Genetic data in health research

CPDP panel January 2017

MLC Foundation

Outline

- ‘Modest’ , an overview
  - ‘genetics’ in health care
  - From research to prevention and care
  - Will not discuss outside health care
  - Hence focus possible application in European solidarity based and regulated health care systems
    - But admit there are fuzzy boundaries here
- It’s starts with research with genetic (and other data) and it’s possible consequences

Some common sense remarks

- Is there geneticist in the room ?
- A little more about the genetic determinism
- Not a crash course in genetics
- We inherit our genes , 50 % from each parent
- But these change as well
  - Directly after conception
  - Also during our lifetime
- Random mutations
- More ‘deliberate’
  - Epigenetics

More about that….

- There is not a gene for “talent” (as mentioned in the invitation for the panel)
  - Anyhow, talent for what ???
- There are only relatively few mono genetic diseases
- Most depend on a more intricate interplay of various genes and the environment

- Twin studies
  - With many thanks to Dorret Boonsma

Discordant MZ twin design

MZ concordance

for complex disease (heritability) and MZ and DZ twin concordance		
	Probandwise concordance (%)	
	MZ	DZ
Diabetes Type 1 (88%)	**42.9**	7.4
Diabetes Type 2 (64%)	**34**	16
Multiple Sclerosis (25-70%)	**25.3**	5.4
Alzheimer's Disease (48%)	**32.2**	8.7
Parkinson Disease (34%)	**15.5**	11.1
Schizophrenia (81%)	**40.8**	5.3
Major Depresssion (37%)	**31.1**	25.1

Personalized medicine?

Incomplete concordance of MZ twins indicates that a genome cannot predict individual outcome.

The Holy Grail ….

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# of pesonalized prevention and medicine

- Much research geared towards that
- Unknown yet in many cases why one falls ill and the other not (under similar circumstances)
- Why a drug works in 1 patient and not in the other, or has more side effects etc.

Research

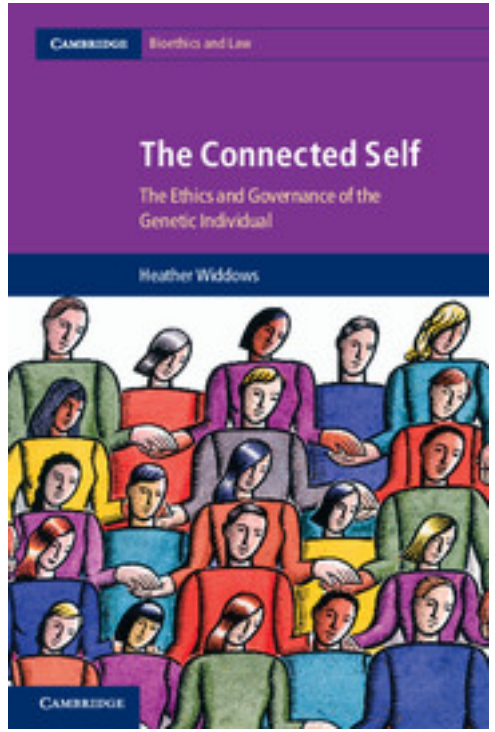
- Clinical research (clinical trials)
- Observational
  - Biobanking

- In clinical research , effects already noticable

Companion diagnostics

- Especially in cancer treatment
- Drug becomes more specific for a subgroup of patients
- Through a test
  - Either on the genetics of the cancer
  - Or the genetics of the patient, lacking a certain gene
- The challenge for the health care system
- A drug which would previously not have been approved
- Now is for a subgroup, though at a (huge) cost

Biobanking



- Many biobanks throughout Europe
- Biobanking research = biomarker research
  - Not always genetic
- Huge amounts of data
  - From volunteers
  - From other sources (residual tissue, hospital records, death registries etc. etc.)
  - Linked with analyses from the tissue (new data)
    - See www.bbmri-eric.eu
- Based on broad consent and governance
  - With residual tissue sometimes informed opt-out

Data protection….

- Many….
- Of course pseudonymised, at least
- Federated systems
- Bringing the questions to the data
- Oversight
  - Ethic committees
- Datasharing and FAIR principles
- Data are safe but fully anonymous often an illusion

Many challenges

- For privacy
  - Granular consent
  - Does not work ……
- For the health care system
  - General prevention (population a-symptomatic)
  - personalised prevention
    - Reasonably suspicion to be at risk
  - In health care treatment once one has fallen in

General, population based, prevention

- Will be at best an elevated chance …..
- Are we going to screen everybody ??
- I think not
  - Wilson and Younger (WHO) criteria
  - There public screening
- For the rest general prevention seems sufficiently ‘paternalistic’ as it is already…

For the health care system

- Personalised prevention
  - For people from families who feel at risk
- As we have genetic counselling already for families at risk
  - There it will help, always informed consent
- More general, in health care also for common diseases
  - Great promises
  - New knowledge which a simple doctor cannot manage
  - ‘Watson like’ decision support systems
  - More flow of patient data
  - Underlying algorithms remain in the public domain ??

A last remark

One of the main things we want to know — the concern that's hidden in that question — is: How plastic are people? To what extent are we stuck with what we are endowed with genetically? We're stuck with our DNA, but lots of things affect the way DNA is deployed. ***It's not enough to know what your DNA sequence is to understand about disease, behavior, and physiology. We need to know what the patterns of gene expression are. And that's not written into the genes.*** *Variable gene expression is not exactly a new insight, but its importance has only recently become apparent. So too, the whole issue of the plasticity. For example, We used to think there was no new nerve growth after adulthood. Well, there is new nerve growth. When people are severely injured, it is possible to develop new neural networks to compensate for that injury. But it's hard. And the relevant questions are, how difficult is it to change behavior or physiology? What are the ranges of variation? …*