

INNOVATIVE CARE MODELS

“FROM SWEDISH AND EUROPEAN PERSPECTIVES”

BY

KÅRE SYNNESE, PHD

PROFESSOR IN PERVASIVE AND MOBILE COMPUTING, LULEÅ UNIVERSITY OF TECHNOLOGY

VISITING PROFESSOR IN MEDIA TECHNOLOGY, BLEKINGE INSTITUTE OF TECHNOLOGY

2017-06-29

CONNECTED HEALTH SUMMER SCHOOL

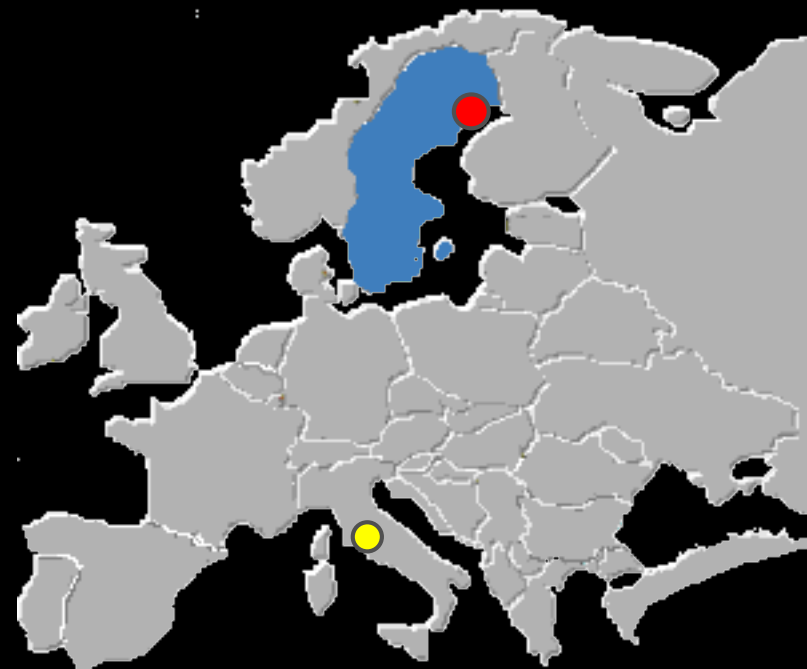
ARTIMINO, FLORENCE, ITALY

THANKS!





Luleå, Sweden





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ARTIMINO, FLORENCE, ITALY



“Beyond IT - About health in a digital era”

Ekholm, Anders , Jebari, Karim Fredrik Nilsson,
Sara Riggare, Drasko Markovic, Erik Wetter,
Jenny Wahlgren, Jesper Olsson,
Anna Krohwinkel, Hans Winberg, Jon Rognes,
Britt-Marie Ahrnell, Patrik Sundström,
Fredrik Lindencrona, Tomas Bokström,
Ing-Marie Wieselgren

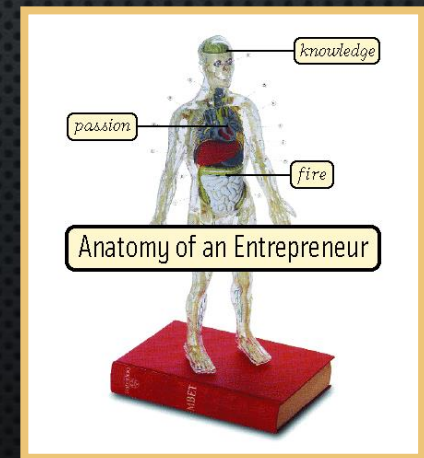
Research report 2016:2, 233 pages.

SWEDEN 1845



SWEDEN, 2017

- LARGE COUNTRY AND LOW POPULATION DENSITY (10 MILLION)
- WAS MAINLY A VERY POOR REGION IN THE 1800s – STRONG ECONOMIC BOOM DURING THE INDUSTRIALIZATION & POST-WAR ERA
 - BNP INCREASE DRIVEN BY BETTER HEALTH (INCREASED AGE)
- TODAY GENERALLY A VERY HIGH LIVING STANDARD
 - “THE HIGHEST INTERNET CONNECTIVITY IN THE WORLD”
- TOP-RANKED ON THE EU INNOVATION SCOREBOARD

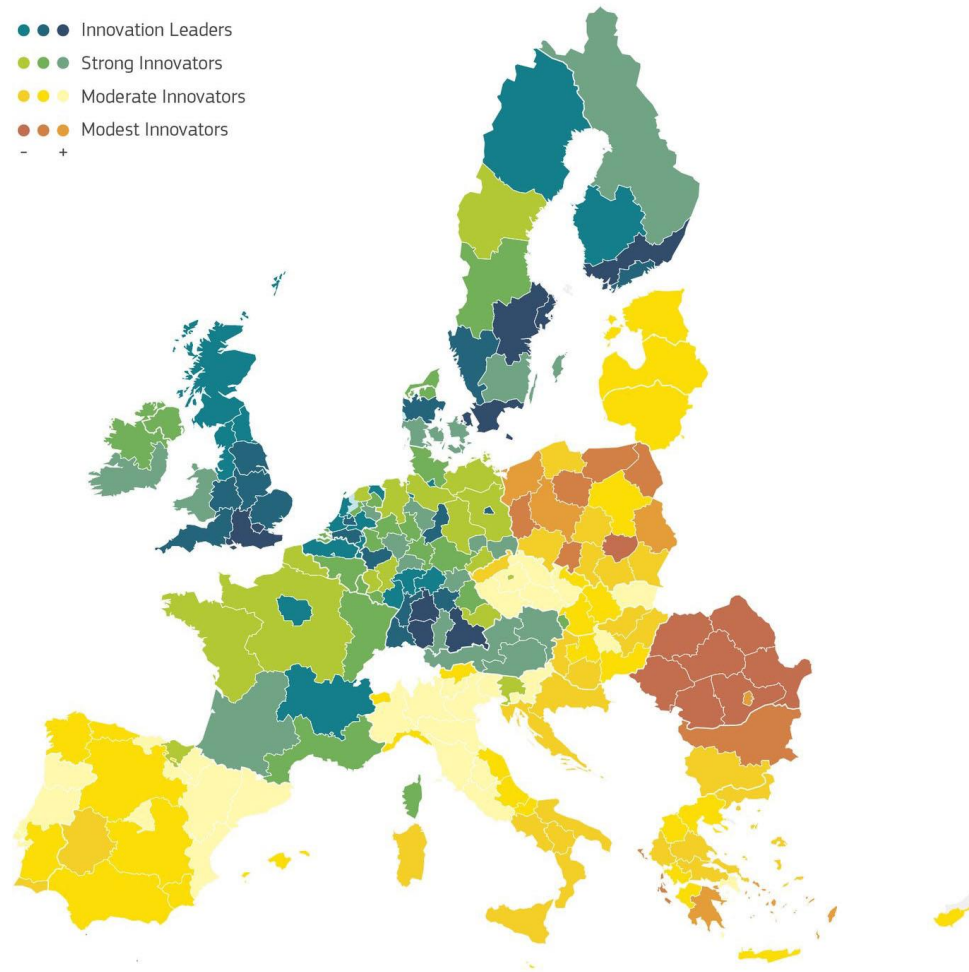




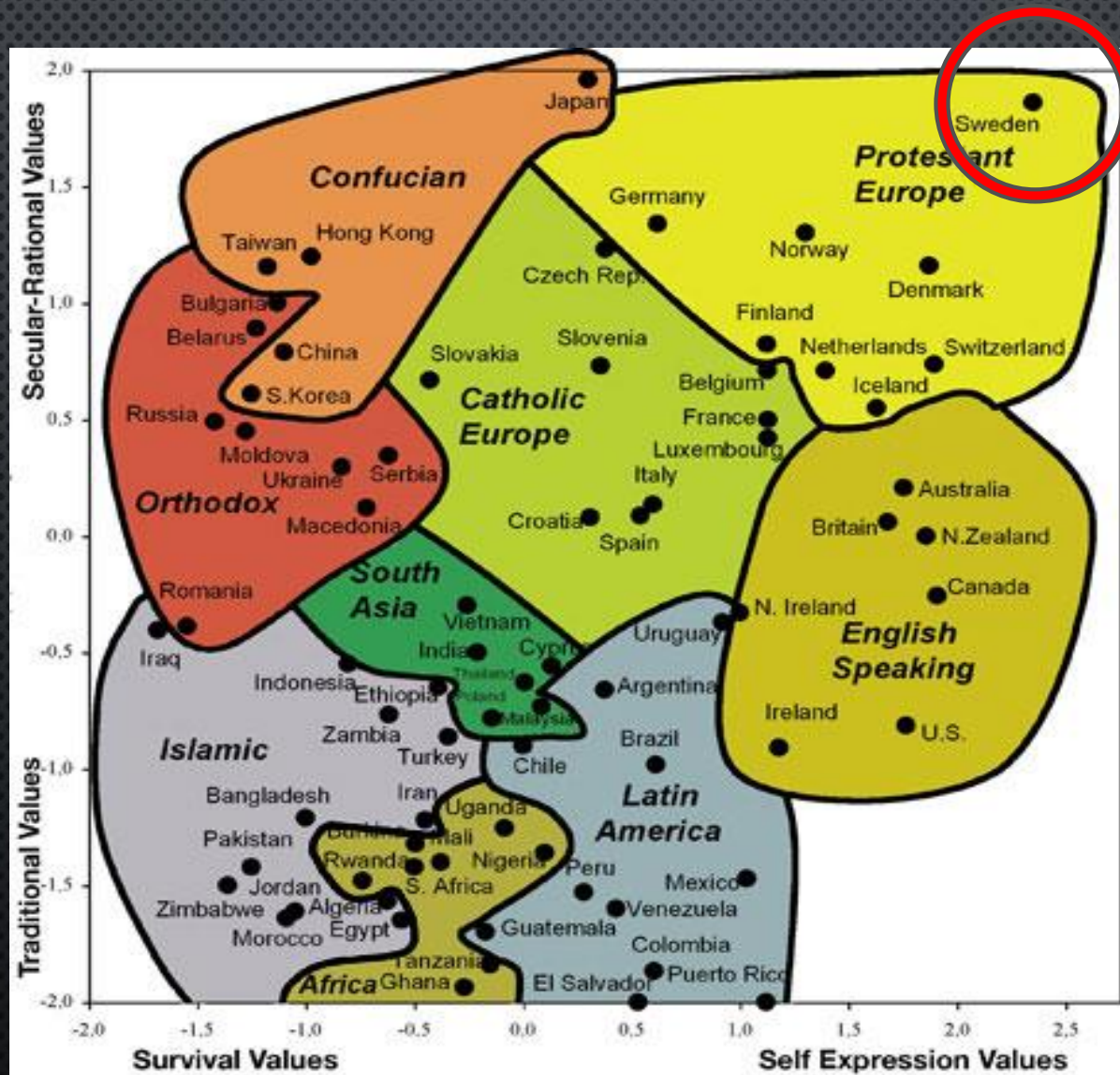
European
Commission

2017 REGIONAL INNOVATION SCOREBOARD

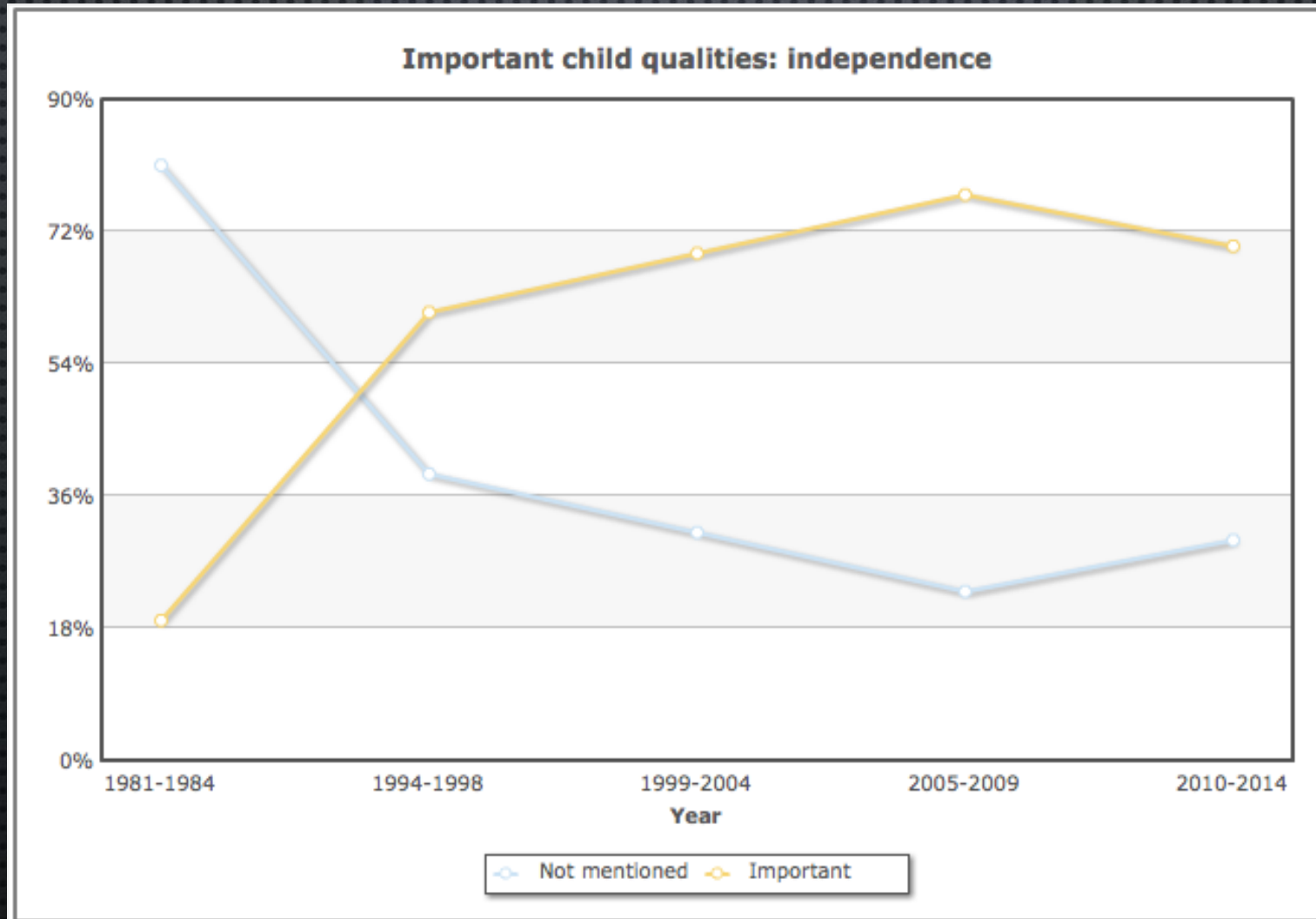
- ● ● Innovation Leaders
- ● ● Strong Innovators
- ● ● Moderate Innovators
- ● ● Modest Innovators
- +



WORLD VALUES SURVEY



WORLD VALUES SURVEY



SWEDEN AND THE SWEDE, 2017

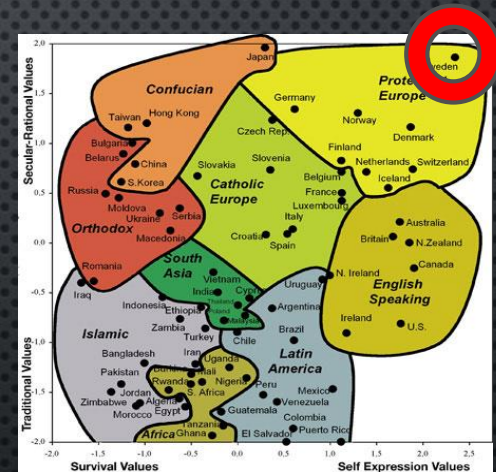
- WELL-DEVELOPED AND STRONG SOCIETAL SYSTEMS

- EXTREMELY GOOD “SAFETY NET”
- NO EXTREME POVERTY
- FREE EDUCATION
- (ALMOST) FREE HEALTHCARE

- “IT IS ALL ABOUT ME”

- INDEPENDENCE, AUTONOMY
- INDIVIDUALISM, PERSON-CENTERED
- FREEDOM, OPEN, RIGHTS, EQUALITY

- A BALANCE BETWEEN SOCIALISTIC/DEMOCRATIC AND INDIVIDUAL VALUES!

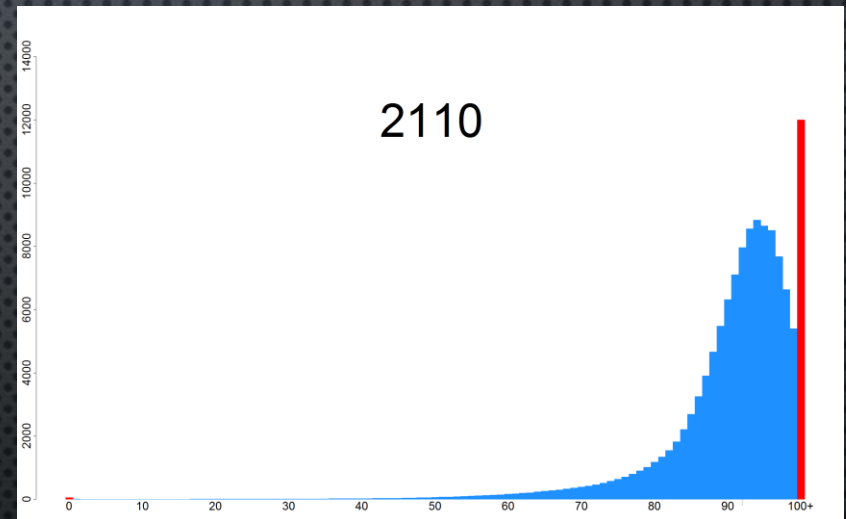
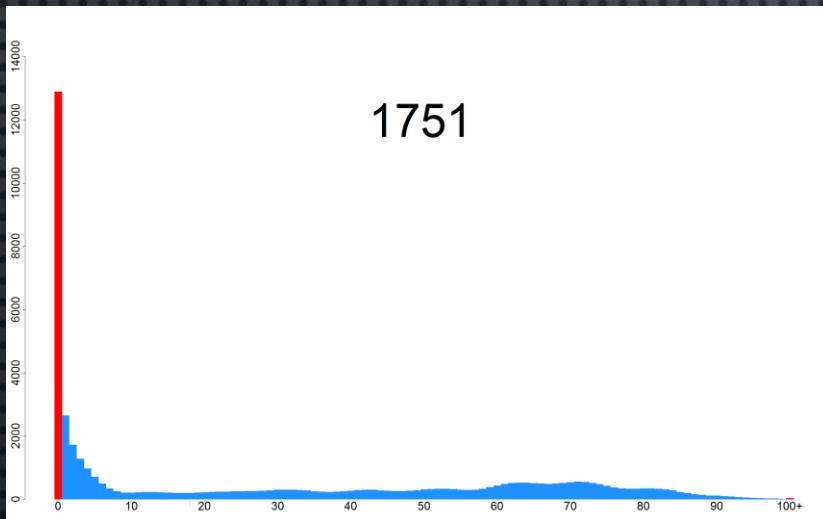


NEW EXPECTATIONS



“We live longer, are healthier and have higher requirements for better and more personalized services.”
- Vinnova, Sweden

LIFESPAN IN SWEDEN 1751 VS 2110



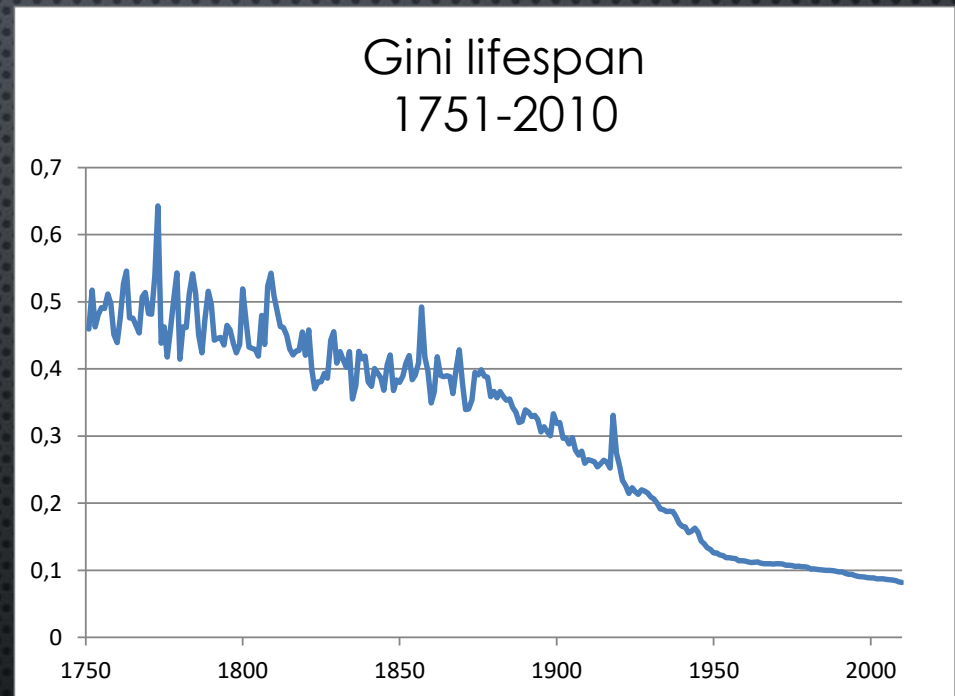
Source: *Human Mortality Database*. University of California, Berkeley (USA), and Max Planck Institute for Demographic Research (Germany), SCB.

“IF THE AGE CONTINUE TO
INCREASE AT THE SAME RATE AS
DURING THE LAST 250 YEARS THEN
AT LEAST HALF OF THE SWEDES
BORN TODAY WILL AGE BEYOND
100 YEARS”

“Den åldrande befolkningen”, Läkartidningen, nr 48, 2010-11-30.

LIFESPAN DISTRIBUTION IN SWEDEN

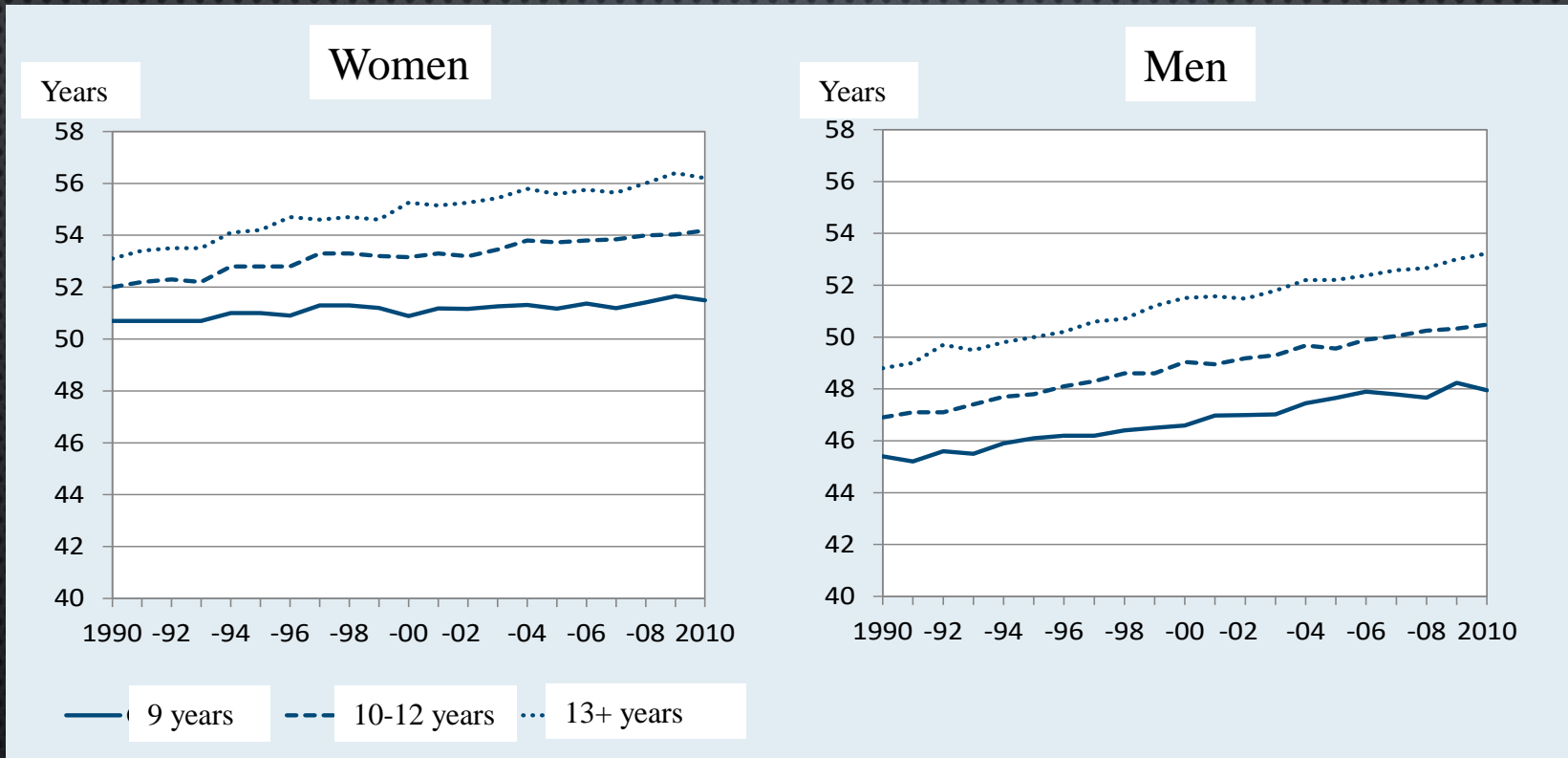
- TODAY AN ALMOST EQUALLY DISTRIBUTION OF LIFESPAN IN SWEDEN
- GINI – A MEASURE OF LIFESPAN DISTRIBUTION
 - GINI 1:
1 PERSON LIVE ALL YEARS
 - GINI 0:
ALL PERSONS LIVE EQUALLY LONG



Source: *Human Mortality Database*. University of California, Berkeley (USA), and Max Planck Institute for Demographic Research (Germany).

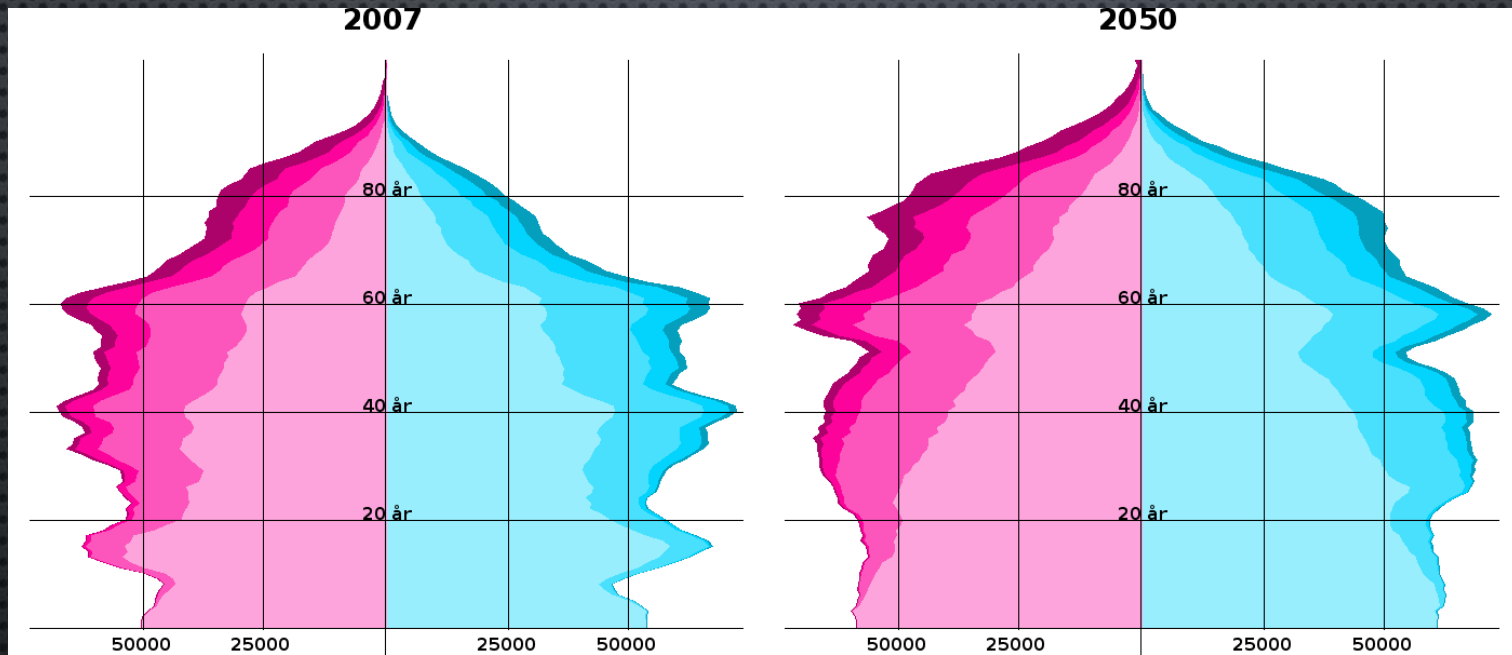
EXPECTED REMAINING LIFESPAN

GAP FOR PERSONS AGED 30 BASED ON EDUCATION



Source: Folkhälsan (Peoples Health) in Sweden, Annual report, 2012, SoS and FHI.

HEALTH IN SWEDEN 2007 VS 2050

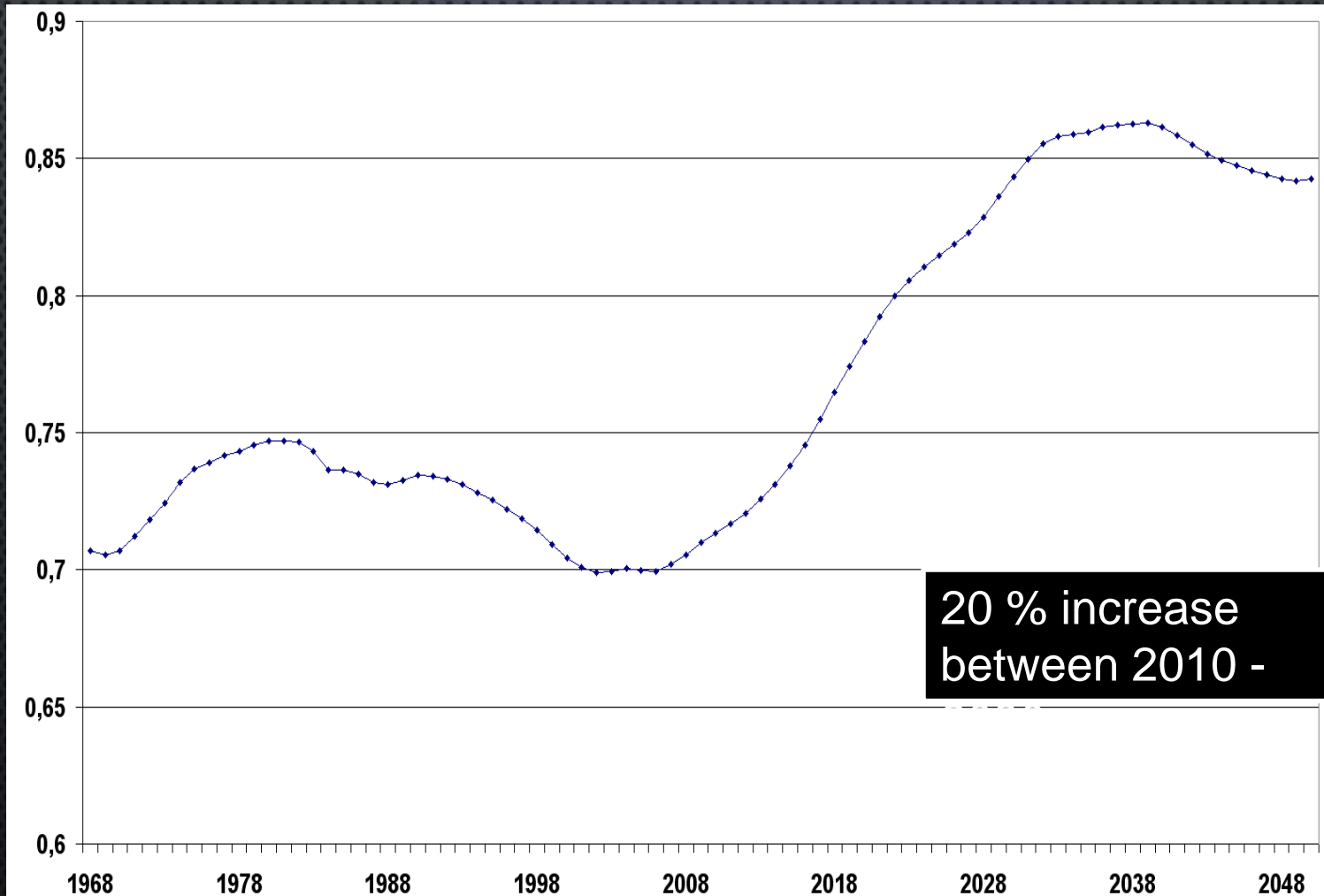


Kvinnor svår ohälsa
Kvinnor måttlig ohälsa
Kvinnor lätt ohälsa
Kvinnor full hälsa

Män svår ohälsa
Män måttlig ohälsa
Män lätt ohälsa
Män full hälsa

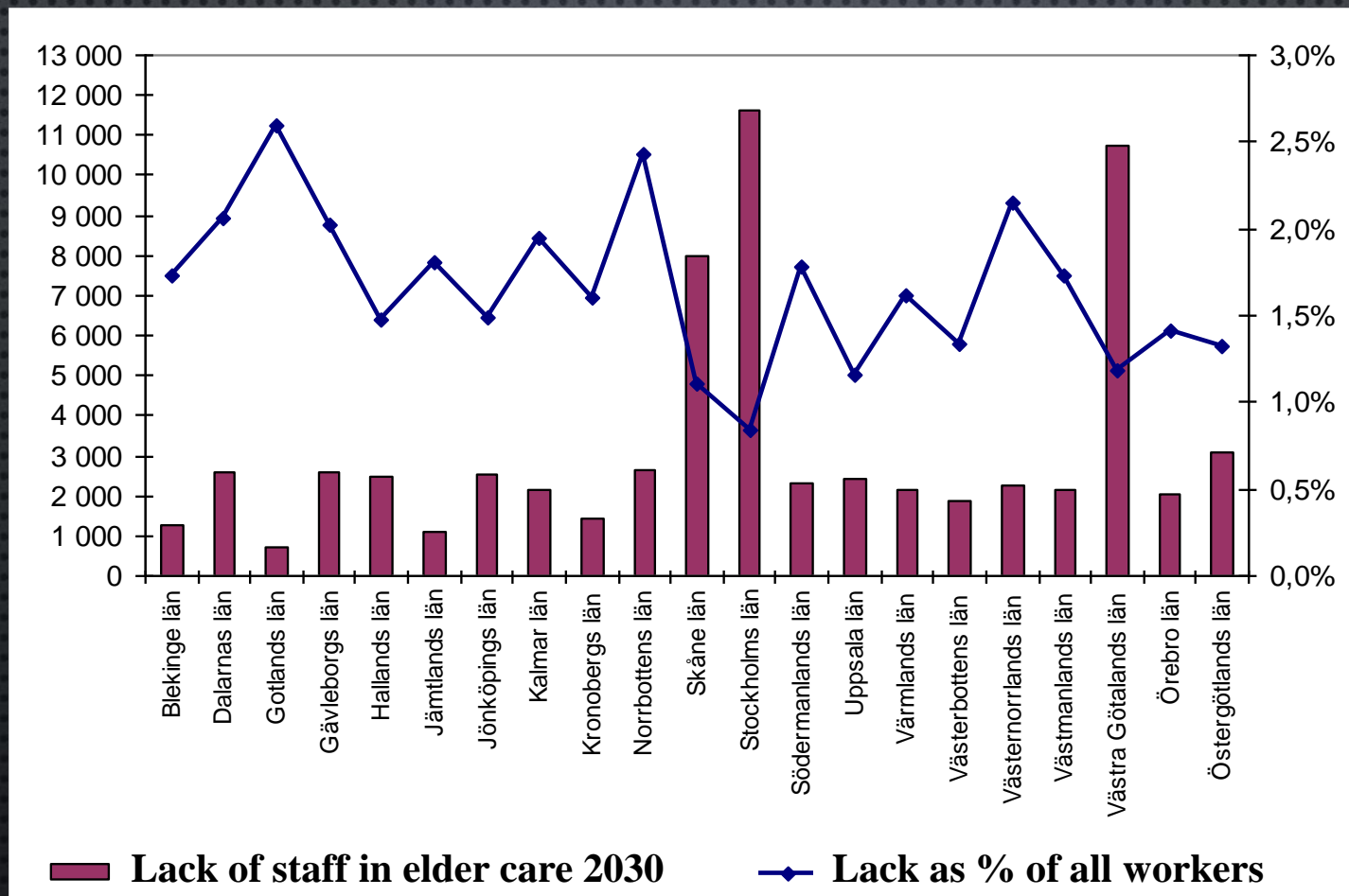
TENDING QUOTA (16-64)

"HOW MANY PERSONS EACH WORKING PERSON NEED TO TEND FOR"



20 % increase
between 2010 -

LACK OF ELDER CARE STAFF IN SWEDEN 2030



Total need: 65 000 staff

Worst counties: Gotland, Norrbotten, Dalarna and Västerbotten

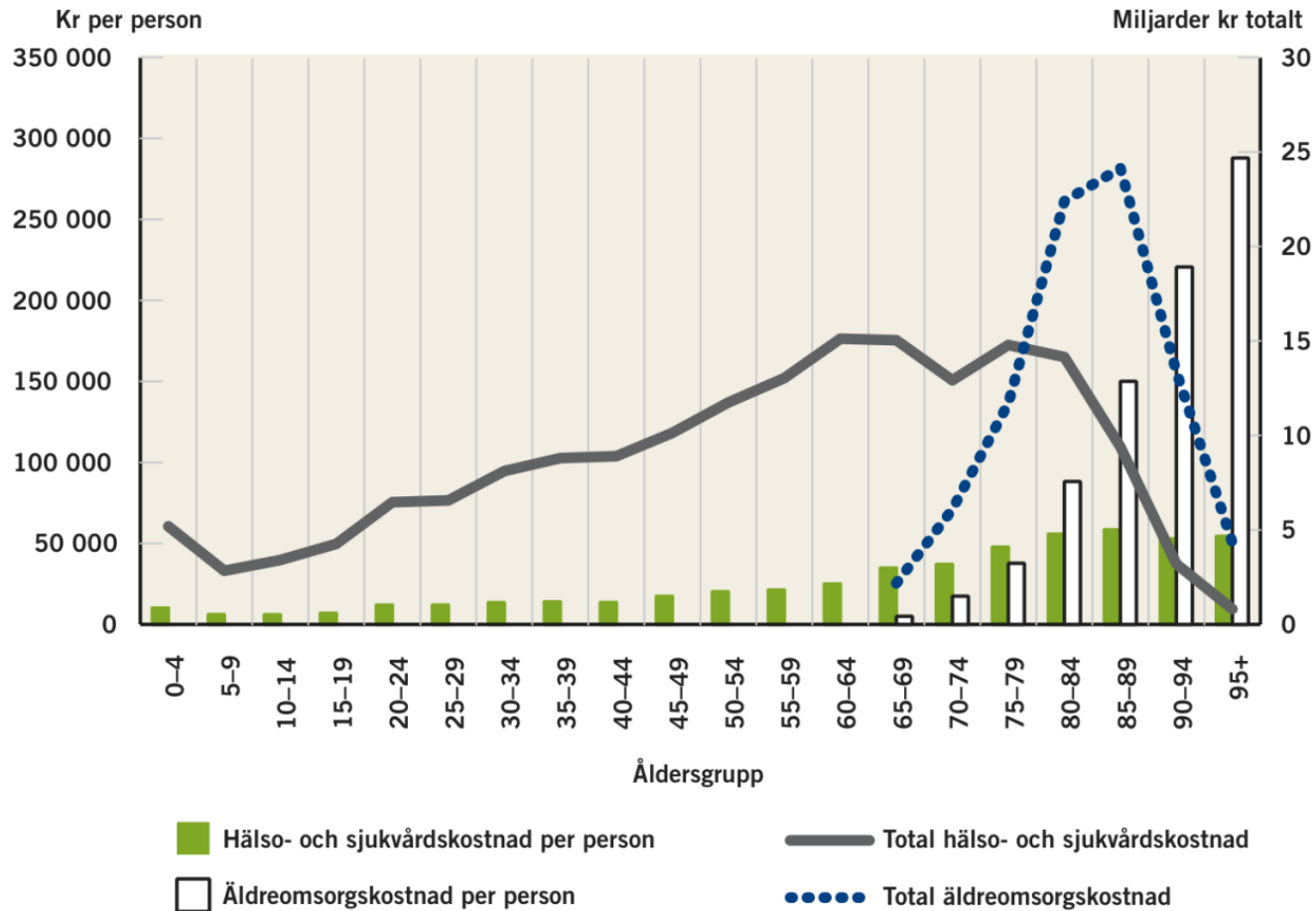
EDUCATIONAL NEED

1 : 2

Source: NST, Tromsö

COST, 2006

HEALTH SERVICES AND ELDER CARE



SOURCE: HEK 2006, FINANSDEPARTEMENTET 2006.

COST OF UNHEALTH IN SWEDEN

- ONLY 1/3 OF THE COST FINANCED BY THE PUBLIC CARE
- 2 / 3 OF THE CARE IS MANAGED BY RELATIVES
 - PARENTS, CHILDREN, SPOUSES
- NEW COLLABORATIVE MODELS NEEDED?





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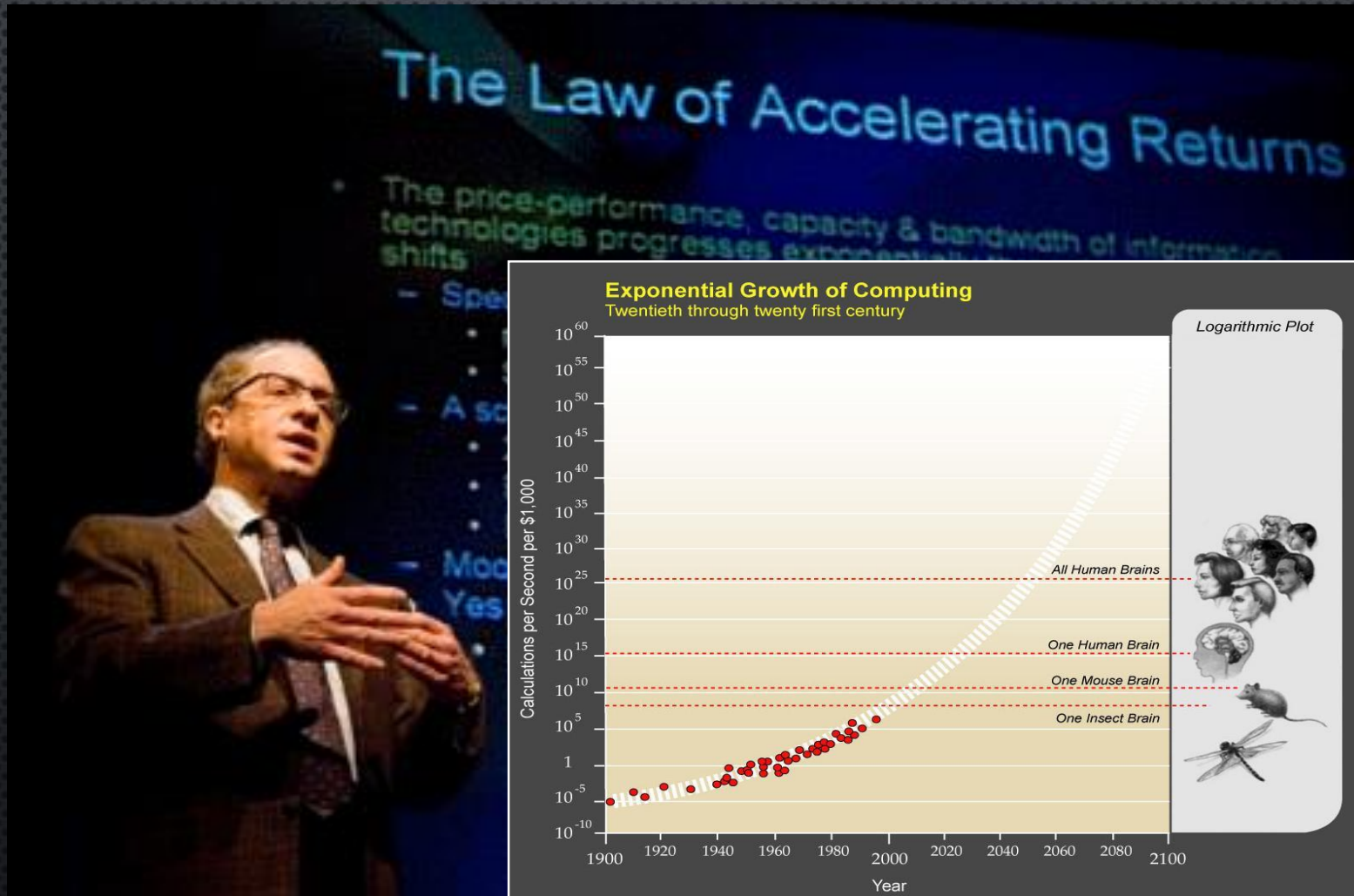
ARTIMINO, FLORENCE, ITALY



**DIGITISATION
&
DIGITALISATION**

THE LAW OF ACCELERATING RETURNS

RAY KURTZWEIL



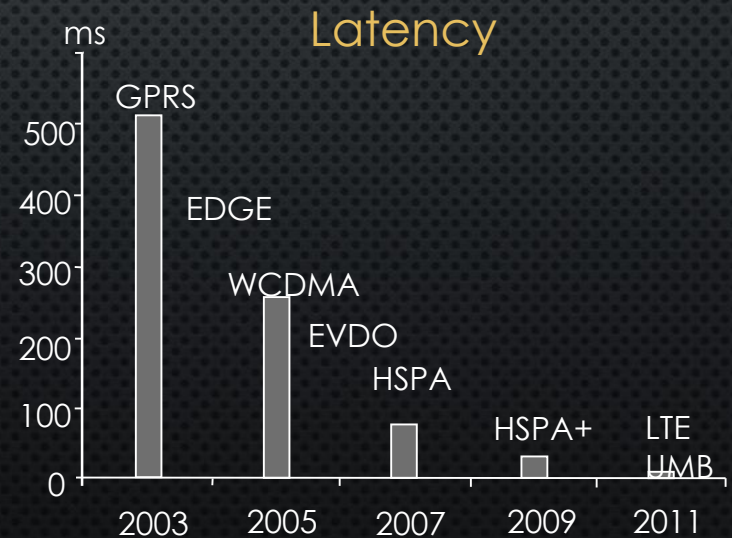
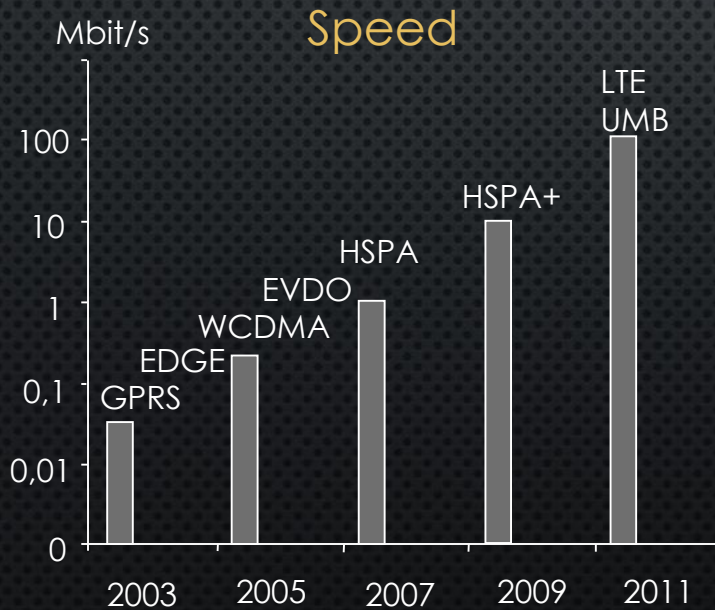
MOBILE ACCESS

2000

12% had a mobile phone.

2008

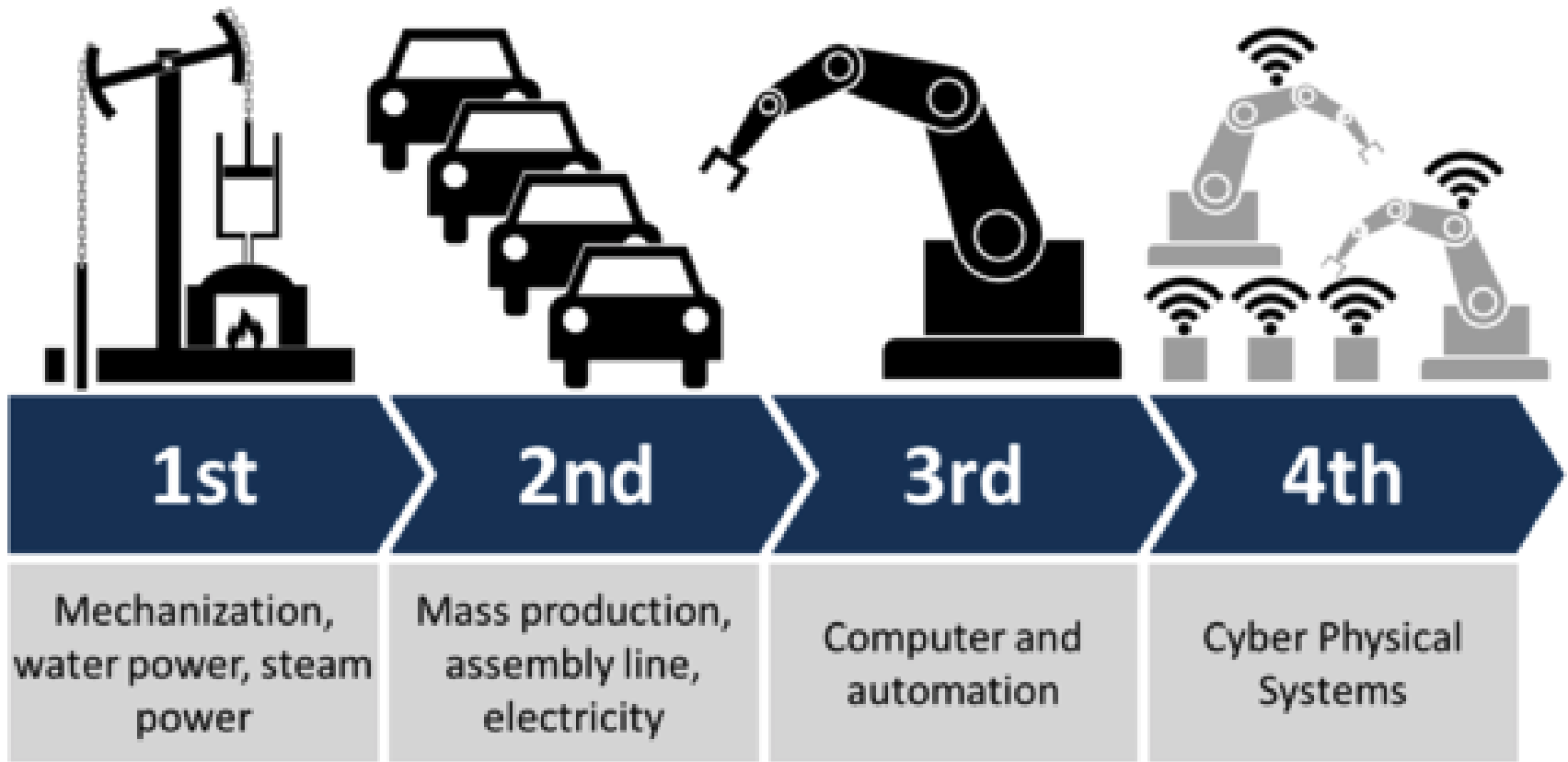
50% had a mobile phone.



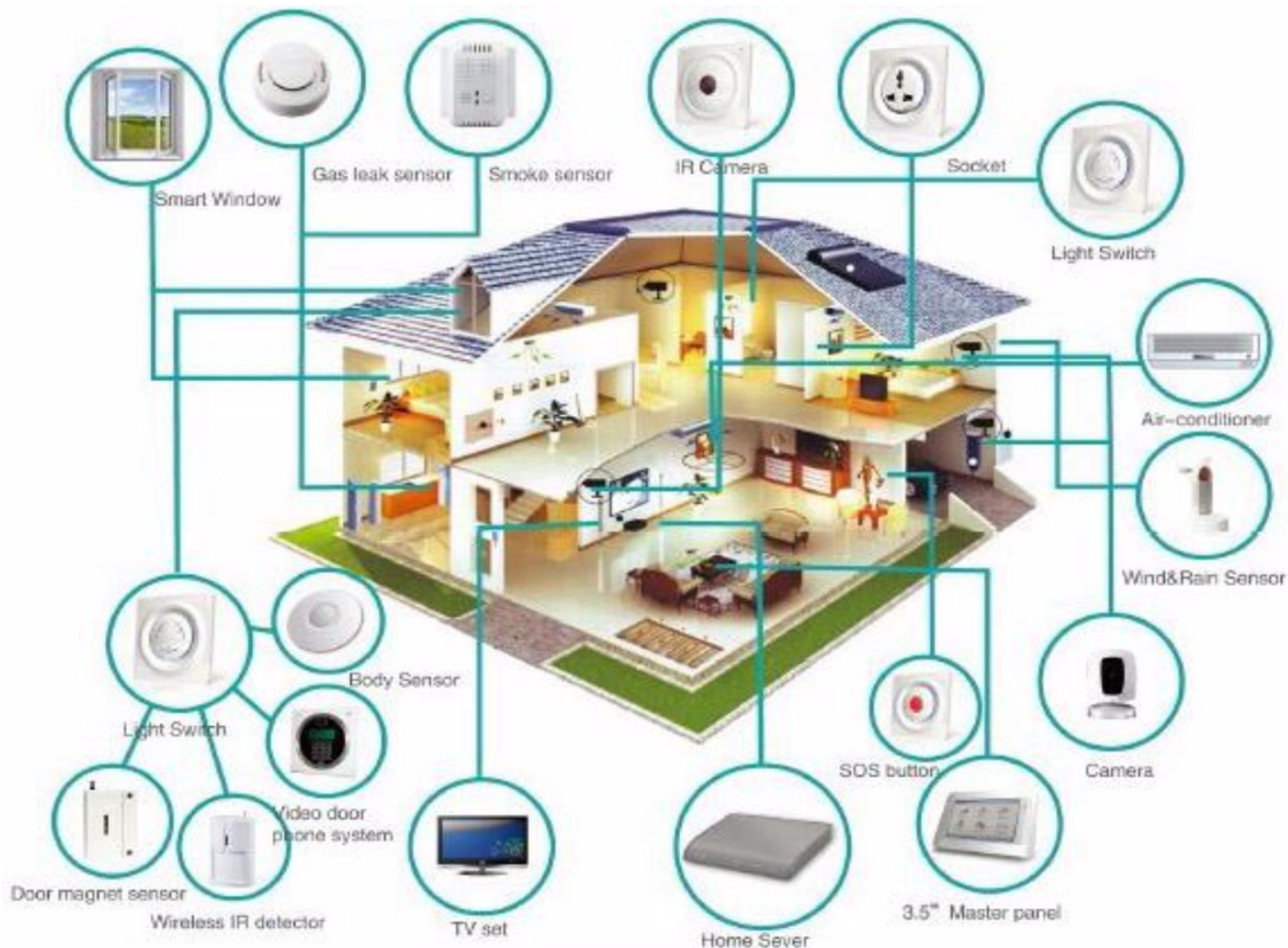
The Internet Of Things?



Industry 4.0



Smart Homes and Environments



The Quantified Self





Steve Mann's "wearable computer" and "reality mediator" inventions of the 1970s have evolved into what looks like ordinary eyeglasses.



(a)
1980



(b)
Mid 1980s



(c)
Early 1990s



(d)
Mid 1990s



(e)
Late 1990s

What can I help you with?



Apple Siri
Amazon Alexa
Google Assistant

...

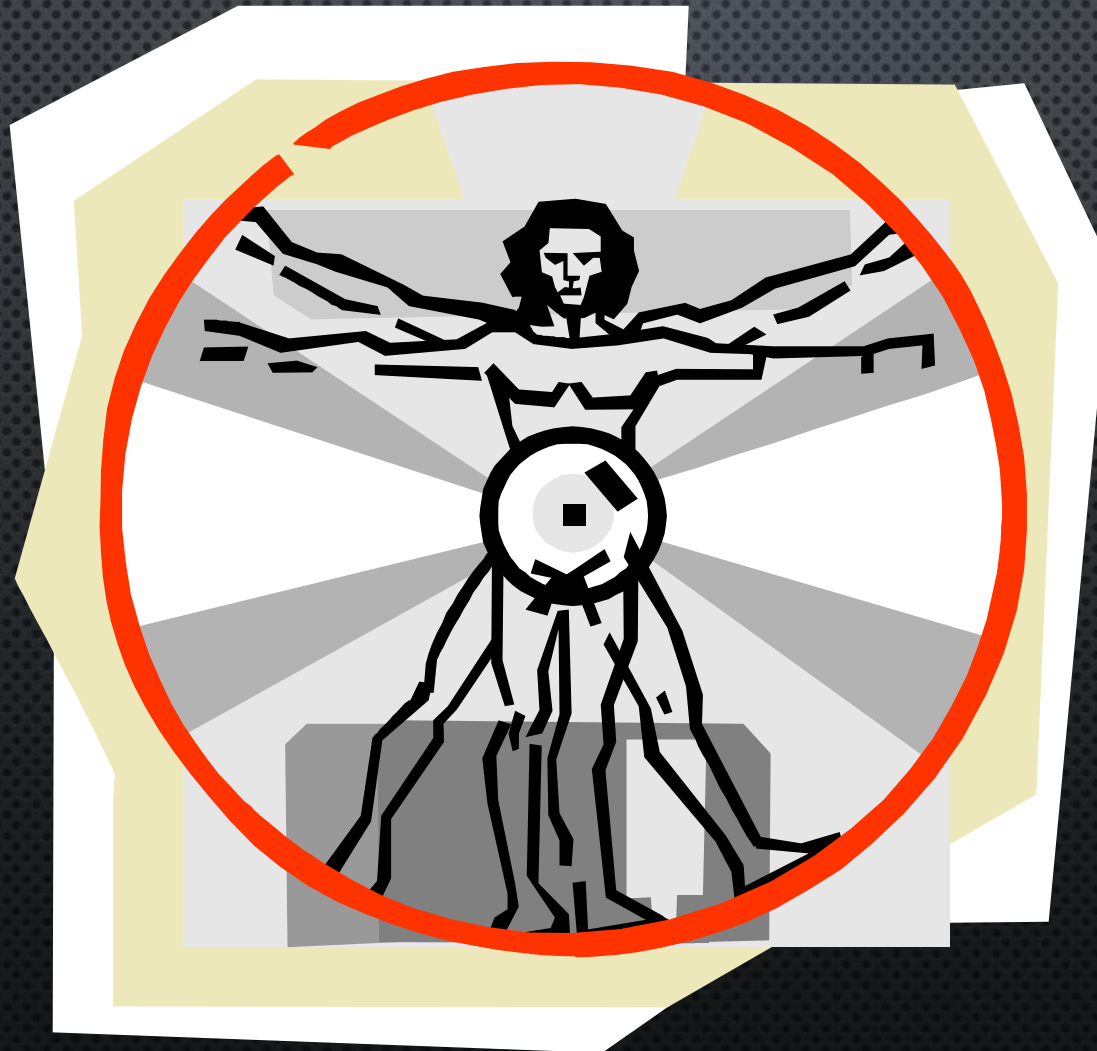




Lalala

Cyber-Physical Systems

Devices in the environment, worn and 'inside'



Kinseowear





HAL

Power Units
for upper limb
(+Angle Sensor)

Battery Pack

Control Unit on back

Bio-electric Signal Sensors

Power Units
for lower limb
(+Angle Sensor)

Floor Reaction Force Sensor



CYBERNETICS & IMPLANTS



Maker Culture



CNN: 3D-printed prosthesis





Big Data Analytics

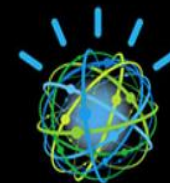
*Exponential
Growth of Data*





Artificial Intelligence

Machine Learning – Deep Learning



IBM WATSON

“BIG DATA ANALYTICS ENABLES AN ENTIRELY NEW EPISTEMOLOGICAL APPROACH FOR MAKING SENSE OF THE WORLD; RATHER THAN TESTING A THEORY BY ANALYSING RELEVANT DATA, NEW DATA ANALYTICS SEEK TO GAIN INSIGHTS *BORN FROM THE DATA*”.

Source: Kitchin R. “Big Data, new epistemologies and paradigm shifts”, *Big Data & Society* 1(1), 2014

"Big Data Analytics will bring profound changes to our health systems.

For example,
by analyzing whether a person through
life tends to pay bills on time,
we can predict with accuracy
how well medication will be taken."

-- ALEC2017, Luleå, 1-2 February 2017

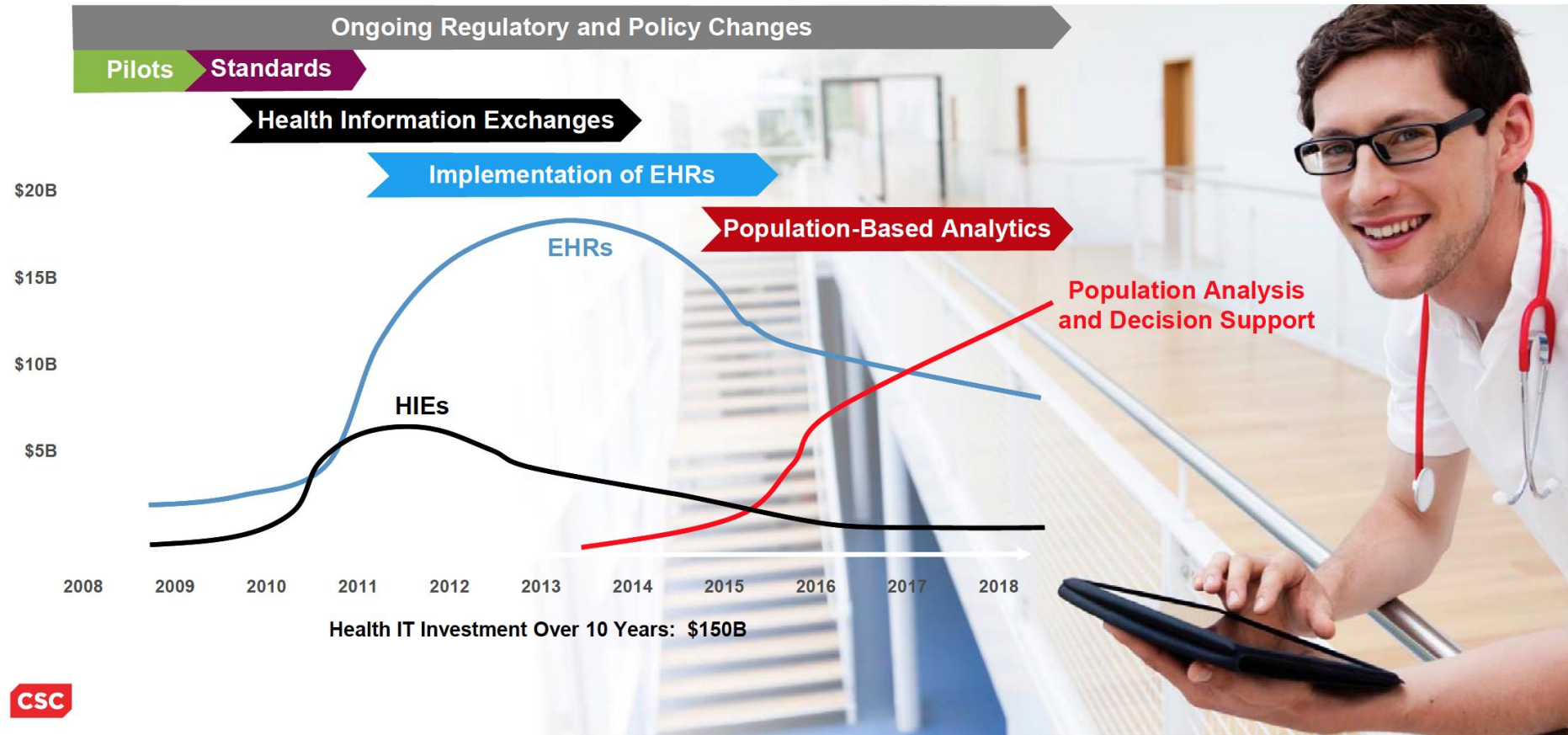
Dr Robert Wah

**Global Chief Medical Officer
Computer Sciences
Corporation**



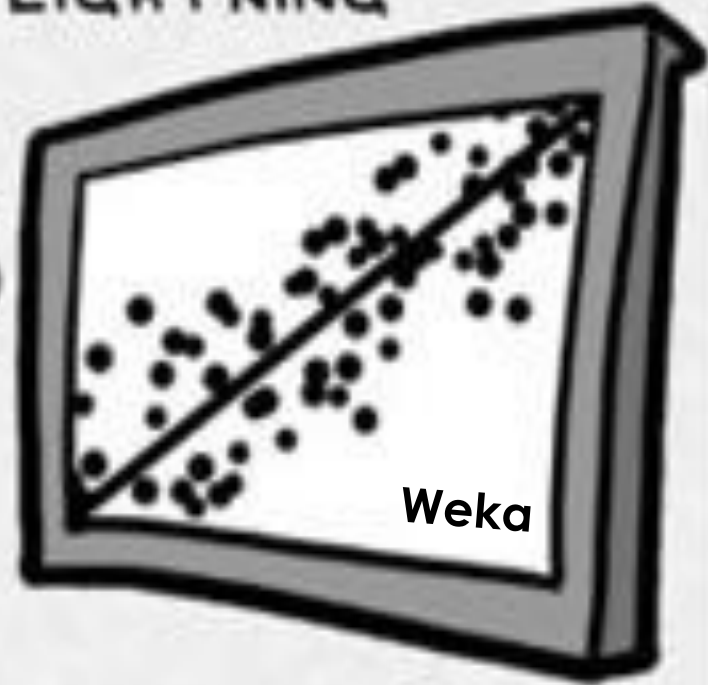
Three Waves of Health IT Investment

Health Information Exchanges (HIEs) • Electronic Health Records (EHRs) • Tools for Health Analytics



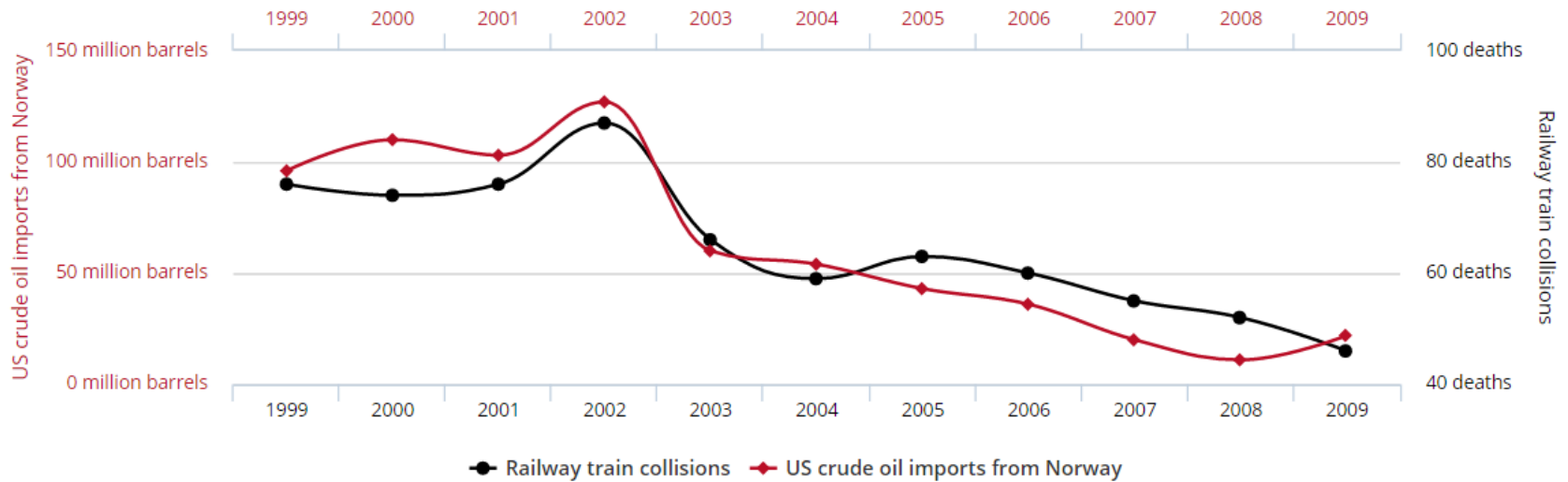
-- Dr Robert Wah, ALEC2017, Luleå, 1-2 February 2017

WHAT'S FREAKING US OUT HERE IS THAT WE'VE
FOUND A CORRELATION BETWEEN OWNING CATS
AND BEING STRUCK BY LIGHTNING



US crude oil imports from Norway correlates with Drivers killed in collision with railway train

Correlation: 95.45% ($r=0.954509$)



tylervigen.com

Data sources: Dept. of Energy and Centers for Disease Control & Prevention

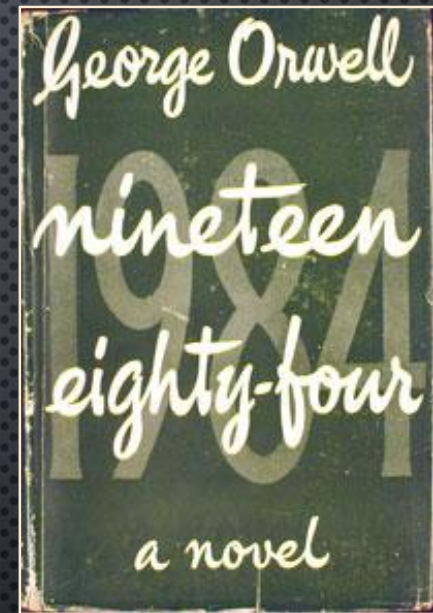
T. Vigen, *Spurious Correlations*, Hachette Books 2015



"After careful consideration of all 437 charts, graphs, and metrics, I've decided to throw up my hands, hit the liquor store, and get snocked. Who's with me?!"

“ **BIG BROTHER**
IS
WATCHING YOU!
”

- From the novel '1984' by Orson Welles (1949)





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ARTIMINO, FLORENCE, ITALY

SWEDEN, 2017, THE PARADOX

- SWEDEN IS IN THE TOP REGARDING MANY LIVING FACTORS
 - FOR EXAMPLE, OECD “FIVE YEAR SURVIVAL RATES”
- ‘ISLANDS’ OF HIGHLY DIGITIZED AND/OR HIGH TECH UNITS
 - EXTREMELY SUCCESSFUL SILOS FOR SPECIALIZED TREATMENTS
- VERY HARD TO ACT OUTSIDE OF THE SILOS AND PROCESSES
- THE SYSTEMIC CONNECTION OF HEALTH SYSTEMS IS POOR
 - TREATMENT OF PERSONS WITH MULTIPLE DIAGNOSES IS HARD
- THE INDIVIDUAL (OR THE CARER) IS OFTEN COORDINATING THE CARE
- FLEXIBLE AND CONNECTED HEALTH SYSTEMS ARE REQUIRED!



CROSSING BORDERS

- SWEDEN CONSISTS OF SEMI-AUTONOMOUS REGIONS
 - EACH REGION HAS THEIR OWN (SET OF) CARE SYSTEMS
- THIS IS VERY SIMILAR IN ALL SCANDINAVIAN COUNTRIES
- AT A EUROPEAN LEVEL THE CARE IS EVEN MORE DISPERSED
- **VERY HARD TO DELIVER CARE WHILE SPANNING REGIONAL BORDERS**



GLOBAL CARE

- A RAPIDLY GROWING NUMBER OF SWEDES ARE CARED FOR OUTSIDE SWEDEN
 - DENTAL CARE, PLASTIC SURGERY, ELDER HOMES...ETC
- GLOBAL CARE OFFERS A WIDE RANGE OF POTENTIAL BENEFITS
 - (EVEN) MORE SPECIALIZED CARE
 - INCREASED QUALITY OF CARE
 - SHORTER TREATMENT TIMES
 - CARE 24/7
 - REDUCED COSTS
- STILL NOT VERY CONNECTED
 - HEALTH SYSTEMS IN ISOLATION!



DOCTOR AND PATIENT ON THE INTERNET

- VIDEO CONSULTATION HAS BEEN INVESTIGATED SINCE THE MID 1990s

- MARRATECH AB
(ACQUIRED BY GOOGLE IN 2007 FOR HANGOUTS)

- SWEDEN HAS SEVERAL CARE ORGANISATIONS “DESIGNED FOR THE INTERNET”

- KRY.SE (PRIMARY CARE UNIT)

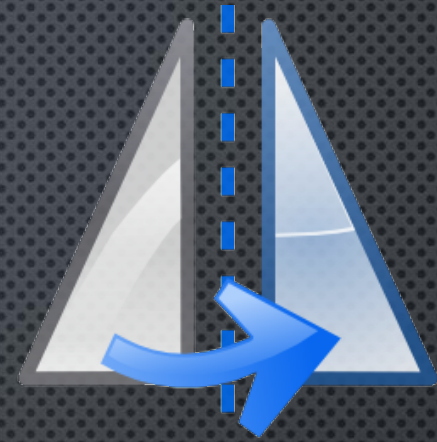
- PATIENTS ARE “SELF-EDUCATED” ON THEIR ILLNESSES

- THE INITIAL CONTACT IS LIKELY TO BECOME MAINLY INTERNET-BASED

- SUPPORTED BY EXPERT SYSTEMS?



“THE FLIP”



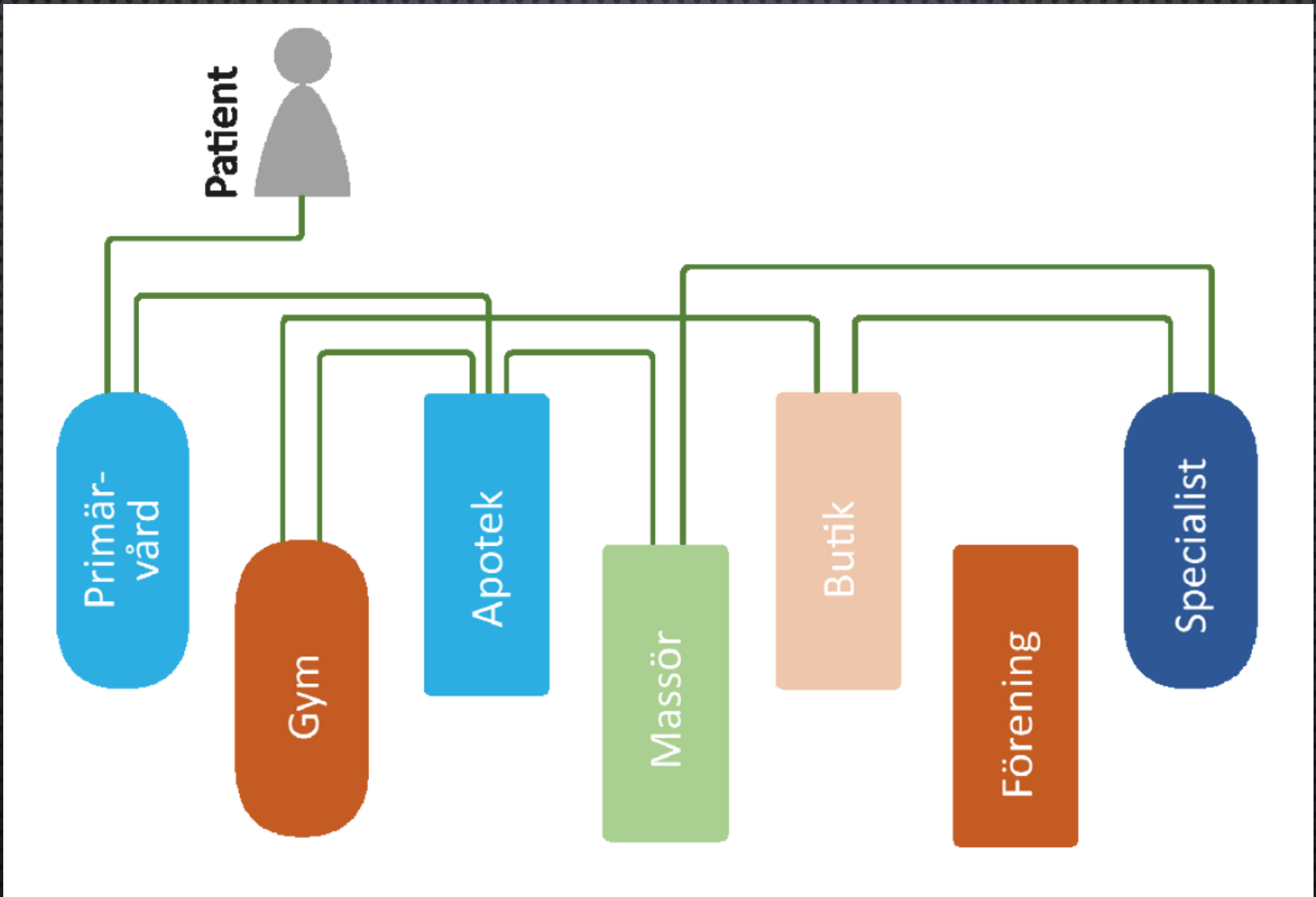
- SWEDEN HAS STARTED INITIATIVES FOR PERSONALIZED CARE (FLIP)
 - CENTER THE CARE PROCESSES AROUND THE PATIENTS
- THE FLIP HAS ALLOWED PATIENTS TO BOOK THEIR OWN APPOINTMENTS
- THE CHALLENGE IS TO ALLOW PERSONAL FLEXIBILITY IN OFTEN RIGID AND COMPLEX CARE PROCESSES (BREAK THE SILOS)

SUPERPATIENTS

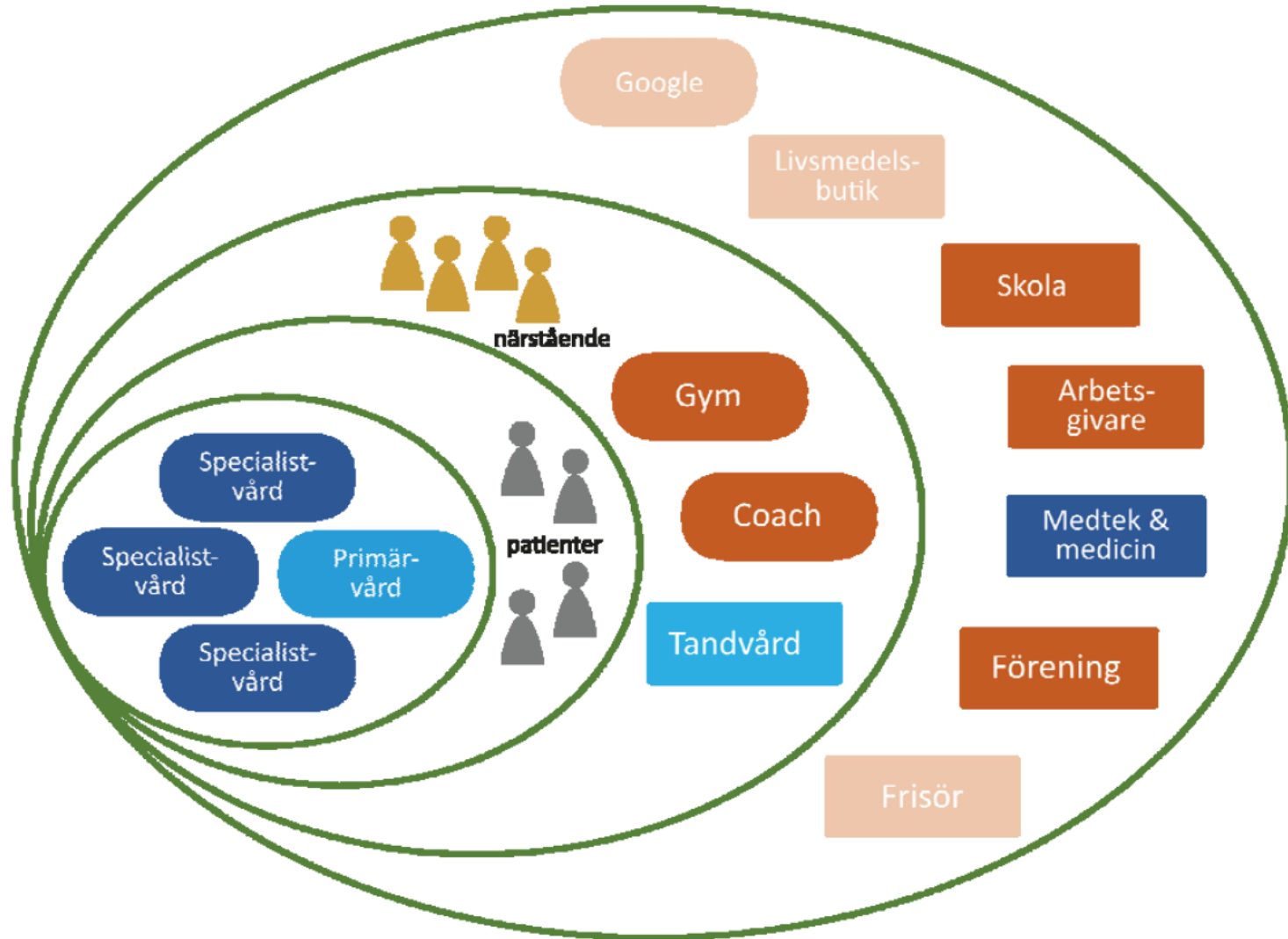
- PATIENTS CARING FOR THEMSELVES
- CARER (PARENTS, SPOUSE) CARING FOR THE PATIENT
- INDIVIDUALIZED CARE PATHWAYS, RESPONSIBILITIES AND RIGHTS
 - FOR EXAMPLE PRESCRIPTIONS
- DIABETES TYPE-II (CGM - CONTINUOUS GLUCOSE MONITORING)
- CARDIOLOGY (ICD - IMPLANTABLE CARDIAC DEFIBRILLATOR)
- PARKINSSON (IMPLANTABLE LEVODOPA PUMP)
- **AUTONOMY!**



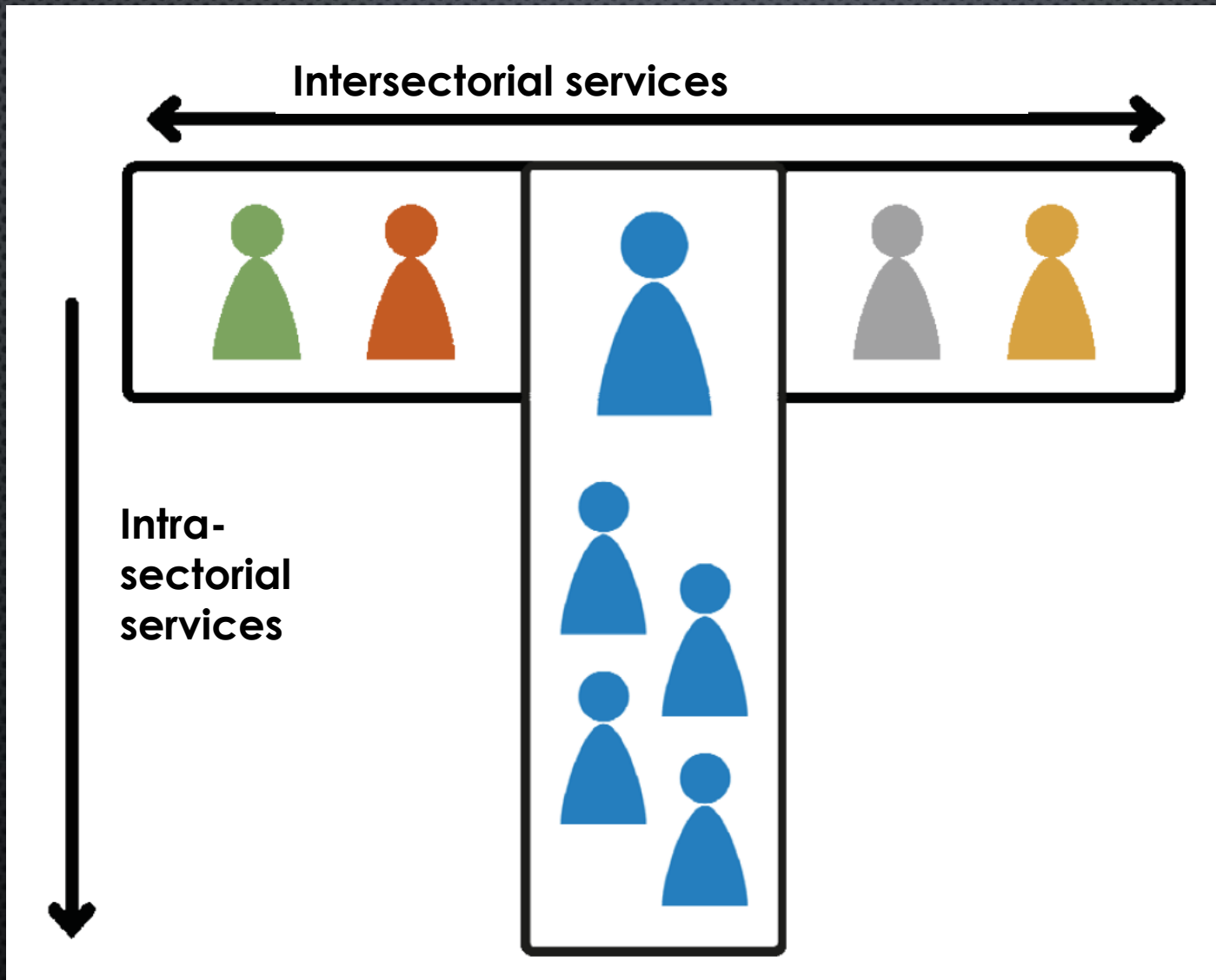
THE PATIENT IS THE COORDINATOR



EXPANDING HEALTH SECTORS

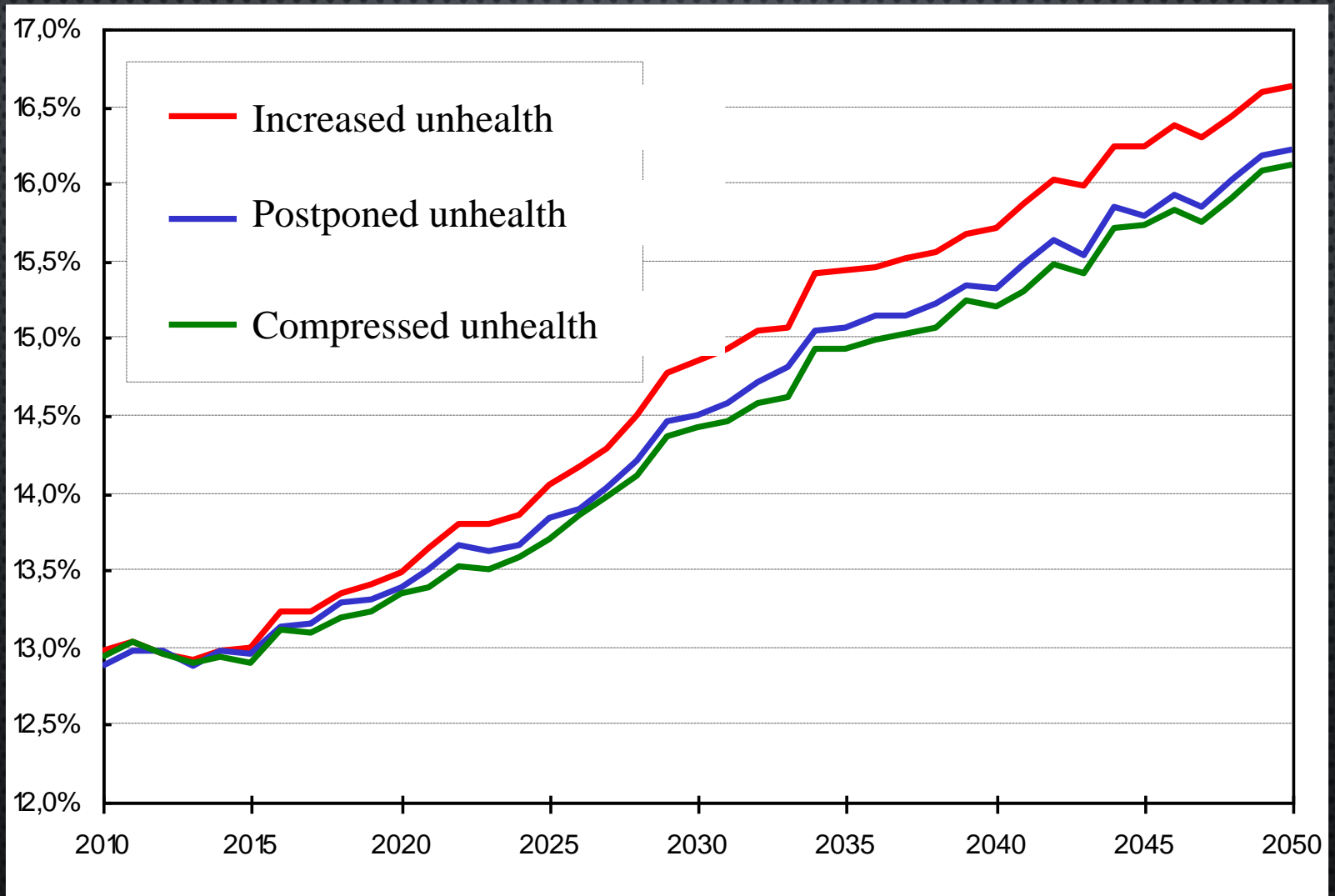


INTERSECTORIAL SERVICES – THE “T”



PART OF BNP

HEALTH SERVICES AND ELDER CARE



DISTRIBUTED LEDGER TECHNOLOGIES

- FULLY DISTRIBUTED SYSTEMS
 - NO 'TRUSTED' "MIDDLE-MAN"
 - TRUST IN THE SHARED SYSTEM (VOTING, MAJORITY, ETC)
 - I.E. "DISTRIBUTED TRUST"

- MUTUAL AGREEMENTS – AUTOMATION!

- A SUPPLEMENT FOR MONETARY SYSTEMS

- BASED ON EFFORT, TIME, ETC
- GAMIFICATION (BADGES, SCOREBOARDS)

- COLLABORATIVE CARE MODELS



PREDICTIONS



- THE CULTURE WITHIN THE CARE SECTOR WILL EVOLVE – BREAK THE SILOS
- CARE SYSTEMS WILL BE HIGHLY MODULAR – FLEXIBILITY!
- INFORMATION WILL BE OWNED AND CONTROLLED BY THE INDIVIDUALS
- EXPERT SYSTEMS WILL BE ACTING ON A GLOBAL SCALE
- INDIVIDUALS WILL BE CENTRAL IN THE CARE SYSTEM – NEW CARE PATHWAYS
- INITIAL INCREASE IN DO IT YOURSELF CARE

REMEMBER THIS



Increasing needs and expectations

A reduction of resources is required

Sociotechnical innovation is the key

You Matter!

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