Boehringer Ingelheim

More Than Correct: Turning R Shiny Apps into Intuitive Decision-Support Tools

A pragmatic case for foundational UX competence in clinical data science

Barbara Doll, 17-Sep-2026

PHUSE SDE Basel,

„Reimagining the Clinical Data Scientist Role: Future-Proofing Skills and Partnerships“

Life forward

Disclaimer

The following slides include statements and approaches that represent my personal perspective and may not necessarily reflect the official positions or recommendations of Boehringer Ingelheim.

It is important to acknowledge that the subject matter allows for a variety of valid approaches, and the methods I present are not intended to be extensive.

Where applicable, I have indicated the locations of official sources. The primary focus of this presentation, however, is a hypotheses generation.

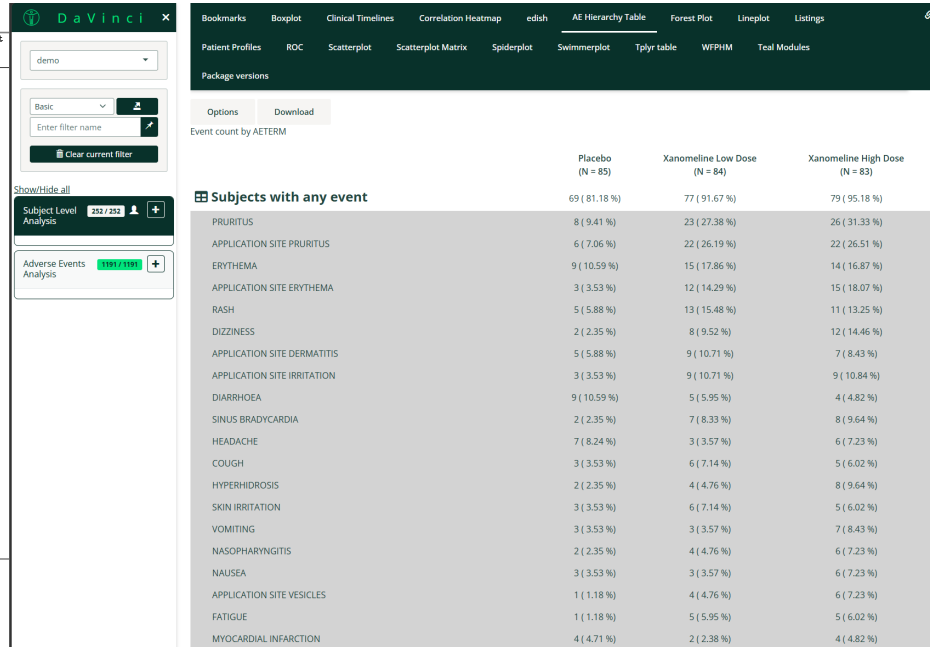
The shift: from efficiency to effectiveness

Static output

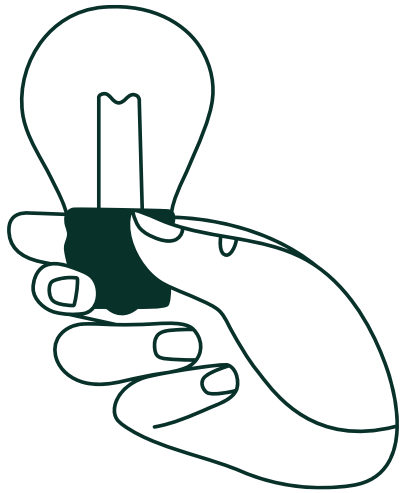
Table 1 Frequency [N (%)] of subjects with adverse events by treatment, primary system organ class and preferred term - Treated Set

	Placebo N	Placebo %	Xanomeline High Dose N	Xanomeline High Dose %	Xanomeline Low Dose N	Xanomeline Low Dose %
Number of subjects	69	100.0	79	100.0	77	100.0
Number of subjects with at least one adverse event	69	100.0	79	100.0	77	100.0
GENERAL DISORDERS AND ADMINISTRATION SITE CONDITIONS	21	30.4	40	50.6	47	61.0
APPLICATION SITE PRURITUS	6	8.7	22	27.8	22	28.6
APPLICATION SITE ERYTHEMA	3	4.3	15	19.0	12	15.6
APPLICATION SITE DERMATITIS	5	7.2	7	8.9	9	11.7
APPLICATION SITE IRRITATION	3	4.3	9	11.4	9	11.7
APPLICATION SITE VESICLES	1	1.4	6	7.6	4	5.2
FATIGUE	1	1.4	5	6.3	5	6.5
OEDEMA PERIPHERAL	2	2.9	2	2.5	1	1.3
PYREXIA	2	2.9	1	1.3	0	0.0
APPLICATION SITE URTICARIA	0	0.0	1	1.3	2	2.6
OEDEMA	0	0.0	0	0.0	2	2.6
APPLICATION SITE PAIN	0	0.0	2	2.5	0	0.0
APPLICATION SITE PERSPIRATION	0	0.0	2	2.5	0	0.0
APPLICATION SITE SWELLING	0	0.0	2	2.5	1	1.3
CHEST DISCOMFORT	0	0.0	2	2.5	0	0.0
CHEST PAIN	0	0.0	2	2.5	0	0.0
MALAISE	0	0.0	2	2.5	1	1.3
APPLICATION SITE INDURATION	1	1.4	0	0.0	0	0.0
APPLICATION SITE REACTION	1	1.4	1	1.3	0	0.0
ASTHENIA	1	1.4	1	1.3	0	0.0
CHILLS	1	1.4	1	1.3	1	1.3
APPLICATION SITE BLEEDING	0	0.0	0	0.0	1	1.3
APPLICATION SITE DESQUAMATION	0	0.0	0	0.0	1	1.3
APPLICATION SITE DISCHARGE	0	0.0	1	1.3	0	0.0
APPLICATION SITE DISCOLOURATION	0	0.0	0	0.0	1	1.3
APPLICATION SITE WARMTH	0	0.0	0	0.0	1	1.3
CYST	0	0.0	0	0.0	1	1.3
FEELING ABNORMAL	0	0.0	1	1.3	0	0.0
FEELING COLD	0	0.0	1	1.3	0	0.0
INFLAMMATION	0	0.0	0	0.0	1	1.3
PAIN	0	0.0	1	1.3	1	1.3
SECRETION DISCHARGE	0	0.0	0	0.0	1	1.3
SUDDEN DEATH	0	0.0	0	0.0	1	1.3
SWELLING	0	0.0	0	0.0	1	1.3
ULCER	0	0.0	0	0.0	1	1.3
SKIN AND SUBCUTANEOUS TISSUE DISORDERS	21	30.4	42	53.2	42	54.5
PRURITUS	8	11.6	26	32.9	23	29.9
ERYTHEMA	9	13.0	14	17.7	15	19.5

Interactive analysis



Decision focused delivery

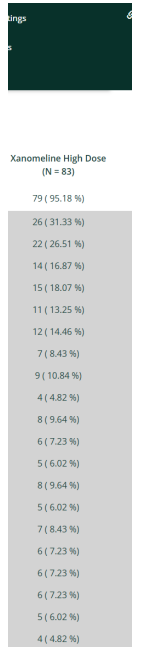


Boehringer Ingelheim

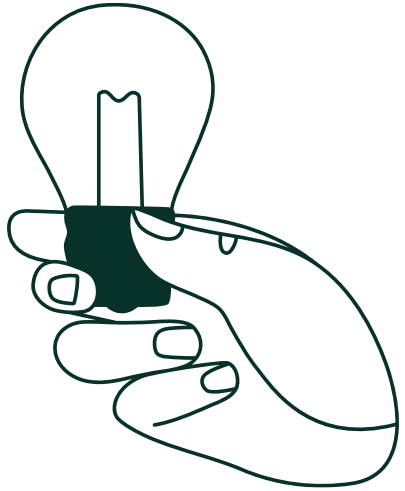
The shift: from efficiency to effectiveness

Table 1 Frequency [N (%)] of subjects with adverse events by treatment, primary system organ class and preferred term - Treated Set

	Placebo N	Placebo %	Xanomeline High Dose N	Xanomeline High Dose %	Xanomeline Low Dose N	Xanomeline Low Dose %
Number of subjects	69	100.0	79	100.0	77	100.0
Number of subjects with at least one adverse event	69	100.0	79	100.0	77	100.0
GENERAL DISORDERS AND ADMINISTRATION SITE CONDITIONS	21	30.4	40	50.6	47	61.0
APPLICATION SITE PRURITUS	6	8.7	22	27.8	22	28.6
APPLICATION SITE ERYTHEMA	3	4.3	15	19.0	12	15.6
APPLICATION SITE DERMATITIS	5	7.2	7	8.9	9	11.7
APPLICATION SITE IRRITATION	3	4.3	9	11.4	9	11.7
APPLICATION SITE VESICLES	1	1.4	6	7.6	4	5.2
FATIGUE	1	1.4	5	6.3	5	6.5
OEDEMA PERIPHERAL	2	2.9	2	2.5	1	1.3
PYREXIA	2	2.9	1	1.3	0	0.0
APPLICATION SITE URTICARIA	0	0.0	1	1.3	2	2.6
OEDEMA	0	0.0	0	0.0	2	2.6
APPLICATION SITE PAIN	0	0.0	2	2.5	0	0.0
APPLICATION SITE PERSPIRATION	0	0.0	2	2.5	0	0.0
APPLICATION SITE SWELLING	0	0.0	2	2.5	1	1.3
CHEST DISCOMFORT	0	0.0	2	2.5	0	0.0
CHEST PAIN	0	0.0	2	2.5	0	0.0
MALAISE	0	0.0	2	2.5	1	1.3
APPLICATION SITE INDURATION	1	1.4	0	0.0	0	0.0
APPLICATION SITE REACTION	1	1.4	1	1.3	0	0.0
ASTHENIA	1	1.4	1	1.3	0	0.0
CHILLS	1	1.4	1	1.3	1	1.3
APPLICATION SITE BLEEDING	0	0.0	0	0.0	1	1.3
APPLICATION SITE DESQUAMATION	0	0.0	0	0.0	1	1.3
APPLICATION SITE DISCHARGE	0	0.0	1	1.3	0	0.0
APPLICATION SITE DISCOLOURATION	0	0.0	0	0.0	1	1.3
APPLICATION SITE WARMTH	0	0.0	0	0.0	1	1.3
CYST	0	0.0	0	0.0	1	1.3
FEELING ABNORMAL	0	0.0	1	1.3	0	0.0
FEELING COLD	0	0.0	1	1.3	0	0.0
INFLAMMATION	0	0.0	0	0.0	1	1.3
PAIN	0	0.0	1	1.3	1	1.3
SECRETION DISCHARGE	0	0.0	0	0.0	1	1.3
SUDDEN DEATH	0	0.0	0	0.0	1	1.3
SWELLING	0	0.0	0	0.0	1	1.3
ULCER	0	0.0	0	0.0	1	1.3
SKIN AND SUBCUTANEOUS TISSUE DISORDERS	21	30.4	42	53.2	42	54.5
PRURITUS	8	11.6	26	32.9	23	29.9
ERYTHEMA	9	13.0	14	17.7	15	19.5



Decision focused delivery



The shift: from efficiency to effectiveness

Static

sion focused

ery

Table 1 Frequency [N (%)] of subjects with

Number of subjects	
Number of subjects with at least one advers	
GENERAL DISORDERS AND ADMINISTRATION SITE CONDITIONS	
APPLICATION SITE PRURITUS	
APPLICATION SITE ERYTHEMA	
APPLICATION SITE DERMATITIS	
APPLICATION SITE IRRITATION	
APPLICATION SITE VESICLES	
FATIGUE	
OEDEMA PERIPHERAL	
PYREXIA	
APPLICATION SITE URTICARIA	
OEDEMA	
APPLICATION SITE PAIN	
APPLICATION SITE PERSPIRATION	
APPLICATION SITE SWELLING	
CHEST DISCOMFORT	
CHEST PAIN	
MALAISE	
APPLICATION SITE INDURATION	
APPLICATION SITE REACTION	
ASTHENIA	
CHILLS	
APPLICATION SITE BLEEDING	
APPLICATION SITE DESQUAMATION	
APPLICATION SITE DISCHARGE	
APPLICATION SITE DISCOLOURATION	
APPLICATION SITE WARMTH	
CYST	
FEELING ABNORMAL	
FEELING COLD	
INFLAMMATION	
PAIN	
SECRETION DISCHARGE	
SUDDEN DEATH	
SWELLING	
ULCER	
SKIN AND SUBCUTANEOUS TISSUE DISORDERS	
PRURITUS	
ERYTHEMA	

DaVinci

demo

Basic

Enter filter name

Clear current filter

Show/Hide all

Subject Level Analysis 252 / 252

Adverse Events Analysis 1191 / 1191

Bookmarks | Boxplot | Clinical Timelines | Correlation Heatmap | edish | AE Hierarchy Table | Forest Plot | Lineplot | Listings

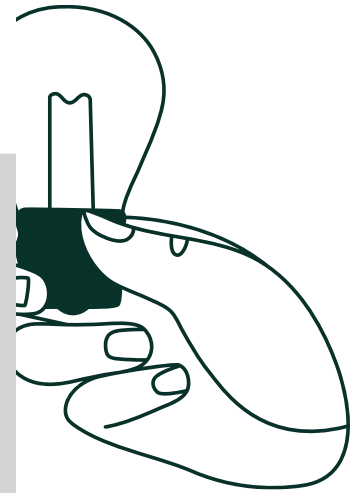
Patient Profiles | ROC | Scatterplot | Scatterplot Matrix | Spiderplot | Swimmerplot | Tplyr table | WFPHM | Teal Modules

Package versions

Options | Download

Event count by AETERM

	Placebo (N = 85)	Xanomeline Low Dose (N = 84)	Xanomeline High Dose (N = 83)
Subjects with any event	69 (81.18 %)	77 (91.67 %)	79 (95.18 %)
PRURITUS	8 (9.41 %)	23 (27.38 %)	26 (31.33 %)
APPLICATION SITE PRURITUS	6 (7.06 %)	22 (26.19 %)	22 (26.51 %)
ERYTHEMA	9 (10.59 %)	15 (17.86 %)	14 (16.87 %)
APPLICATION SITE ERYTHEMA	3 (3.53 %)	12 (14.29 %)	15 (18.07 %)
RASH	5 (5.88 %)	13 (15.48 %)	11 (13.25 %)
DIZZINESS	2 (2.35 %)	8 (9.52 %)	12 (14.46 %)
APPLICATION SITE DERMATITIS	5 (5.88 %)	9 (10.71 %)	7 (8.43 %)
APPLICATION SITE IRRITATION	3 (3.53 %)	9 (10.71 %)	9 (10.84 %)
DIARRHOEA	9 (10.59 %)	5 (5.95 %)	4 (4.82 %)
SINUS BRADYCARDIA	2 (2.35 %)	7 (8.33 %)	8 (9.64 %)
HEADACHE	7 (8.24 %)	3 (3.57 %)	6 (7.23 %)
COUGH	3 (3.53 %)	6 (7.14 %)	5 (6.02 %)
HYPERHIDROSIS	2 (2.35 %)	4 (4.76 %)	8 (9.64 %)
SKIN IRRITATION	3 (3.53 %)	6 (7.14 %)	5 (6.02 %)
VOMITING	3 (3.53 %)	3 (3.57 %)	7 (8.43 %)
NASOPHARYNGITIS	2 (2.35 %)	4 (4.76 %)	6 (7.23 %)
NAUSEA	3 (3.53 %)	3 (3.57 %)	6 (7.23 %)
APPLICATION SITE VESICLES	1 (1.18 %)	4 (4.76 %)	6 (7.23 %)
FATIGUE	1 (1.18 %)	5 (5.95 %)	5 (6.02 %)
MYOCARDIAL INFARCTION	4 (4.71 %)	2 (2.38 %)	4 (4.82 %)



Boehringer Ingelheim

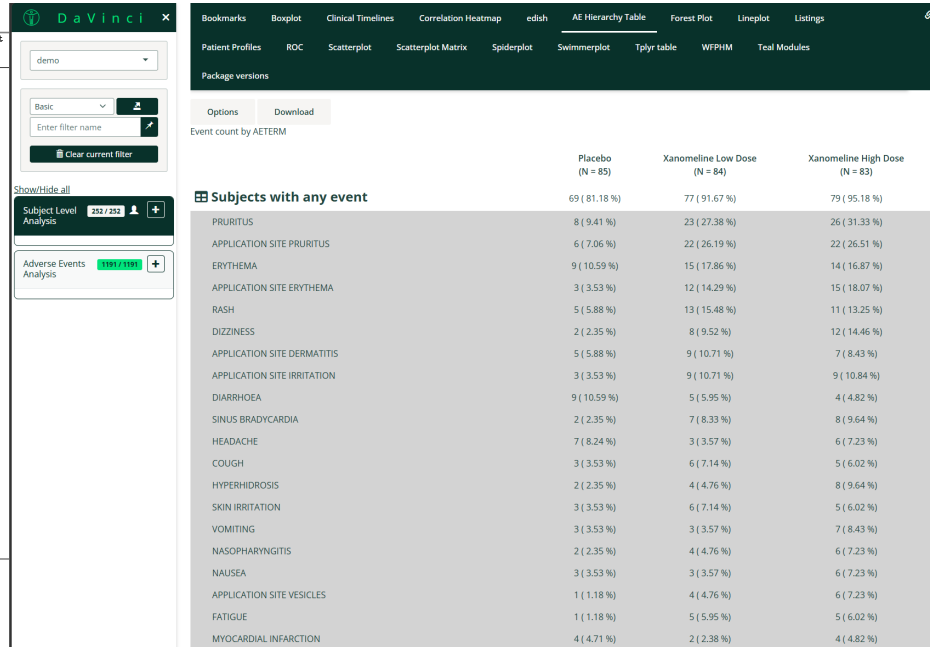
The shift: from efficiency to effectiveness

Static output

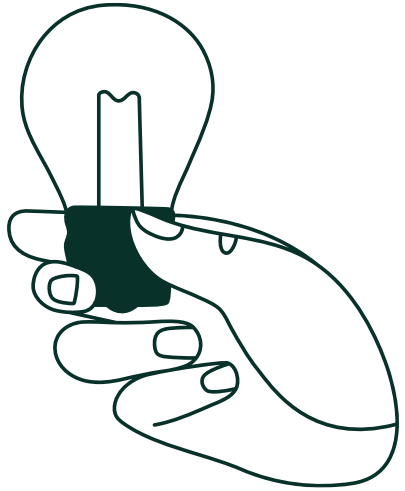
Table 1 Frequency [N (%)] of subjects with adverse events by treatment, primary system organ class and preferred term - Treated Set

	Placebo N	Placebo %	Xanomeline High Dose N	Xanomeline High Dose %	Xanomeline Low Dose N	Xanomeline Low Dose %
Number of subjects	69	100.0	79	100.0	77	100.0
Number of subjects with at least one adverse event	69	100.0	79	100.0	77	100.0
GENERAL DISORDERS AND ADMINISTRATION SITE CONDITIONS	21	30.4	40	50.6	47	61.0
APPLICATION SITE PRURITUS	6	8.7	22	27.8	22	28.6
APPLICATION SITE ERYTHEMA	3	4.3	15	19.0	12	15.6
APPLICATION SITE DERMATITIS	5	7.2	7	8.9	9	11.7
APPLICATION SITE IRRITATION	3	4.3	9	11.4	9	11.7
APPLICATION SITE VESICLES	1	1.4	6	7.6	4	5.2
FATIGUE	1	1.4	5	6.3	5	6.5
OEDEMA PERIPHERAL	2	2.9	2	2.5	1	1.3
PYREXIA	2	2.9	1	1.3	0	0.0
APPLICATION SITE URTICARIA	0	0.0	1	1.3	2	2.6
OEDEMA	0	0.0	0	0.0	2	2.6
APPLICATION SITE PAIN	0	0.0	2	2.5	0	0.0
APPLICATION SITE PERSPIRATION	0	0.0	2	2.5	0	0.0
APPLICATION SITE SWELLING	0	0.0	2	2.5	1	1.3
CHEST DISCOMFORT	0	0.0	2	2.5	0	0.0
CHEST PAIN	0	0.0	2	2.5	0	0.0
MALAISE	0	0.0	2	2.5	1	1.3
APPLICATION SITE INDURATION	1	1.4	0	0.0	0	0.0
APPLICATION SITE REACTION	1	1.4	1	1.3	0	0.0
ASTHENIA	1	1.4	1	1.3	0	0.0
CHILLS	1	1.4	1	1.3	1	1.3
APPLICATION SITE BLEEDING	0	0.0	0	0.0	1	1.3
APPLICATION SITE DESQUAMATION	0	0.0	0	0.0	1	1.3
APPLICATION SITE DISCHARGE	0	0.0	1	1.3	0	0.0
APPLICATION SITE DISCOLOURATION	0	0.0	0	0.0	1	1.3
APPLICATION SITE WARMTH	0	0.0	0	0.0	1	1.3
CYST	0	0.0	0	0.0	1	1.3
FEELING ABNORMAL	0	0.0	1	1.3	0	0.0
FEELING COLD	0	0.0	1	1.3	0	0.0
INFLAMMATION	0	0.0	0	0.0	1	1.3
PAIN	0	0.0	1	1.3	1	1.3
SECRETION DISCHARGE	0	0.0	0	0.0	1	1.3
SUDDEN DEATH	0	0.0	0	0.0	1	1.3
SWELLING	0	0.0	0	0.0	1	1.3
ULCER	0	0.0	0	0.0	1	1.3
SKIN AND SUBCUTANEOUS TISSUE DISORDERS	21	30.4	42	53.2	42	54.5
PRURITUS	8	11.6	26	32.9	23	29.9
ERYTHEMA	9	13.0	14	17.7	15	19.5

Interactive analysis



Decision focused delivery



Boehringer Ingelheim

Usability gap

Fragmented context

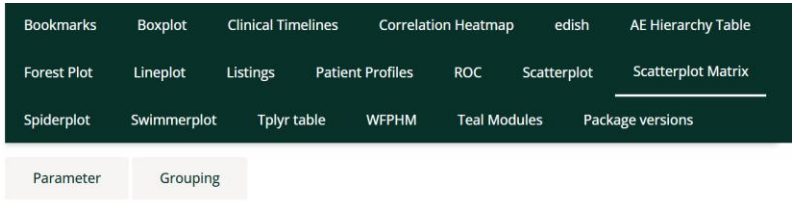
Definitions of derivations/analysis are stored in multiple sources

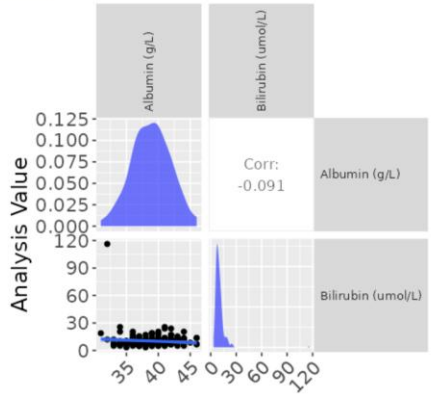
Interface mirrors analysis types

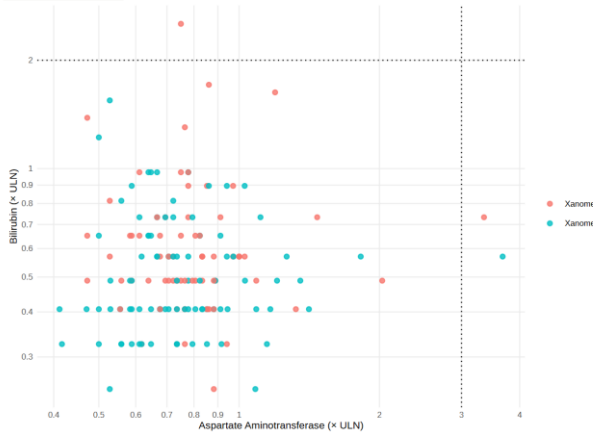
whilst within TOCs/PDFs we grouped by context.

Non-intuitive user interface

What is relevant for me in my role at the current stage of the trial?







Effort shifts away from evaluating evidence towards operating the application!

From analysis topics to workflows

Analysis-Centered

Are all variables available?

Are calculations correct?

Are outputs complete?

User-Centered

What decision is the user making?

Which type of workflow is relevant for the user?

Where is context obtained?

Boehringer Ingelheim

Example findings from a SDTM Transformation Prototype (1)

Master Thesis: Design and Evaluation of a User Interface for SDTM Data Transformation

Comparative usability study between the newly developed SDTM Transformation prototype & the existing active reference system.

Who and how?

5 users tested the reference system first
5 users tested the prototype first

Remote

Tasks?

Participants had to execute typical SDTM activities:

1) Open system and select study
2) Navigate to source data
3) Open mapping
4) Use a mapping template
5) Modify mappings manually
6) Identify unmapped variables

Masterarbeiten / Entwurf und Evaluation eines User Interfaces zur Datentransformation in den SDTM-Standard (German only)

Example findings from a SDTM Transformation Prototype (2)

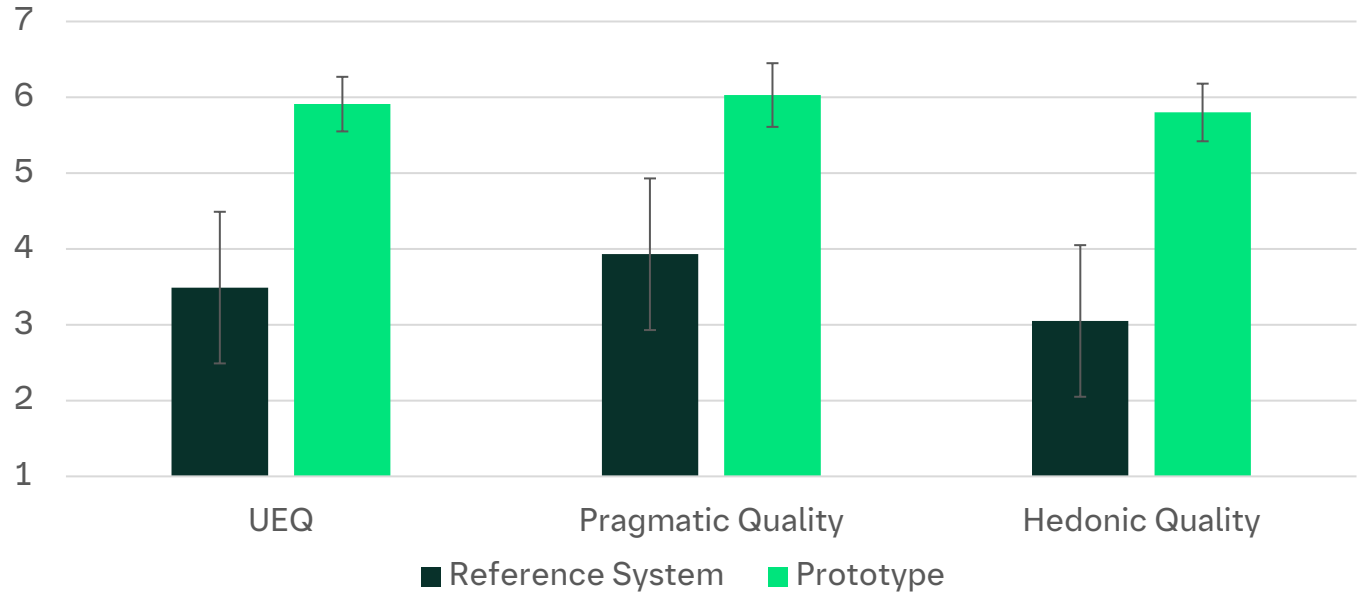
Master Thesis: Design and Evaluation of a User Interface for SDTM Data Transformation

What?

User Experience Questionnaire (UEQ-S)
measures:

- Pragmatic quality
- Hedonic quality
- Overall user experienc

n=10,
higher is better



Time on Task

Error Rate (clarification, navigation guidance, step-by-step instructions)

Qualitative Component
After testing both systems, structured interviews were conducted.

Masterarbeiten / Entwurf und Evaluation eines User Interfaces zur Datentransformation in den SDTM-Standard (German only)

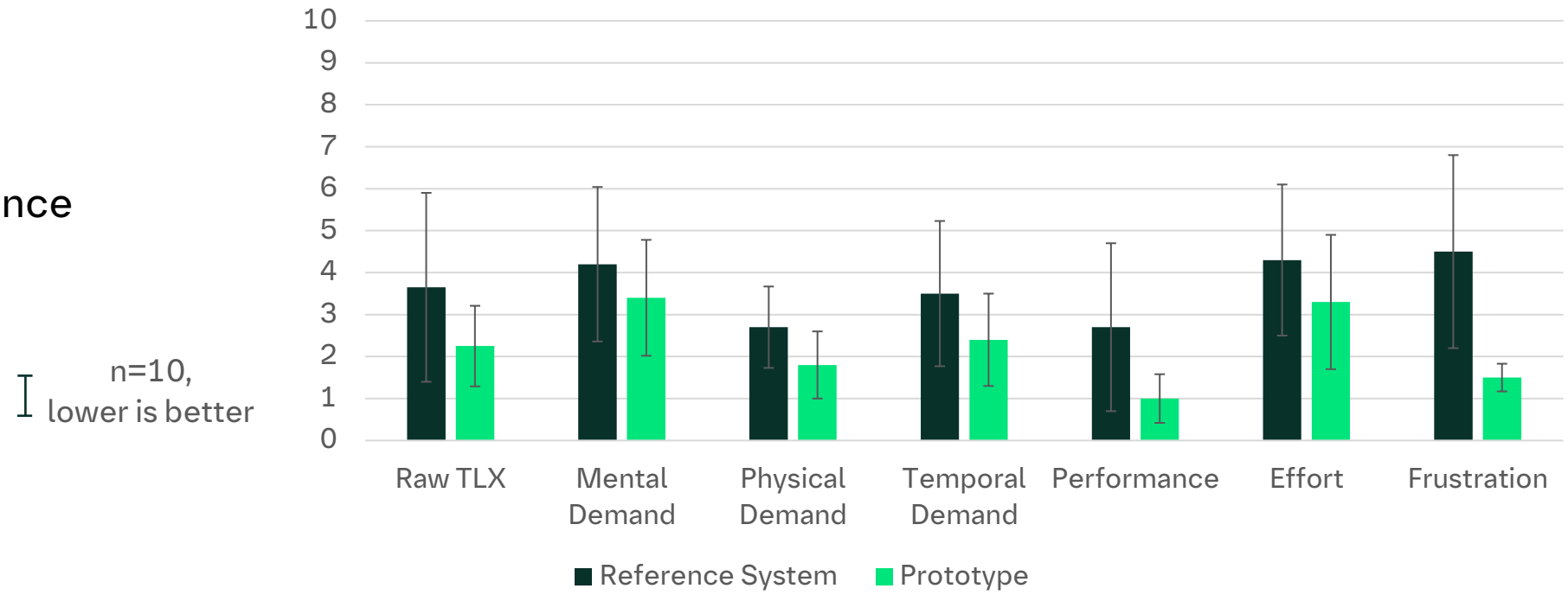
Boehringer Ingelheim

Example findings from a SDTM Transformation Prototype (3)

Master Thesis: Design and Evaluation of a User Interface for SDTM Data Transformation

NASA Task Load Index (TLX)
measures perceived workload capturing:

- Mental demand
- Effort
- Frustration
- Temporal demand
- Physical demand
- Perceived performance

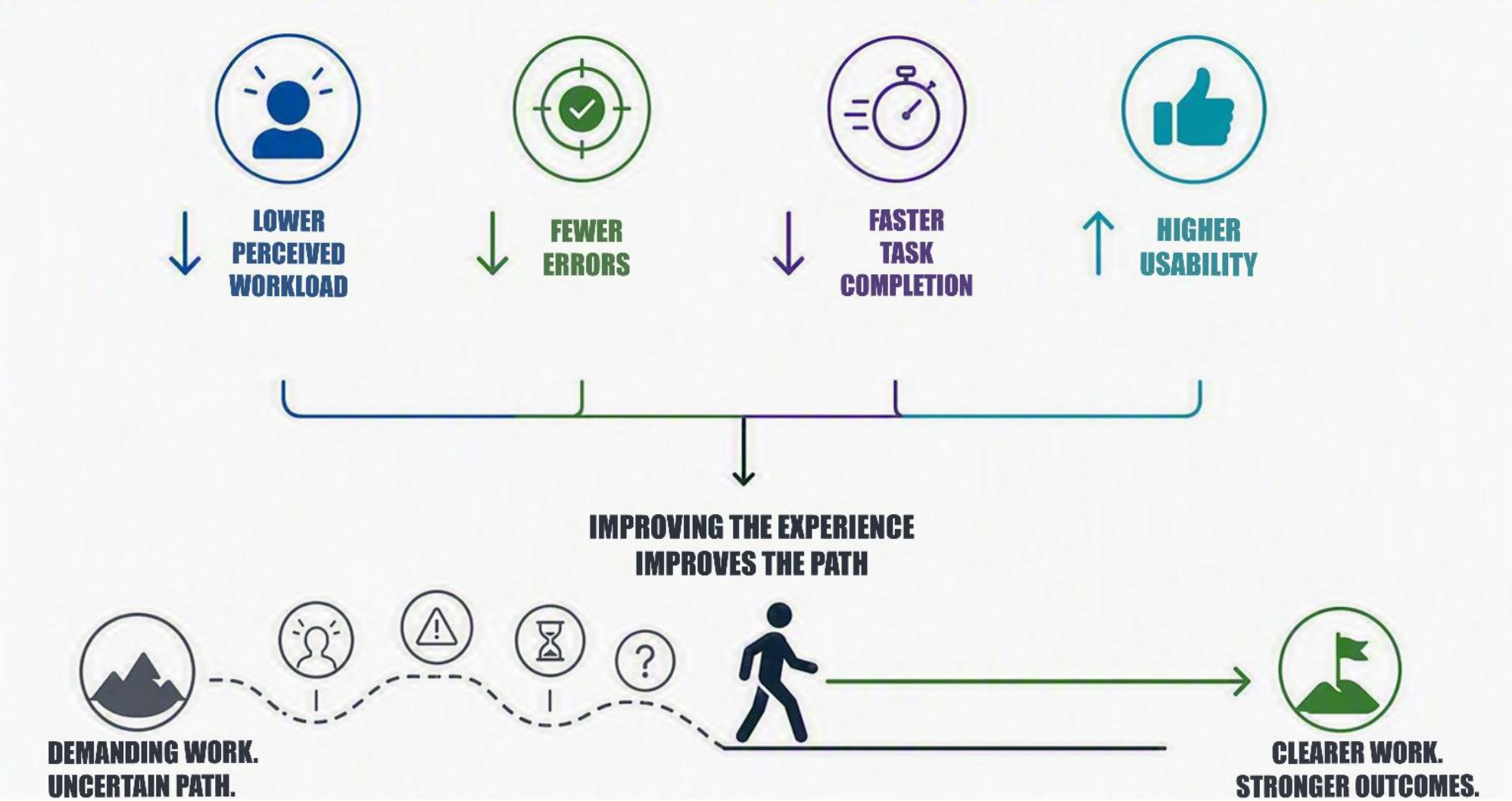


Masterarbeiten / Entwurf und Evaluation eines User Interfaces zur Datentransformation in den SDTM-Standard (German only)

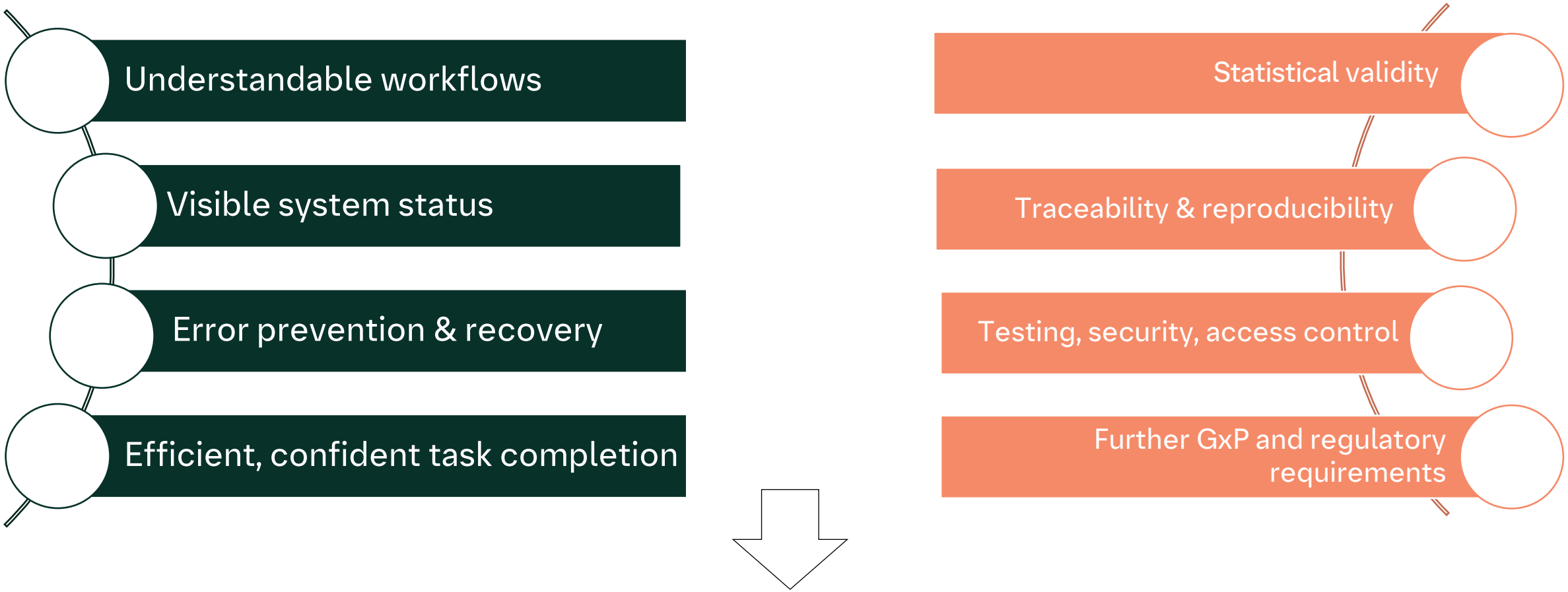
Boehringer Ingelheim

Example findings from a SDTM Transformation Prototype (4)

Master Thesis: Design and Evaluation of a User Interface for SDTM Data Transformation



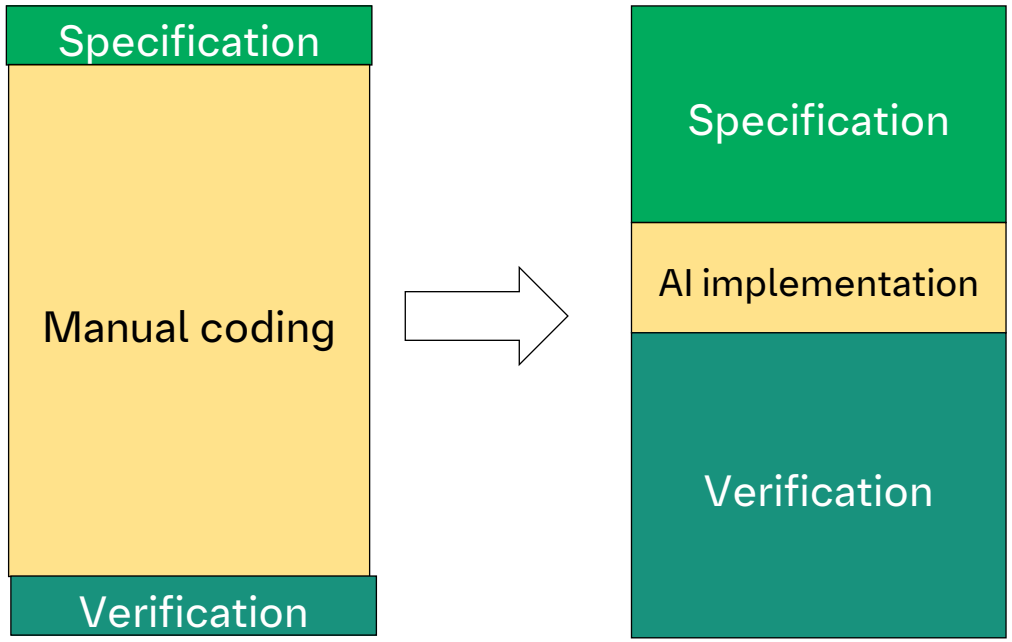
UX and R Shiny apps in the context of a clinical data scientist



Usability is complementary

AI – the solution?

Coding is no longer the time consumer/cost driver



From Implementers to Solution Architects | by Agoda Engineering | Agoda Engineering & Design | Medium

Precision Proactivity: Measuring Cognitive Load in Real-World AI-Assisted Work

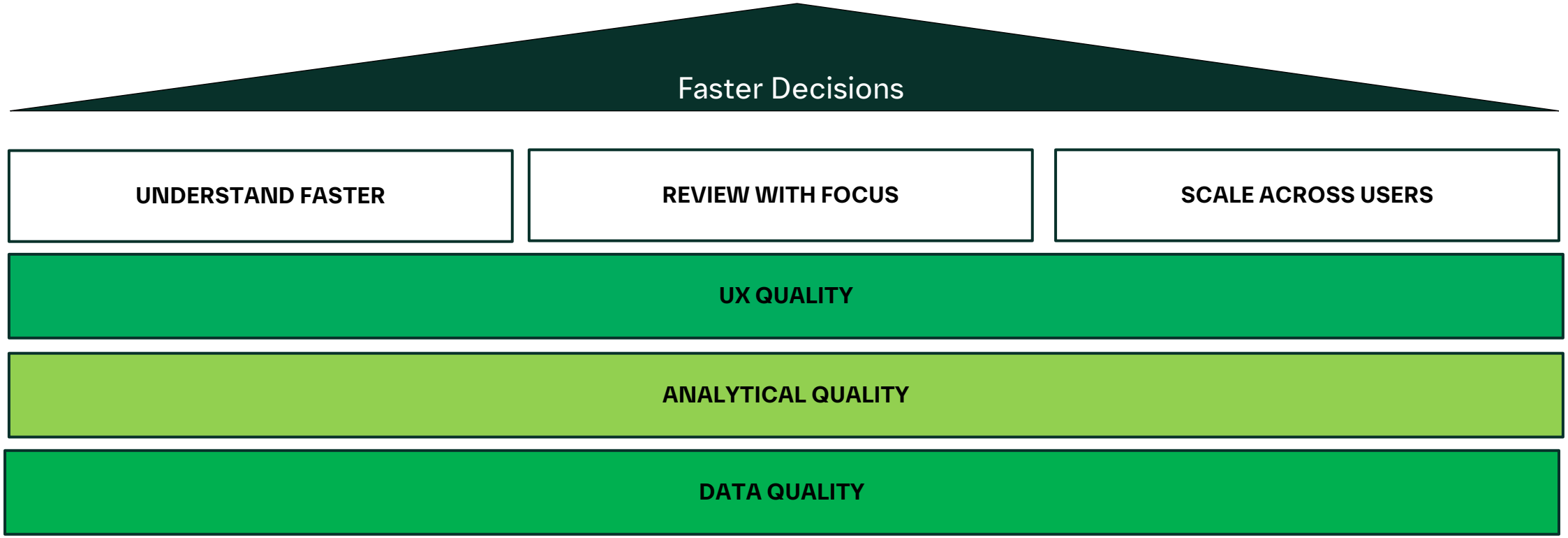
"AI can provide more relevant information faster, but complex human-AI interactions introduce

***additional coordination demands**:*

- *users must select what to trust,*
- *integrate outputs with existing knowledge,*
- *reconcile inconsistencies, and*
- *preserve a coherent mental representation of the task."*

Precision Proactivity: Measuring Cognitive Load in Real-World AI-Assisted Work

Conclusion



Better UX does not replace sound data and methods –
it accelerates the path from evidence to decision.

Acknowledgements and References

Special thanks to my mentee, Lennart Hergel, for enlightening me with respect to the power of UX Techniques –

it is more than the GUI ☺

Entwurf und Evaluation eines User Interfaces zur Datentransformation in den SDTM Standard. urn:nbn:at:at-ftw:1-81892

R submission working group, (05. 08 2026). *Making R Submissions Reviewable for FDA – R Consortium*. Von https://r-consortium.org/: https://r-consortium.org/posts/making-r-submissions-reviewable-for-fda/ abgerufen

Lepine B., K. J. (03 2026). Precision Proactivity: Measuring Cognitive Load in Real-World AI-Assisted Work. *ACM Trans.Comput.-Hum.Interact. 1*, S. 61.

Stern, L. (. (26. 02 2026). *From Implementers to Solution Architects, Why AI Makes*. Von Medium : https://medium.com/agoda-engineering/from-implementers-to-solution-architects-250a95087d75 abgerufen

Thank you!
Any questions?

In case of questions please contact:

Barbara Doll

barbara.doll@boehringer-Ingelheim

Boehringer Ingelheim