Personalised Medicine and Society

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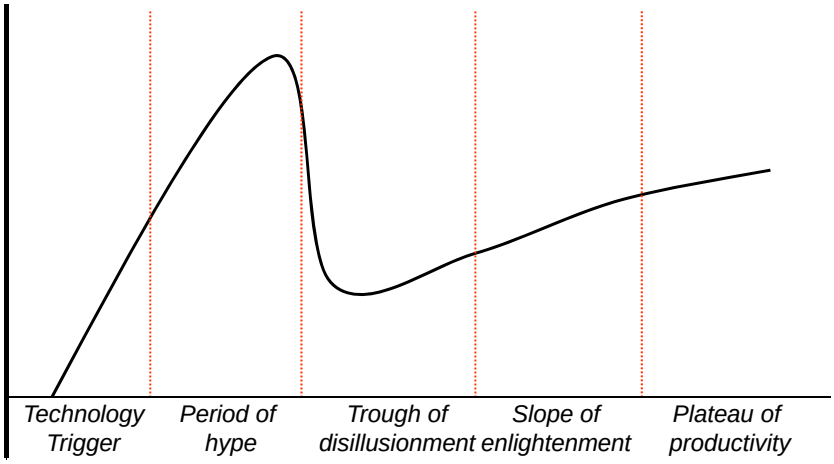
Hype *vs.* Realism



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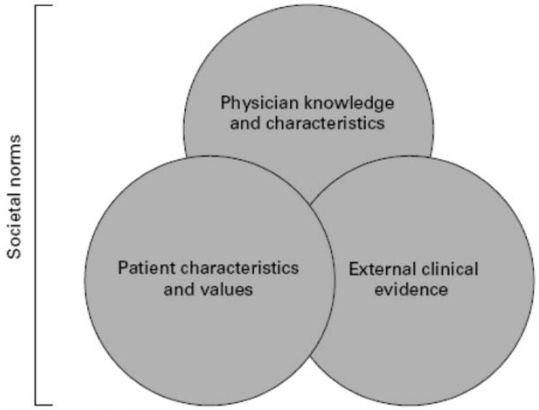
Changing Physician Behaviour is Difficult

- There are individual, institutional, and regional variations in diagnostic testing, hospitalisation rates, therapeutic interventions, and outcomes



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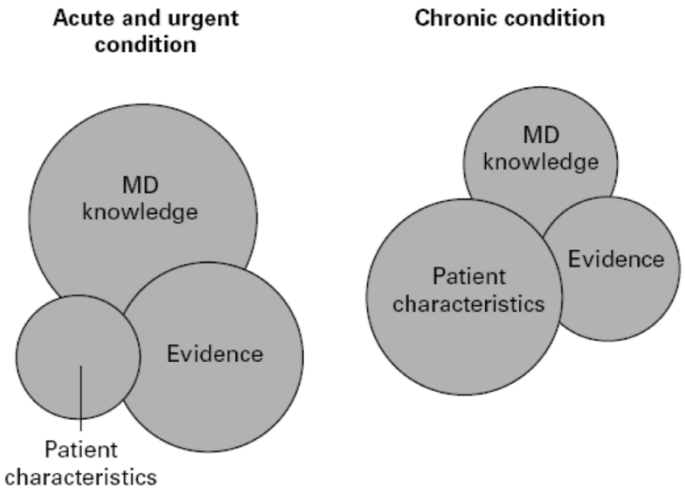
Bauchner et al, Arch. Dis. Child. 2001;84;459-462

Physician Behaviour: A Dynamic Model



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Need for Personalised Medicine

Society

Individual

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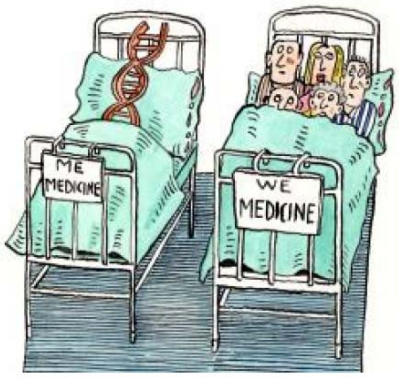
We Medicine vs Me Medicine

Arguments against Personalised Medicine

- Public health initiatives such as flu vaccine produce greater benefits
- Developing drugs for a proportion will cost more, and will only target a minority
- Rescuing the pharmaceutical industry
- Personal genetic tests have only been recommended for 4% of patients (US, 2012)



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Ideal Diagnostic Test (WHO definition)

A Affordable
S Sensitive
S Specific
U User-friendly
R Rapid and robust
E Equipment-free
D Delivered to those in need

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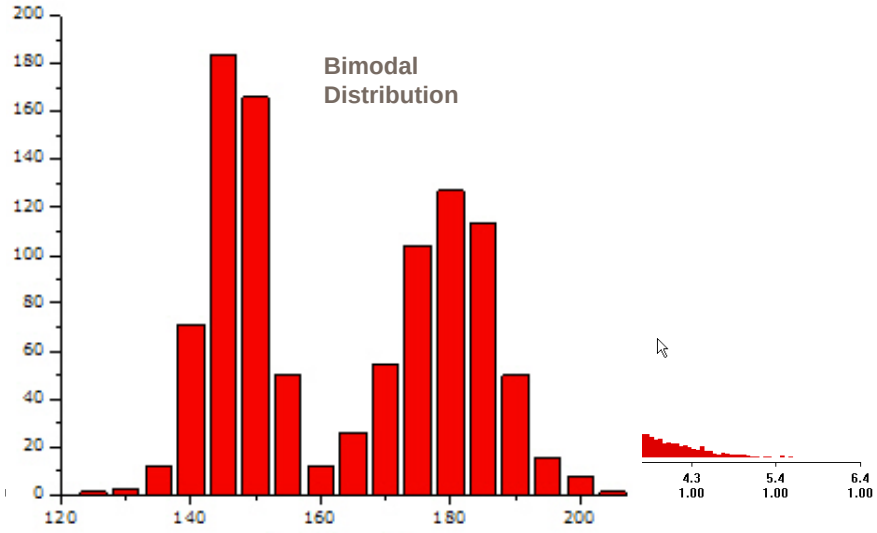
Definition of Response



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What do Patients Want?

- Unlikely that we will get tests that are 100% sensitive and 100% specific
- In some countries, patients have to pay for tests
- If we take cancer as a theoretical scenario:
  - Increasing sensitivity was an important determinant for the willingness to pay for the test
  - Reducing severity of side effects from severe to mild was also associated with greater acceptance of testing

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Consider a Test?

- The test predicts the likelihood of a side effect with a drug
- It can prevent mild side effects which occur in 1 in 20 patients taking the drug
- It can also prevent severe side effects which occur in 1 in 5000 patients taking the drug (these can kill)
- When a patient first develops the signs of a side effect, one cannot tell whether the ultimate side effect will be mild or severe
- The test is not absolutely predictive
  - Pre-test probability – 5% (1 in 20)
  - Post-test probability – 26% (1 in 4)
- Would you want a family member to have the test?

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Personal Utility

- "the meaning and worth a genomic test brings to an individual from that individual's perspective rather than any external metric such as morbidity or mortality" (Feero et al, JAMA 2013)
- Will be difficult to ignore
- How do you assess personal utility in the context of benefits and harms?

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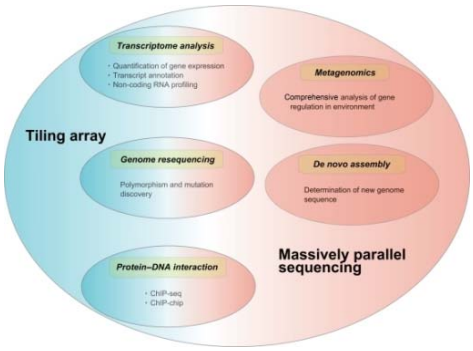
Returning Incidental Results

- Incidental findings likely to become commonplace as sequencing becomes routine?
- Should we return incidental results?
- If so, what should we return?
  - Not know function
  - Actionable (3%)
  - May affect disease in later life
  - May affect family
  - May affect response to drugs
- Survey of 200 – 187 (93.5%) would want to know



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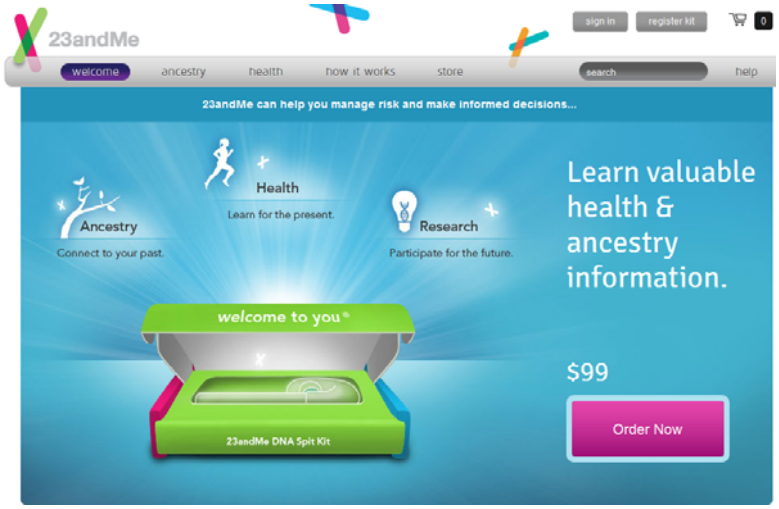
Direct to Consumer Services



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DTC Genetic Testing

- Market is likely to reach $230 million in 5 years time
- Why do testing?
  - Identity seeking – who am I?
  - Disease risk testing
    - BRCA1 – 87% risk of developing breast cancer and 50% risk of developing ovarian cancer
    - But most genes do not provide this degree of accuracy: insufficient clinical value
  - Curiosity driven
    - 94% did it out of curiosity
    - 91% learn about future diseases
- Does it improve lifestyle or will it increase health-care utilisation?

Empowerment

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Why 23andMe Genetic Testing Is A Waste Of Time And Money

Elevated Risk

Name	Confidence	Your Risk	Avg. Risk	Compared to Average
Heart Attack	★★★★	8.9%	7.4%	1.21x

I almost had a heart attack right there. This made no sense. I was 1.21 times more likely than the average person to suffer a heart attack, despite having no family history of anything remotely related to heart disease.

But then I clicked on the link that took me to a detailed report and saw this:

Your Genetic Data » Share your health results

Show information for Elly Hart assuming European ethnicity and an age range of 40–79

Where's mine?

Elly Hart
8.9 out of 100
women of European ethnicity who share Elly Hart's genotype will develop Heart Attack between the ages of 40 and 79.

What does the Odds Calculator show me?
Use the ethnicity and age range selectors above to see the estimated incidence of Heart Attack due to genetics for women with **Elly Hart's** genotype. The 23andMe Odds Calculator assumes that a person is free of the condition at the lower age in the range. You can use the name selector above to see the estimated incidence of Heart Attack for the genotypes of other people in your account.

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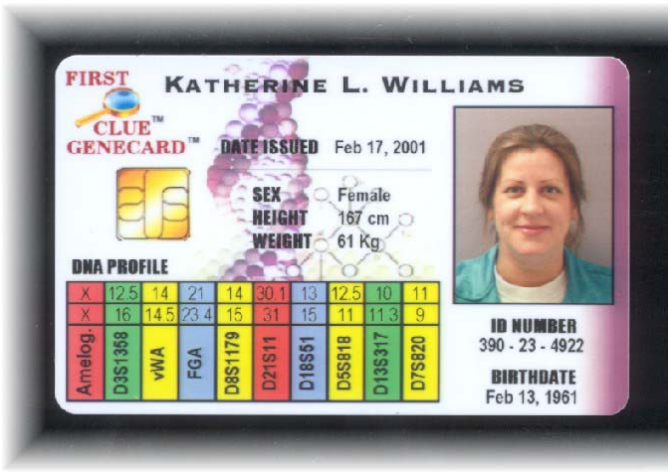
Privacy and Confidentiality



Your Genome on a SMART Card

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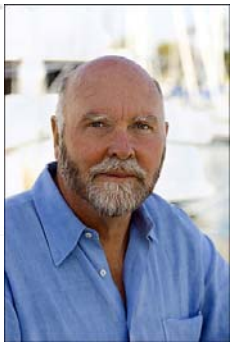
Publishing Your Genome

J. Craig Venter™ INSTITUTE

About the HuRef Project

HuRef Genome Browser

This browser enables access to the diploid genome sequence of J. Craig Venter as recently published in PLoS Biology. The graphical interface depicts the haploid sequence with SNP and insertion/deletion DNA variants as identified by genome assembly and comparison methods. The interface also represents the haplotype blocks from which diploid genome sequence can be inferred and gene annotations. This work was done at the J. Craig Venter Institute, with collaborators from The Hospital for Sick Children in Toronto, Canada, University of California, San Diego, and Universidad de Barcelona, Spain.



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HM Government

ABI Association of British Insurers

Concordat and Moratorium on Genetics and Insurance

- In force till 2017
- Applies to predictive genetic tests (not diagnostic tests)
- Insurers should not treat customers who have an adverse predictive genetic test result less favourably than others without justification

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Ethical, Legal and Social Issues

- **Fairness in the use of genetic information** by employers, courts, schools, adoption agencies, and the military, among others.
- **Psychological impact, stigmatization, and discrimination** due to an individual's genetic differences.
- **Reproductive issues**: use of genetic information in reproductive decision making
- **Clinical issues** including education of healthcare providers of benefits and limitations

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Health Inequalities

- Is this going to be the preserve of the reach within society?
- Problems akin to "postcode prescribing"
- Will it only be used in rich countries?
- Possibility that it will exacerbate health inequalities

Published online 11 March 2009 | *Nature* **458**, 131-132 (2009) | doi:10.1038/458131a

News

Personalized cancer therapy gets closer

Genetic testing allows doctors to select best treatment.

Erika Check Hayden

The long-awaited era of personalized genetic medicine may finally be arriving for people with cancer. Some cancer centres are preparing to screen all patients for genetic glitches associated with the disease, and scientists are starting to use detailed information about patients' tumour genomes to decide which treatments might benefit them most.

Some patients with cancer have gene mutations that can be targeted by specific drugs.

BURGER/PHANIE/REX FEATURES

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The Next 20 Years

Prediction is very difficult, especially about the future

Niels Bohr, Danish Physicist

The best way to predict the future is to invent it

Alan Kay, American Computer Scientist

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