Health risk factor time trends and risk prevention

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Seeing the benefits of trends in risk factors
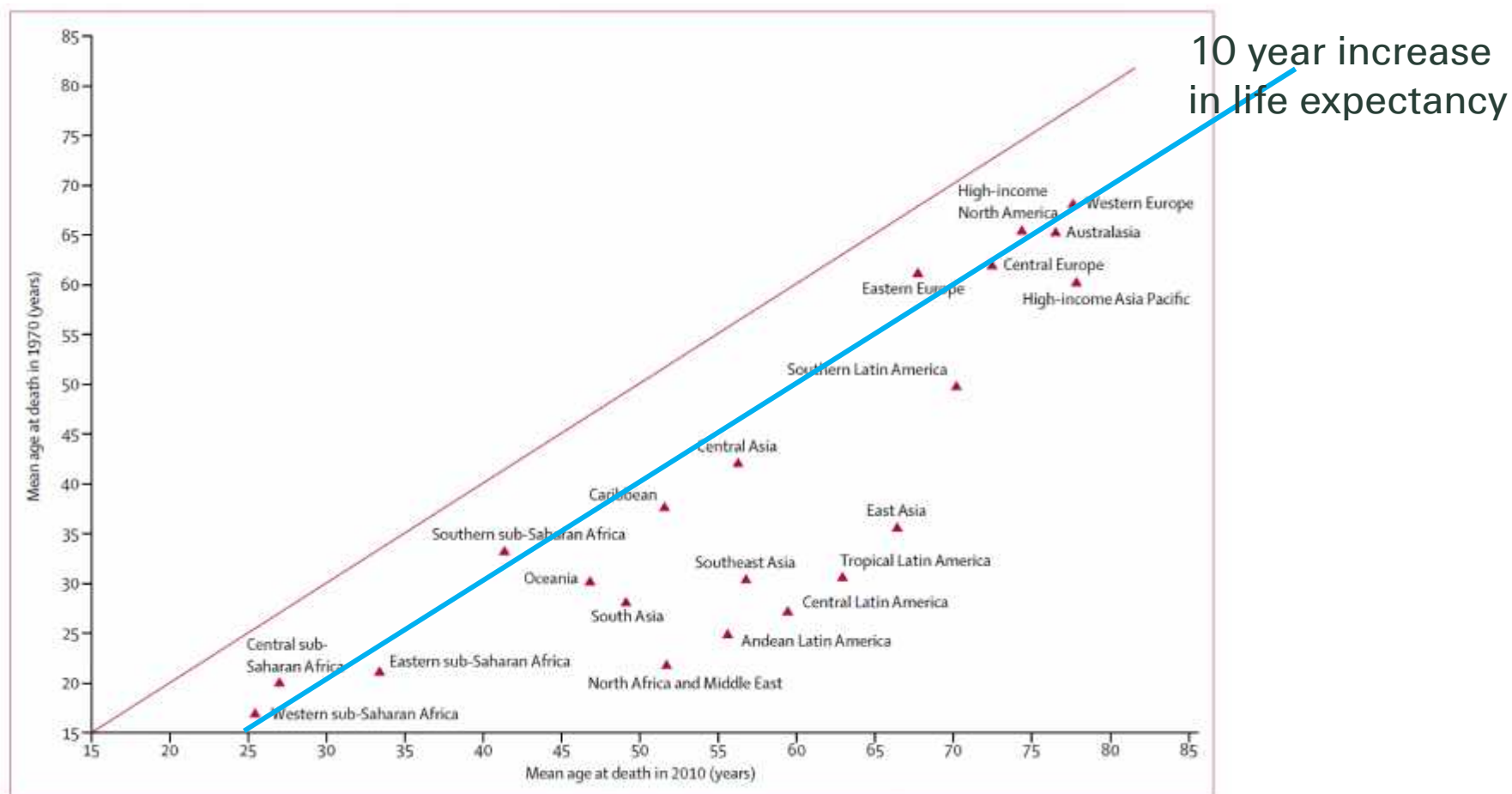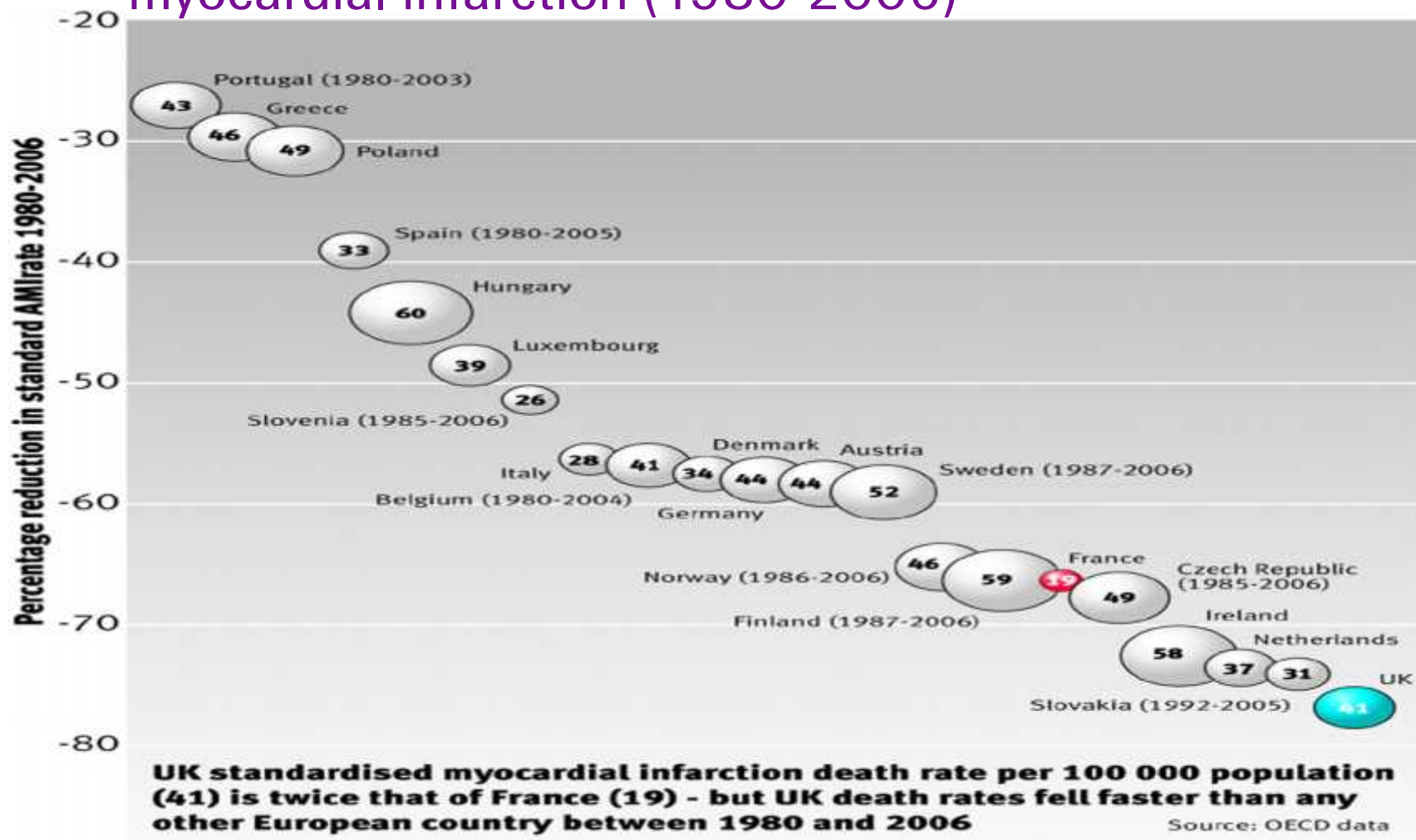
Rapid pace of improvements in life expectancy

Figure 8: Mean age of death in Global Burden of Disease regions in 1970 compared with 2010

Source: Global Burden of Disease 2010

International trends in cause-specific mortality
- myocardial infarction (1980-2006)

UK standardised myocardial infarction death rate per 100 000 population (41) is twice that of France (19) – but UK death rates fell faster than any other European country between 1980 and 2006

Source: OECD data

Leading risks factors
Analysis by region from Global Burden of Disease 2010

Ranking legend

- 1–5
- 6–10
- 11–15
- 16–20
- 21–25
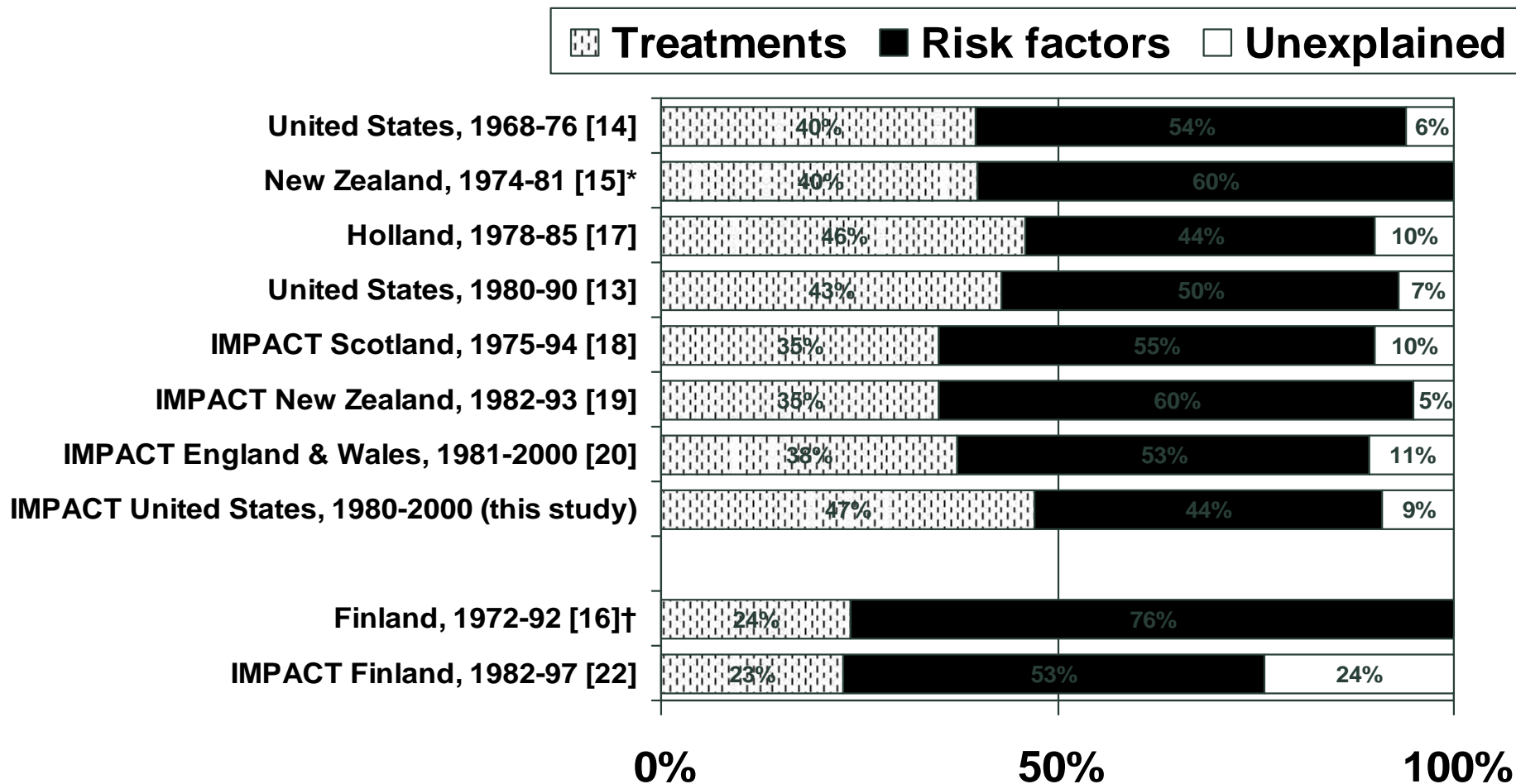- 26–30
- 31–35
- 36–40
- >40

Risk factor	Global	High-income Asia Pacific	Western Europe	Australasia	High-income North America	Central Europe	Southern Latin America	Eastern Europe	East Asia	Tropical Latin America	Central Latin America	Southeast Asia	Central Asia	Andean Latin America	North Africa and Middle East	Caribbean	South Asia	Oceania	Southern sub-Saharan Africa	Eastern sub-Saharan Africa	Central sub-Saharan Africa	Western sub-Saharan Africa
High blood pressure	1	1	2	3	4	1	2	2	1	2	4	1	1	2	1	1	3	6	2	6	5	6
Tobacco smoking, including second-hand smoke	2	2	1	2	1	3	3	3	2	4	5	2	3	3	3	3	2	3	5	7	12	10
Alcohol use	3	3	4	4	3	7	4	1	6	1	1	6	7	1	11	5	8	5	1	5	6	5
Household air pollution from solid fuels	4	42	..	..	..	14	23	20	5	18	11	3	12	7	13	9	1	4	7	2	2	2
Diet low in fruits	5	5	7	7	7	5	6	5	3	6	7	4	5	10	6	8	5	9	8	8	11	13
High body-mass index	6	8	3	1	2	4	1	4	9	3	2	9	4	3	2	2	17	2	4	14	18	14
High fasting plasma glucose	7	7	6	6	5	7	5	10	8	5	3	5	7	5	4	4	7	1	6	10	13	11
Childhood underweight	8	39	38	37	39	38	38	38	38	37	23	13	25	18	21	14	4	8	9	1	1	1
Ambient particulate matter pollution	9	9	11	26	14	12	24	14	4	27	19	11	10	24	7	19	6	32	25	16	14	7
Physical inactivity and low physical activity	10	4	5	5	6	6	7	7	10	8	6	8	9	3	5	7	11	7	11	15	15	16
Diet high in sodium	11	6	10	11	11	9	11	9	7	9	13	7	6	13	8	15	14	16	13	21	17	18
Diet low in nuts and seeds	12	11	9	8	8	8	8	8	12	10	8	15	8	12	9	10	13	13	16	22	16	21
Iron deficiency	13	20	32	21	35	22	17	21	19	14	12	12	17	4	12	6	9	11	10	4	4	4
Suboptimal breastfeeding	14	..	..	..	..	..	27	..	24	22	15	14	16	9	15	13	10	10	4	3	3	3
High total cholesterol	15	12	8	9	9	10	9	6	13	11	10	16	14	16	10	16	20	14	19	38	27	30
Diet low in whole grains	16	10	16	16	17	11	12	11	11	12	14	26	13	17	14	12	15	15	32	24	19	24
Diet low in vegetables	17	14	13	12	13	13	10	12	15	16	20	10	11	14	18	11	16	12	15	23	23	20
Diet low in seafood omega-3 fatty acids	18	17	15	13	16	16	14	13	17	17	18	19	15	23	16	17	18	20	23	21	25	25
Drug use	19	13	14	10	10	20	13	17	18	13	16	18	20	11	19	18	22	19	12	19	24	22
Occupational risk factors for injuries	20	24	24	20	25	26	16	25	20	19	22	23	21	21	23	31	17	22	22	20	22	17

Pioneers in assessing importance of risk factors

- Capewell & Critchley explained historical changes in CHD mortality through observed changes in risk factors and treatments

- Initial studies in UK, USA and other developed countries, but more recently focusing on former East European countries and Beijing in China

- For given study period, comparisons focus on difference between projected and actual number of deaths

- Relatively simple population model without disease-transitions hosted in EXCEL

- Widely used to test "What if" scenarios based on policy intervention or changes in risk behaviour

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Country differences in explanatory studies
% reduction in CHD mortality

	Treatments	Risk factors	Unexplained
United States, 1968-76 [14]	40%	54%	6%
New Zealand, 1974-81 [15]*	40%	60%	
Holland, 1978-85 [17]	46%	44%	10%
United States, 1980-90 [13]	43%	50%	7%
IMPACT Scotland, 1975-94 [18]	35%	55%	10%
IMPACT New Zealand, 1982-93 [19]	35%	60%	5%
IMPACT England & Wales, 1981-2000 [20]	38%	53%	11%
IMPACT United States, 1980-2000 (this study)	47%	44%	9%
Finland, 1972-92 [16]†	24%	76%	
IMPACT Finland, 1982-97 [22]	23%	53%	24%

0%   50%   100%

Explaining increase in CHD deaths in Beijing

Figure 1. CHD mortality trends in Beijing 1984 to 1999: additional deaths attributable to risk factor changes and deaths prevented or postponed by treatments.
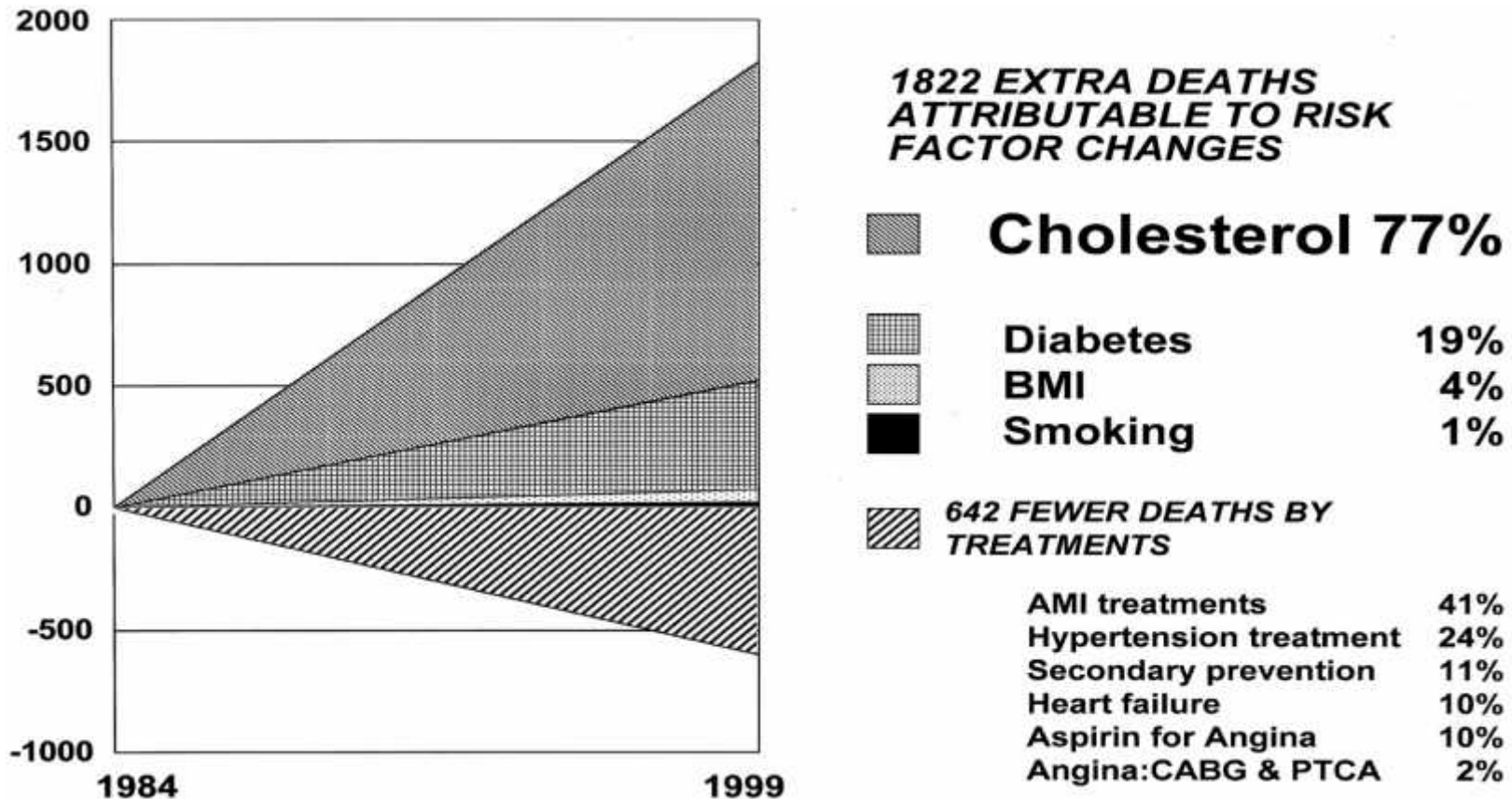
Critchley J et al. Circulation. 2004;110:1236-1244

Understanding the drivers to future longevity

GENETICS

ENVIRONMENT

HEALTHCARE

BEHAVIOUR

INTERACTIONS

Healthcare in the future

Current cost of pharmaceutical research

Company	Ticker	Number of drugs approved	R&D Spending Per Drug ($Mil)	Total R&D Spending 1997-2011 ($Mil)
AstraZeneca	AZN	5	11,790.93	58,955
GlaxoSmithKline	GSK	10	8,170.81	81,708
Sanofi	SNY	8	7,909.26	63,274
Roche Holding AG	RHHBY	11	7,803.77	85,841
Pfizer Inc.	PFE	14	7,727.03	108,178
Johnson & Johnson	JNJ	15	5,885.65	88,285
Eli Lilly & Co.	LLY	11	4,577.04	50,347
Abbott Laboratories	ABT	8	4,496.21	35,970
Merck & Co Inc	MRK	16	4,209.99	67,360
Bristol-Myers Squibb Co.	BMY	11	4,152.26	45,675
Novartis AG	NVS	21	3,983.13	83,646
Amgen Inc.	AMGN	9	3,692.14	33,229

Sources: InnoThink Center For Research In Biomedical Innovation; Thomson Reuters Fundamentals via FactSet Research Systems

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The contribution of robots to our future
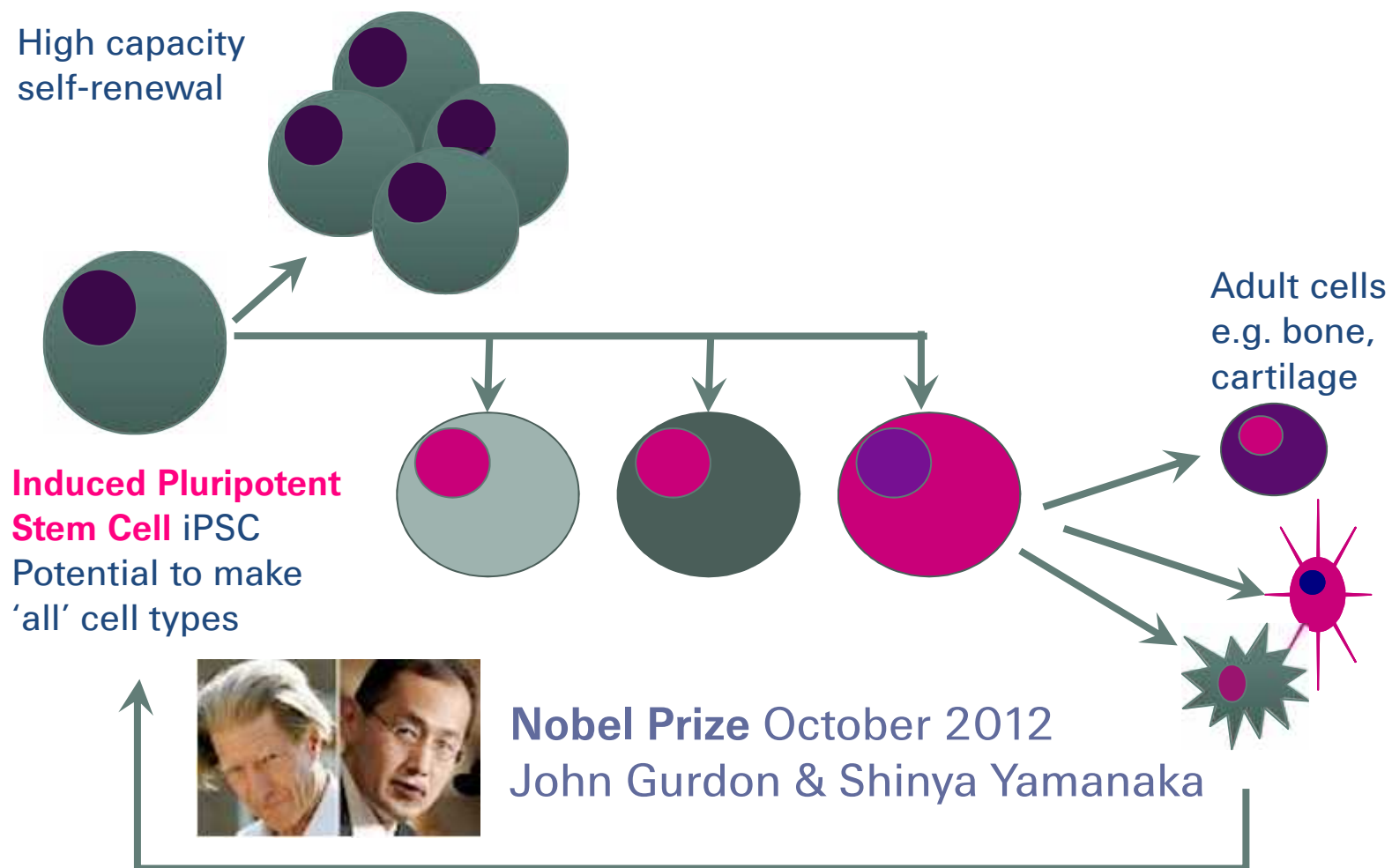## New possibilities for healthcare delivery & support
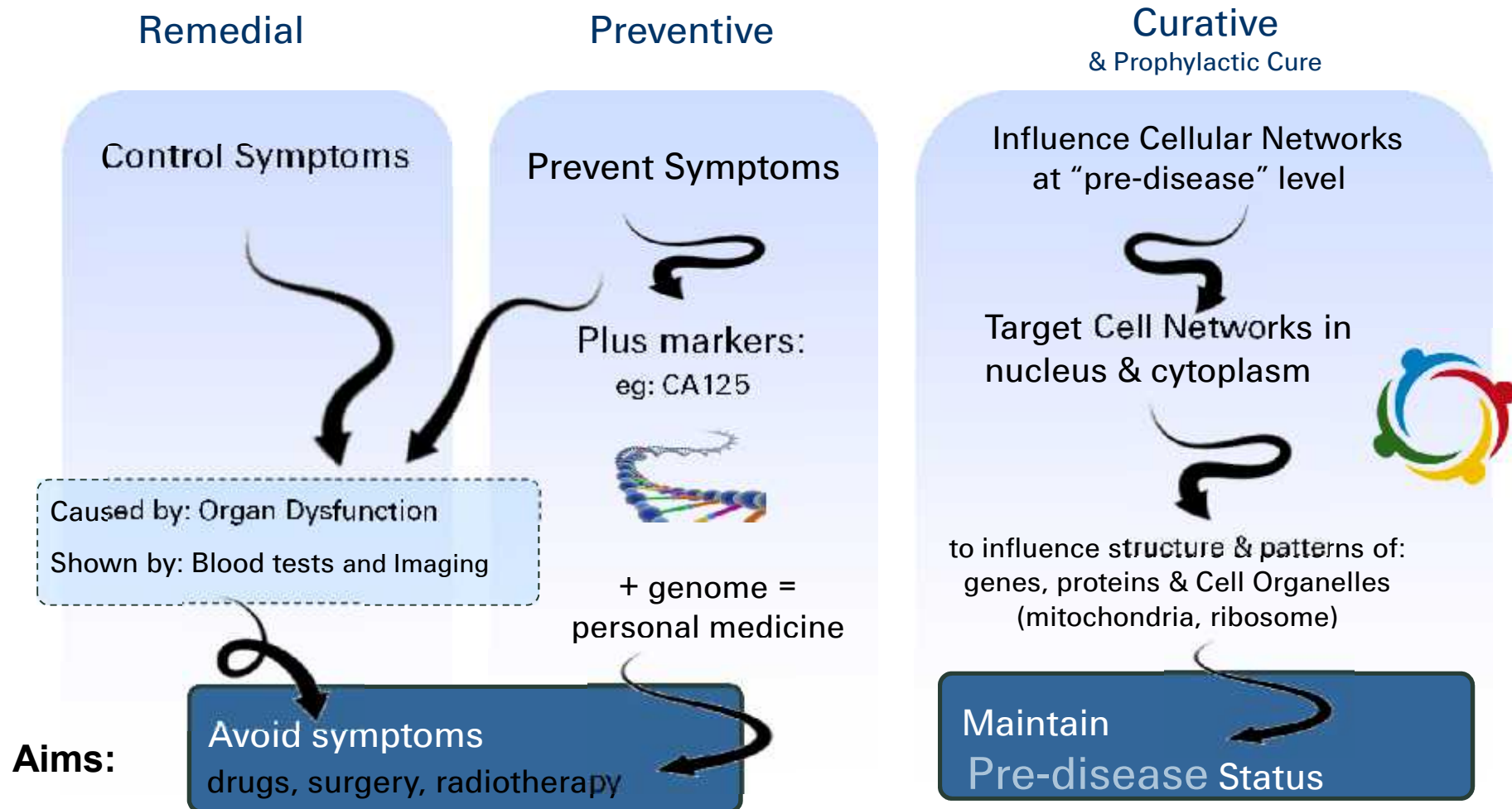

Source: Cyberdyne & Tsukuba University

Source: Toyota
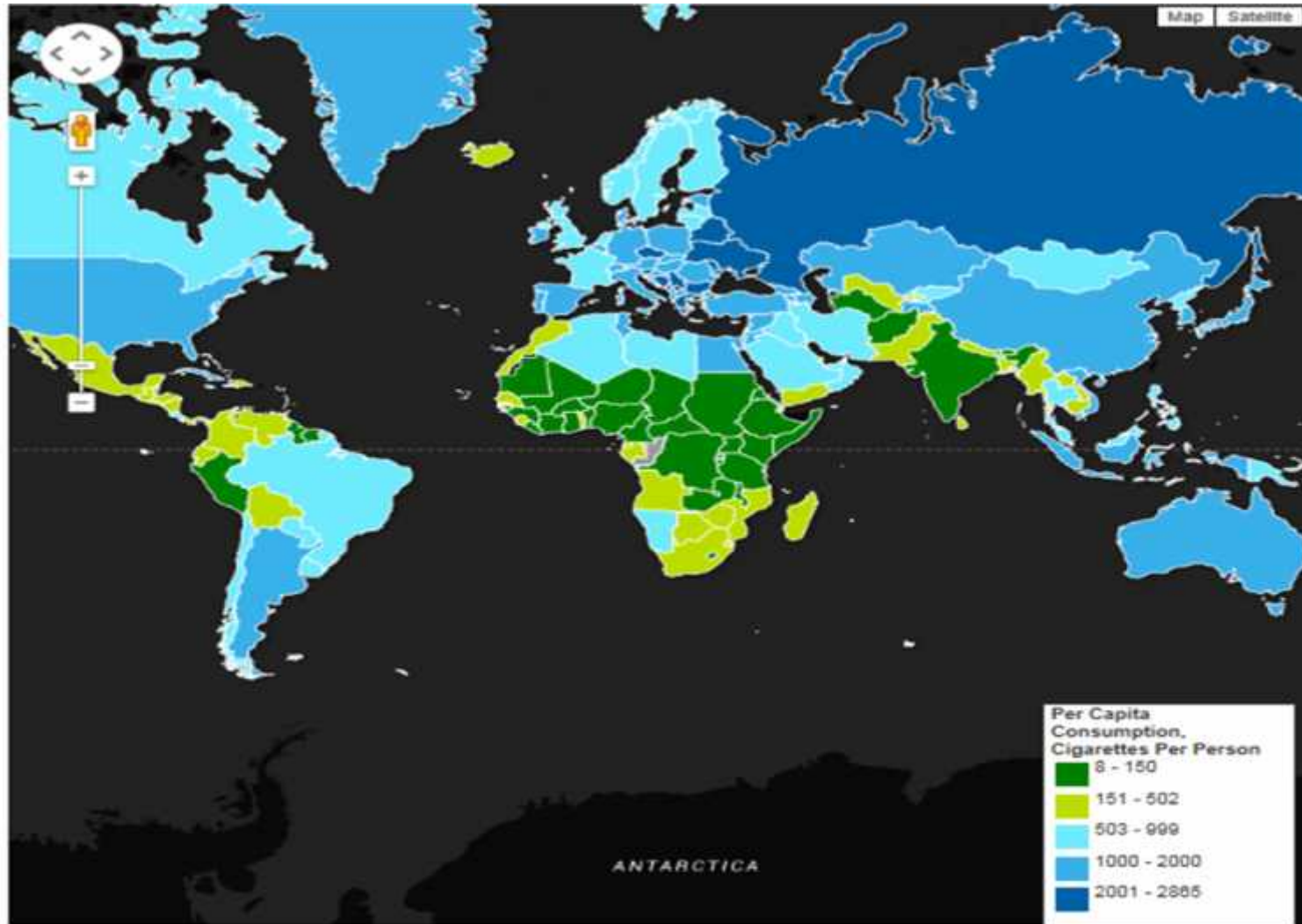
The rediscovery of regenerative medicine

High capacity
self-renewal

**Induced Pluripotent
Stem Cell** iPSC
Potential to make
'all' cell types

Adult cells
e.g. bone,
cartilage

Nobel Prize October 2012
John Gurdon & Shinya Yamanaka

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New horizons in curative healthcare

Remedial	Preventive	Curative
		& Prophylactic Cure

Control Symptoms

Prevent Symptoms

Influence Cellular Networks at "pre-disease" level

Plus markers:
eg: CA125

Target Cell Networks in nucleus & cytoplasm

Caused by: Organ Dysfunction

Shown by: Blood tests and Imaging

+ genome = personal medicine

to influence structure & patterns of: genes, proteins & Cell Organelles (mitochondria, ribosome)

Aims:

Avoid symptoms
drugs, surgery, radiotherapy

Maintain
Pre-disease Status

Individual choices in the future

1 billion will die from smoking in 21st century

Source: Tobacco Cancer Atlas

Promoting healthy behaviour

Salience

More information

Norms

Incentives
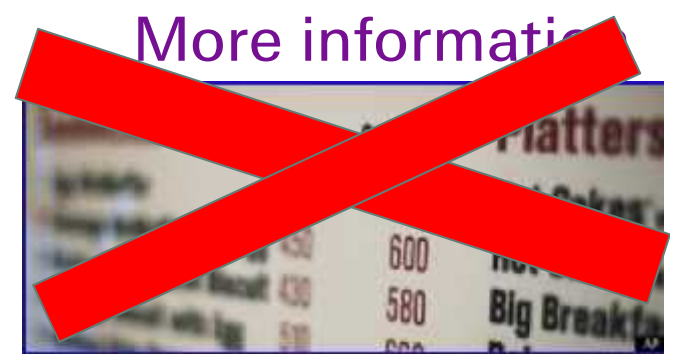
Yellow tape was placed across a shopping cart indicating where fruit and vegetables should be placed. Result:102% increase in sales of fruit and vegetables.
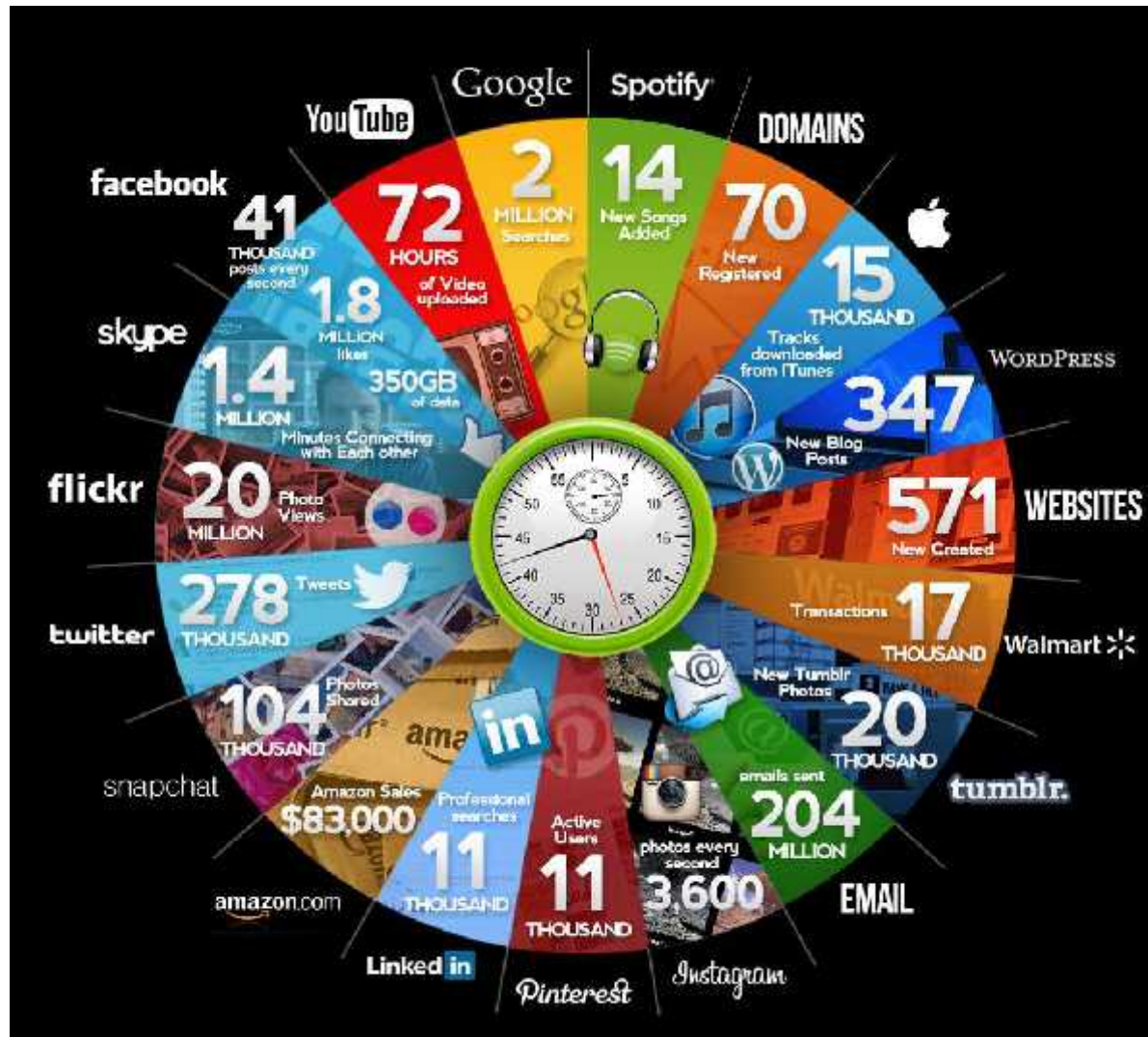
At Google's cafeteria, junk food is out of sight, and pizza is (almost) out of reach. (Credit: Mike McQuade)

Google cafeteria hid unhealthy food out of sight and out of reach and placed healthy food more centrally. Result: fat consumption from chocolate decreased by 11%.

What we share with one another every minute

Our ability to influence risk factors in the future

Wearable sensors

Smart lenses

Smart Pill

Smart garments

Handheld medical scanner

Towards a better understanding of the future

Developing our disease-centred view of longevity

General drivers

Individual Risk Factors	Healthcare Funding	Doctor-Patient Interaction	Research & Development

Disease type & progression

- Circulatory
- Respiratory
- Multiple diseases
- Healthy
- Neurological
- Cancer
- Death

Disease-specific factors

- Risk factors
- Early detection
- Medical innovation)
- Breast cancer
- Current treatments
- Clinical trials pipeline
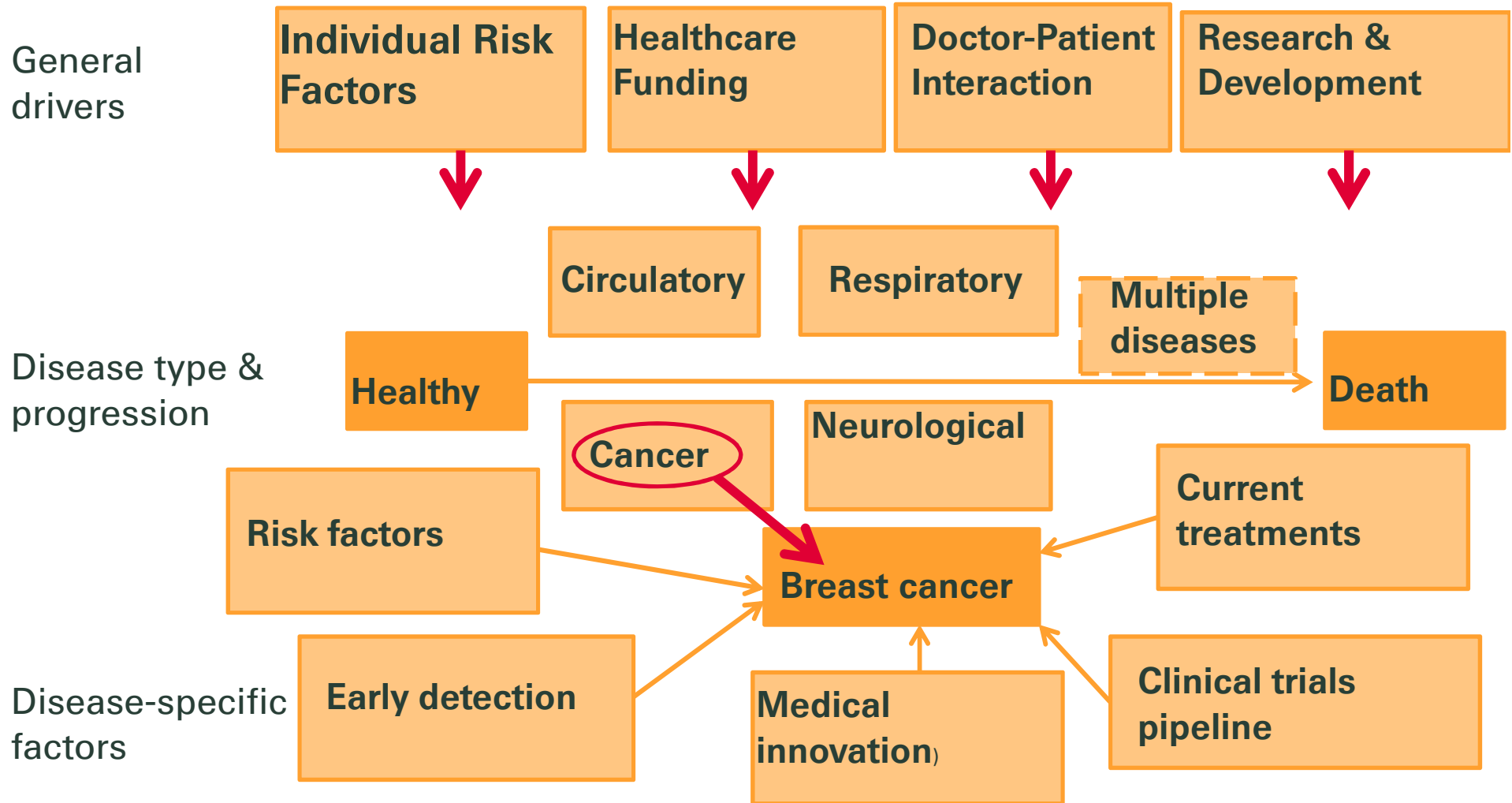
SEARCH − raising our ambition for better predictions of future mortality & longevity

- Complementary to actuarial/demographic approaches
  - stochastic mortality models
  - blending between current mortality improvements and long-term assumptions over defined horizons

- Bringing together:
  - Annual assessment of changes in key risk factors and their impact
  - Large cohort databases in different countries
  - Networks of engaged expert opinion − forward-looking scenarios

- Causal-based mortality predictions, evaluating factors such as:
  - Promotion and adoption of healthy lifestyle choices
  - Advances in screening and diagnostic technology
  - Pharmaceutical pipeline and its likely impact

Thank you

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