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Interactive graphics in Pharma R&D: The right decision

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Strata-EU 2013, London, 12-Nov-2013

Multiple Sclerosis

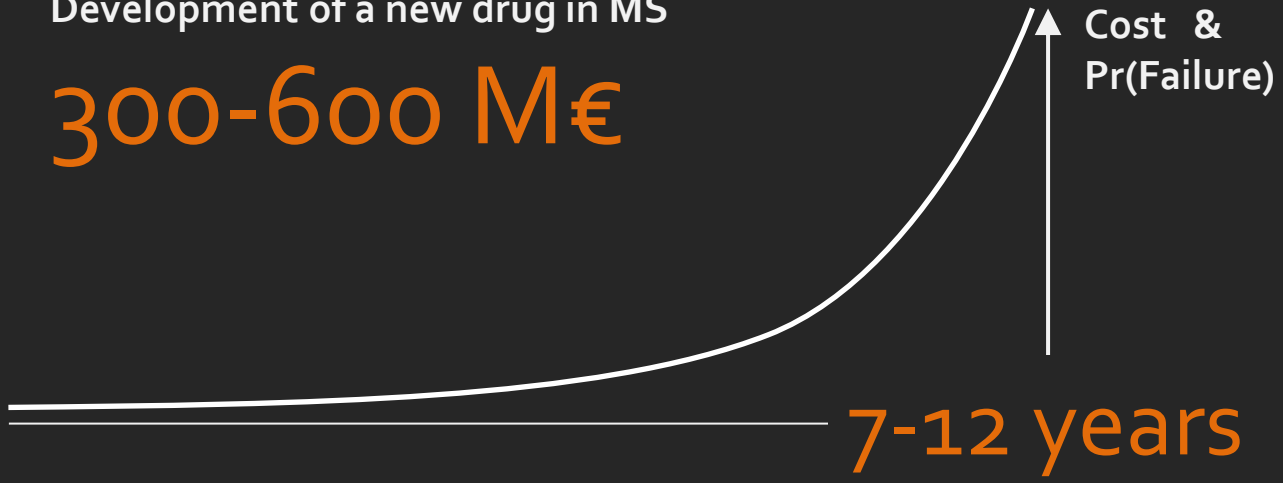
2,500,000

People with MS, in the world
Mainly in western countries
Mainly women 35-45 y.o.

#15 in R&D spending (~2 $bn/yr)

Development of a new drug in MS

300-600 M€

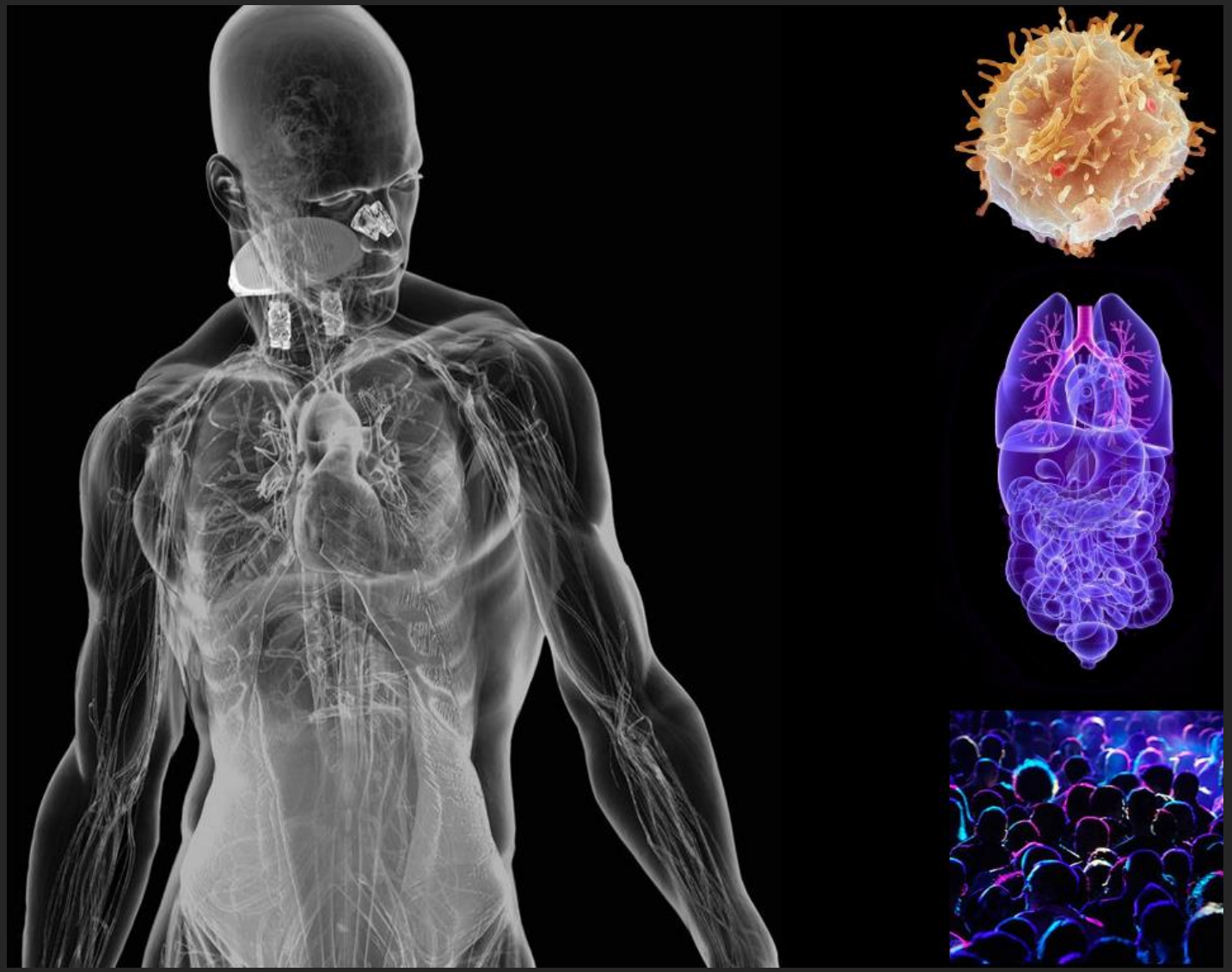


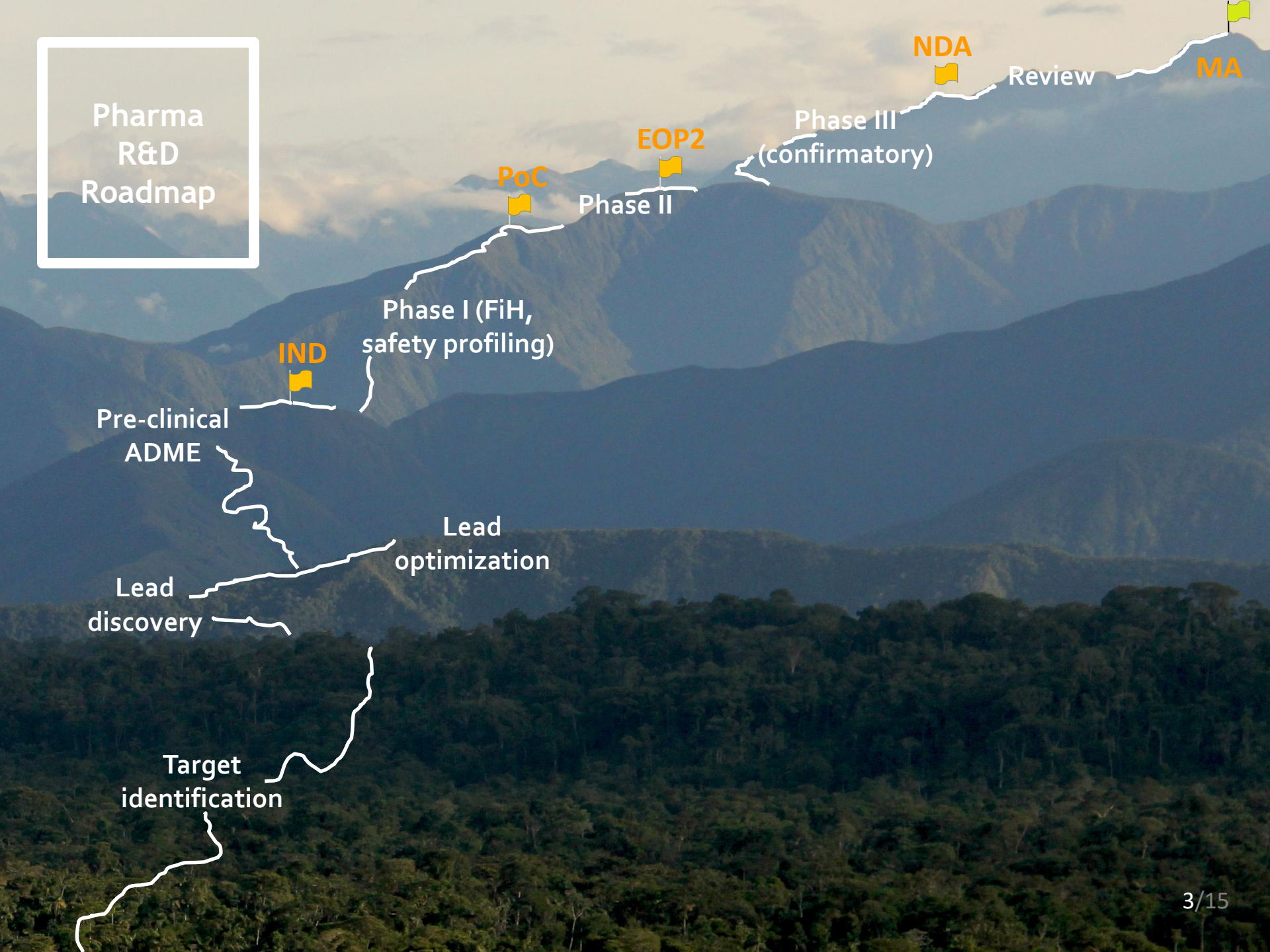
Price of a marketed MS treatment

30-45 k€/year/patient

*http://www.imshealth.com/, http://www.nationalmssociety.org/index.aspx

Complex Systems




Pharma
R&D
Roadmap
Target
identification
Lead
discovery
Lead
optimization
Pre-clinical
ADME
IND
Phase I (FiH,
safety profiling)
PoC
Phase II
EOP2
Phase III
(confirmatory)
NDA
Review
MA

Regulatory Enviro-nment

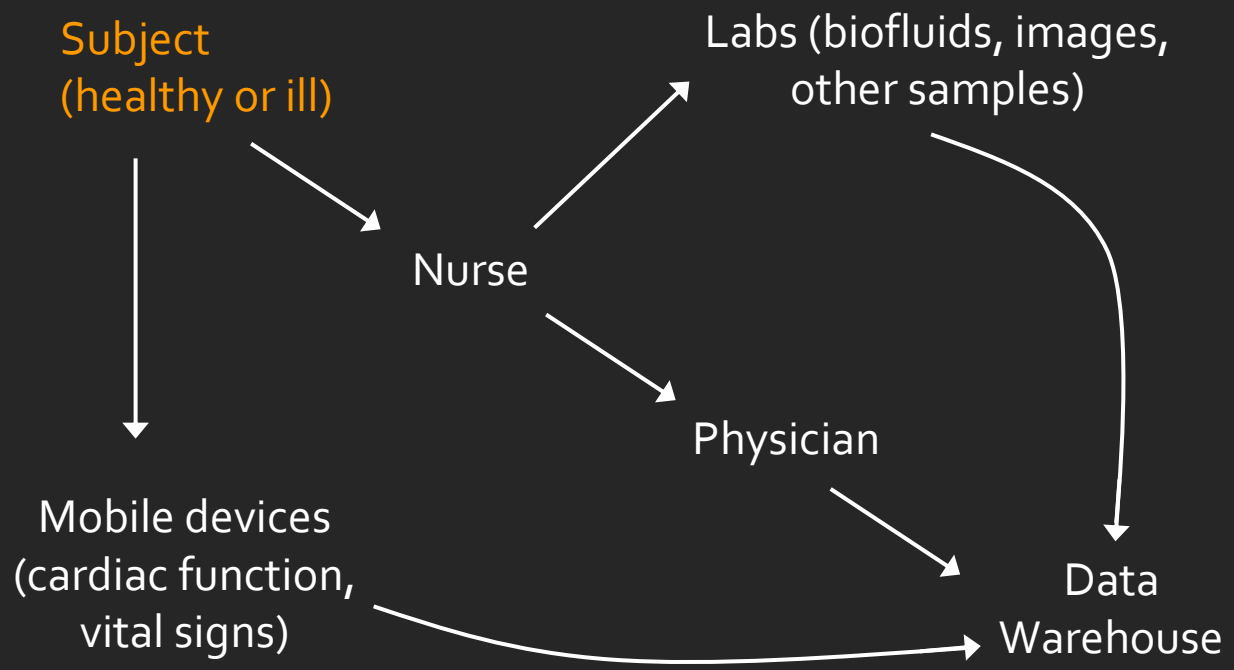
IN THE INTEREST OF
ALL,
STAY INSIDE THE BOX

EUROPEAN MEDICINES AGENCY
SCIENCE MEDICINES HEALTH

Data analyses have to be **reproducible**

- Source data are safely stored and data manipulation are **traced**
- Data analyses are available in the form of programs (no GUI)

From Patient To Data

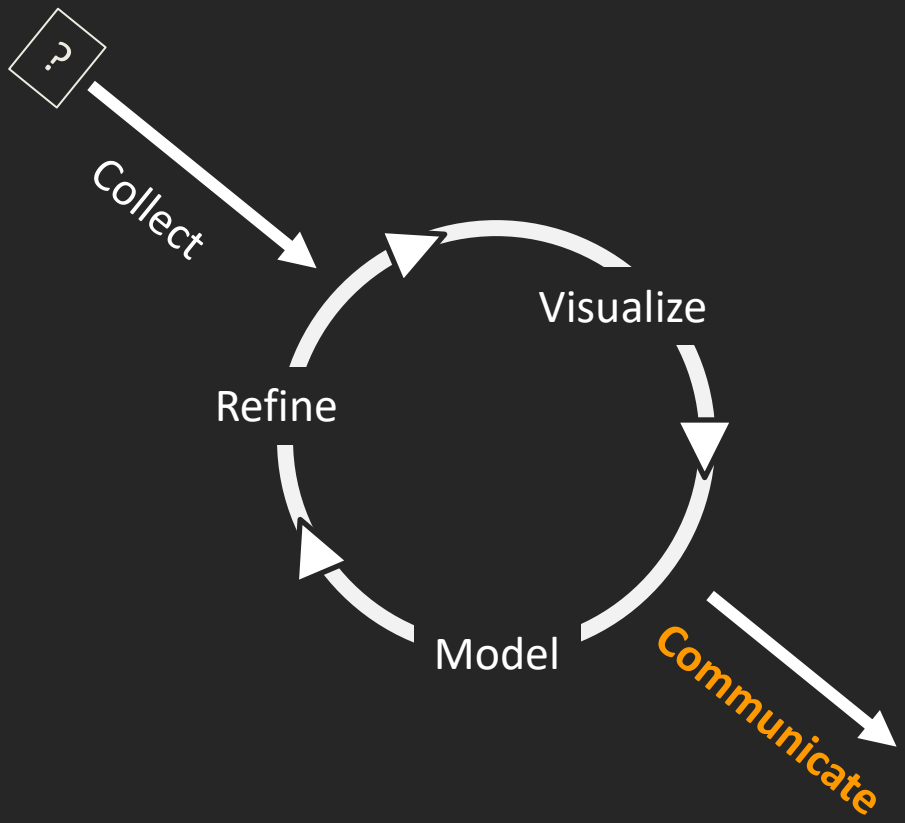


100 subjects ≈ 1-5 GB

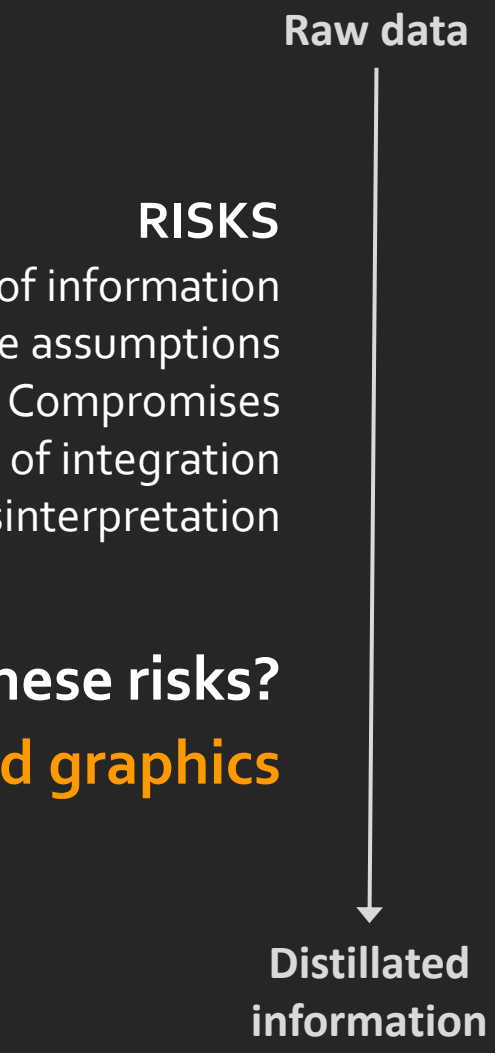

From Data To Decision
Raw data
Data manager
Data scientist
Clinical project leader
Therapeutic area head
Clinical development head
Pharmaceutical division head
Distillated information


Clinical Develop. Strategy
Data manager
Data scientist
Clinical project leader
Therapeutic area head
Clinical development head
Pharmaceutical division head
$\sqrt[3]{R_x}$
€
In clinical projects, a strategy is defined as a **compromise** between **money** and **science**

Decision Making Process



Commu-Nication Risks



How to mitigate these risks?

We use models and graphics

Models & Graphics

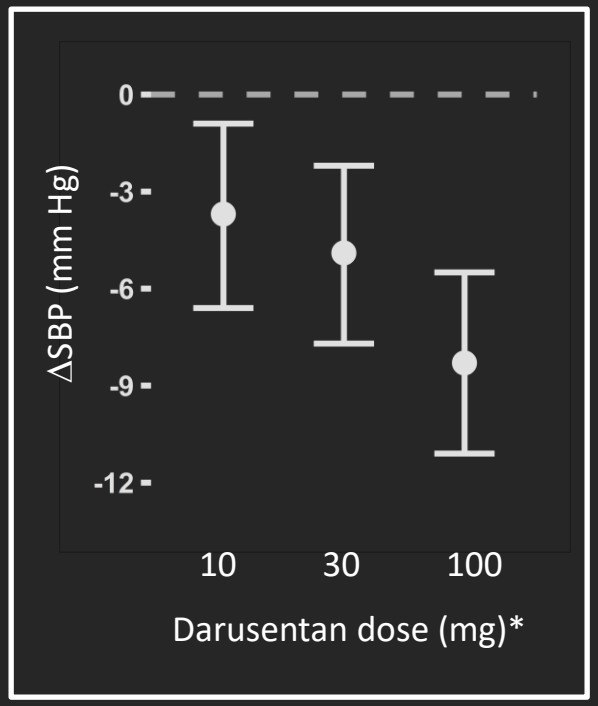
Two sides of the same coin

Model

$$\Delta SBP_{ij} = \beta_i + \varepsilon_{ij}$$
$$\varepsilon_{ij} \sim N(0, \sigma^2)$$
$$i = \{1, 2, 3\}$$
$$j = \{1, \cdots, N\}$$

- Gaussian distrib°
- Homoscedasticity
- Dose is discrete

Visualize



− Mathematical language
+ Assumptions

+ Universal language
− Limited in space and form (2D)

*Data from Nakov *et al*. *Am. J. Hypertension*, 2002, **15**:583-9.

Real life Is Complex

How many static graphics to depict this model?

$$Y_{ij} = MESOR_i \times \left(1 + \sum_{k=1}^{K} Amp_{ik} \times cos\left(\frac{2\pi}{24} \times k \times (t_j - \phi_{ik})\right)\right) + \varepsilon_{ij}$$

$$MESOR_i = AMESOR_i \times exp(\eta_{1i})$$

$$Amp_{ik} = Amp_k \times exp(\eta_{2ki})$$

$$\phi_{ik} = \phi_k \times exp(\eta_{(2k+1)i})$$

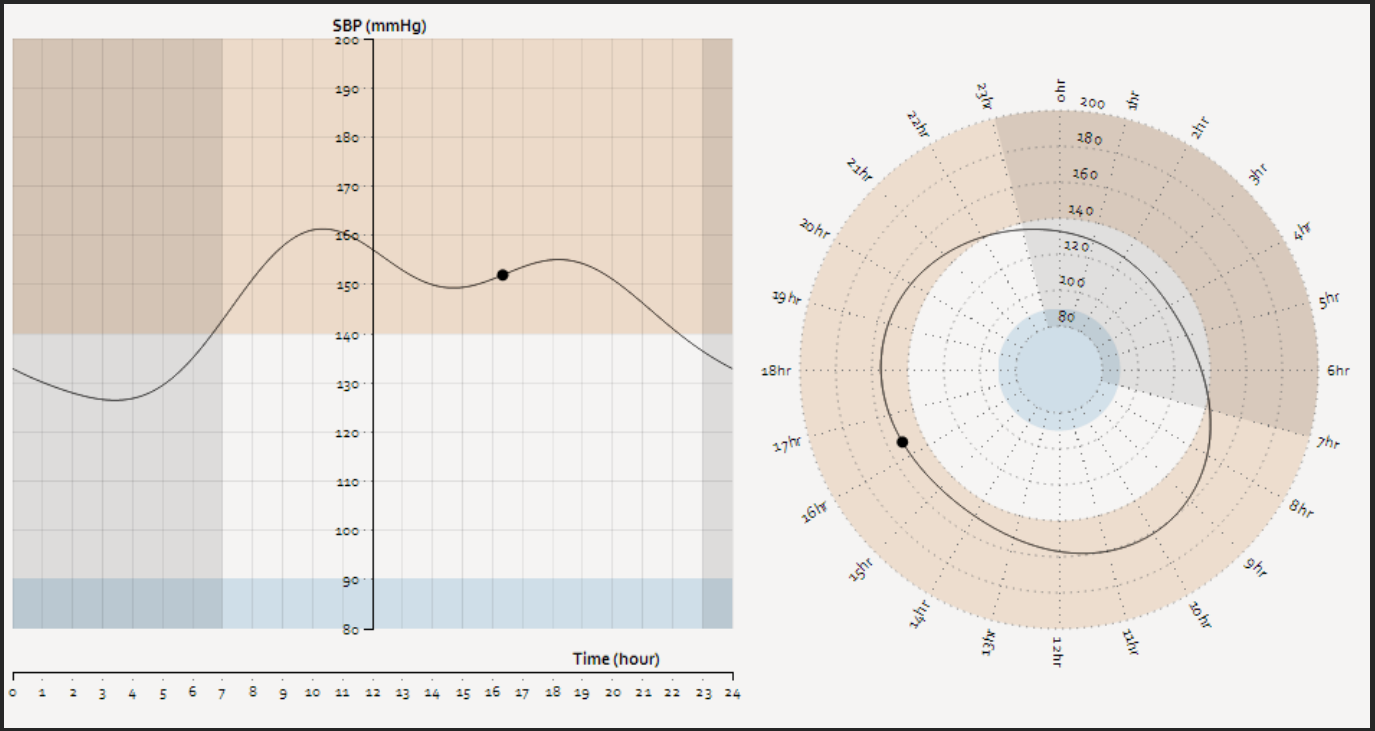
$$AMESOR_i = \theta_0 \times \left(1 + \frac{E_{max,i} \times Dose_{ij}{}^{Hill}}{EC_{50}{}^{Hill} + Dose_{ij}{}^{Hill}}\right)$$

$$E_{max,i} = \theta_1 \times (1 + \gamma \times Sex_i = 2)$$

$$\varepsilon_{ij} \sim N(0, \sigma^2)$$

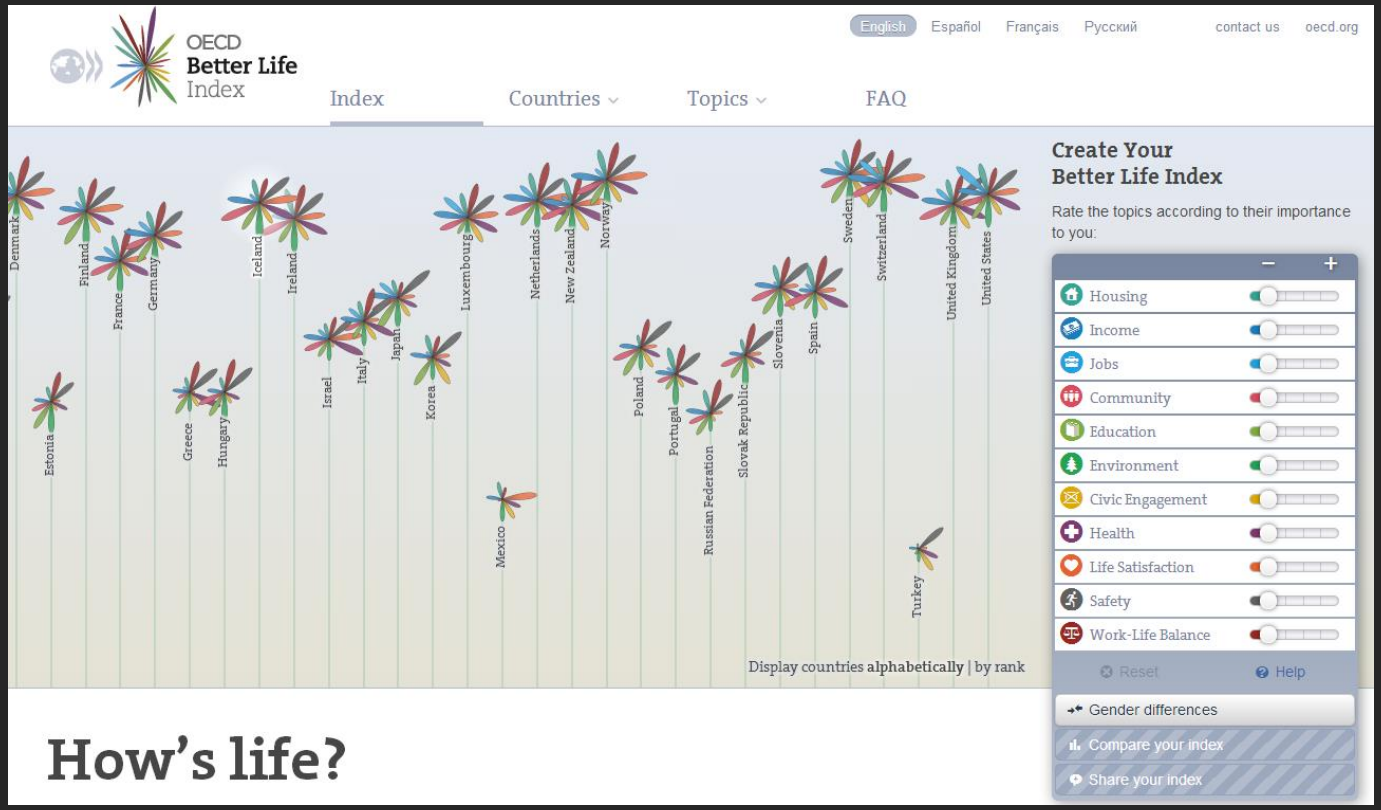
Interactive Graphics

Use interactive graphics



Interactive Graphics

Use interactive graphics



Conclusion

Interactive graphics in Pharma R&D:
The right decision

- Give control to the end-user
- Make scientific discussions an enjoyable experience
- Provide context, perspective
- Make the assumptions explicit

To take quick and accurate decisions

Acknow Ledgments

Jean Mercier (http://www.khawai.com/)

Olivier Luttringer (Novartis)

Hadley Wickham (http://had.co.nz/)

Mike Bostock (http://bost.ocks.org/mike/)

Thank you

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