



Developing a Shiny Web Application to Address Suboptimal Treatment of Urology Patients Through Predictive Modelling and Improved Communication of Science

Federico Concas

About me

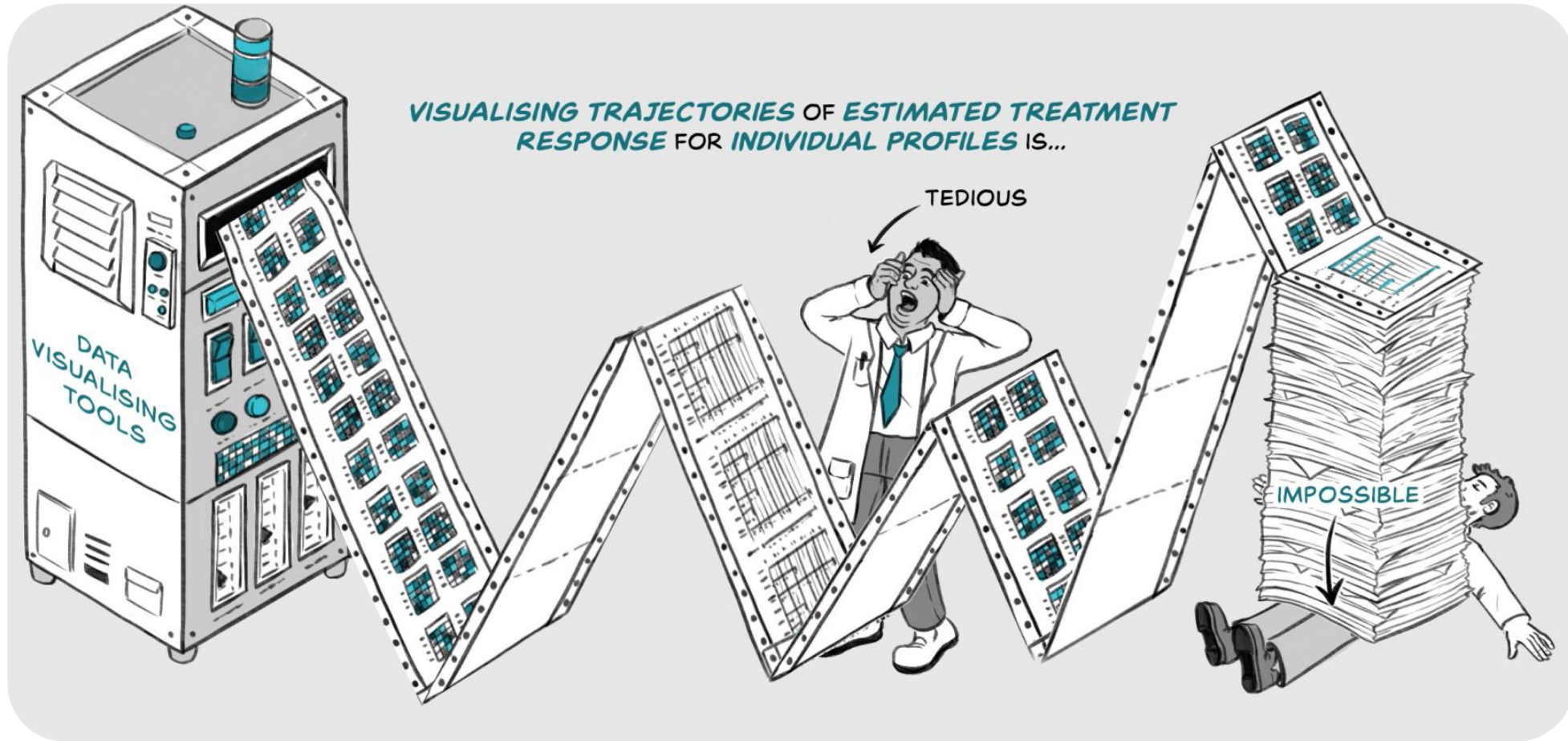


Federico Concas

Principal Data Scientist at GSK

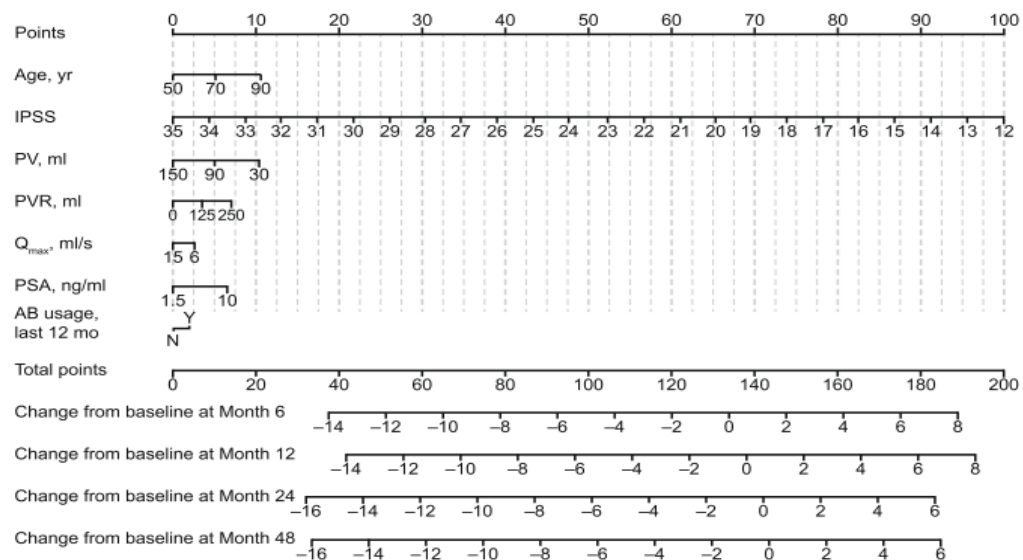
- Work on cross-departmental projects
- Experience with Shiny and R development
- Worked on this project

Ineffective communication of science



Traditional displays

Nomograms

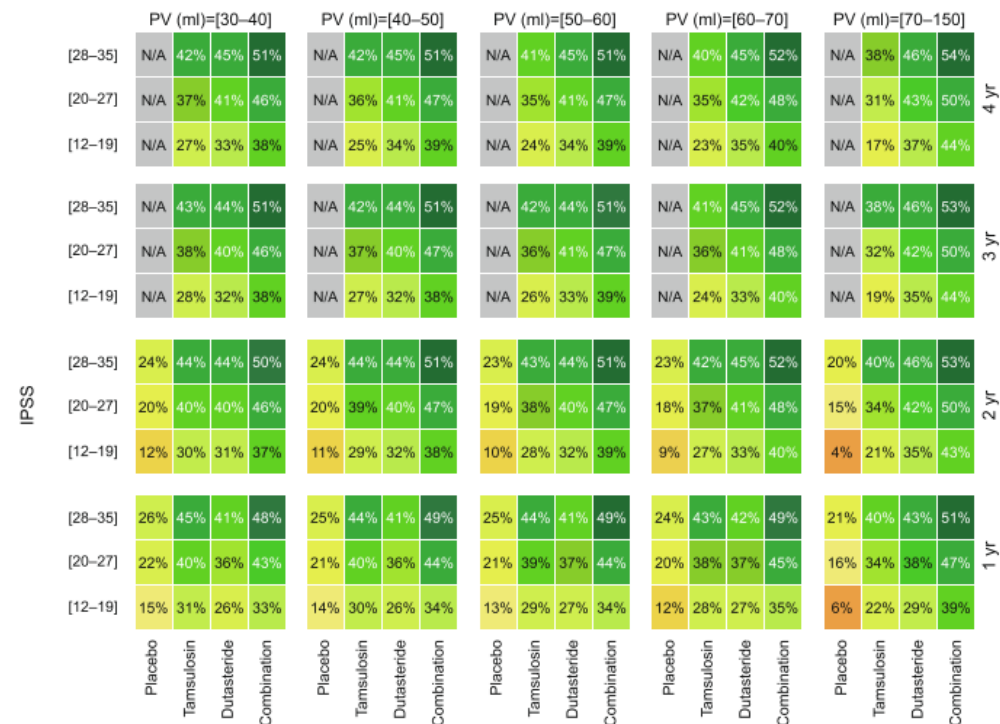


Model effects

Parameter	Model 1A	Model 1B			Model 1C	
		Combination	Tamsulosin	Dutasteride	Placebo	Dutasteride
AGE (10-years)	0.12 (-0.09, 0.34)	0.38 (0.01, 0.75)	-0.10 (-0.47, 0.27)	0.07 (-0.29, 0.43)	-0.33 (-0.60, -0.06)	-0.05 (-0.32, 0.21)
IPSS (5-units)	-2.96 (-3.08, -2.84)	-3.15 (-3.36, -2.95)	-2.88 (-3.09, -2.67)	-2.79 (-3.00, -2.58)	-1.80 (-1.96, -1.63)	-1.84 (-2.01, -1.68)
PV (50 mL)	-0.01 (-0.34, 0.32)	-0.62 (-1.19, -0.05)	0.97 (0.40, 1.53)	-0.39 (-0.96, 0.19)	0.89 (0.40, 1.38)	-0.16 (-0.61, 0.28)
PVR (20-units)	0.11 (0.06, 0.15)	0.08 (0.00, 0.16)	0.10 (0.02, 0.18)	0.13 (0.05, 0.21)	0.13 (0.07, 0.18)	0.07 (0.02, 0.12)
QMAX (2-units)	-0.10 (-0.18, -0.02)	-0.08 (-0.22, 0.06)	-0.06 (-0.20, 0.08)	-0.18 (-0.32, -0.04)	-0.15 (-0.27, -0.04)	-0.10 (-0.22, 0.02)
PSA (5-units)	-0.01 (-0.39, 0.36)	0.55 (-0.10, 1.20)	-0.13 (-0.78, 0.52)	-0.55 (-1.20, 0.09)	-0.22 (-0.72, 0.27)	-0.90 (-1.39, -0.41)
Alpha blocker (yes vs no)	0.50 (0.20, 0.80)	0.28 (-0.23, 0.80)	0.58 (0.06, 1.09)	0.61 (0.09, 1.13)	0.85 (0.39, 1.31)	0.83 (0.37, 1.29)
CT vs Dutasteride	-0.97 (-1.36, -0.57)	-	-	-0.84 (-1.36, -0.33)	-	-
Tamsulosin vs Dutasteride	1.56 (1.17, 1.96)	-	-	1.38 (0.86, 1.89)	-	-
Dutasteride vs CT	-	0.84 (0.33, 1.36)	-	-	-	-
Tamsulosin vs CT	-	2.22 (1.70, 2.74)	-	-	-	-
CT vs Tamsulosin	-	-	-2.22 (-2.74, -1.70)	-	-	-
Dutasteride vs Tamsulosin	-	-	-1.38 (-1.89, -0.86)	-	-	-
Dutasteride vs Placebo	-	-	-	-	-3.17 (-4.46, -1.89)	-
Placebo vs Dutasteride	-	-	-	-	-	3.17 (1.89, 4.46)

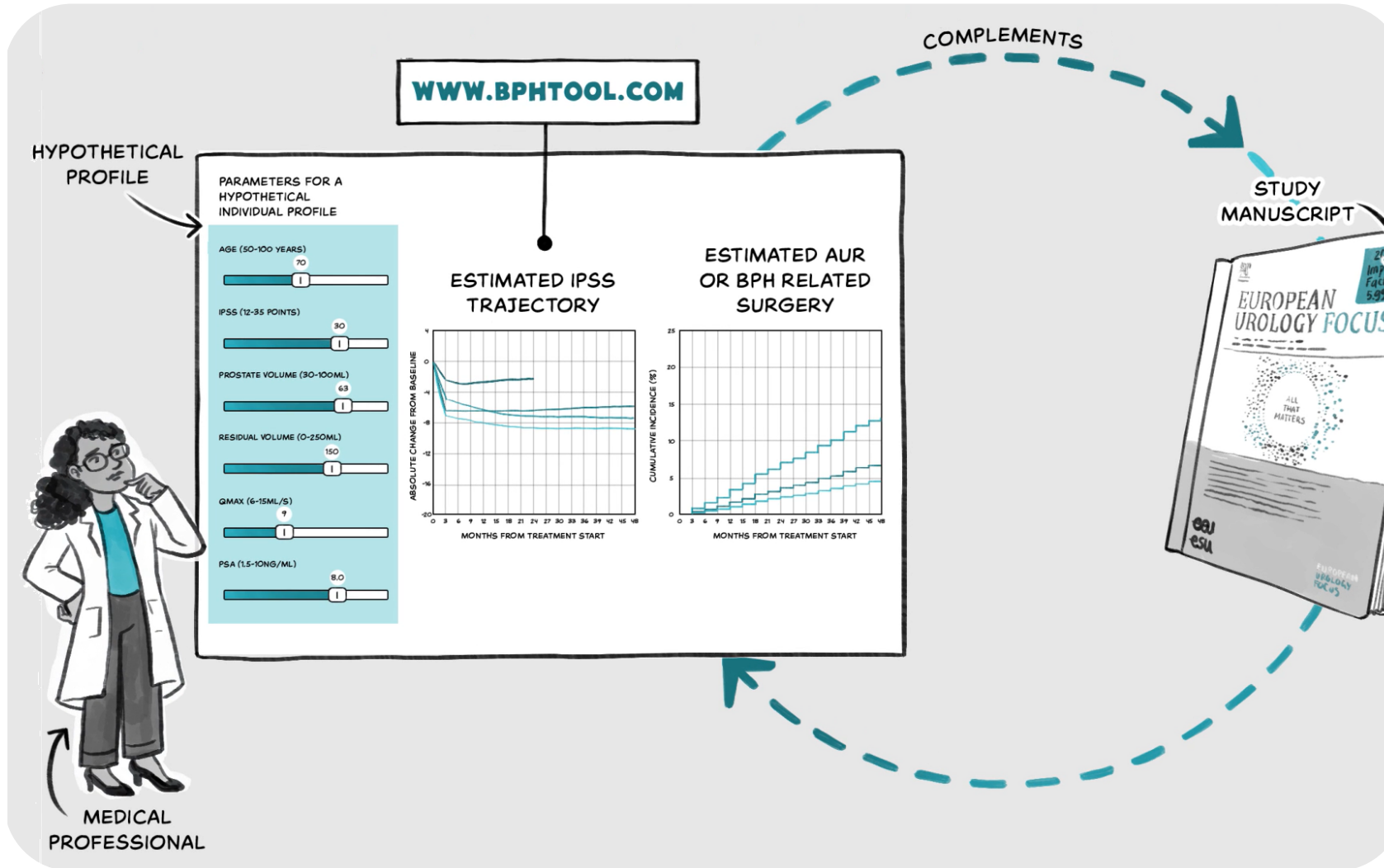
Note: These effects are extracted directly from the corresponding multivariable model fits. The size of effect is scaled relative to a number of units in each case for the parameter column so as to signify more meaningful comparisons and interpretations of the parameters. Months from treatment start is set fixed to 48 months in the table above.

Score charts



Gravas, S., Palacios-Moreno, J. M., Thompson, D., Concas, F., Kamola, P. J., Roehrborn, C. G., Oelke, M., Kattan, M. W., Averbek, M. A., Manyak, M., Cortés, V., & Lulic, Z. (2023). Understanding Treatment Response in Individual Profiles of Men with Prostatic Enlargement at Risk of Progression. *European Urology Focus*, 9(1), 178-187. <https://doi.org/10.1016/j.euf.2022.07.004>

Innovative tools that are intuitive to clinicians



An online interactive portal that accompanies the manuscript

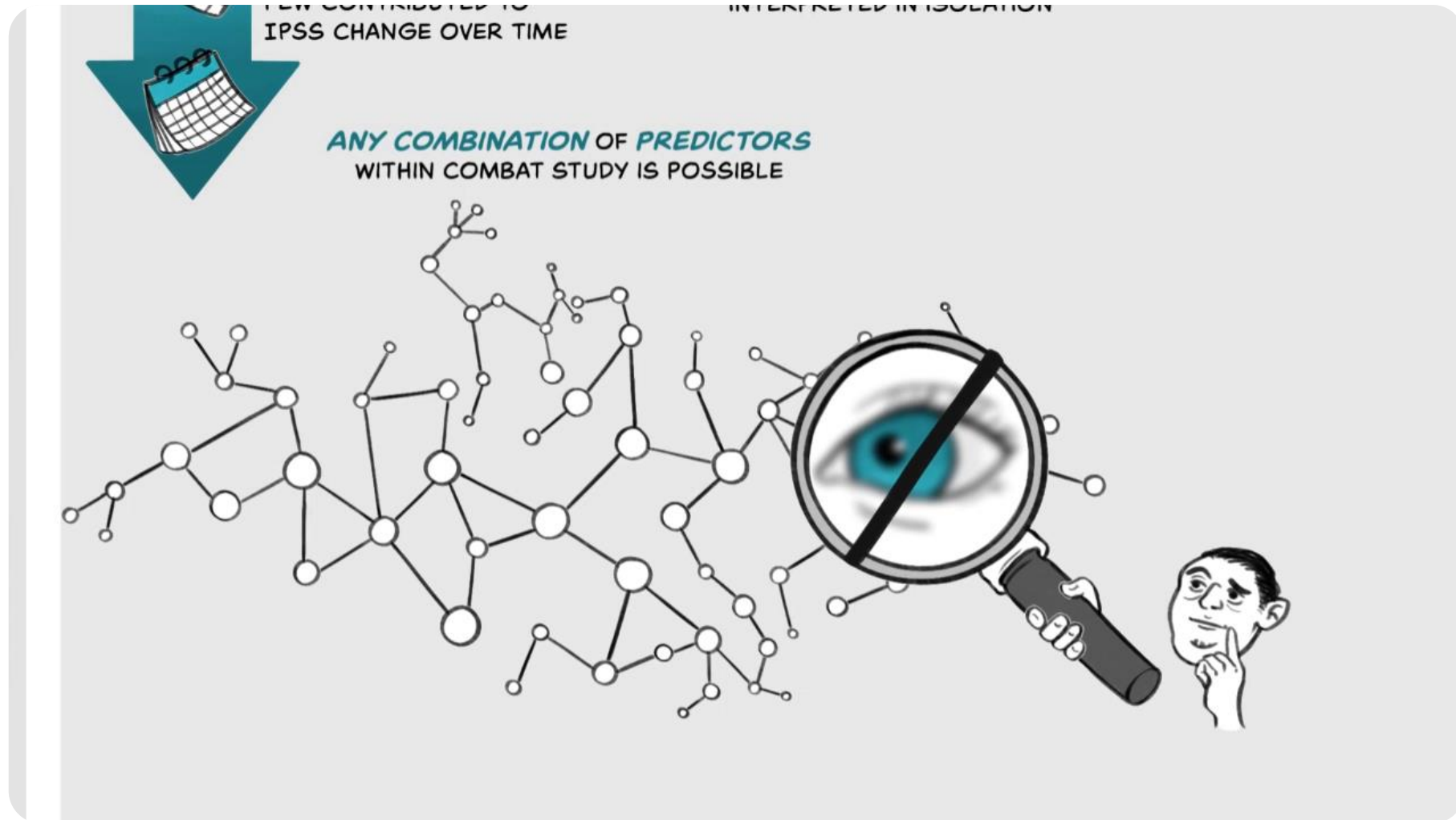


Demo of BPHtool.com

The first external Shiny app at GSK

Animated study description

To explain the statistical analysis in simpler terms



The power of Shiny for communicating analysis results

Interactive apps and visualisations are better tools to communicate results to external audiences

Those who performed the study should be those who help explain it



Captainvector. Retrieved from 123RF website:
https://www.123rf.com/profile_captainvector

Shiny apps are increasingly used in production

Shiny is the alternative to inflexible and expensive software

Shiny integrates efficiently with data analysis tools

There are many **challenges**.
You can **learn from us**.

Problem 1

Shiny and application developer role overlap



Captainvector. Retrieved from 123RF
website: https://www.123rf.com/profile_captainvector

No awareness

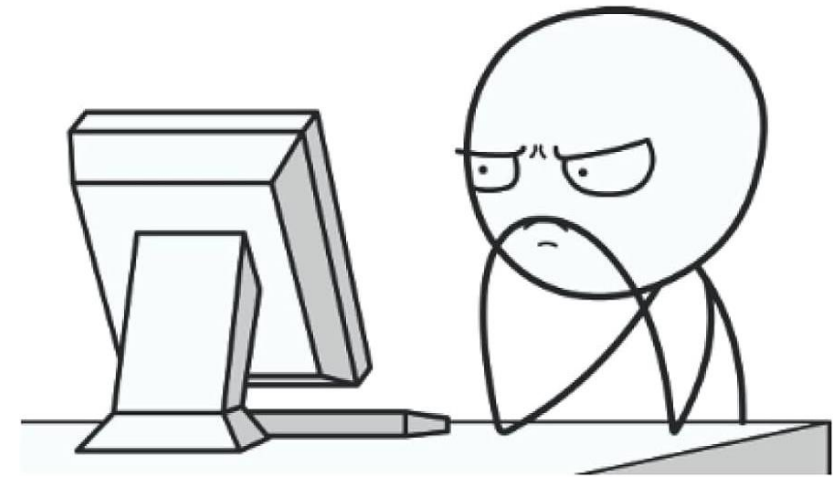
Shiny developer and application developers are in different departments

Unknown SOPs

Shiny developer is unaware of the robust internal procedures to create external web apps

No Shiny infrastructure

Shiny developer is told to develop the app with standard process in different languages



Problem 2

Risk-averse attitude of pharmaceutical companies

Organisational Inertia

Resistance to change due to established practices

Extra caution

Caution due to possible implications on human lives

Need for Change

Doing more for patients requires taking smart risks

Problem 3

Software as a Medical Device regulation

Novelty

Software has started transforming healthcare in the past decade, so regulations are new and evolving

Different regulations for different countries

Varying implementations across regions

Unclear internal guidance

Limited experience in software production for the communication of R&D science

Problem 4

Clinicians' preference for familiar figures and tools

Clinicians are logical people

Research indicates that clinicians tend to prefer figures and tools they already know how to interpret and use [1].

User-centred design

New tools must be intuitive to physicians.

Development WITH physician

Collaboration between tool developers and physicians is crucial.

Proof of Problem 4

Clinicians' preference for familiar figures and tools

Our manuscript

Despite the introduction of the web app,
generation of nomograms and other displays
was still required

Hope for change

Phasing out old ways to communicate
science requires time and more
examples

Our goal

Inspire you to use innovative displays!

Problem recap



**Organisational
structure**

**Software as a
Medical Device
regulation**

**Organisational
inertia**

**Need to convince
clinicians that new
tools are better**

By Vincent Le Moign, CC BY 4.0, <https://commons.wikimedia.org/w/index.php?curid=68650153>

Outcomes

What we achieved



Outcomes



**GSK's First
External Shiny App**

**Creation of New
Shiny Infrastructure**

**Internal Guidance
for Software as a
Medical Device**

**Successful Tool
Publication**

Aiding urologists and patients

Vincent Le Moign, CC BY 4.0 <<https://creativecommons.org/licenses/by/4.0/>>, via Wikimedia Commons

How did we do it?

There were no procedures to follow

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Our 7-step system

To overcome the unforeseen

1

Identify target audience,
outcome, etc.

2

Sketch interface and
show PoC to user sample

3

Meet a design expert

4

Identify a few key people
within each department

5

Contact Legal,
Compliance, and
Regulatory teams

6

Implement features

7

Constant feedback and
periodic reviews with
users

If you decide to use **our proposed system**.
Adapt it to your company's structure.
Follow the logic.

Key takeaway

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Follow our 7 steps to develop your first external Shiny app.

Improve science communication

Encourage investments in new technologies

Inspire the creation of new infrastructure and guidance

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Refer to the presentation paper (AD02) for the more detail.

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