Males, 1970-94

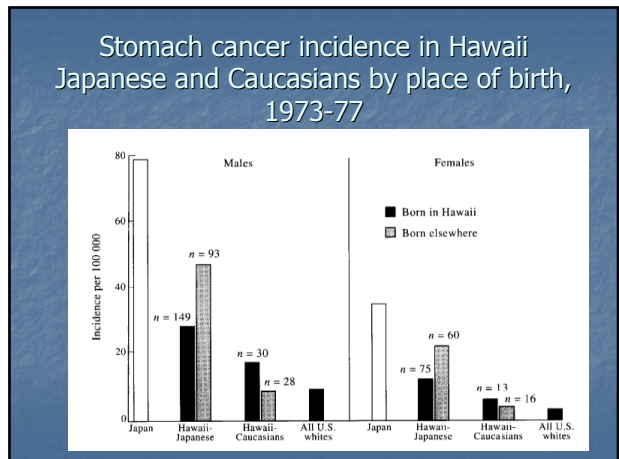
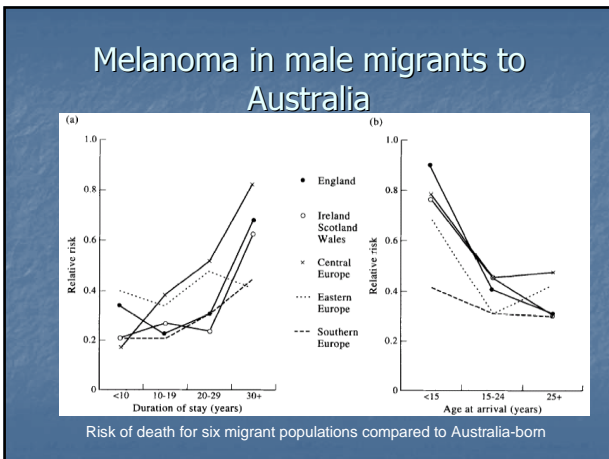


<http://www3.cancer.gov/atlasplus/>



Migrant studies

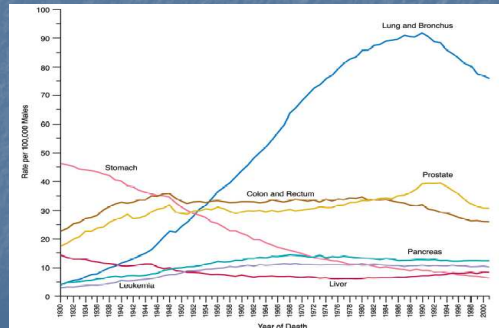
- Extent and rate of change that are informative
  - A rapid change in risk following migration
  - A slow change
- Persistence of rates between generations





## Common reasons for secular trends in cancer rates

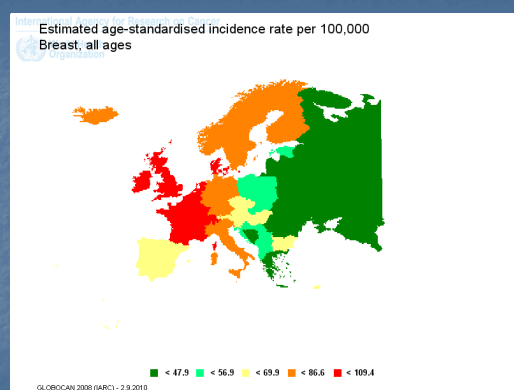
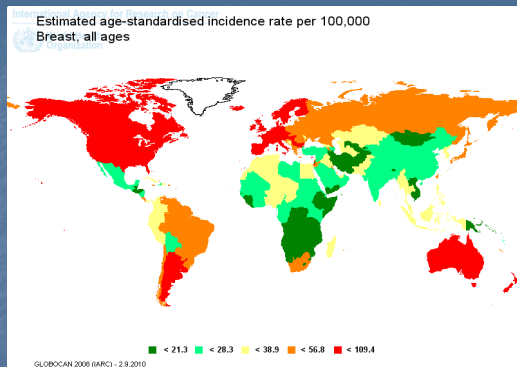
## Cancer death rates for selected cancer types among males, US, 1930-2001



## Geographical diversity

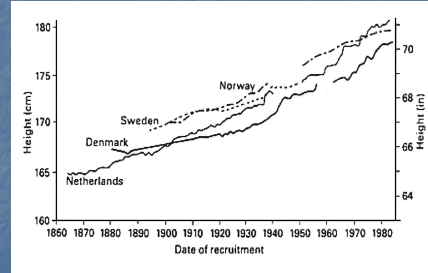
- Cancer is universal, but types of cancer show a very different pattern according to where you live
- Migrant studies: differences are largely based on environment-lifestyle habits, not due to ethnic or genetic differences

- Global burden of cancer
  - 12 million new cases a year, 1 million breast
  - Large geographical differences
  - Cancer patterns are strongly related to lifestyle
- Breast cancer: causes and prevention



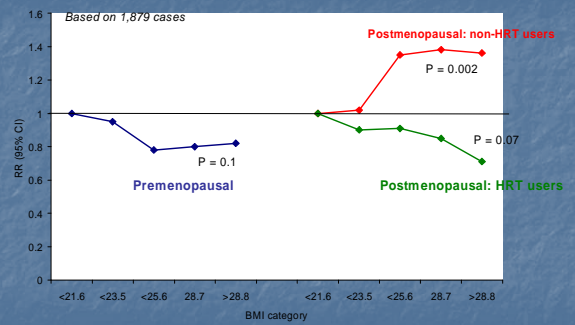
## Risk factors for breast cancer (1)

## Trends Towards Greater Adult Body Height



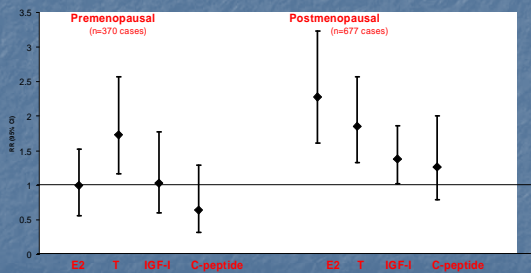
## Risk factors for breast cancer (1)

## BMI and breast cancer in EPIC



Source: Lahmann, IJC, 2004;111:762-771

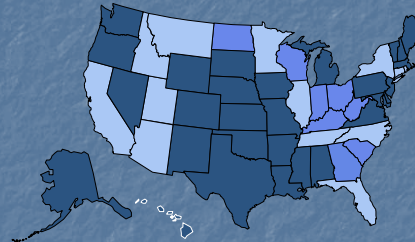
## Hormones, C-peptide and breast cancer in EPIC: High vs. Low serum levels



Source: Kaaks et al, JNCI;97:755-65; Kaaks et al, ERC, 2005;12:1071-82; Verheus et al, IJC, 2006;119:659-667.

## Obesity Trends\* Among U.S. Adults

BRFSS, 1985  
(\*BMI ≥30, or ~30 lbs. overweight for 5' 4" person)

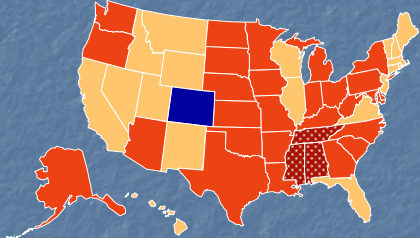


Legend: No Data, <10%, 10%-14%

## Obesity Trends\* Among U.S. Adults

BRFSS, 2007

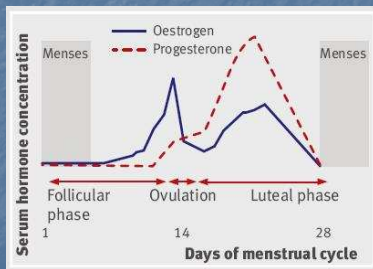
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



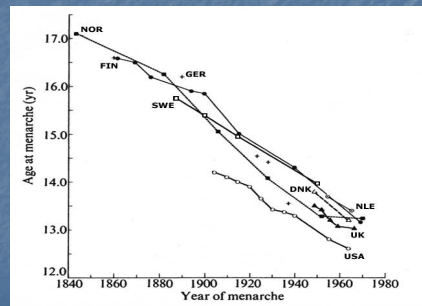
## Risk factors for breast cancer

(2)

## MacMahon and Cole: Oestrogens



## Trends Towards Earlier Menarche



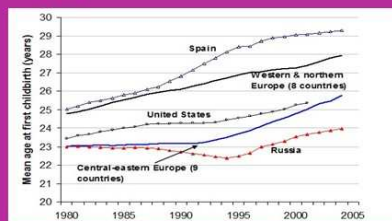
From: J.M. Tanner *Nature* 243: 95-96 (1973)

## Risk factors for breast cancer

(2)

### Demography Matters

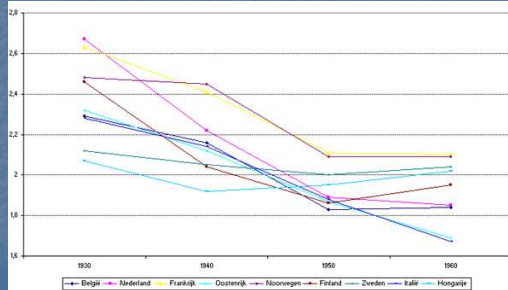
### The Tempo or Postponement Effect



Sources: Council of Europe, Eurostat, National Statistics Offices



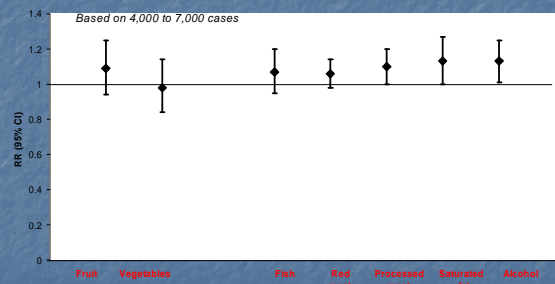
## Mean number of children for women of specific birth cohorts



## Risk factors for breast cancer (2)

## Risk factors for breast cancer (3)

## Diet and breast cancer in EPIC: High vs. Low intake

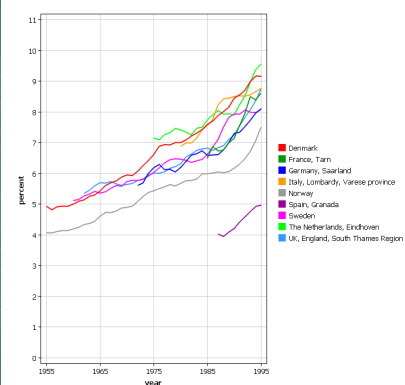


Source: van Gils et al. JAMA 2006;293:183-93; Engeset et al. IJC 2006;119:175-82; Pala et al. AJCN 2009;90:609-12; Sieri et al. AJCN 2008;88:1304-12; Tjønneland et al. CCC 2007;18:361-73.

## Figures and Facts of Breast Cancer

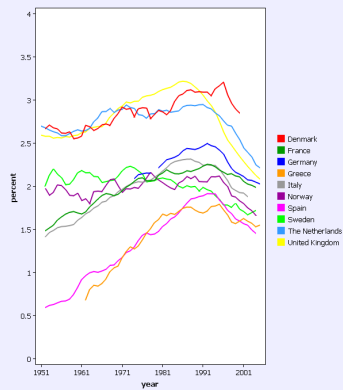
- Most prevalent cancer in women worldwide
- Genes do not explain the observed variation
- A symphony of causes, characterised by westernised lifestyle and urbanisation

## Breast Cumulative Incidence Rate, age [0-74]



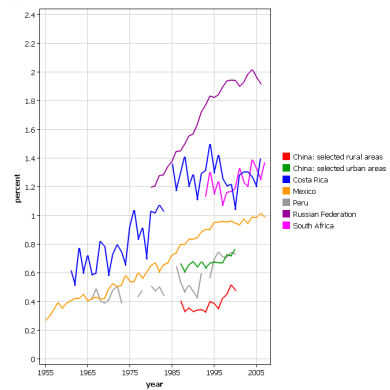
International Agency for Research on Cancer (IARC) - 10.3.2009

Mortality from Breast Cancer  
Cumulative risk, age (0-74)



International Agency for Research on Cancer (IARC), 20.2.2009

Mortality from Breast Cancer  
Cumulative risk, age (0-74)



International Agency for Research on Cancer (IARC), 20.11.2009

## Summary

- Global burden of cancer
  - 12 million new cases a year
  - Large geographically differences
  - Cancer patterns are strongly related to lifestyle
- Breast cancer: causes and EPIC
  - Hormone dependant type of cancer
  - Related to reproductive factors and hormone use
  - Nutrition: no clear relations
  - Postmenopausal obesity related to breast cancer