



Showcase:

PHREND

*Predictive Healthcare with Real-world
Evidence for Neurological Disorders*



pwc

Philip van Hövell
Sarah Grimm

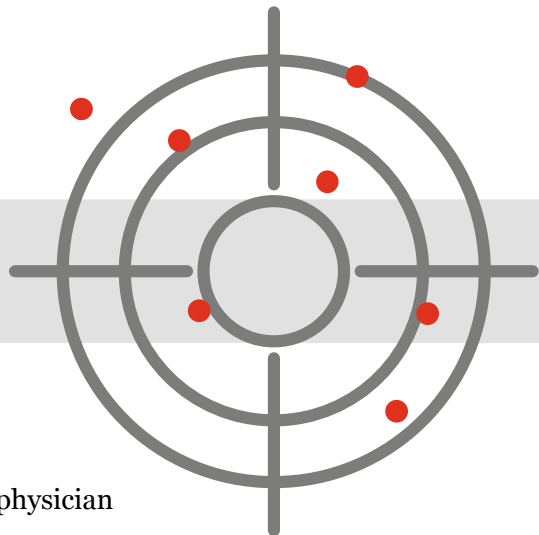


Part I: Background & Showcase
Part II: Development & Implementation

What is the need?

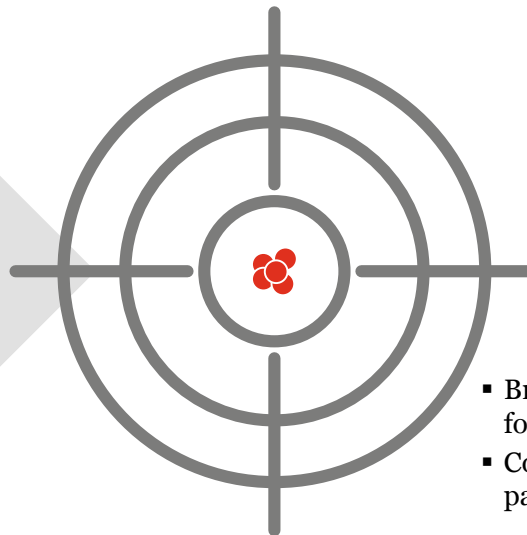
- Currently in **multiple sclerosis (MS)**, therapy decision is based on **gut instinct from doctors**.
- **Patients have a desire to get a second opinion** on what therapy could work best for themselves based on the experience from other patients with the same disease.

‘Shotgun blast’



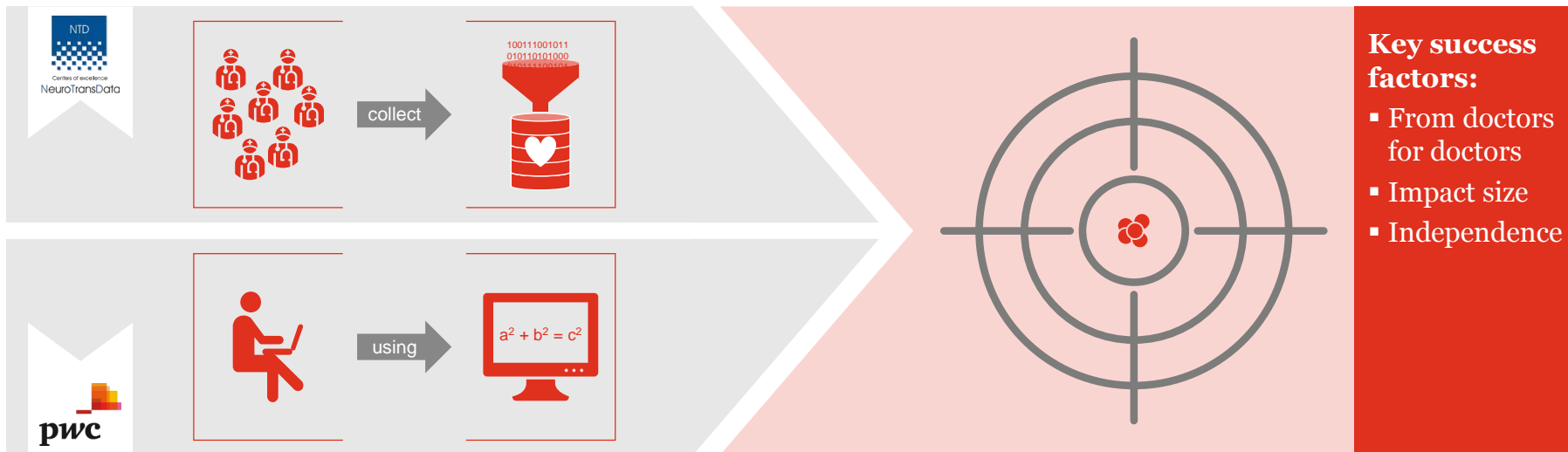
- Study results
- Empirical values
- ‘Intuitive’ decision by physician

‘Marksman’s shot’



- Broadest database as foundation
- Considers individual patient characteristics

What is the solution?

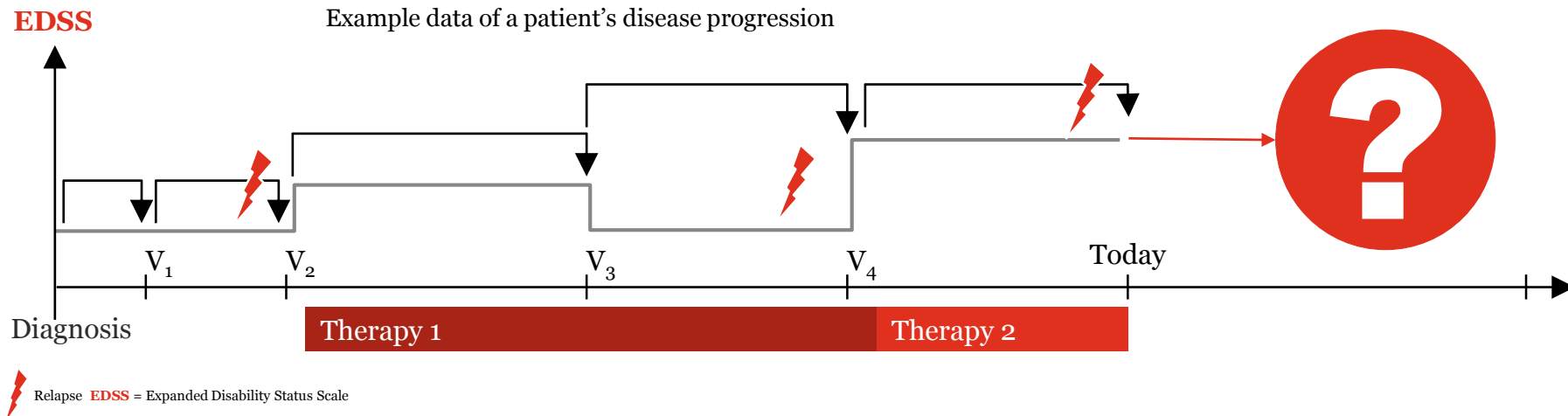


Data-driven solution, achieved through a partnership between:

- Doctor association NTD, which collects Real World Evidence (currently representing 74 offices in Germany – data governance in place)
- PwC, providing analytical & business skills

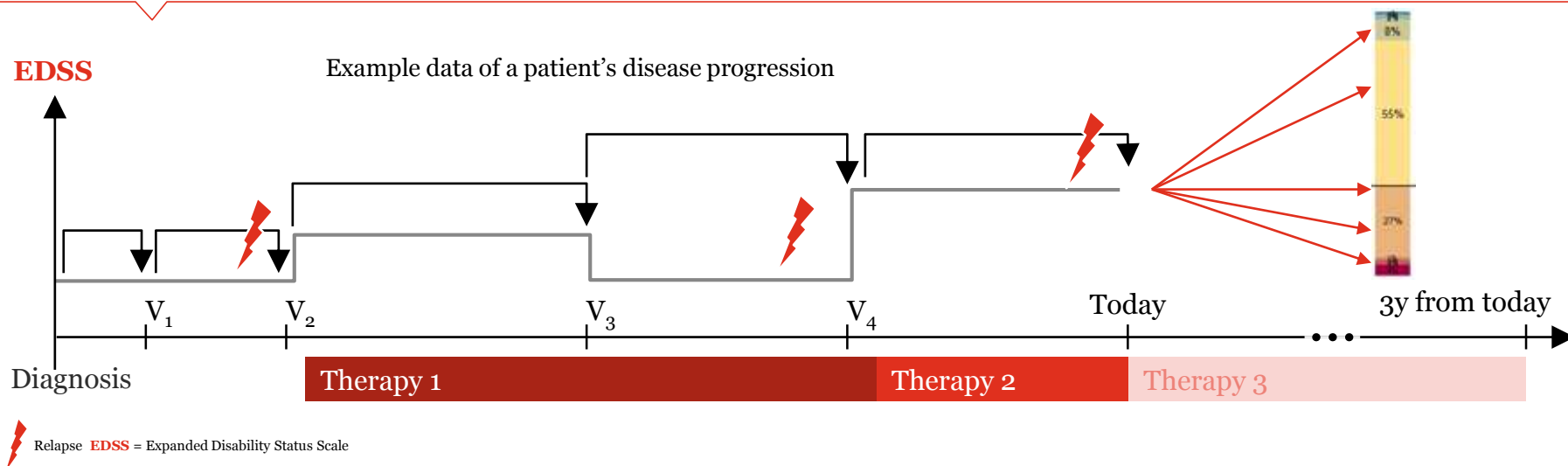
Independence of any pharma company → Building trust in society and solving important problems

Unique patient database from doctor's association



- Significant amount of patients covered: 25'000 MS patients since 1999, covering 20% of all German patients
- Longitudinal: 5 years observation period on average per patient
- Excellent density: On average >3 visits per year and patient
- Almost 1000 features available: clinical, demographic, quality of life, therapy, diagnostic, side effects, reason for switch of therapy

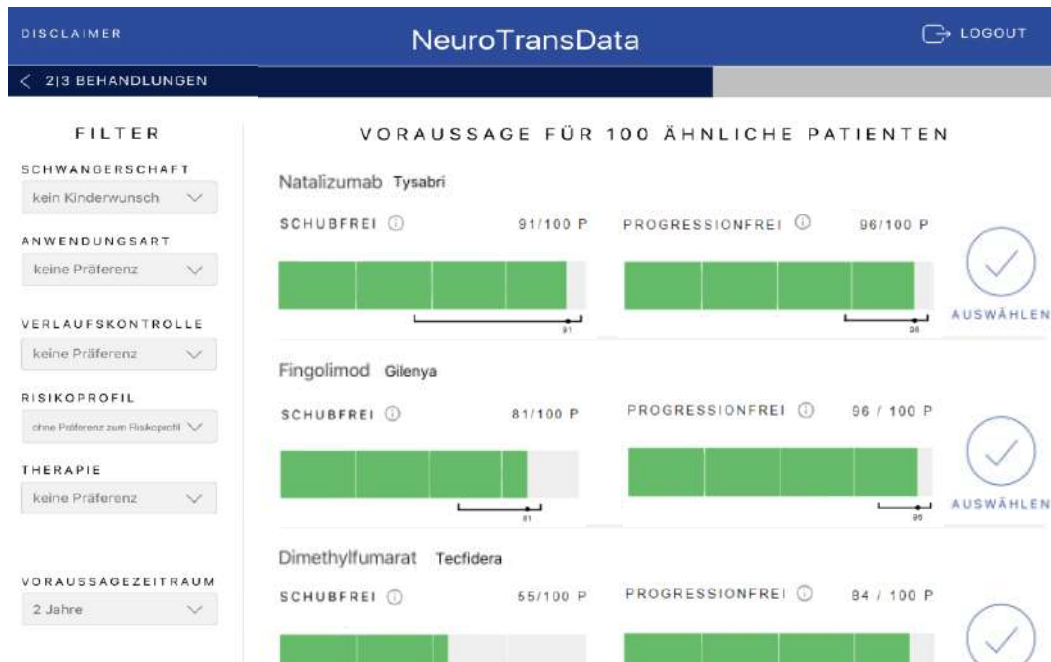
Question to be addressed



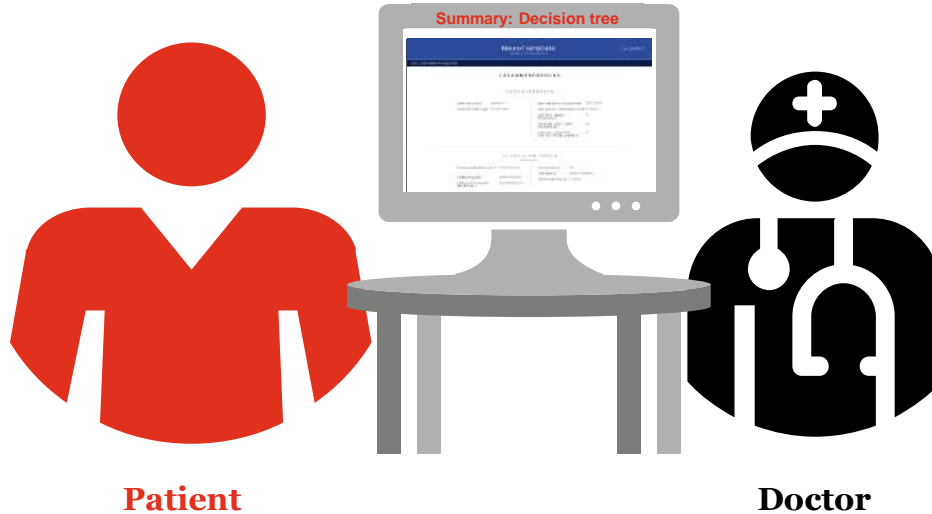
- Target 1: Which therapy can reduce the probability of disease progression most?
- Target 2: Which therapy can reduce the probability of a relapse event most?
- Other targets planned for future (e.g. NEDA types, time-to-discontinuation, MRI)
- Our algorithm is using machine learning & statistics techniques

Showcase PHREND

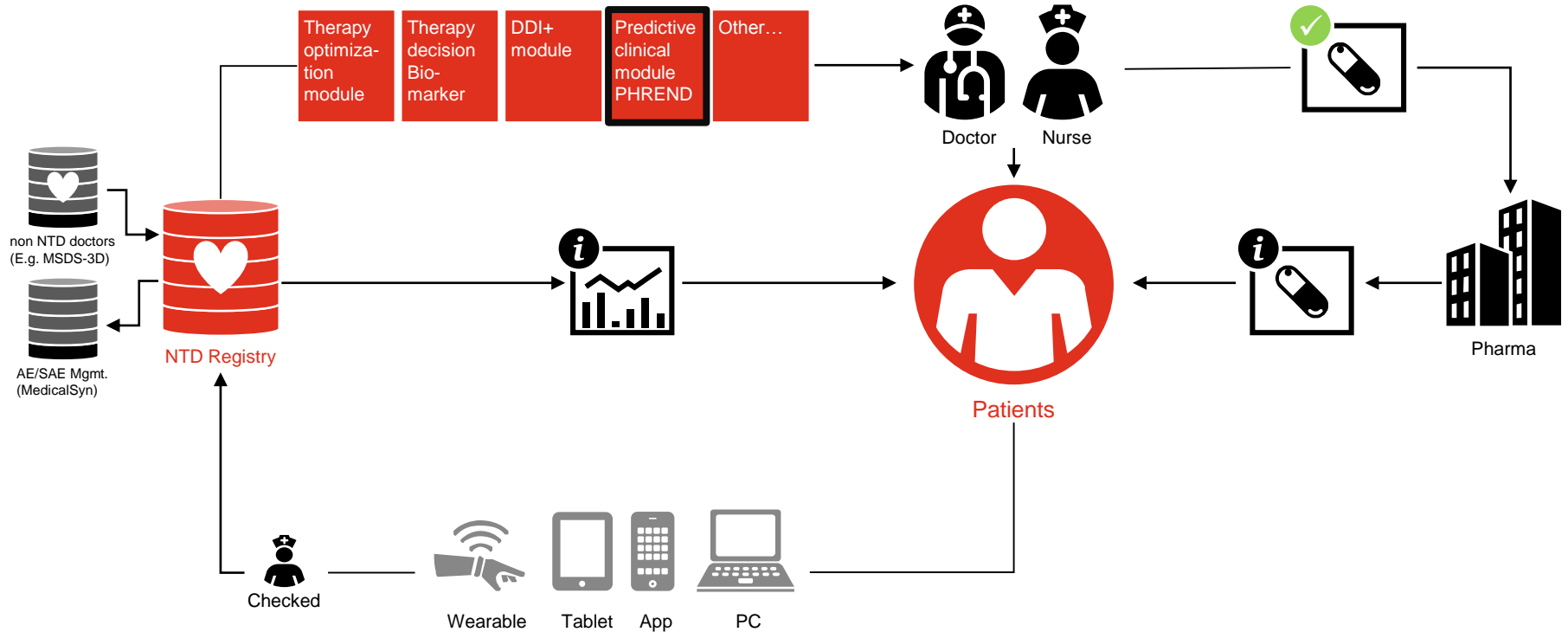
- Web-based tool providing personalized comparisons of treatment effectiveness using real world evidence (RWE)
- Machine learning / statistical model used
- RWE provided by NTD covering 20% of German MS patients
- Currently 11 easy-to-enter input variables for the doctor
- Published in academic literature (in process)
- CE certified as medical device (in process)



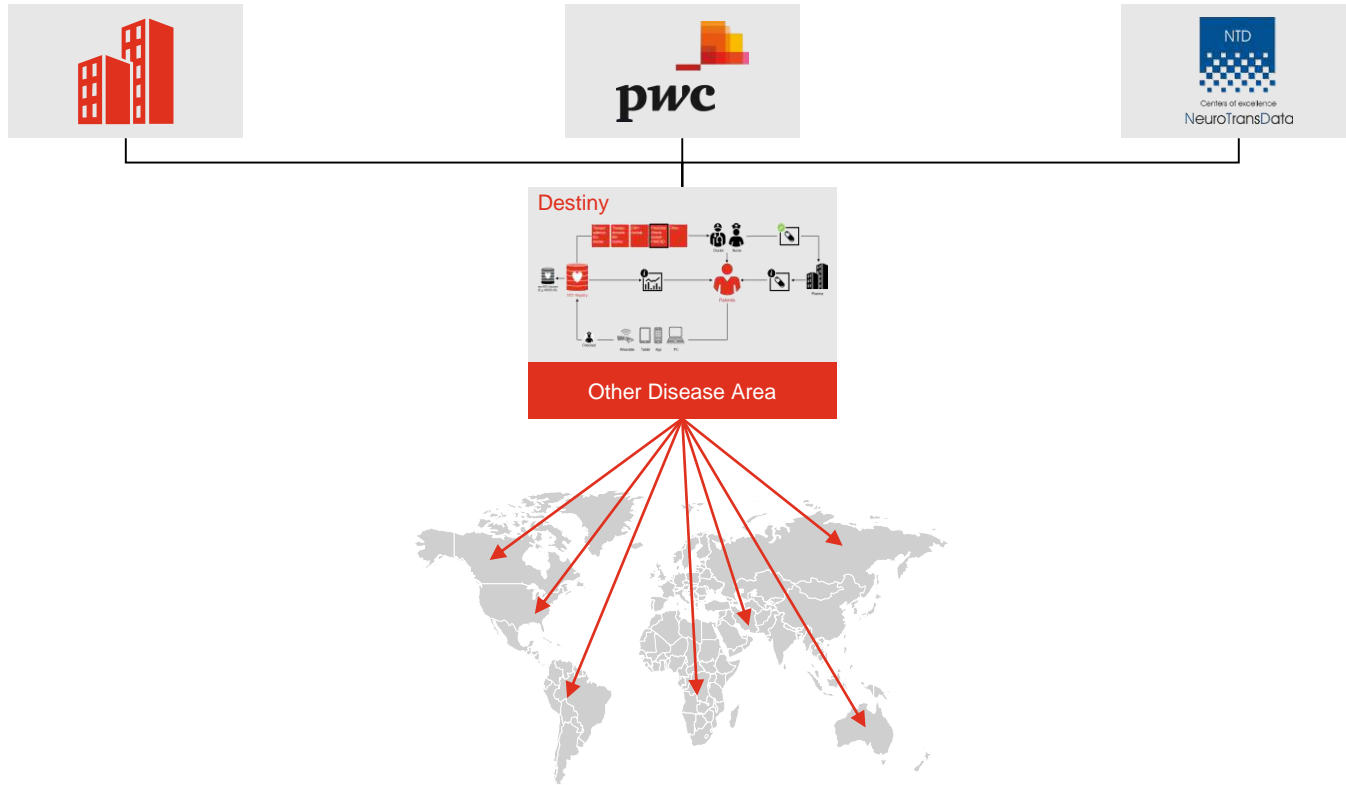
PHREND, providing the second opinion to build trust for the patient



Add PHREND to DESTINY[®] – the patient centric benefit platform



We need your help: Leverage PwC and NTD expertise to scale DESTINY[®] to other disease areas



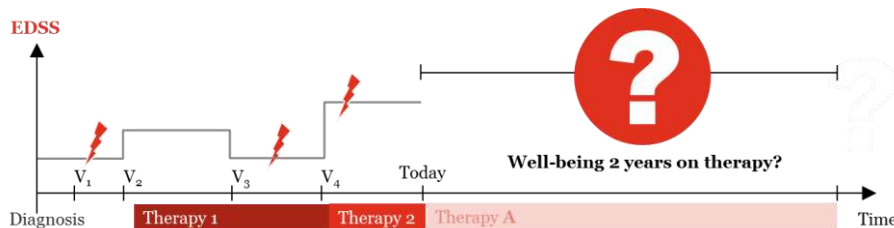
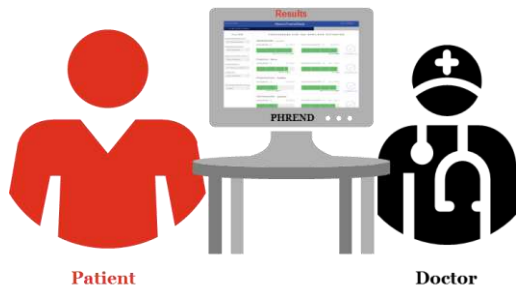


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Part II: Development & Implementation

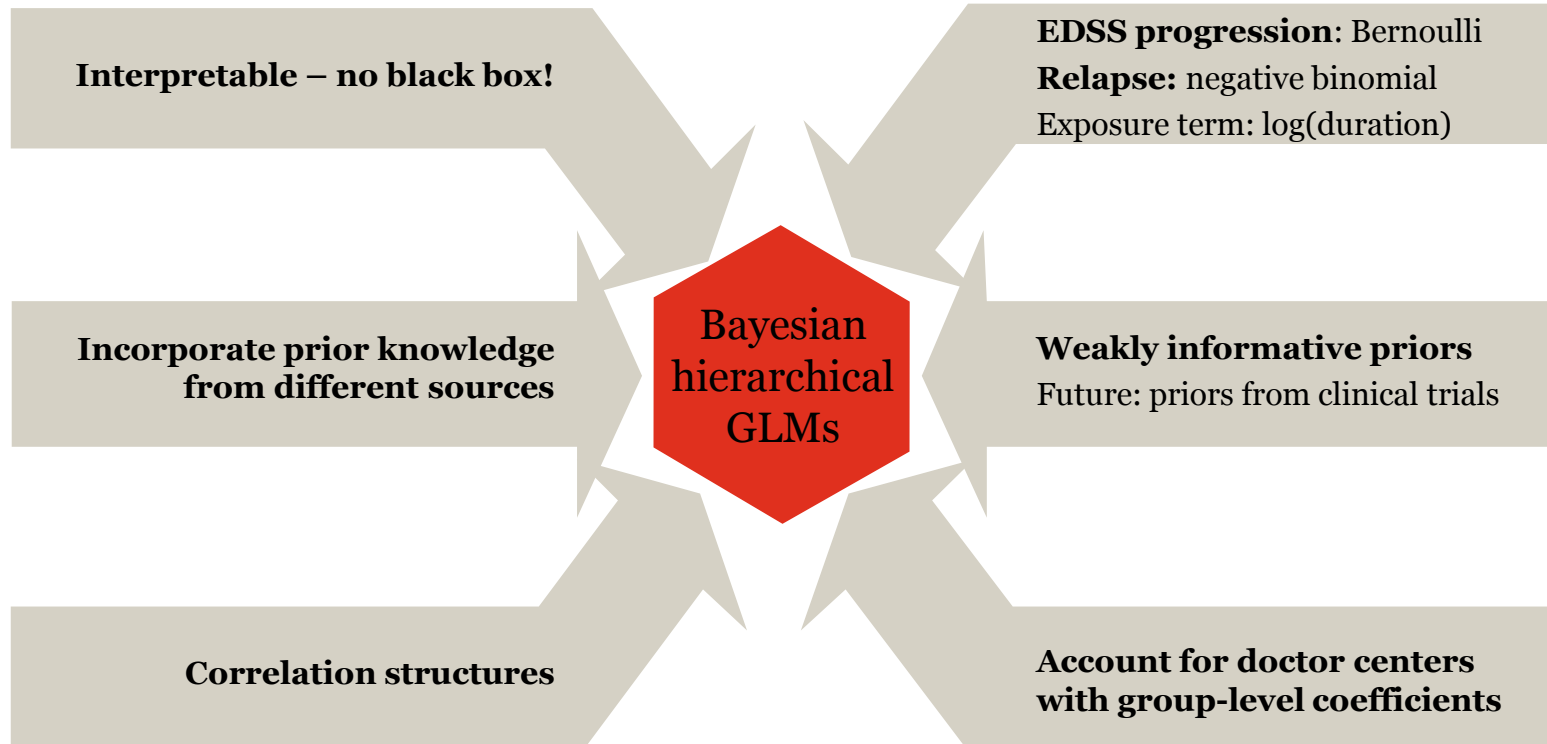
Objectives • Methods • Input • Validation • Future work

What questions are we trying to answer?



- What is the best therapy for a patient given their status and history?
- To address this question, we assess long-term well-being with the on-therapy EDSS progression and relapse rate
- Then we can answer more specifically:
How likely will the patient be progression-free on therapy A? Relapse-free?

How do we model these two outcomes?



How do we choose our input values?

- Therapy choice procedure: identify confounders
 - Medically relevant
 - Recent enough
 - Do not introduce bias
 - Practical
- 12 easy-to-enter inputs
- In future: incorporate more

The screenshot shows a web form titled "NeuroTransData" with a navigation bar containing "1 | 3 PATIENTENDATEN" and "ABMELDEN". The form is divided into two main sections: "PATIENT" and "MS DIAGNOSE".

PATIENT

- GESCHLECHT**: Radio buttons for "Männlich" and "Weiblich".
- GEBURTSDATUM**: Two input fields for "MM" and "JJ".

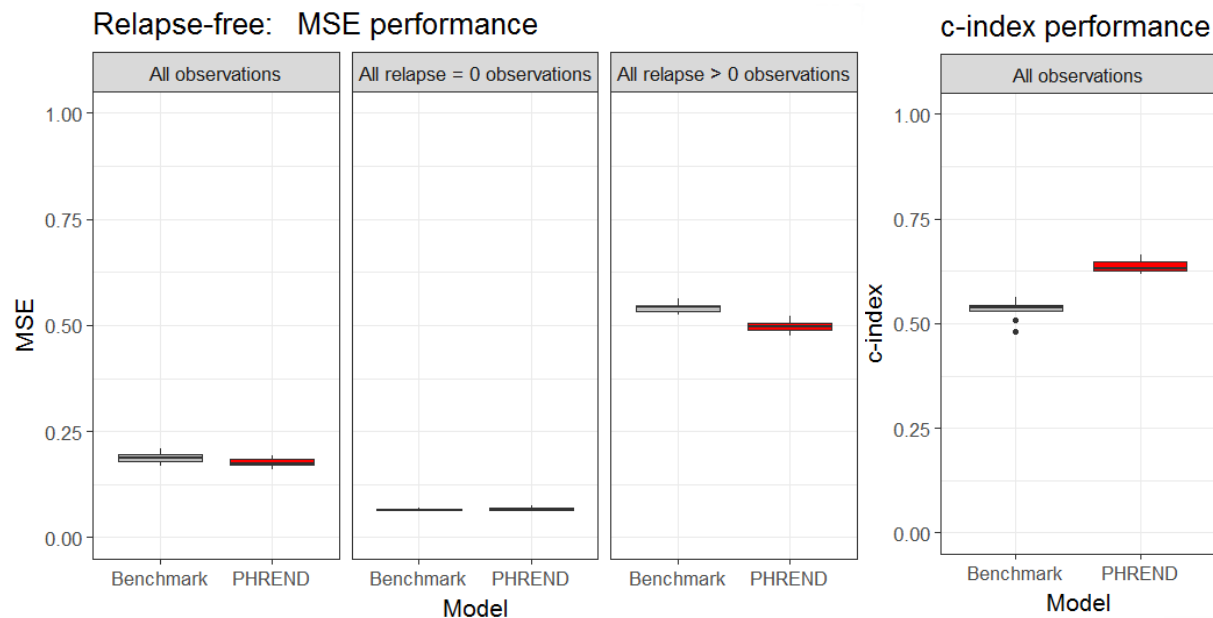
MS DIAGNOSE

- DATUM DER MS DIAGNOSE**: Two input fields for "MM" and "JJ".
- AKTUELLE THERAPIE**: A dropdown menu with "Bitte auswählen..." and a downward arrow.
- DAUER DER AKTUELLEN THERAPIE**: An input field with "Monate" as a placeholder.
- THERAPIE VOR DER AKTUELLEN THERAPIE (OPTIONAL)**: A dropdown menu with "Bitte auswählen..." and a downward arrow.
- AKTUELLER EDSS WERT**: A dropdown menu with "Bitte auswählen..." and a downward arrow.
- WANN WAR DER LETZTE SCHUB?**: A dropdown menu with "Bitte auswählen..." and a downward arrow.
- ANZHAL SCHÜBE IN DEN LETZTEN 12 MONATEN**: A dropdown menu with "Bitte auswählen..." and a downward arrow.

HINWEIS
Nur für Patienten mit der Diagnose RRMS, Frühestens sechs Monate ab Diagnosestellung. Derzeit nur für Patienten mit EDSS Wert bis 6.

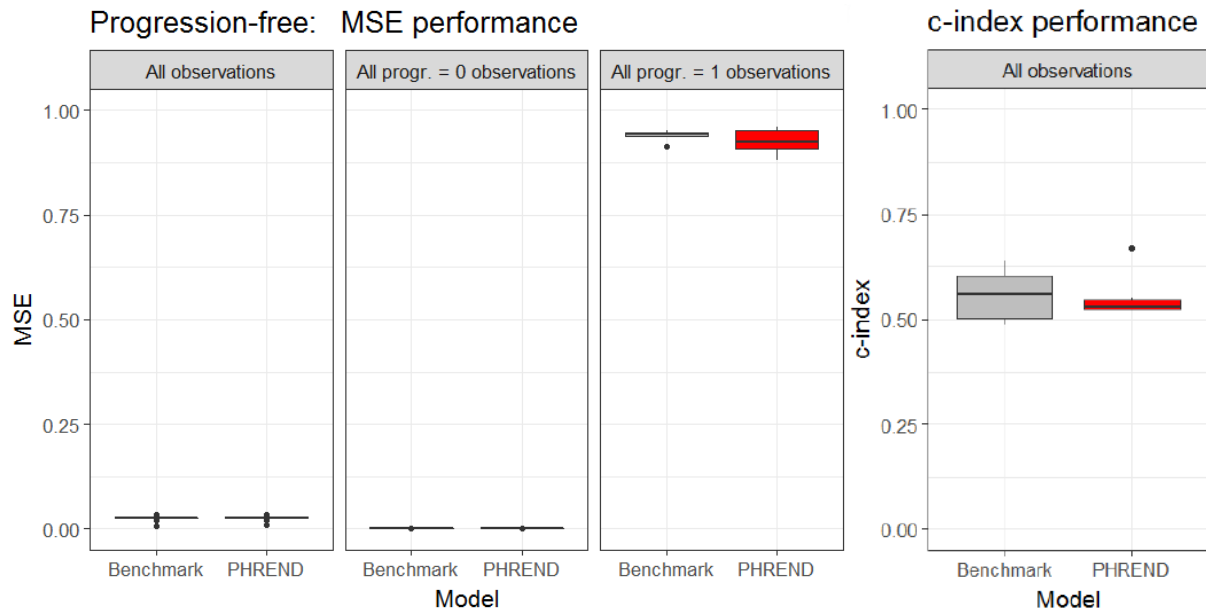
A "WEITER" button is located at the bottom right of the form.

How do we validate our models?



- Cross-validation and test set
- MSE & Harrell's c-index
- Benchmark: event frequencies per therapy
- Relapse model with patient characteristics improves over benchmark

How do we validate our models?



- Cross-validation and test set
- MSE & Harrell's c-index
- Benchmark: event frequencies per therapy
- Relapse model with patient characteristics improves over benchmark
- EDSS model is work in progress

More validation will come from external test data and live performance

What is in plan for the next versions?



Test and monitor live performance

- How to assess influence of app?



Improve EDSS predictions

- Joint modelling
- Work with sub-scores



Incorporate more inputs

- New therapies
- New features



More model flexibility

- Non-constant rates
- Dispersion per therapy

PHREND team

Core Analytics Team



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medical experts

+ business &
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+ Digital Experience
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Thank You

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