

# Introduction to Epidemiology

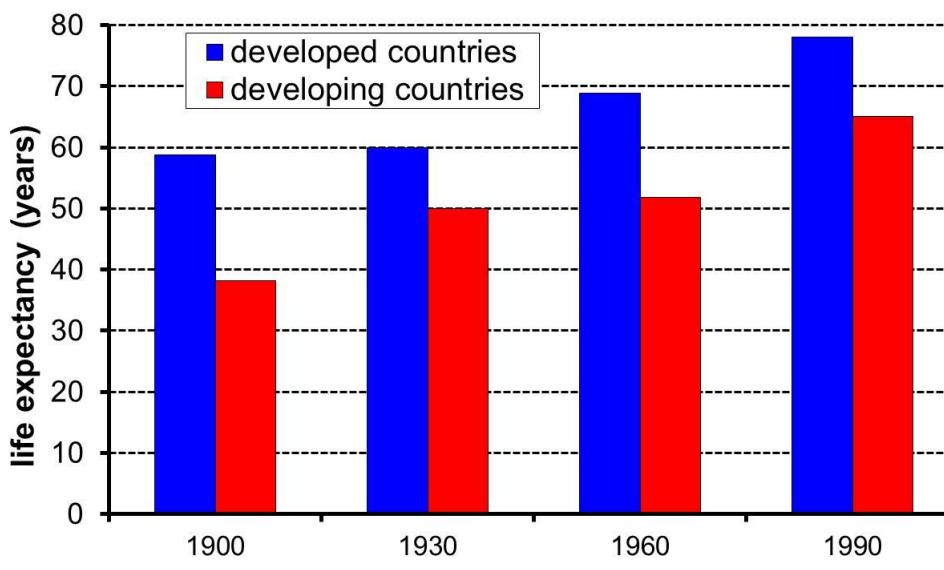
epidemiology = science of prevention  
Epidemiologic Transition

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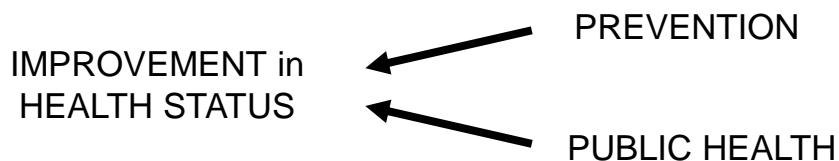
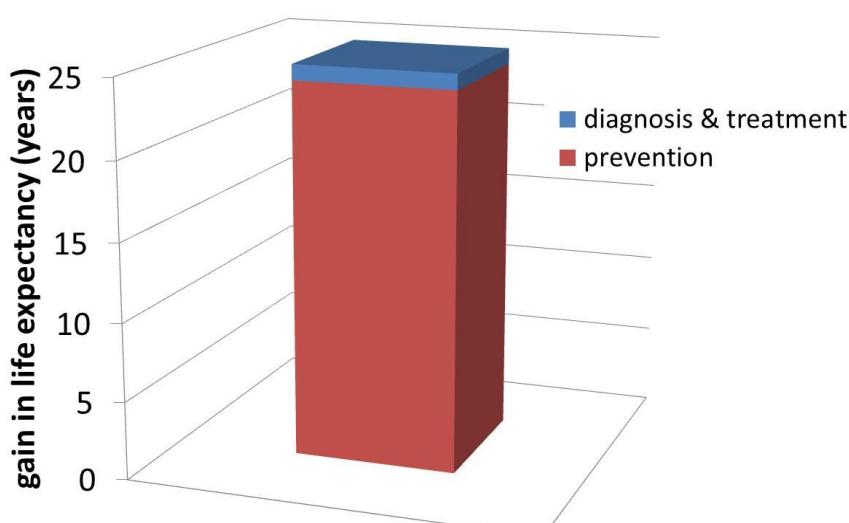
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Life expectancy at birth (*speranza di vita alla nascita*) in developed and developing countries



## Worldwide increase in life expectancy during the 20<sup>o</sup> century



- 1) Infant mortality or life expectancy are poorly related to the number of physicians per 1000 inhabitants.
- 2) Most of the increase in life expectancy, i.e. 24 years out of 25, have been attributed to epidemiologic interventions, prevention and public health.

## DEFINITION of EPIDEMIOLOGY

Epidemiology is the science of prevention.

Epidemiology is the study of the distribution (incidence, prevalence) and determinants (risk factors) of health-related states or events in specified populations, and the application of this study to the control of health problems [Last, 2001].

Clinical medicine → individuals (single patients)  
Epidemiology → populations

## EPIDEMIOLOGY

The word epidemiology comes from the Greek words epi, meaning on or upon, demos, meaning people, and logos, meaning the study of.

pronunciation translation		
επι	epi	on/upon
δημος	demos	people
λογος	logos	study of

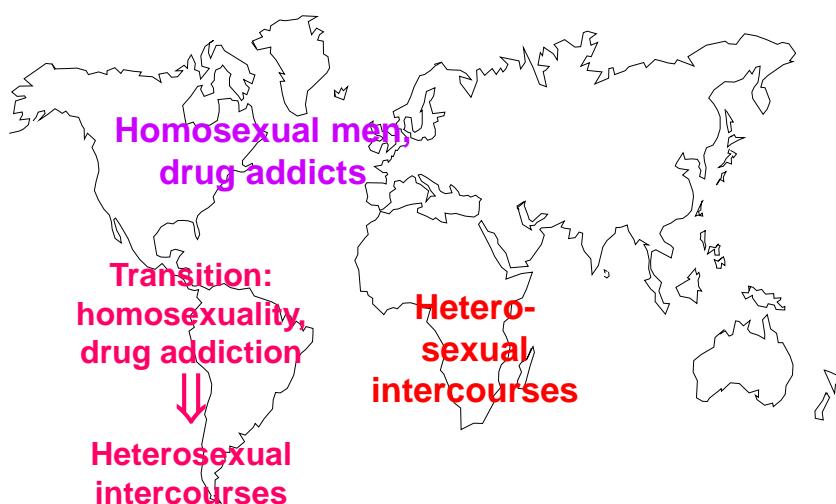


Study on the population

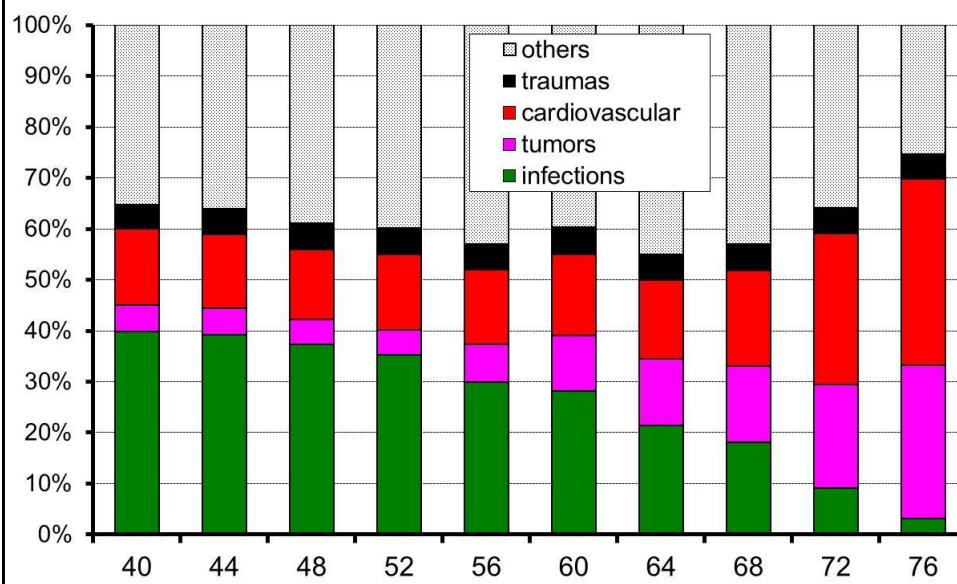
AIDS is a typical example of a disease with strong epidemiological features:

- 1) American statisticians gave an essential contribution to its discovery, as they detected an abnormal increase in *Pneumocysti Carinii* infections among homosexual men.
- 2) While it is not possible to cure AIDS, effective treatments are available. However these antiretroviral therapies have been very expensive till recently, thus limiting their possible use in Developing Countries. Hence, prevention remains the main defense against the disease.
- 3) To implement effective preventive strategies, it is essential to know how the disease is transmitted.

### Routes of transmission in the early stage of HIV pandemic (1988)



## Temporal trend of the main causes of death in industrialized countries



## EPIDEMIOLOGIC TRANSITION

**Infectious diseases**

At the beginning of the 20° century, around 1.5 million people died from smallpox (Italian: vaiolo) every year.

On the 22° of October 1977 a 23-year old cook from Merca, Somalia, developed high fever and skin eruption. He was the last case of smallpox recorded worldwide [World Development Report, 1993].

Smallpox eradication was achieved by prevention (vaccination) rather than by disease treatment.

**Chronic degenerative diseases**

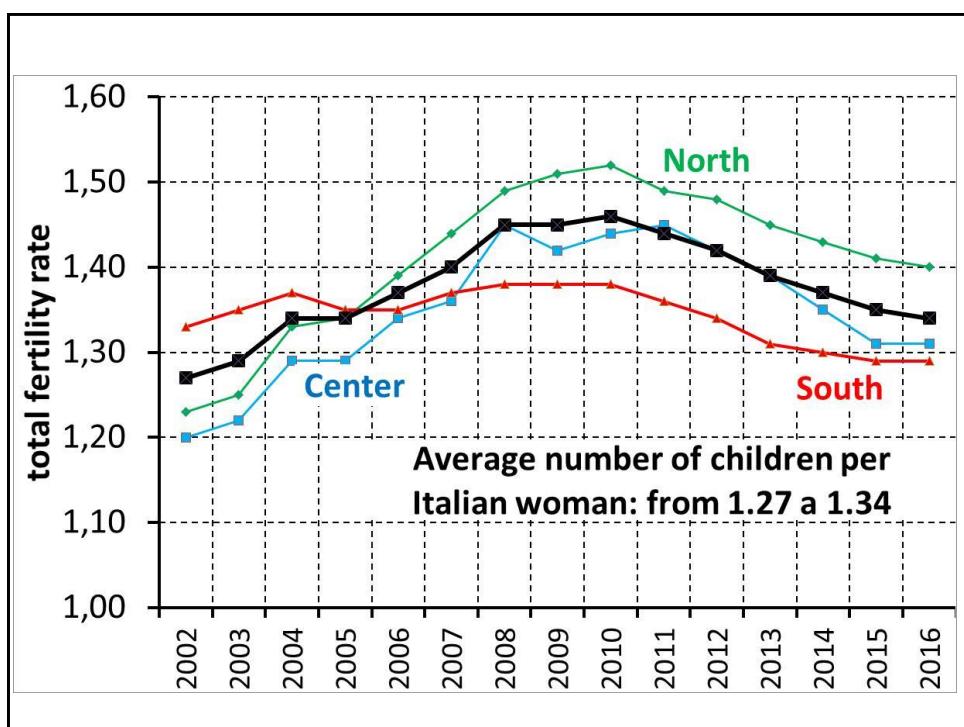
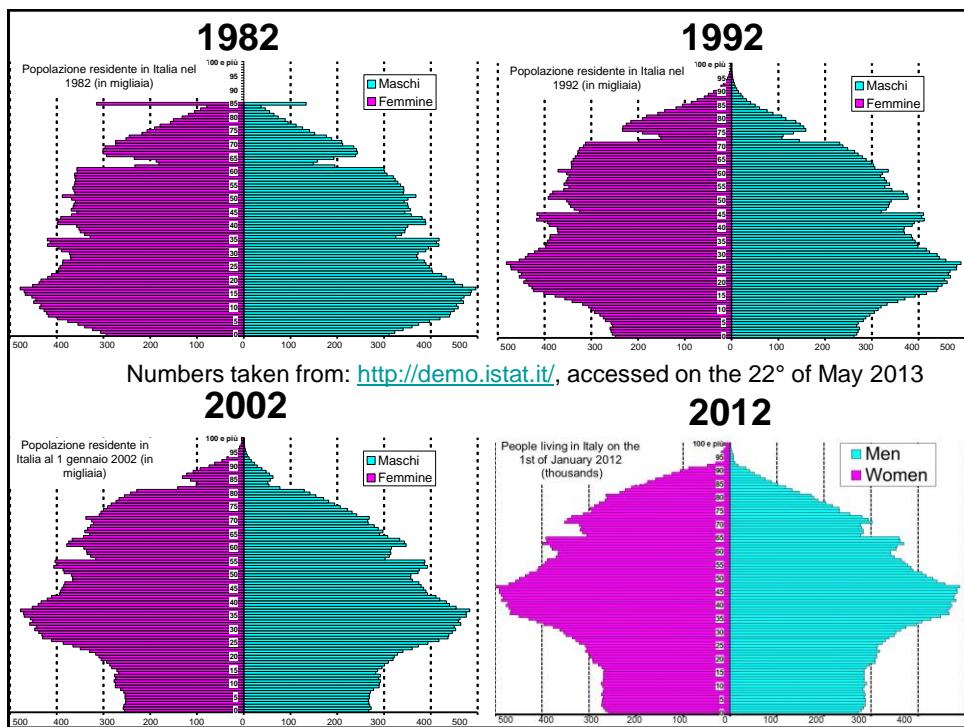
If most chronic degenerative diseases can be treated, but not cured (Italian: guarite), emphasis should be posed on prevention of early onset [WHO World Health Report, 1997].

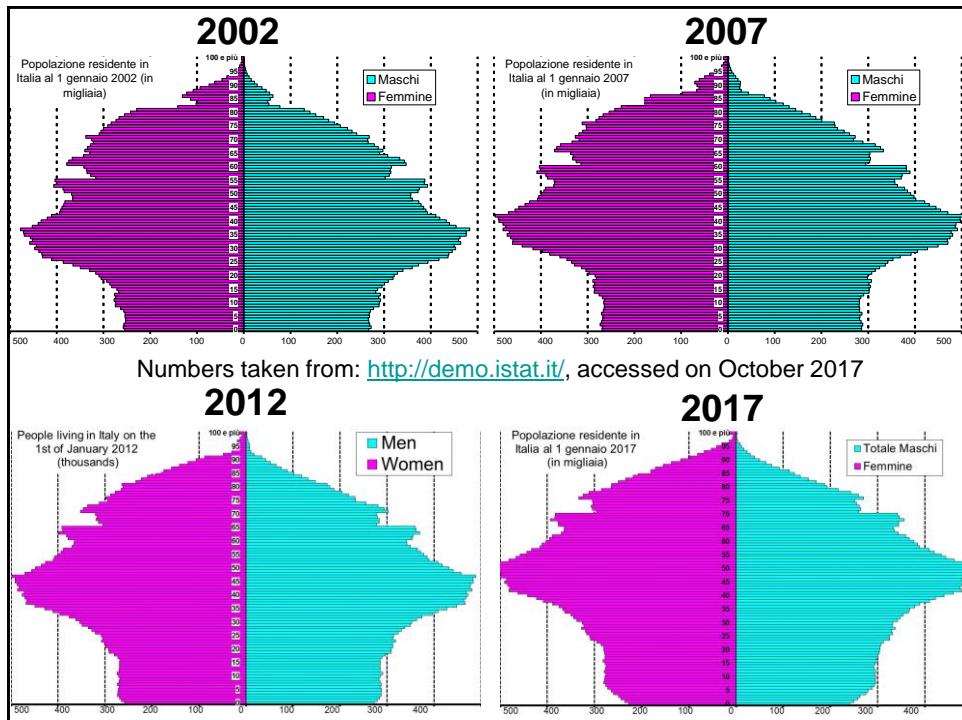
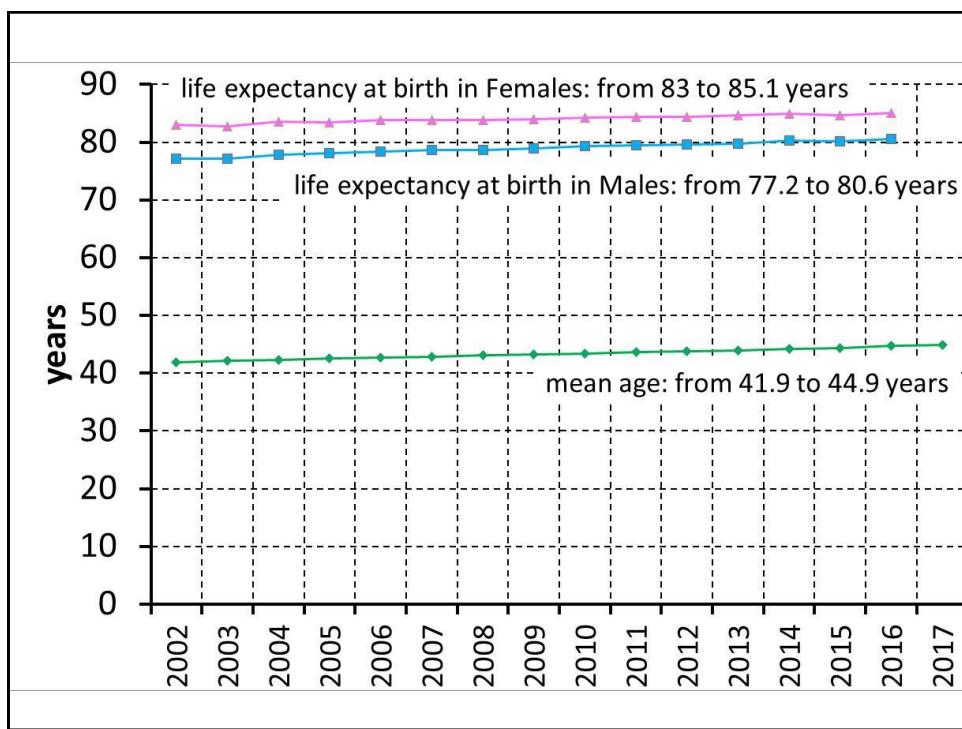
### **Main chronic-degenerative diseases:**

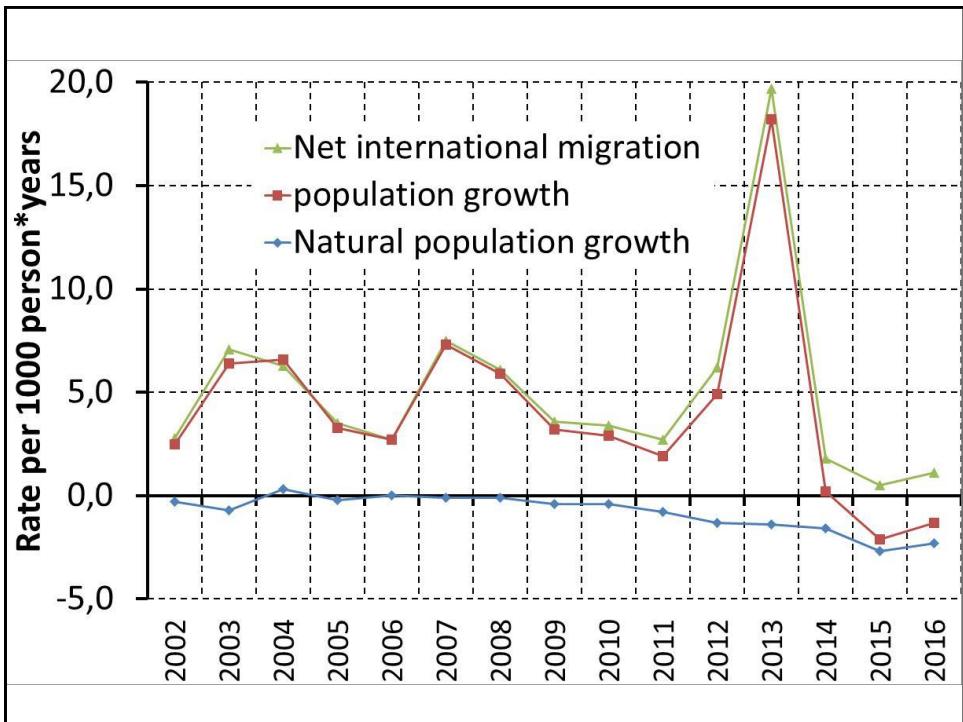
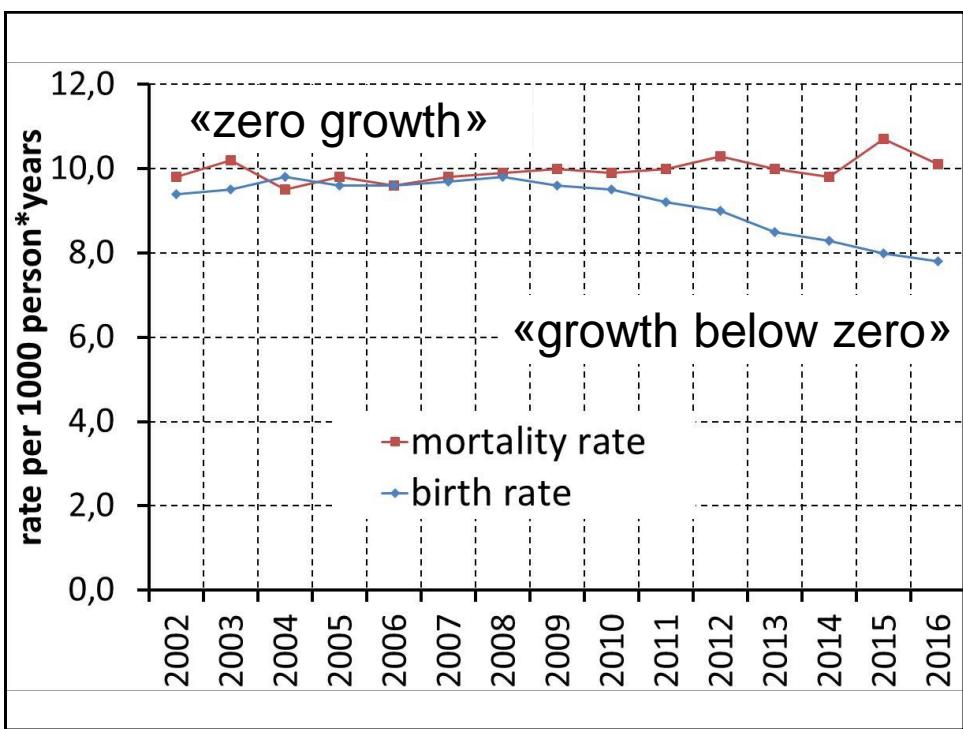
Ischemic heart diseases, cerebrovascular diseases, diabetes, Chronic Obstructive Pulmonary Diseases, osteoarthritis.

In Western Countries, particularly in Italy, the burden of Chronic-Degenerative Diseases and Tumors is increasing further and further increasing, due to **population ageing**.

## **POPULATION AGEING AND EFFECTS ON THE HEALTH SYSTEM**







IL SOLE 24 ORE – 15/6/2015

Istat: popolazione in Italia a crescita zero. Saldo nascite-morti ai minimi dalla Grande Guerra  
La popolazione residente in Italia è sostanzialmente arrivata alla **crescita zero**: i flussi migratori riescono a malapena a compensare il calo demografico dovuto alla dinamica naturale

ISTAT – 19/2/2016

Nel 2015 le nascite sono state 488 mila (-15 mila), nuovo minimo storico dall'Unità d'Italia. Il 2015 è il quinto anno consecutivo di riduzione della fecondità, giunta a **1,35 figli per donna**.

IL FOGLIO – 20/5/2016

**Meno nascite** e più morti: il nostro paese è affetto da un acuto "degiovamento". Sempre meno figli e sempre più a età avanzata

REPUBBLICA – 6/3/2017

Il **livello minimo delle nascite** del 2015, pari a 486mila, è superato da quello del 2016 con 474mila. La riduzione osservata, che a livello nazionale è pari al 2,4%, interessa tutto il territorio. Il numero medio di figli per donna, in calo per il sesto anno consecutivo, si assesta a 1,34.

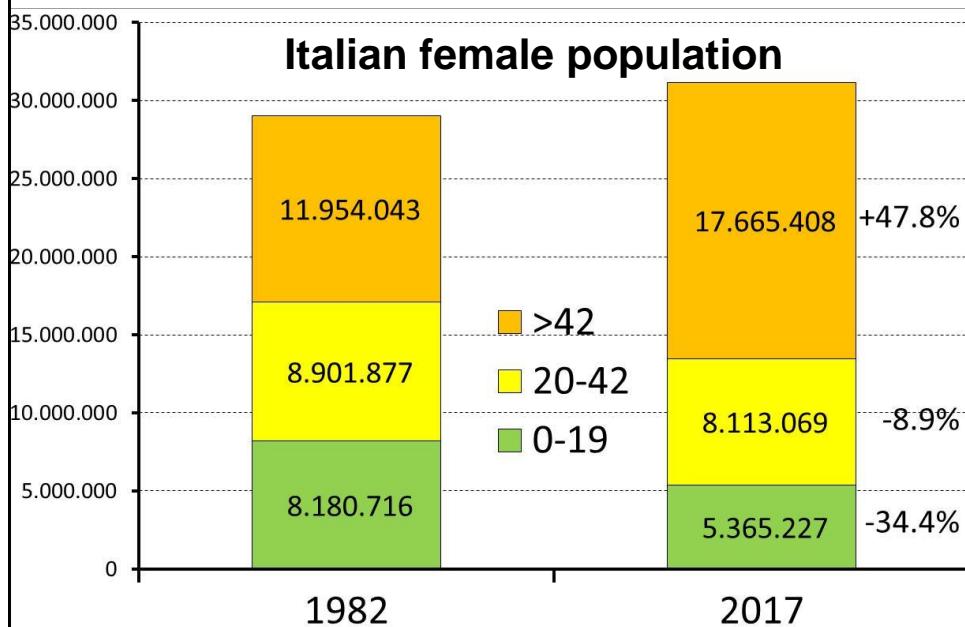
Rispetto all'anno precedente, spiega l'Istat, i tassi di fecondità si riducono in tutte le classi di età della madre sotto i 30 anni mentre aumentano in quelle superiori. La riduzione più accentuata si riscontra nella classe di età 25-29 anni (-6 per mille), l'incremento più rilevante è, invece, nella classe 35-39 (+2 per mille)

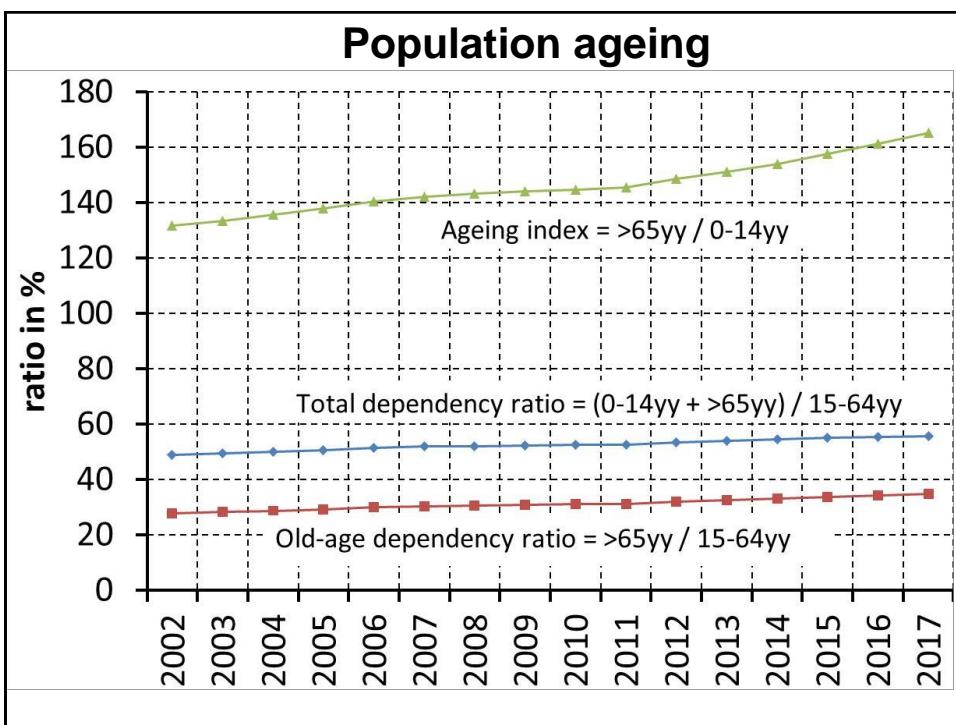


## Macbeth, Shakespeare

- The three witches tell Macbeth: “Be bloody, bold and resolute; laugh to scorn the power of man, for none of woman born shall harm Macbeth.” (IV atto, scena 1)
- On the battlefield Macduff tells Macbeth: “Despair thy charm; and let the angel whom thou still hast served tell thee, Macduff was from his mother’s womb untimely ripp’d.” (V atto, scena 8)

In 2015 Italian women aged 20-42 years bore 96.6% of all neonates.

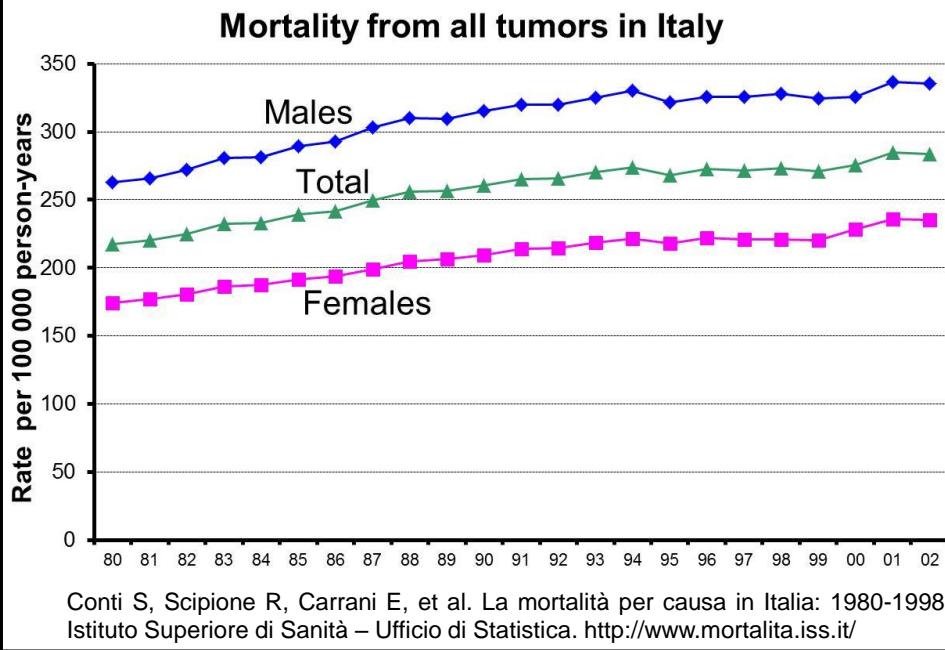




## IN SUMMARY

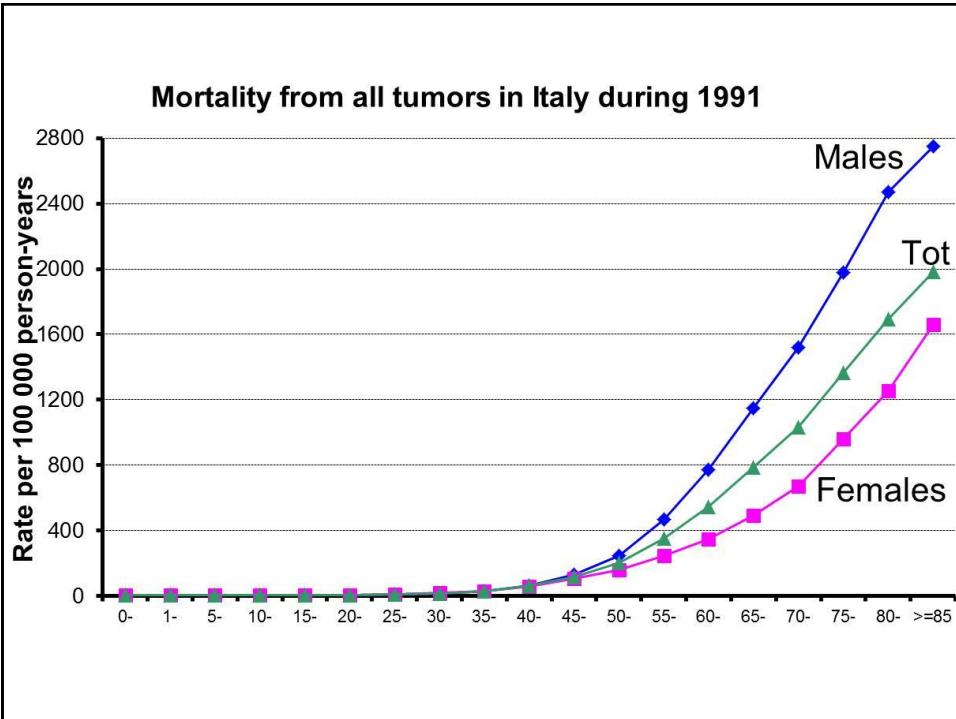
1. The crude difference between number of births and number of deaths is not an adequate index to evaluate population dynamics over time.
2. Italian population has remarkably aged, losing a great deal of its reproductive potential.
3. Population ageing will severely affect the Italian health system.

## 1° EXAMPLE: TREND IN MORTALITY FROM TUMORS IN ITALY



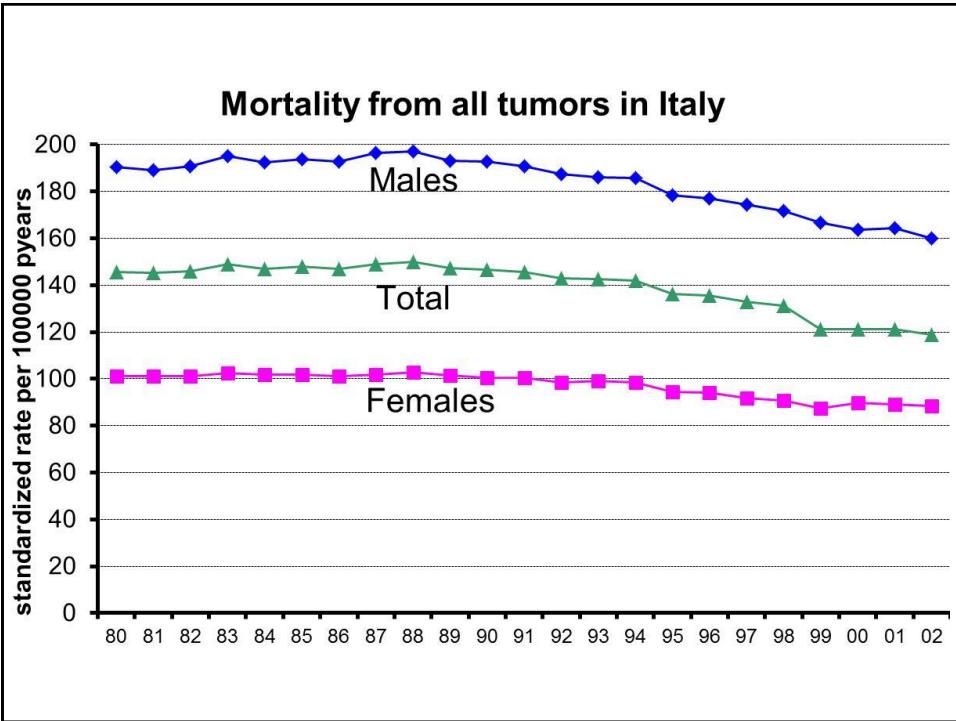
**In Italy mortality from tumors increased from 217.6 deaths per 100,000 person-years in 1980 to 283.8 deaths in 2002 (from 263.1 to 335.7 deaths among males, from 174.35 to 235.1 deaths among females).**

**This corresponds to a percent increase of 30.4% (27.6% in males and 34.8% in females).**



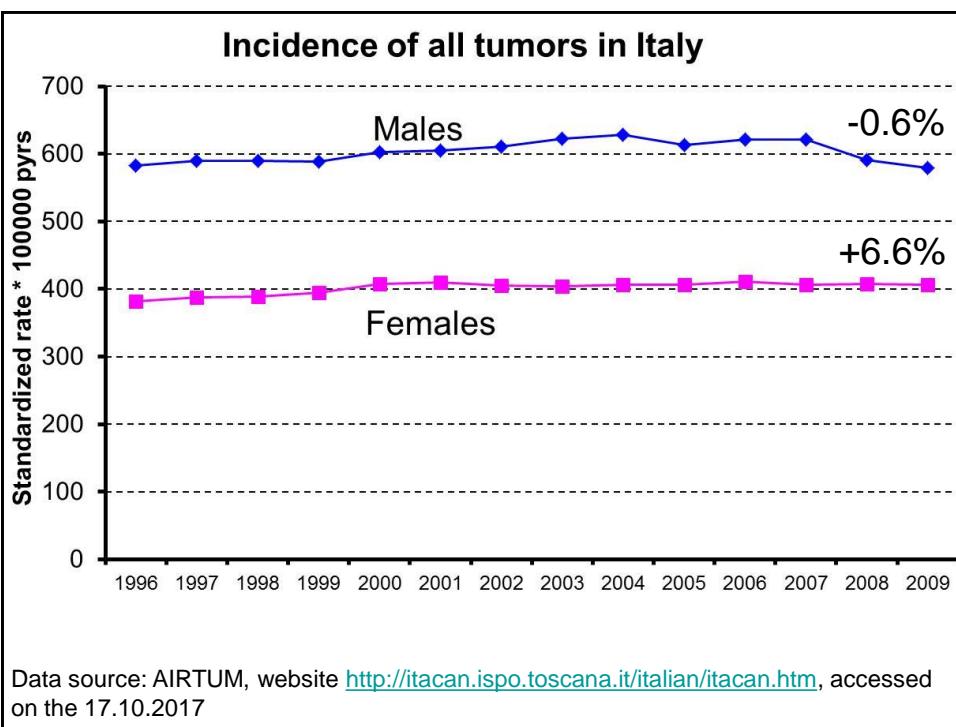
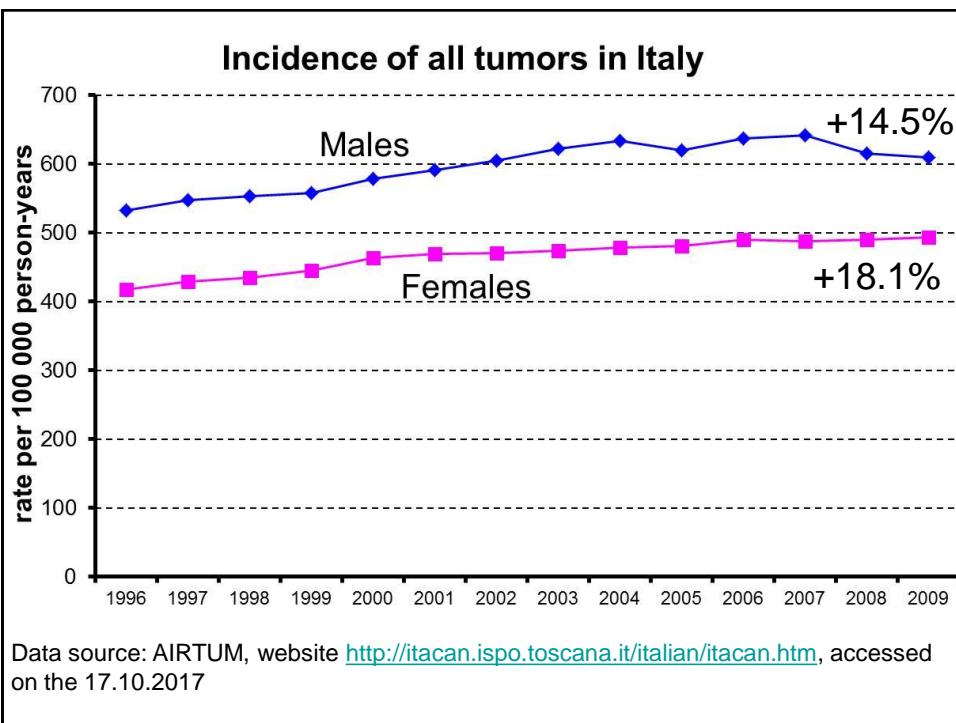
**However:**

- 1) A large population ageing occurred in Italy from 1980 to 2002.
- 1) Mortality from tumors exponentially increases with increasing age.



If we adjust for population ageing by using the statistical method «direct standardization», it is apparent that mortality from tumors has decreased in Italy by 18.4% during the study period (1980-2002).

This decrease is equal to 16.0% among males and 12.6% among females.



According to GIMBE estimates, published in the 2° Report on the sustainability of the Italian National Health System (NHS), in 2025 the NHS will require 210 billion euros. Of note, the estimate is quite conservative.

## Freely accessible database with epidemiological information

Mortality from all and specific causes in Italy → Conti S, Scipione R, Carrani E, Roazzi P, Mari E, Minutoli E. La mortalità per causa in Italia: 1980-1998. Istituto Superiore di Sanità – Ufficio di Statistica. <http://www.mortalita.iss.it/>

Demographic data → ISTAT: <http://demo.istat.it/>  
Istat. Il futuro demografico del paese – Previsioni regionali della popolazione residente al 2065. Statistiche Report, [www.istat.it](http://www.istat.it), 27 aprile 2017

Incidence and mortality from cancer in Italy from 1996 to 2009 → Associazione Italiana Registri Tumori <http://www.registri-tumori.it/>  
Progetto Itacan dell'AIRTUM: <http://itacan.ispo.toscana.it/italian/itacan.htm>