

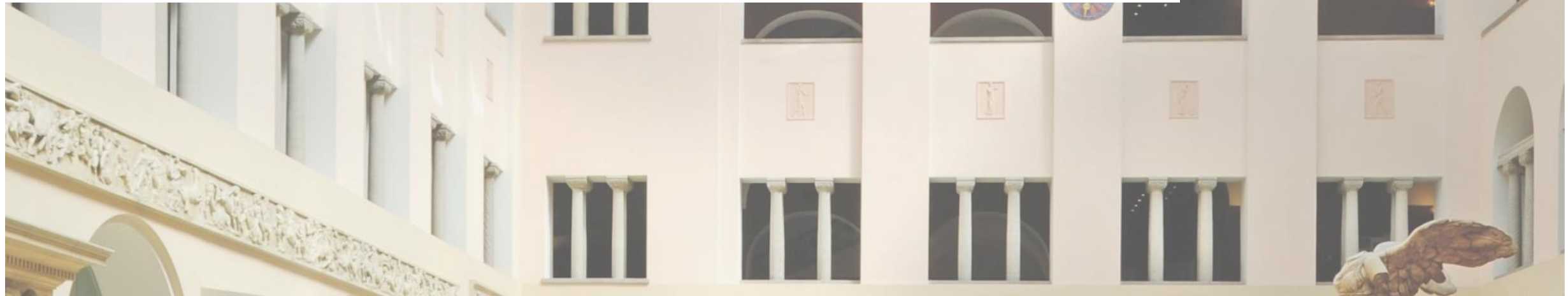


MULTICAST: Monitoring suicidal ideation following hospital discharge

Presenters: Stephanie Homan, Ph.D. & Samantha Weber, Ph.D.

Research groups: B. Kleim, S. Olbrich

Ipsilon Research Meeting, 24 November 2025



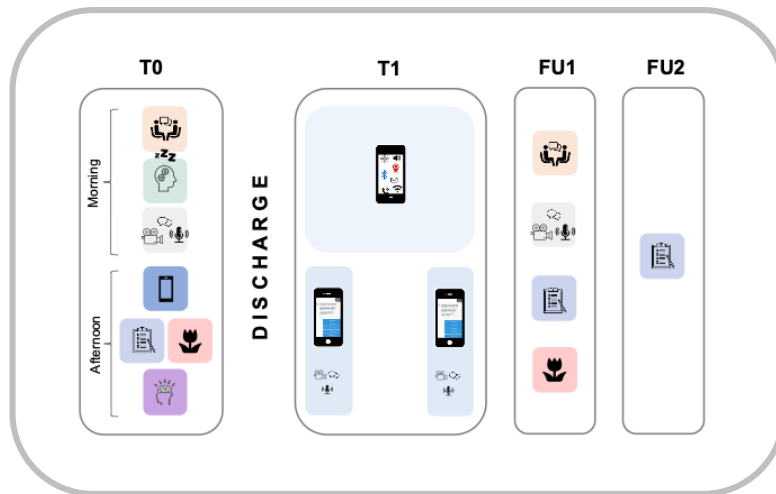
MULTICAST



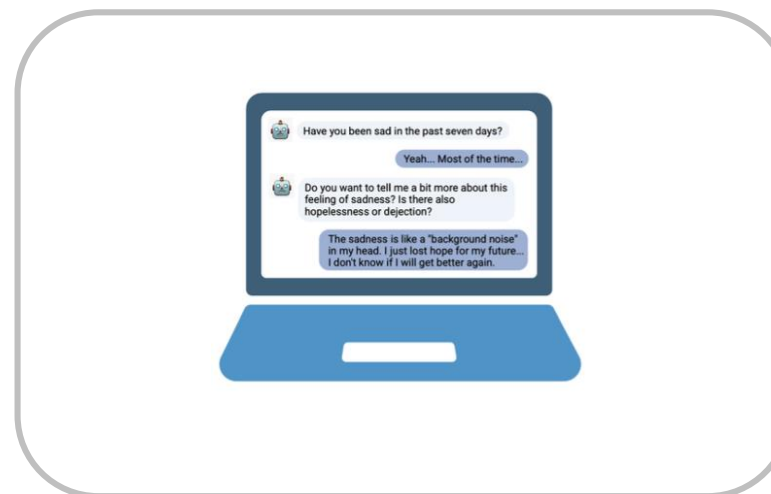
DIGITAL TECHNOLOGIES IN SUICIDE RESEARCH

CHATBOTS/AI IN RESEARCH

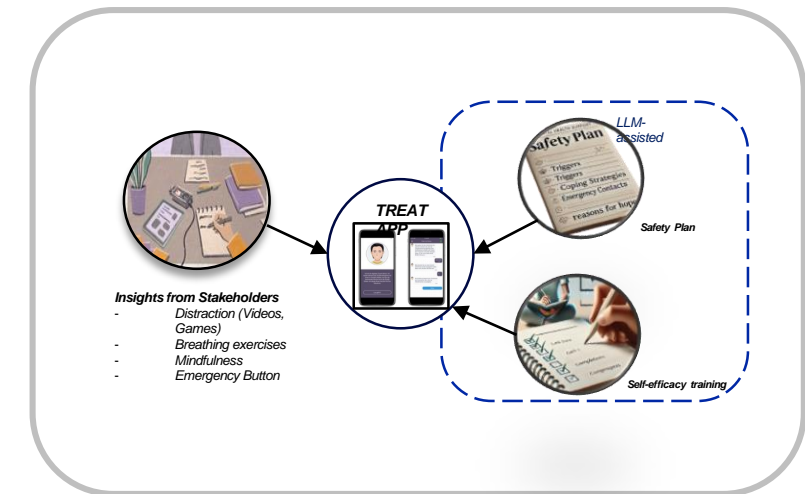
PREDICT



EXPERIMENT



TREAT



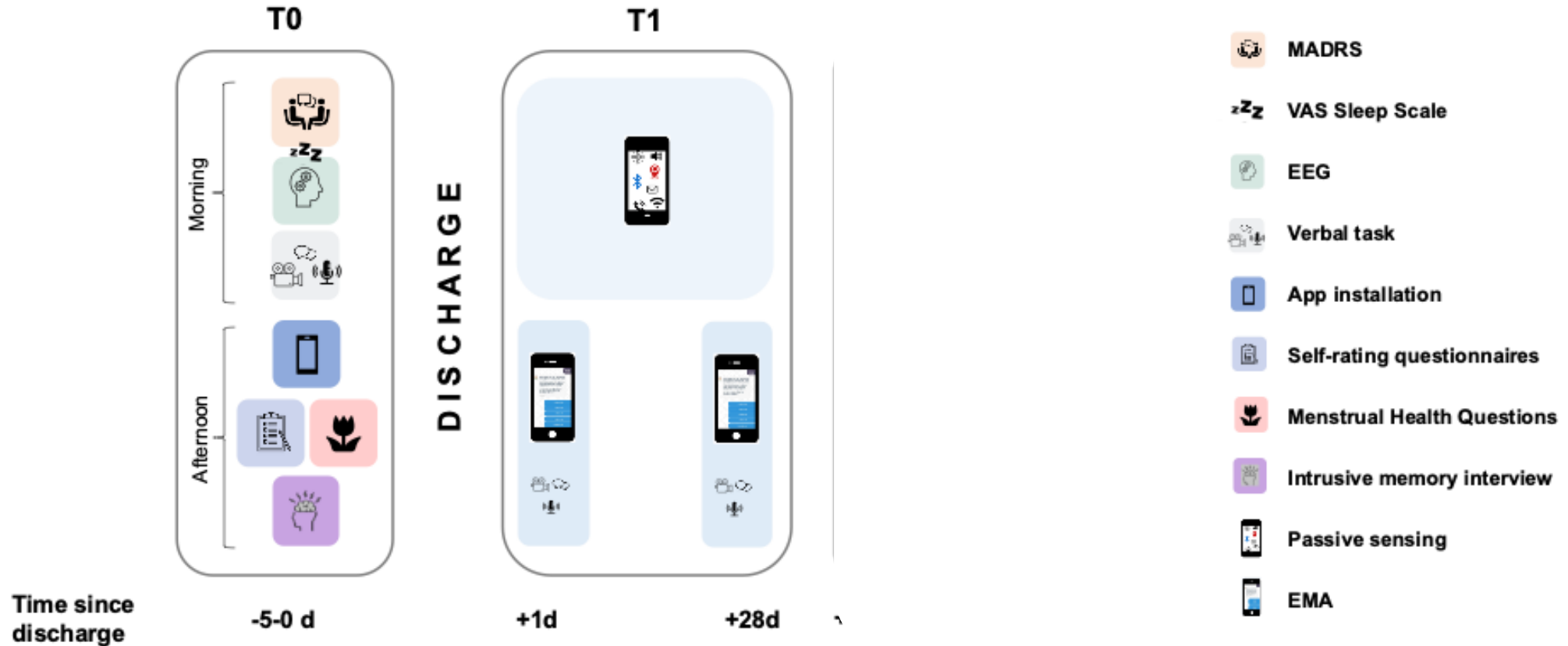
PREDICT: Capturing suicidal thoughts with digital technology

Target population: Transdiagnostic inpatients with current/past suicidal thoughts and behaviors



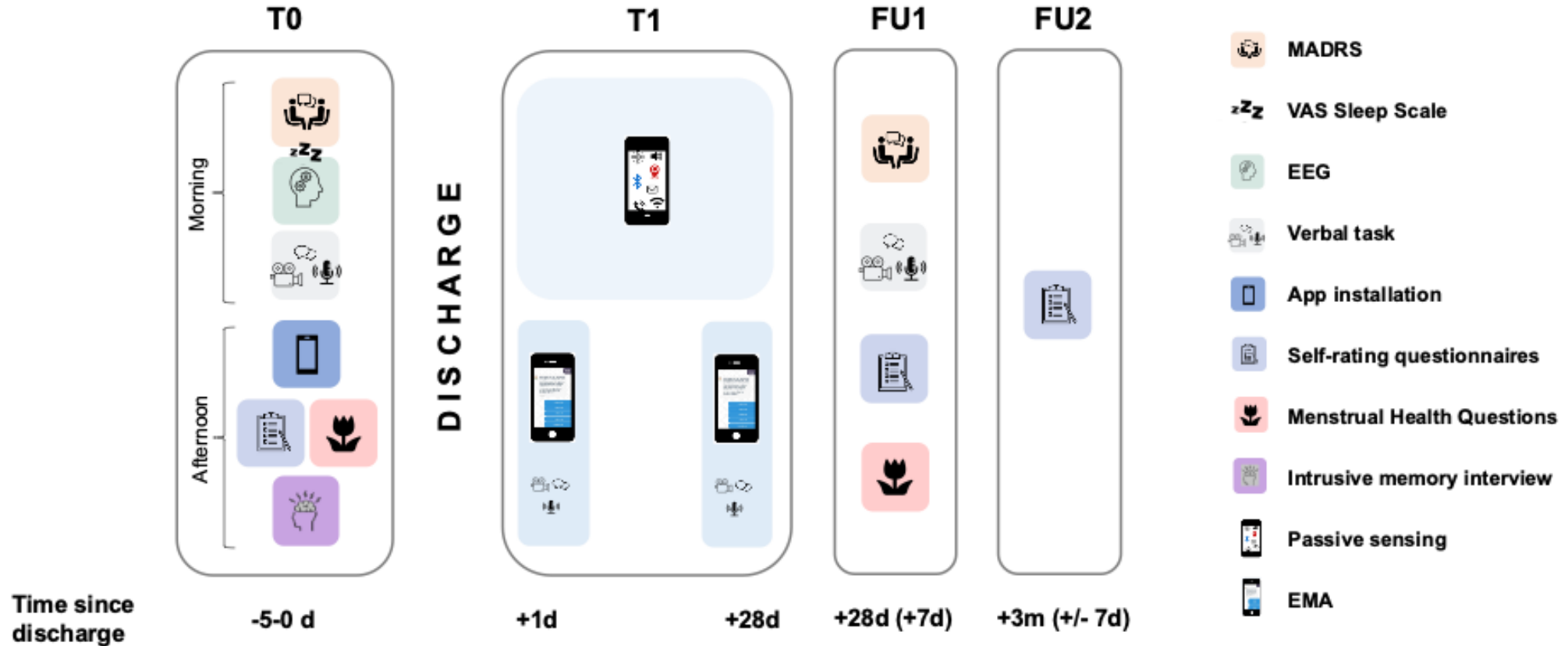
PREDICT: Capturing suicidal thoughts with digital technology

Target population: Transdiagnostic inpatients with current/past suicidal thoughts and behaviors



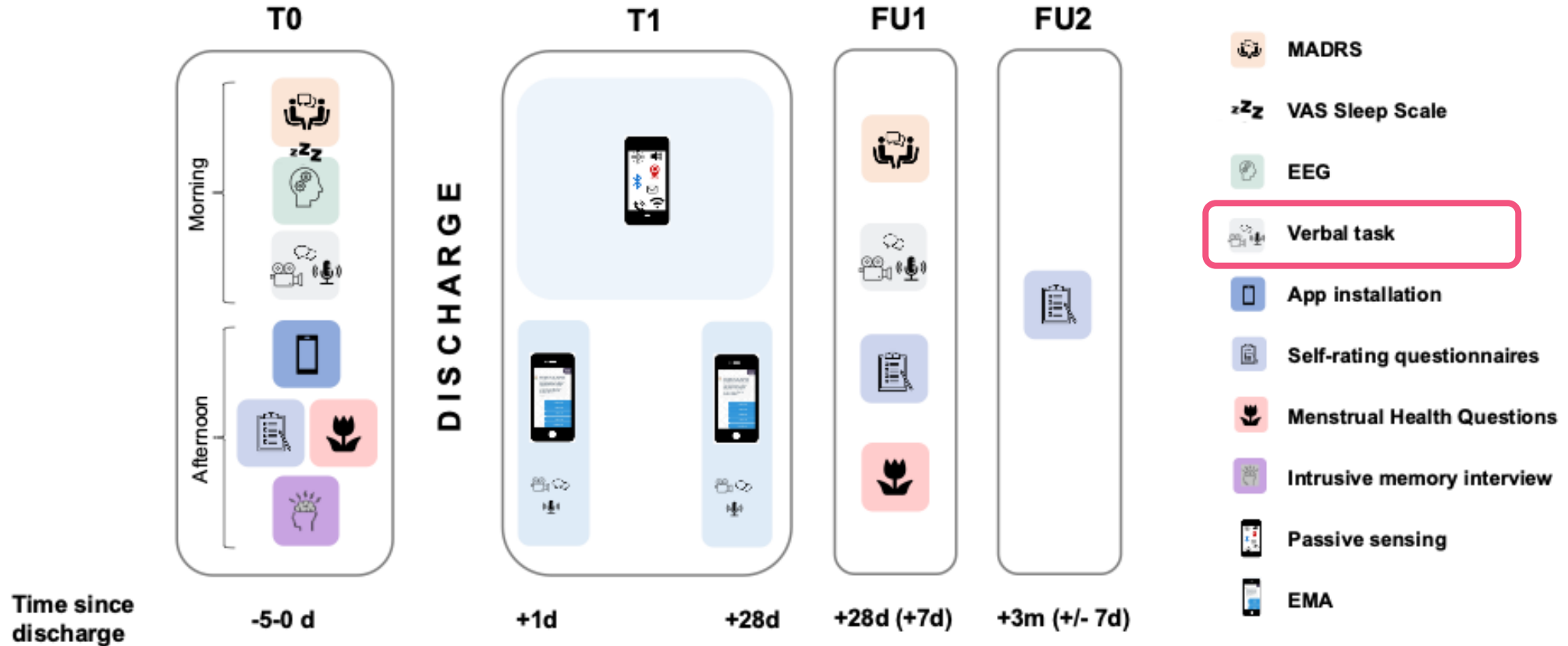
PREDICT: Capturing suicidal thoughts with digital technology

Target population: Transdiagnostic inpatients with current/past suicidal thoughts and behaviors



PREDICT: Capturing suicidal thoughts with digital technology

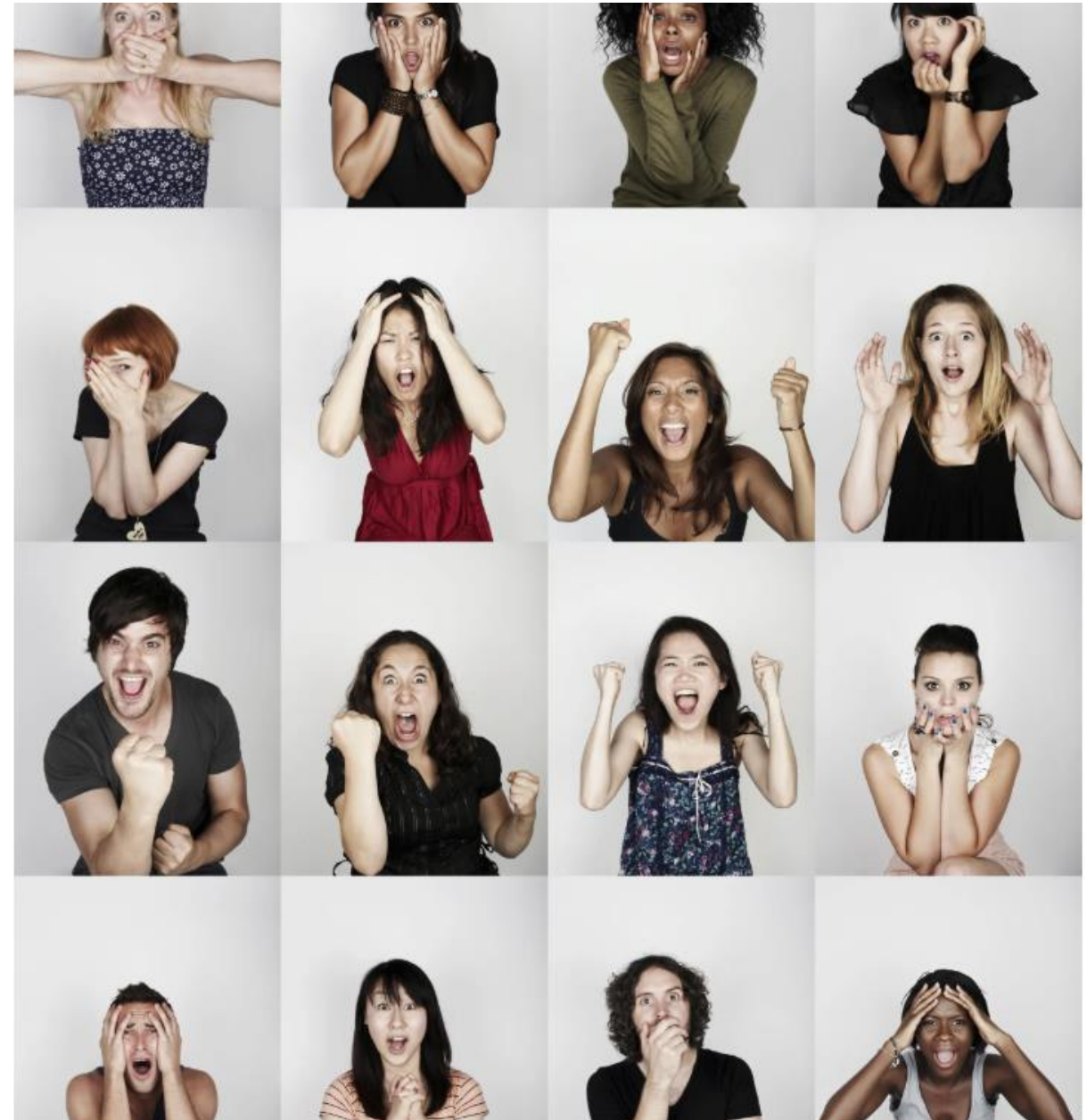
Target population: Transdiagnostic inpatients with current/past suicidal thoughts and behaviors



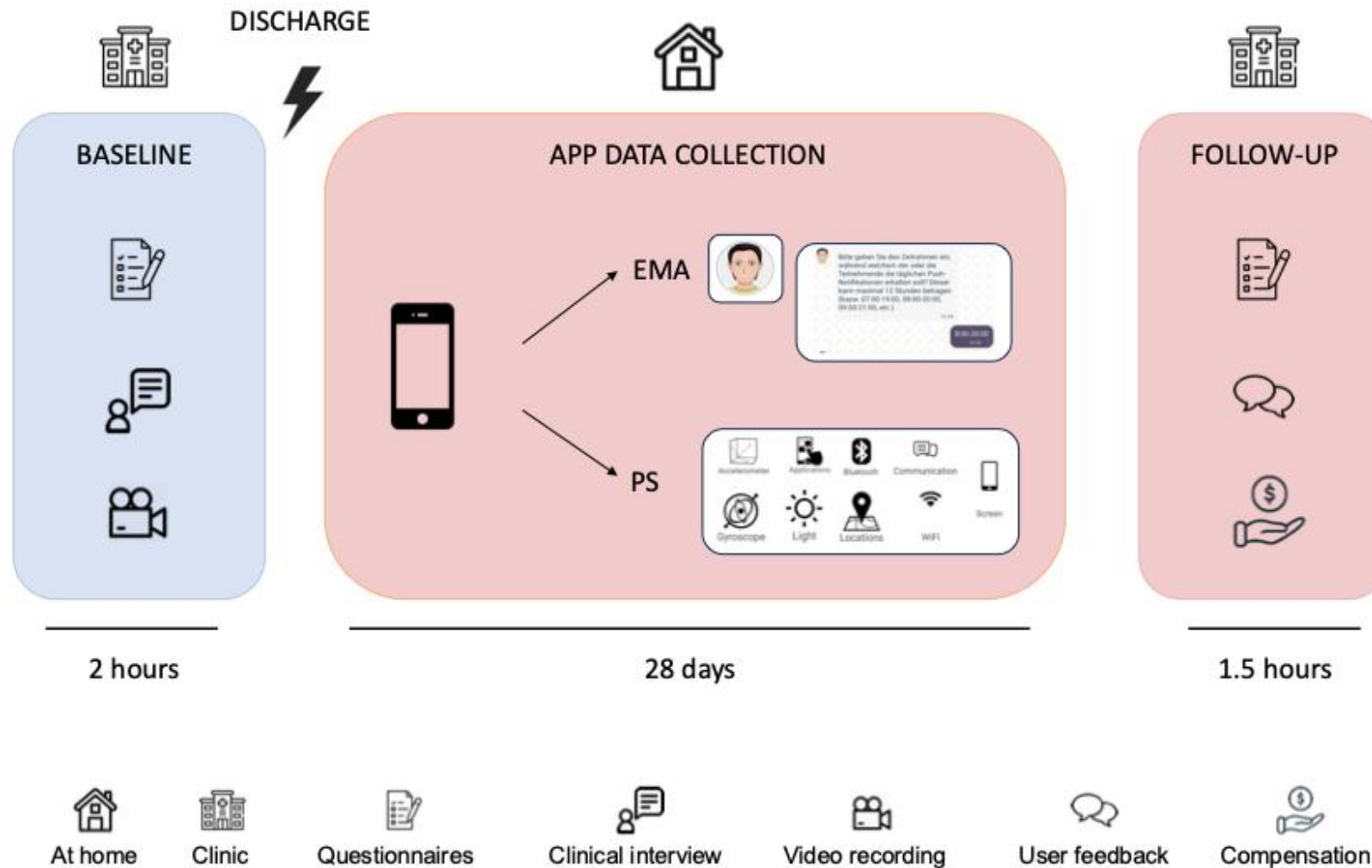
Non-verbal expressions in suicide risk prediction

- Measurable suicide-risk signals: slowed/monotone speech, longer pauses, reduced facial and movement expressivity. (Galatzer-Levy et al., 2021; Iyer et al., 2022)
- Multimodal (audio + video + text) models outperform single-modality approaches. (Alghowinem et al., 2023)

→ Promising **supplementary** markers for suicide-risk detection, but still **early-stage**; larger longitudinal studies and clinical validation are needed. (Parsapoor et al., 2023; Dhelim et al., 2023; Marie et al., 2025; Alghowinem et al., 2023)

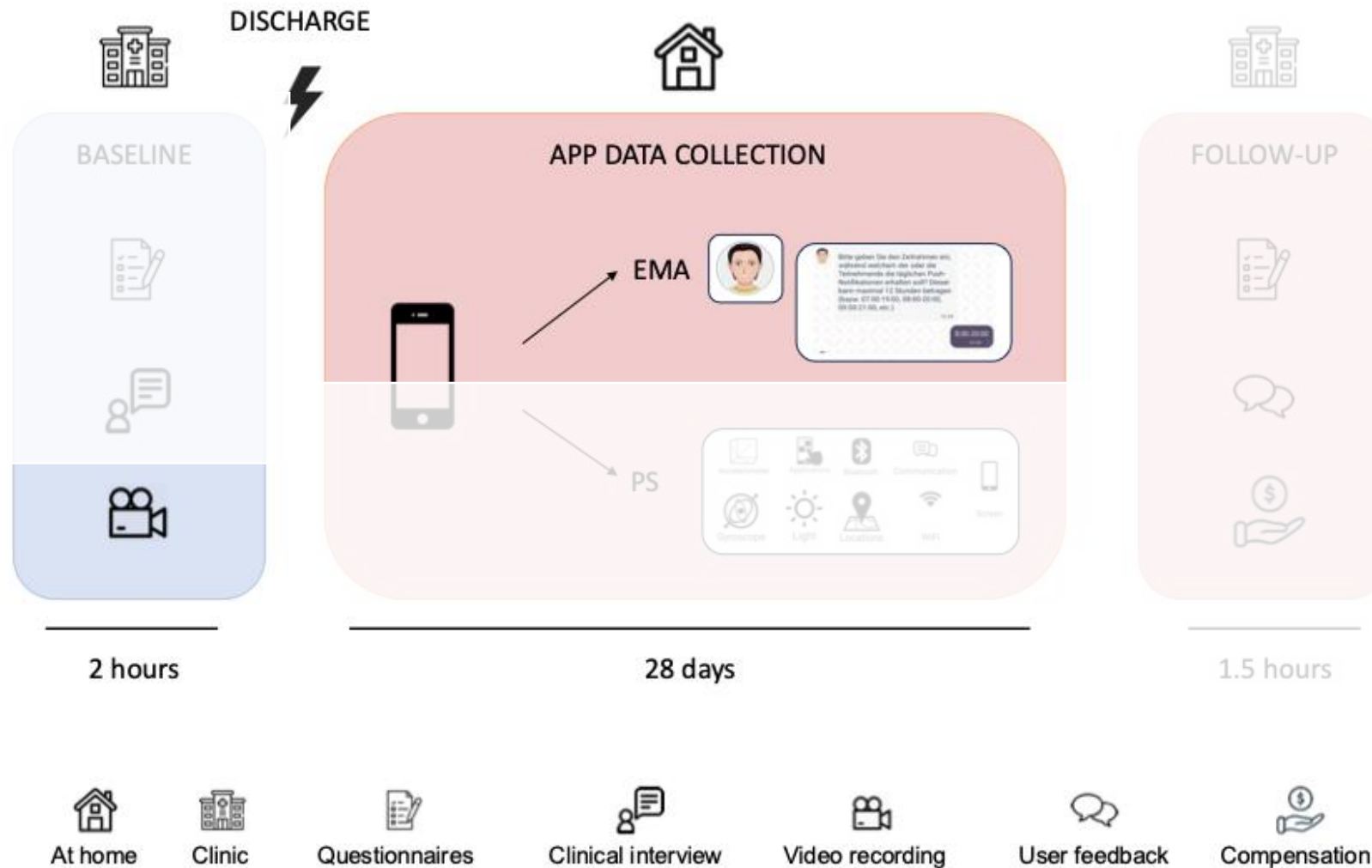


MULTICAST's feasibility study: the SIMON study



Sels et al., 2021

MULTICAST's feasibility study: the SIMON study



Sels et al., 2021

MULTICAST's feasibility study: the SIMON study

The linguistic task



1 min.

Negative Past

"Can you remember an event that was upsetting or stressful for you?"



1 min.

Positive Future

"Is there an event in the coming days that you are looking forward to?"



1 min.

Negative Future

"Is there an event in the coming days that you are not looking forward to or even dreading?"



1 min.

...



1 min.



1 min.

MULTICAST's feasibility study: the SIMON study

The linguistic task



1 min.



1 min.



1 min.



1 min.



1 min.



1 min.

Negative Past

"Can you remember an event that was upsetting or stressful for you?"

Positive Future

"Is there an event in the coming days that you are looking forward to?"

Negative Future

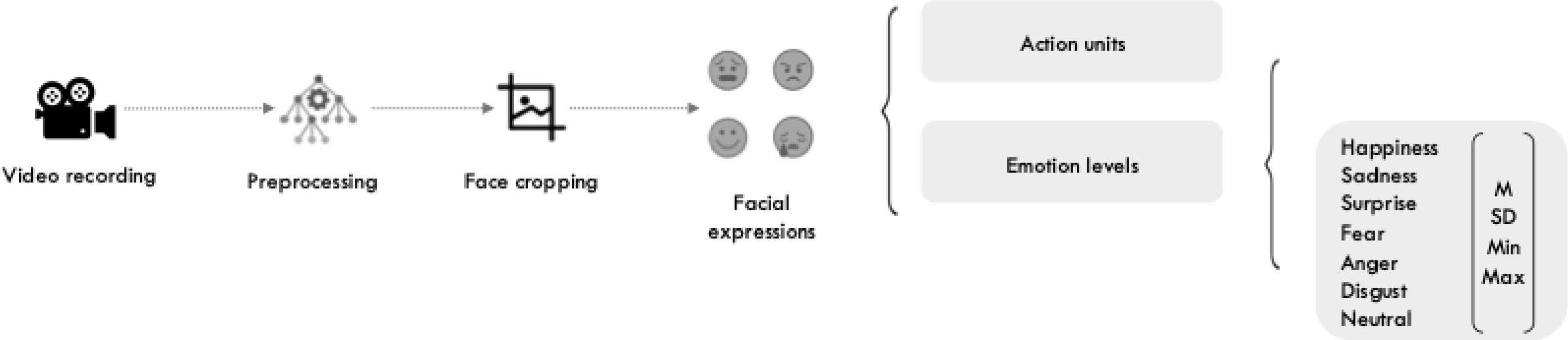
"Is there an event in the coming days that you are not looking forward to or even dreading?"

...

Digital biomarker extraction



Victoria Müller



Homan et al., in prep.

The sample

Variable	N	N = 38 ¹
Age	36	33.72 (12.08)
NA		2
Sex	35	
female		21 / 35 (60%)
male		14 / 35 (40%)
NA		3
Rehospitalized	24	
Yes		10 / 24 (42%)
No		14 / 24 (58%)
NA		14
Severity of suicidal ideation (BSS total score)	23	12.61 (10.68)
NA		15
History of suicide attempts (BSS item 20)	23	
Never		8 / 23 (35%)
Once		4 / 23 (17%)
Twice or more than twice		11 / 23 (48%)
NA		15

¹Mean (SD); n / N (%)

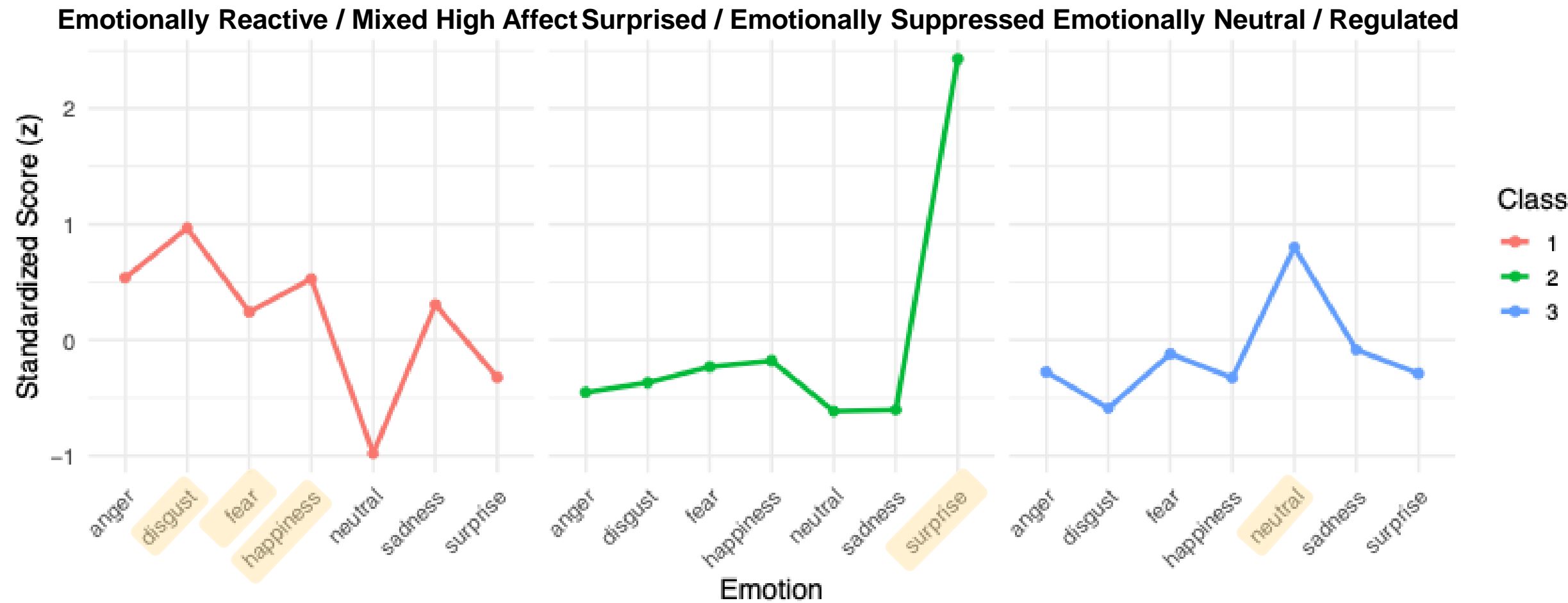
Note. BSS, Beck Scale for Suicide Ideation; Baseline data was not available for all participants.

Homan et al., in prep.

Are there subgroups that experience unique combinations of emotional intensity?

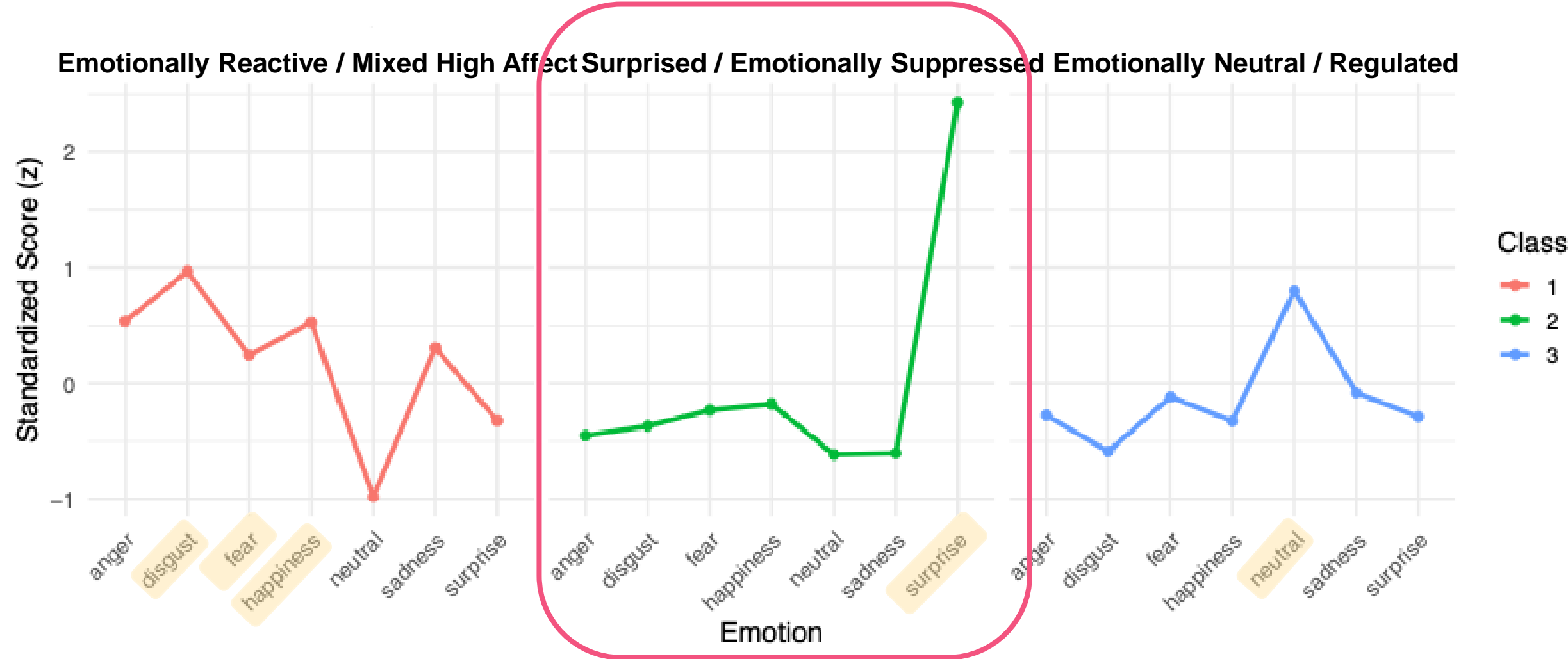
Homan et al., in prep.

Are there subgroups that experience unique combinations of emotional intensity?



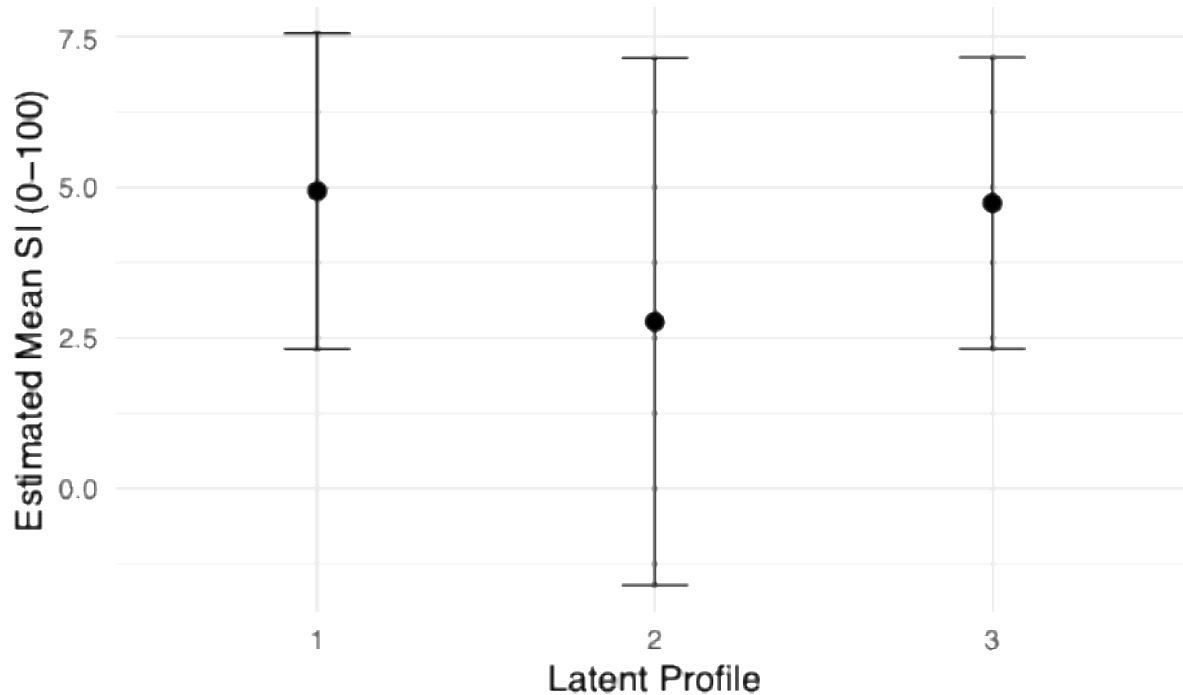
Homan et al., in prep.

Are there subgroups that experience unique combinations of emotional intensity?



Homan et al., in prep.

Are these subgroups related to suicidal ideation post-discharge?

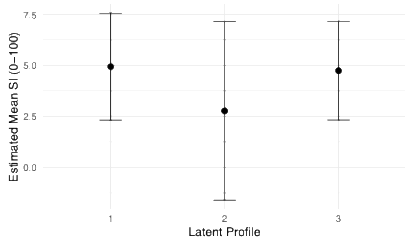


→ **No significant differences** in suicidal ideation across latent profile classes within the **negative past** condition.

→ High standard errors suggest imprecise estimates, likely due to **limited sample size** or variability

Homan et al., in prep.

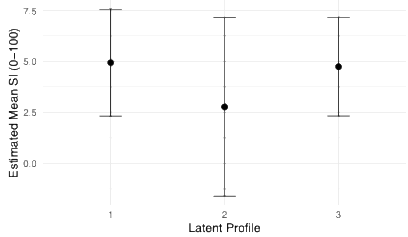
Digital biomarkers as promising correlates for suicidal ideation?



- There is **no easy answer**.
- Digital biomarkers might have **potential for suicide risk prediction** and for complementing clinical practice.
- Before we can use these biomarkers in eMental Health, we need to **understand them better** (i.e., include action units, get clinical ratings of facial expressions).

Homan et al., in prep.

Digital biomarkers as promising correlates for suicidal ideation?



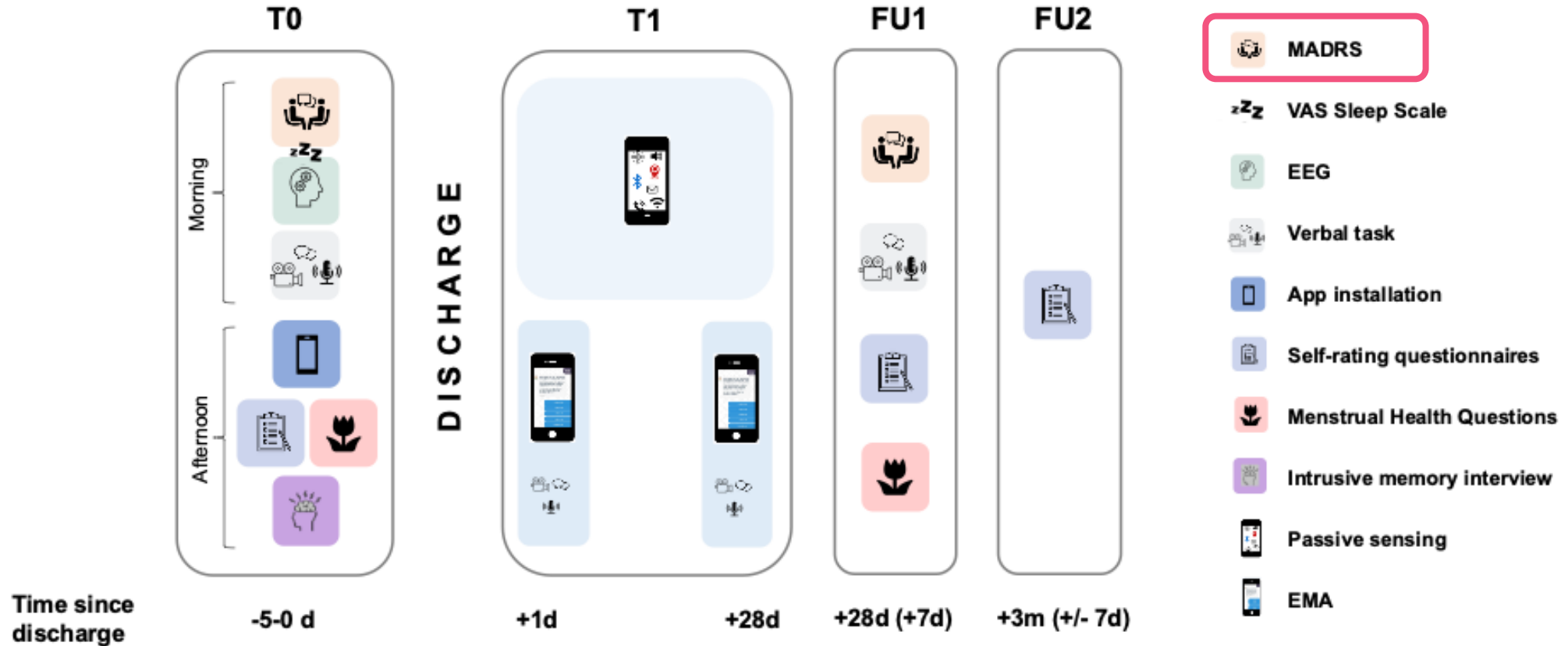
- There is **no easy answer**.
- Digital biomarkers might have **potential for suicide risk prediction** and for complementing clinical practice.
- Before we can use these biomarkers in eMental Health, we need to **understand them better** (i.e., include action units, get clinical ratings of facial expressions).
- And: Replication in a larger sample → MULTICAST-PRED



Homan et al., in prep.

PREDICT: Capturing suicidal thoughts with digital technology

Target population: Transdiagnostic inpatients with current/past suicidal thoughts and behaviors



Using Artificial Intelligence for symptom assessment and monitoring?



MONTGOMERY and ÅSBERG Depression Rating Scale (MADRS)

Each item rated from 0 – 6 [0 = no symptoms]

General: *Hopelessness, dejection, and despair expressed in language, facial expressions, and posture.*

Sadness: *Patient's reports of a depressed mood, including discouragement, dejection, feelings of helplessness, and hopelessness.*

Tension: *Indefinable feeling of discomfort as well as irritability, restlessness, inner excitement up to anxiety and panic.*

Sleep: *Subjective experience of reduced sleep duration or sleep depth.*

Appetite: *The feeling of having less appetite compared to the normal state.*

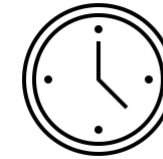
Concentration: *Difficulties in concentrating*

Lack of Drive: *Difficulties in starting or heaviness in beginning and carrying out everyday activities.*

Emotional Numbness: *The subjective feeling of reduced interest in the environment or activities that previously brought joy.*

Pessimistic Thoughts: *Feelings of guilt, inferiority, self-blame, etc.*

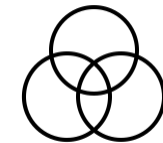
Suicide: *Feeling that life is no longer worth living, natural death would be a relief, thoughts of suicide, and preparation for suicide.*



Time-intensive



Trained Personnel



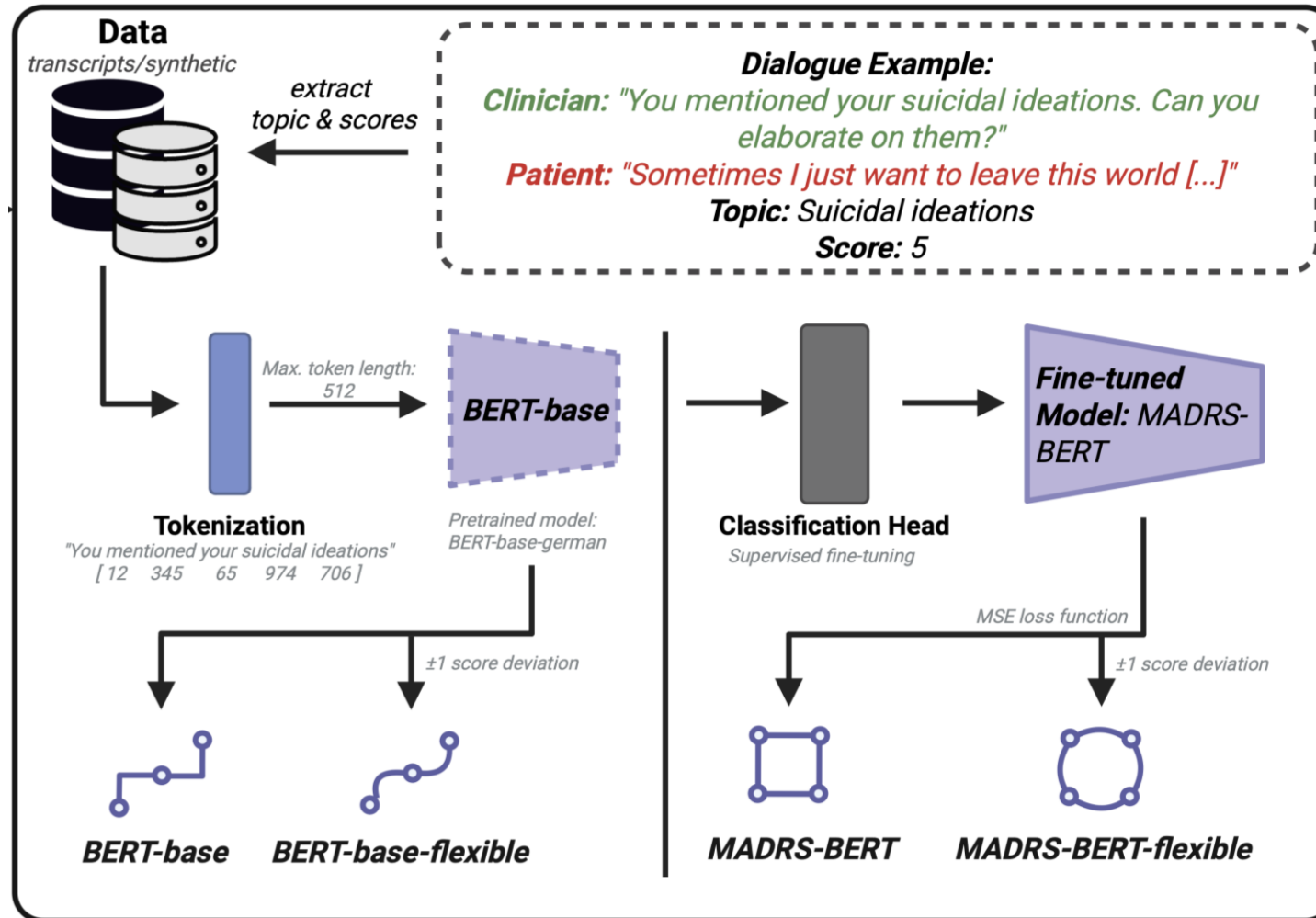
Variability



Artificial Intelligence

Assessing depressive Symptoms using AI – LLM Training and Evaluation

LLM Training



google-bert/bert-base-german-cased

Assessing depressive Symptoms using AI – LLM Training and Evaluation

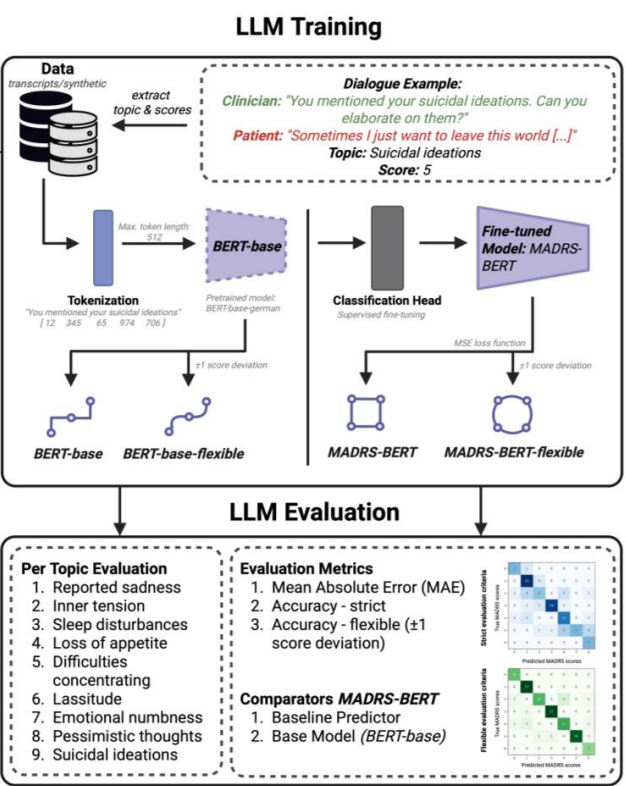


Table 1 | Comparison of *MADRS-BERT* and Baseline Predictor (Mean Regression Model) Performance Across MADRS items

MADRS Item	Mean MADRS Score	MAE ↓ (\pm std)	
		Baseline predictor	<i>MADRS-BERT</i>
Reported sadness	3.0	1.7	0.9 (\pm 0.04)
Inner tension	3.0	1.5	0.7 (\pm 0.15)
Sleep disturbances	2.9	1.7	0.9 (\pm 0.16)
Loss of appetite	2.8	1.8	0.8 (\pm 0.08)
Difficulties concentrating	2.9	1.7	0.8 (\pm 0.22)
Lassitude	2.8	1.8	0.8 (\pm 0.21)
Emotional numbness	2.8	1.8	1.0 (\pm 0.26)
Pessimistic thoughts	2.9	1.6	0.8 (\pm 0.14)
Suicidal ideations	2.9	1.7	0.8 (\pm 0.16)
Total	2.89	1.70	0.83

The table reports the Mean Score, and Mean Absolute Error (MAE) for the baseline predictor and the fine-tuned model (*MADRS-BERT*) across all nine MADRS items. The baseline predictor assigns the mean MADRS score per topic as the predicted value, serving as a naive statistical reference. MAE quantifies the prediction error, with lower values indicating better performance. Bold numbers highlight the best results.

MAE < 1 is comparable with our clinician performance

Assessing depressive Symptoms using AI – LLM Training and Evaluation

Table 2 | Performance metrics of the fine-tuned *MADRS-BERT* and *BERT-base* models under strict and flexible criteria for accuracy

MADRS Item	<i>MADRS-BERT</i>		<i>BERT-base</i>	
	Accuracy ↑ [%] <i>Flexible</i>	Accuracy ↑ [%] <i>Strict</i>	Accuracy ↑ [%] <i>Flexible</i>	Accuracy ↑ [%] <i>Strict</i>
Reported sadness	80 (± 0.03)	40 (± 0.07)	29 (± 0.04)	14 (± 0.03)
Inner tension	88 (± 0.06)	49 (± 0.10)	25 (± 0.04)	12 (± 0.07)
Sleep disturbances	82 (± 0.08)	44 (± 0.09)	30 (± 0.07)	17 (± 0.07)
Loss of appetite	79 (± 0.04)	43 (± 0.12)	33 (± 0.06)	20 (± 0.07)
Difficulties concentrating	83 (± 0.08)	40 (± 0.14)	31 (± 0.06)	15 (± 0.06)
Lassitude	86 (± 0.07)	46 (± 0.16)	31 (± 0.09)	19 (± 0.08)
Emotional numbness	80 (± 0.12)	35 (± 0.11)	33 (± 0.11)	20 (± 0.08)
Pessimistic thoughts	85 (± 0.07)	41 (± 0.10)	26 (± 0.04)	14 (± 0.05)
Suicidal ideations	83 (± 0.10)	44 (± 0.10)	32 (± 0.05)	17 (± 0.04)

Mean and standard deviation of accuracies across five folds. Strict evaluation for accuracy considers exact score predictions, while flexible evaluation allows a deviation of ± 1 from the actual score. Bold numbers highlight the best results.



Universität
Zürich^{UZH}



Psychiatrische
Universitätsklinik
Zürich



Sebastian Olbrich

PI



Birgit Kleim

PI



Andrea Häfliger
PhD student
Andrea.haefliger@uzh.ch



Stephanie Homan
Postdoc
stephanie.homan@bli.uzh.ch



Jacopo Mocellin
PhD student
Jacopo.mocellin@uzh.ch



Anna Monn
PhD student
Anna.monn@uzh.ch



Samantha Weber
Postdoc
Samantha.weber@bli.uzh.ch



Swiss National
Science Foundation

Thanks for your attention!



MULTICAST: Digital pathways for early intervention in suicidal ideation

Presenters: Andrea Häfliger, M.Sc. & Samantha Weber, Ph.D.

Research groups: B. Kleim, S. Olbrich

Ipsilon Research Meeting, 24 November 2025



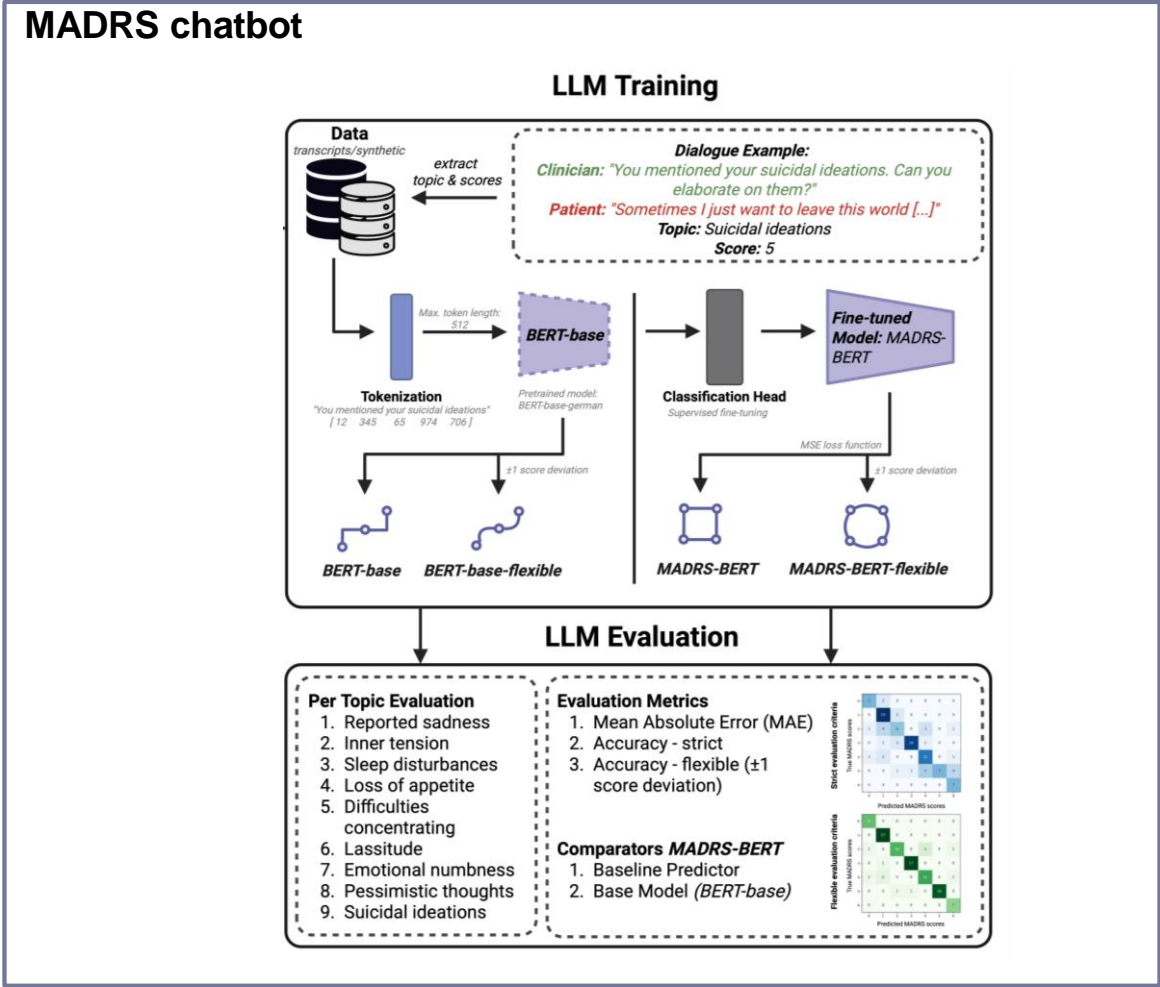
Vision for MULTICAST TREAT

Aim: Developing a digital intervention for people with suicidal thoughts and behaviors that ...

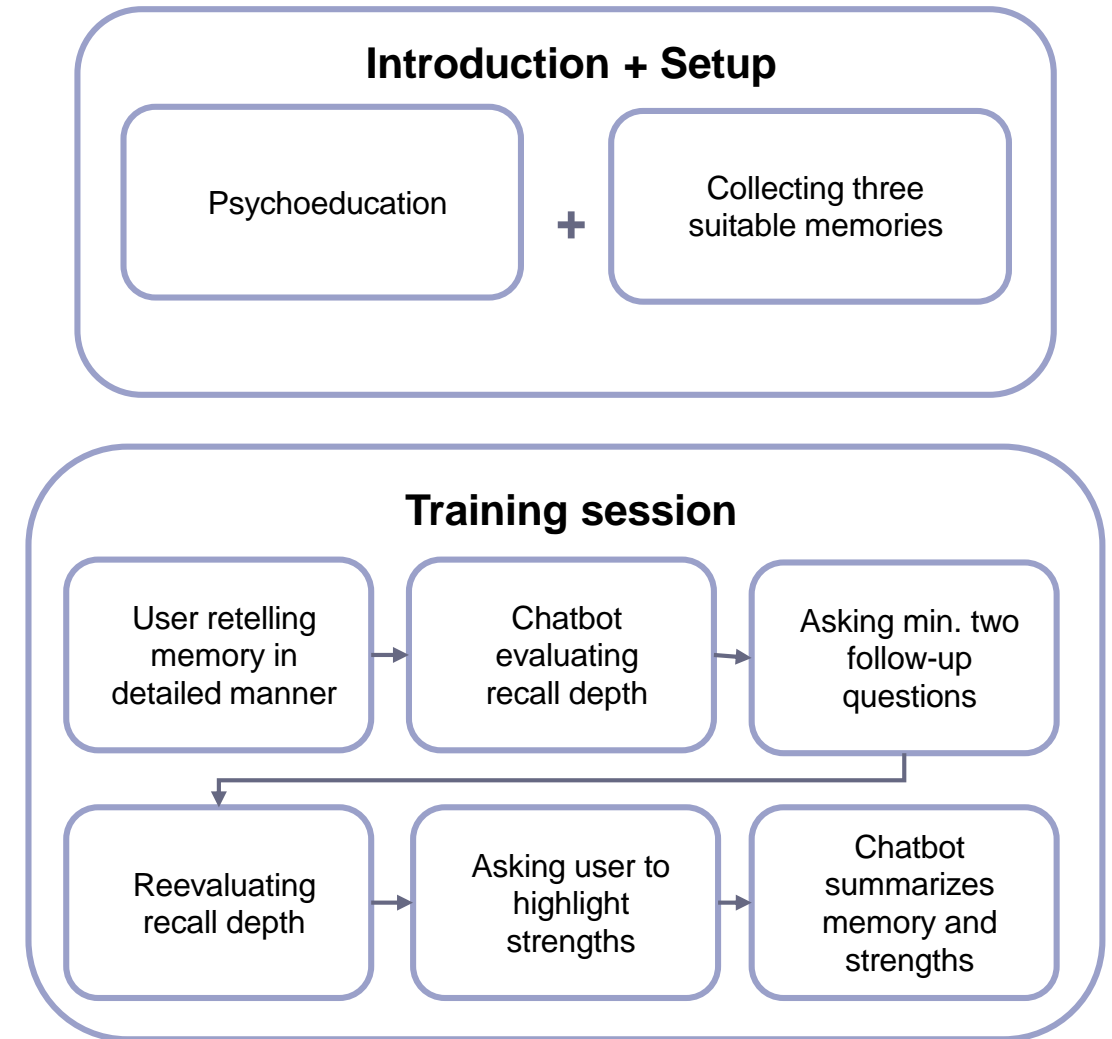
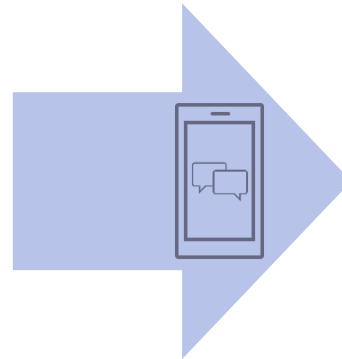
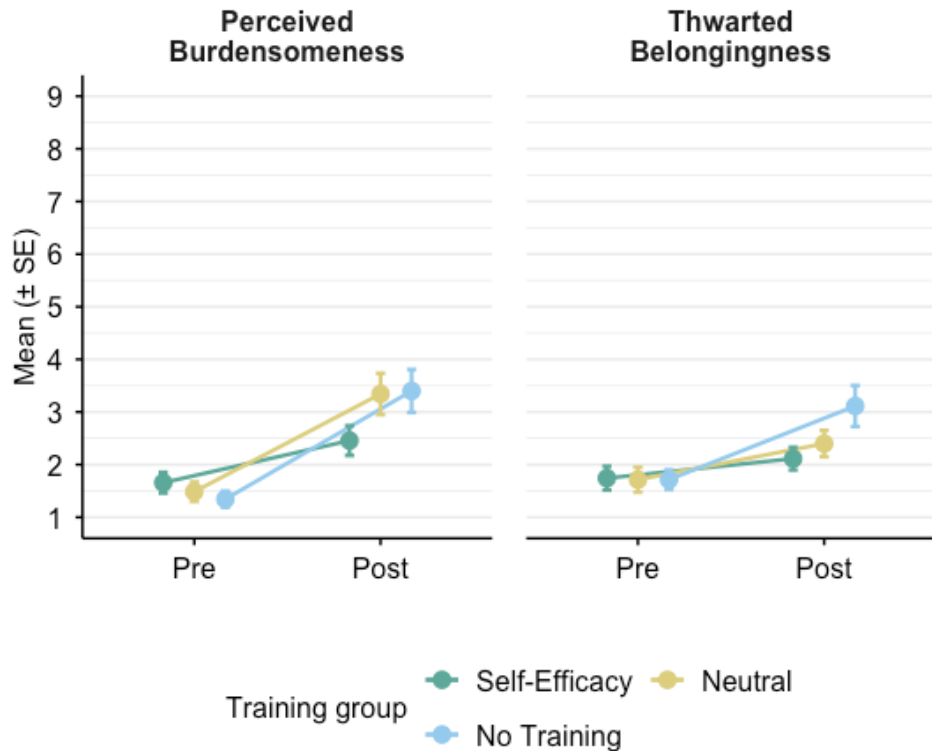
- ...covers different phases of symptom severity
- ...builds on stakeholder input
- ...includes modules that are evidence-based (safety plan) and innovative (self-efficacy training)
- ...leverages modern technologies to promote engagement



MUTLICAST TREAT: Preliminary work




Autobiographical self-efficacy training



→ Rule-based structure + LLM-assisted evaluation and text generation.

MADRS Chatbot

 **MADRS AI-Chatbot – Klinisches Interview zum Erfassung von depressiven Symptomen**

Chatbot


en Alltag besprochen. Ich möchte gerne ein neues Thema ansteuern, um ein umfassenderes Bild von Ihren Emotionen und Gedanken zu erhalten.
Hatten Sie in der vergangenen Woche auch das Gefühl, innerlich angespannt zu sein?

Oh ja. Das kenne ich sehr gut von mir.

Das hört sich sehr realistisch an. Wenn Sie innerlich angespannt sind, können Sie mir bitte beschreiben, wie das für Sie empfunden wird? Ist es eher eine innere Anspannung, Gereiztheit oder eine innere Unruhe, die Sie spüren?

Gereiztheit. Mich nervt alles.

Können Sie mir sagen, wie häufig diese Gereiztheit vorkommt? Ist es den ganzen Tag, oft, selten oder kommt es gelegentlich auf?


 Sprechen Sie Ihre Antwort ein.

Record

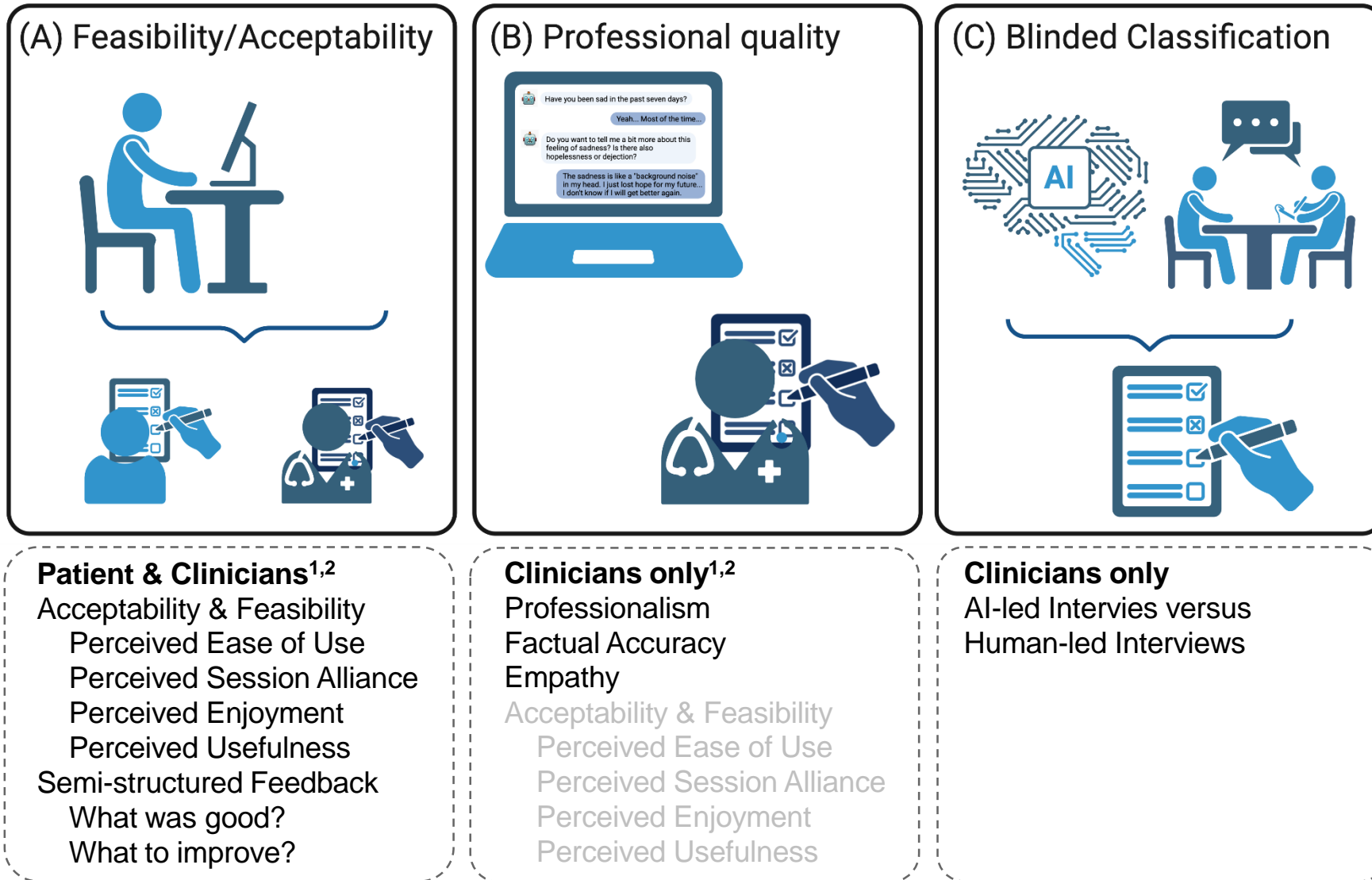
No microphone found

Text

Kommt drauf an. Es ist sehr Situations

 Text senden

MADRS Chatbot: Feasibility & Acceptability Trial at PUK



MADRS Chatbot: Feasibility & Acceptability Trial at PUK

(A) Feasibility/Acceptability



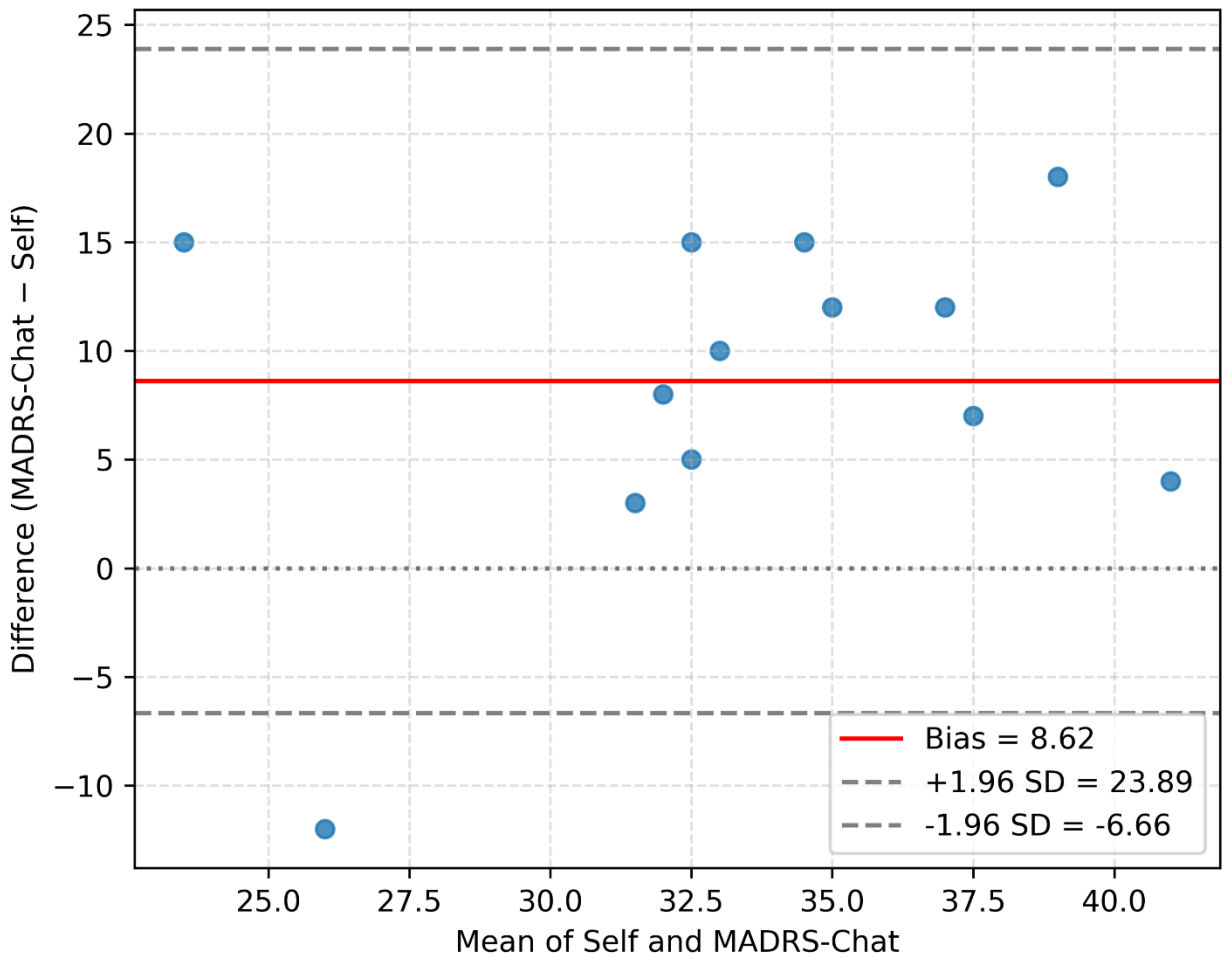
Patient & Clinicians^{1,2}

- Acceptability & Feasibility
- Perceived Ease of Use
- Perceived Session Alliance
- Perceived Enjoyment
- Perceived Usefulness
- Semi-structured Feedback
 - What was good?
 - What to improve?

Number of Participants

13/3
0

Bland-Altman plot: total MADRS-S vs MADRS-Chat



**Total MADRS
Patients ↔ MADRS-Chat**

Mean_{Pat} (± SD) = 29.1 ± 5.3
Mean_{Chat} (± SD) = 37.8 ± 7.0

Stakeholder

Quantitative

Online Questionnaire $N = 30$

Qualitative

Stakeholder Interviews $N = 14$

MULTICAST TREAT - Stakeholder Interview - Paper-Pencil Questionnaire

In this questionnaire, we will ask about your personal experiences with suicidal thoughts and if and how you have previously used digital tools for help. We aim to get insights into how people with suicidal thoughts could profit from apps and what components would be the most helpful to them.

Subjective Experience of Suicidal thoughts and behaviour

1. Let's think about the last seven days: How often did you experience suicidal thoughts?

☐ Never ☐ 1-3 times ☐ 4-6 times ☐ daily ☐ several times a day

2. Please indicate how often you used the strategies in the list in the last five suicidal crises.

	1-2 times	3-4 times	Every time	I don't use this strategy
Reach out to family members or friends				
Reach out to a mental health professional				
Reach out to a crisis service (e.g., <u>Dargebotene Hand</u>)				
Nothing				
Use a specific technique. Please specify: _____				

3. A) Can you anticipate when suicidality will be increasing? Yes No

B) Conditional question if yes is selected in 3A: Please indicate how often you used the strategies in the list in the last five times you anticipated a suicidal crisis.

	1-2 times	3-4 times	Every time	I don't use this strategy



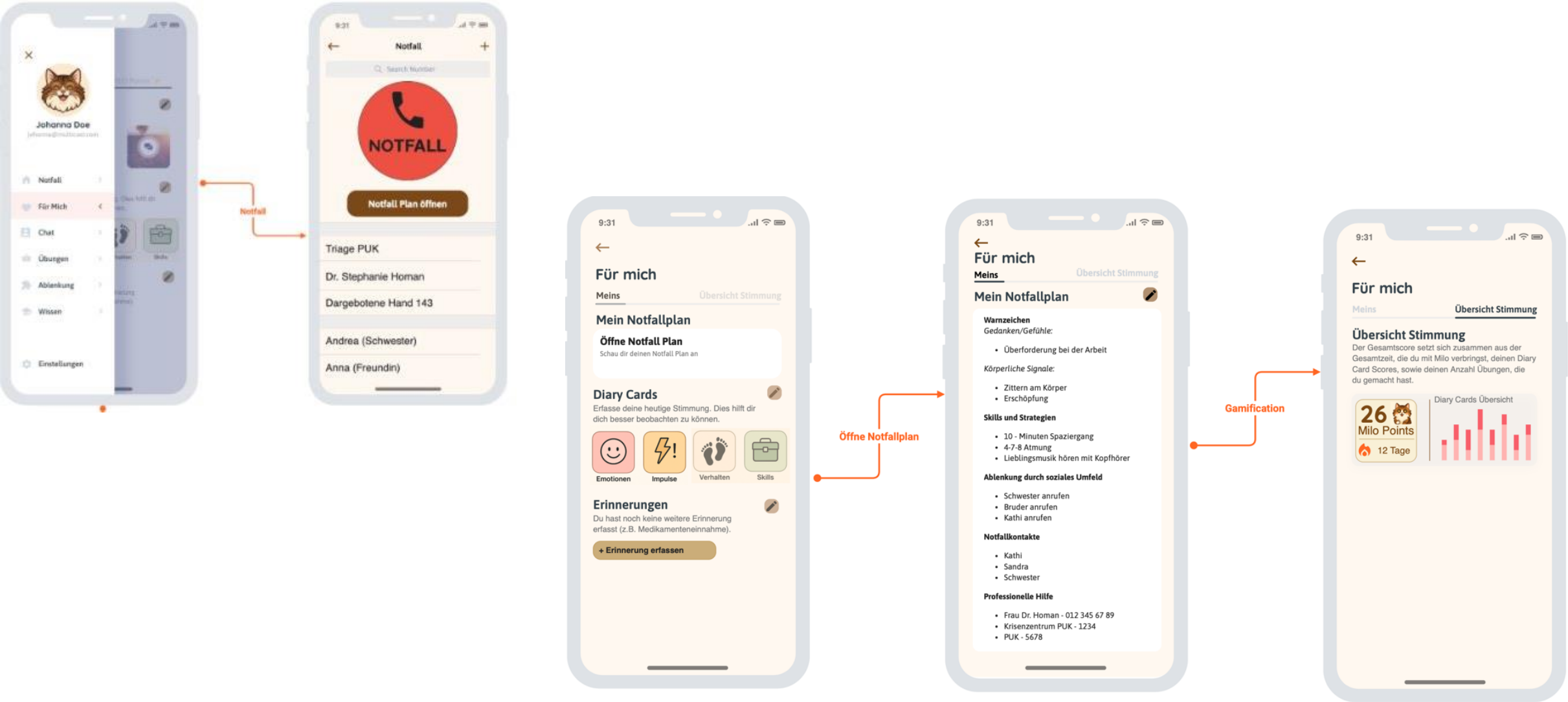
Analyses

Framework Analysis:
“Classical” qualitative analysis

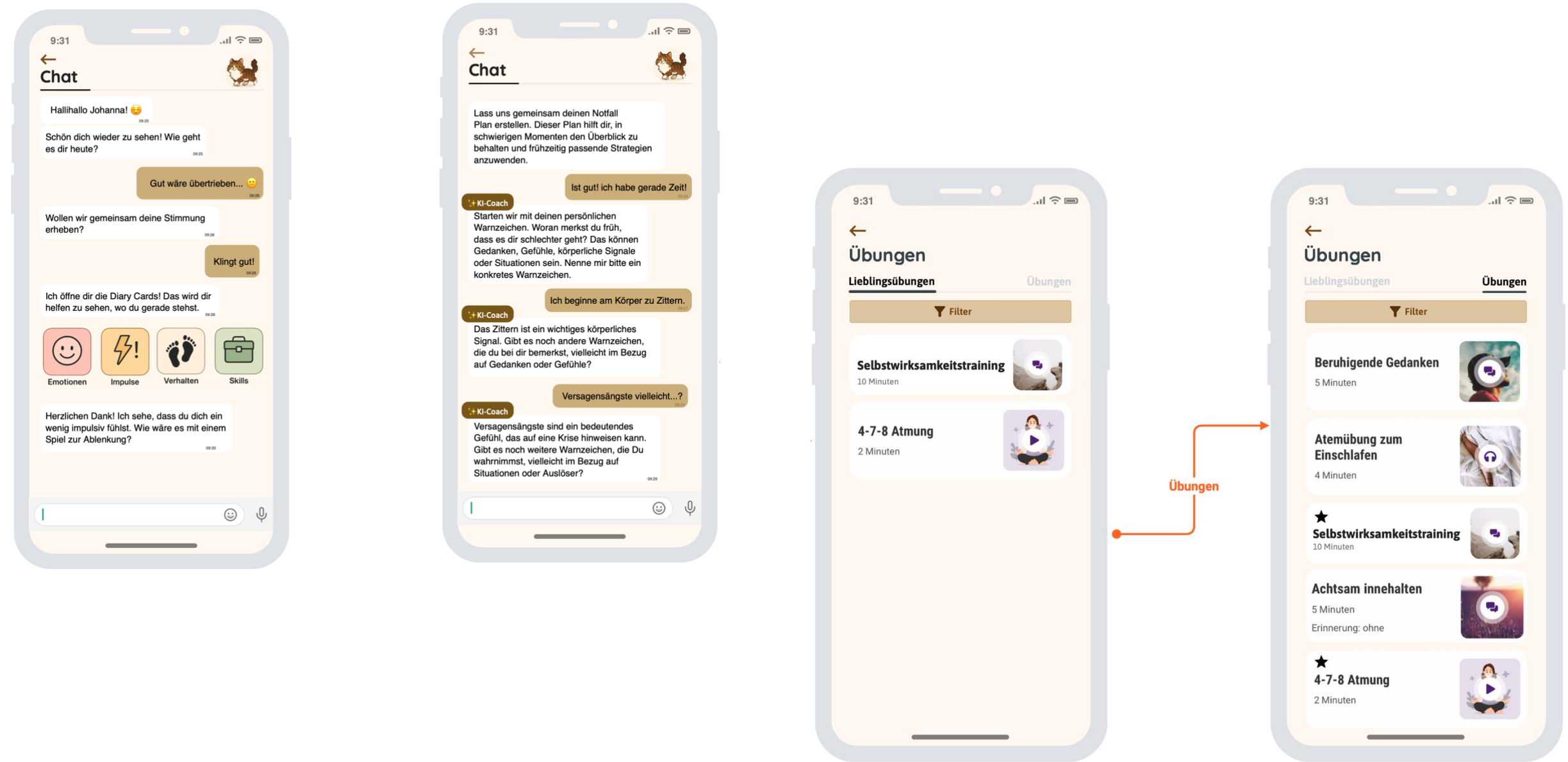
NLP Analysis:
Complementary analysis

Analyses: Descriptive statistics

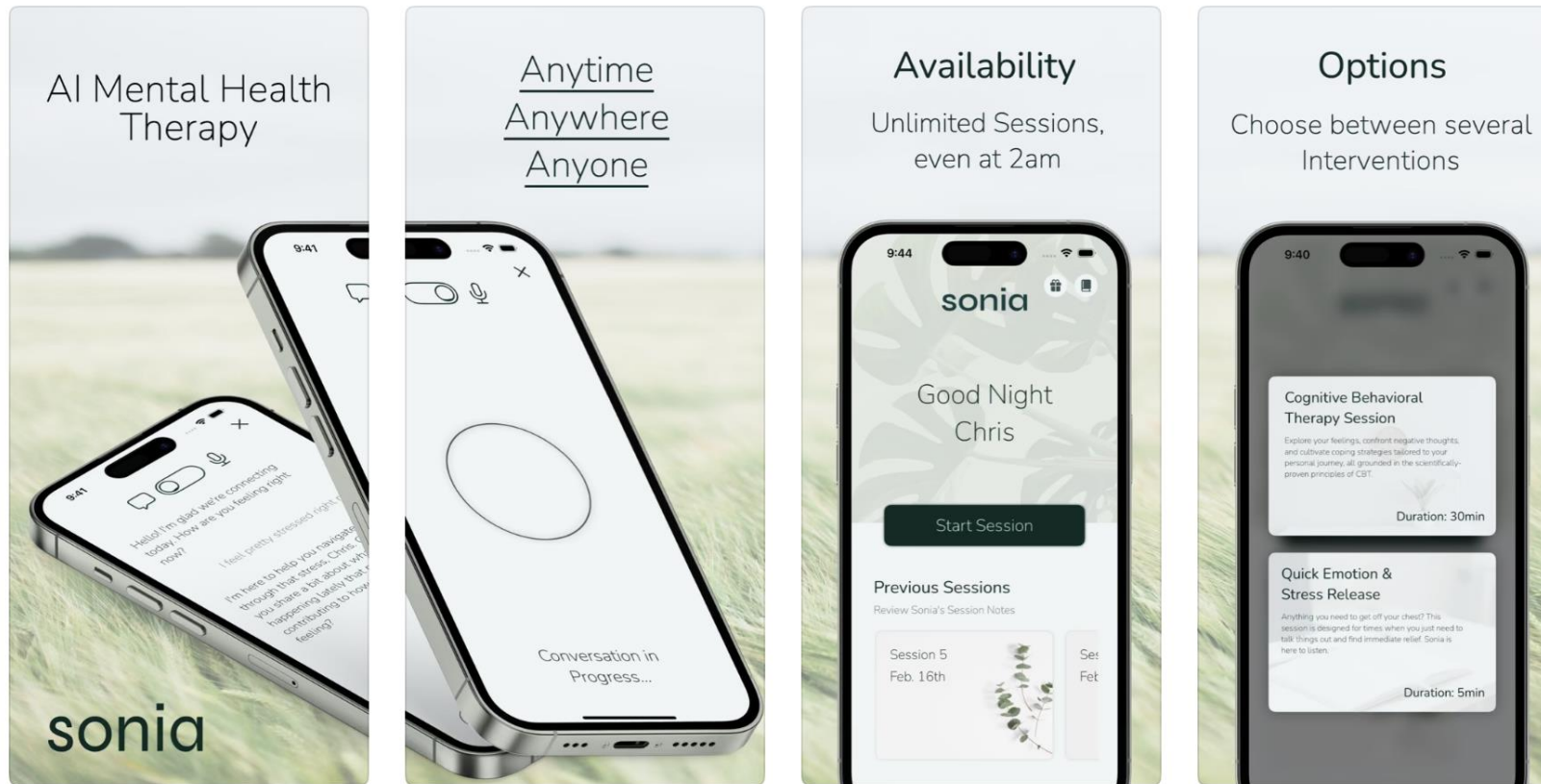
Outlook TREAT App based on Stakeholder Input



Outlook TREAT App based on Stakeholder Input



Real-time Risk-Detection System for Chatbots



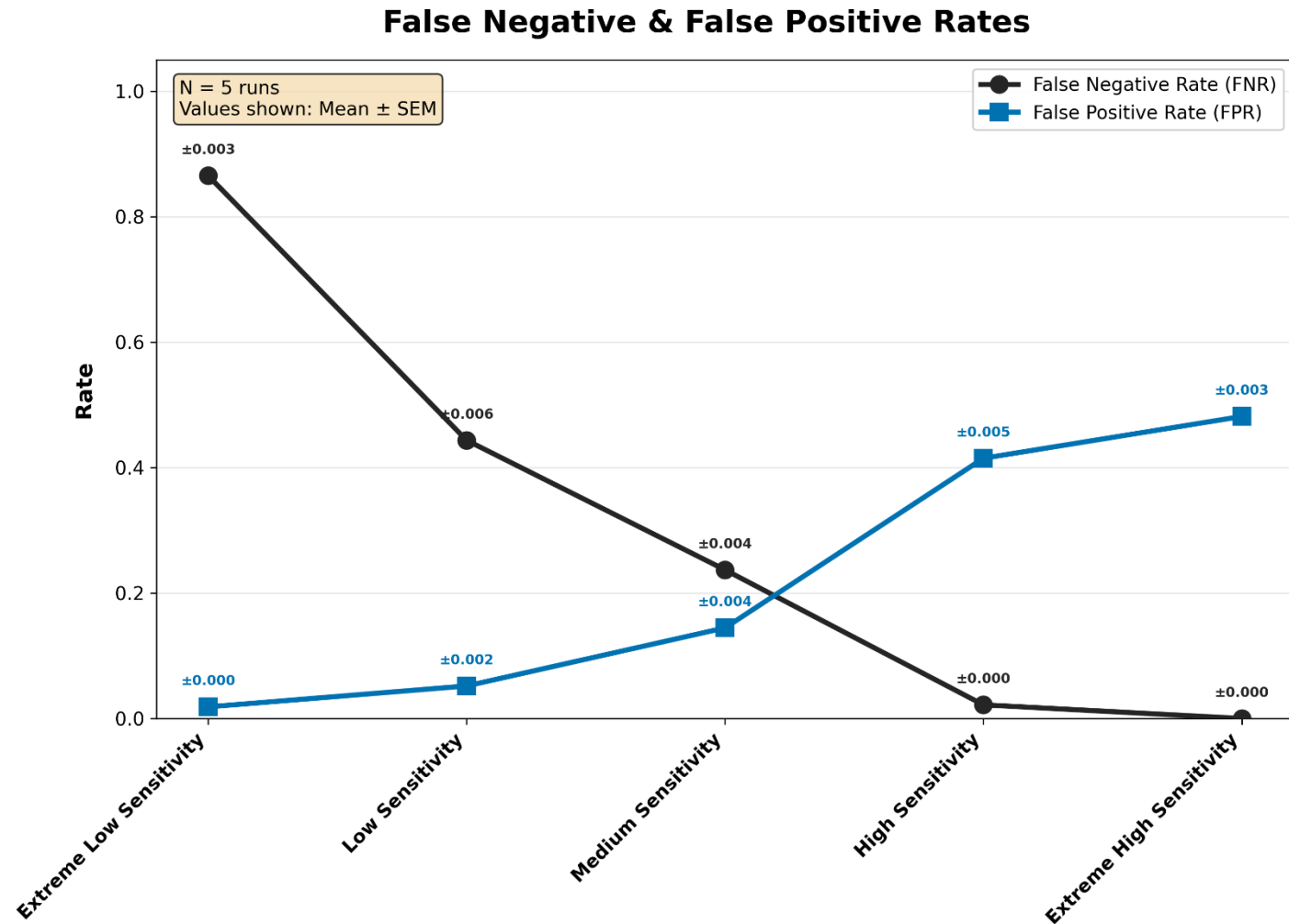
“General purpose models interrupt a conversation when detecting sensitive content (e.g., suicidal ideations).

Aborting the conversation - when the user is in a critical state but also when a user might not be at acute risk - may leave them felt left alone, which -therapeutically speaking – isn’t optimal in either case”

Real-time Risk-Detection System for Chatbots

LLM-based High Risk Detection

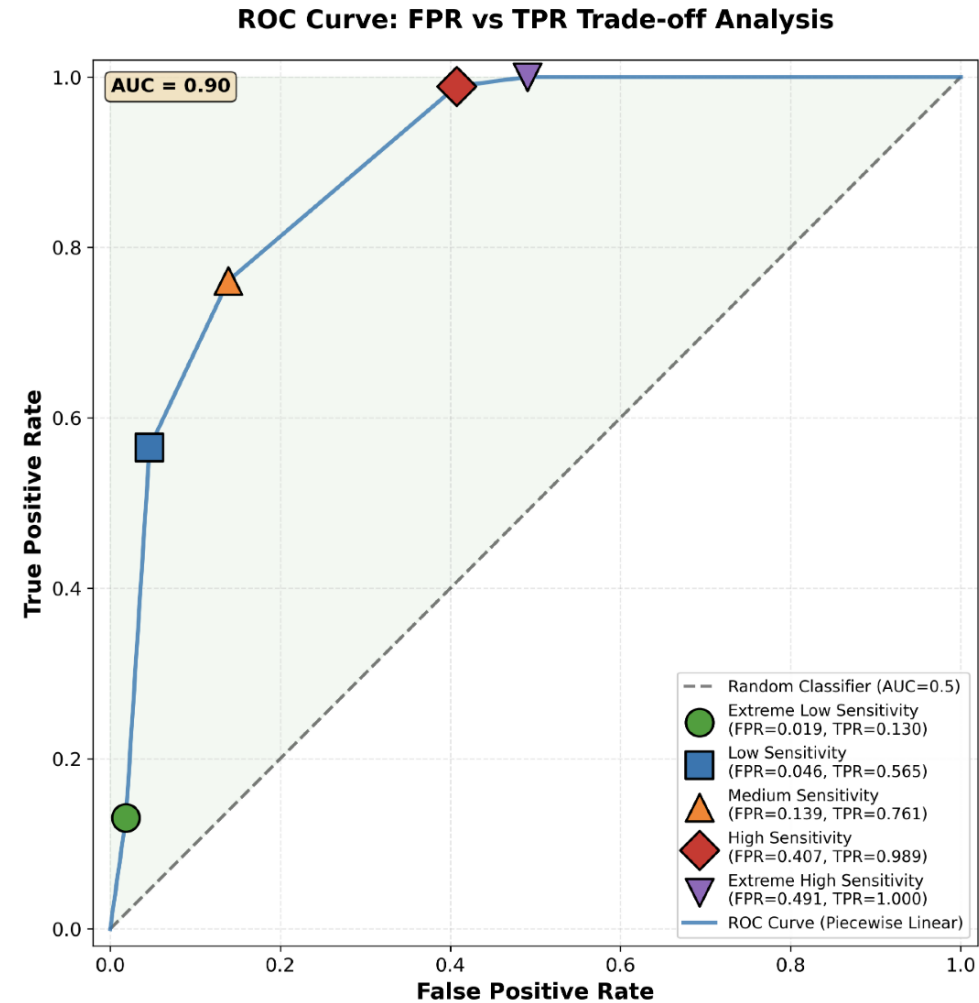
- 200 real user conversation excerpts where general purpose models aborted conversation
- 4 clinicians labelled data according to *High Risk* vs. *Low Risk*
- LLM-based classifier with varying sensitivity threshold to investigate the inevitable trade-off between false-positives (FP) and false-negatives (FN).



Real-time Risk-Detection System for Chatbots

LLM-based High Risk Detection

- 200 real user conversation excerpts where general purpose models aborted conversation
- 4 clinicians labelled data according to *High Risk* vs. *Low Risk*
- LLM-based classifier with varying sensitivity threshold to investigate the inevitable trade-off between false-positives (FP) and false-negatives (FN).





Universität
Zürich^{UZH}



Psychiatrische
Universitätsklinik
Zürich



Sebastian Olbrich

PI



Birgit Kleim

PI



Andrea Häfliger
PhD student
Andrea.haefliger@uzh.ch



Stephanie Homan
Postdoc
stephanie.homan@bli.uzh.ch



Jacopo Mocellin
PhD student
Jacopo.mocellin@uzh.ch



Anna Monn
PhD student
Anna.monn@uzh.ch



Samantha Weber
Postdoc
Samantha.weber@bli.uzh.ch



Swiss National
Science Foundation

Thanks for your attention!

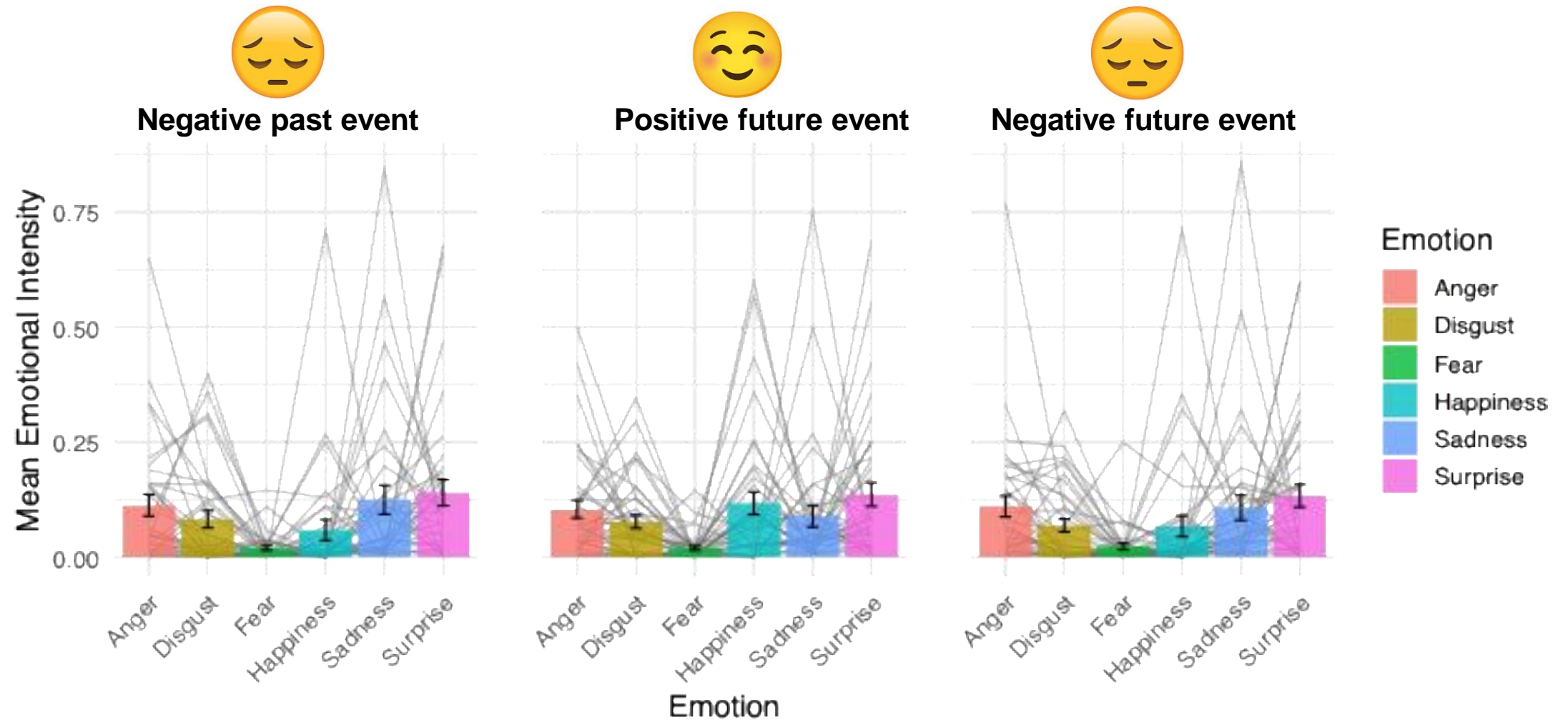
REFERENCES I

- Chu, C., Buchman-Schmitt, J. M., Stanley, I. H., Hom, M. A., Tucker, R. P., Hagan, C. R., ... & Joiner Jr, T. E. (2017). The interpersonal theory of suicide: A systematic review and meta-analysis of a decade of cross-national research. *Psychological bulletin*, 143(12), 1313.
- Coppersmith, D. D., Dempsey, W., Kleiman, E. M., Bentley, K. H., Murphy, S. A., & Nock, M. K. (2022). Just-in-time adaptive interventions for suicide prevention: Promise, challenges, and future directions. *Psychiatry*, 85(4), 317-333.
- Coppersmith, D. D., Fortgang, R. G., Kleiman, E. M., Millner, A. J., Yeager, A. L., Mair, P., & Nock, M. K. (2022). Effect of frequent assessment of suicidal thinking on its incidence and severity: high-resolution real-time monitoring study. *The British Journal of Psychiatry*, 220(1), 41-43.
- Doupnik, S. K., Rudd, B., Schmutte, T., Worsley, D., Bowden, C. F., McCarthy, E., ... & Marcus, S. C. (2020). Association of suicide prevention interventions with subsequent suicide attempts, linkage to follow-up care, and depression symptoms for acute care settings: a systematic review and meta-analysis. *JAMA psychiatry*, 77(10), 1021-1030.
- Franklin, J. C., Ribeiro, J. D., Fox, K. R., Bentley, K. H., Kleiman, E. M., Huang, X., ... & Nock, M. K. (2017). Risk factors for suicidal thoughts and behaviors: A meta-analysis of 50 years of research. *Psychological bulletin*, 143(2), 187.
- Hallensleben, N., Spangenberg, L., Forkmann, T., Rath, D., Hegerl, U., Kersting, A., ... & Glaesmer, H. (2017). Investigating the dynamics of suicidal ideation. *Crisis*.
- Homan, S., Roman, Z. J., Santhanam, P., Michel, S., Bertram, A. M., Klee, N., ... & Kleim, B. (2022). Identifying distinct subgroups of suicidal ideations: A pre-registered ecological momentary assessment study in psychiatric patients.
- Kleiman, E. M., & Nock, M. K. (2018). Real-time assessment of suicidal thoughts and behaviors. *Current Opinion in Psychology*, 22, 33-37.
- Kleiman, E. M., Turner, B. J., Fedor, S., Beale, E. E., Huffman, J. C., & Nock, M. K. (2017). Examination of real-time fluctuations in suicidal ideation and its risk factors: Results from two ecological momentary assessment studies. *Journal of abnormal psychology*, 126(6), 726
- Kleiman, E. M., Glenn, C. R., & Liu, R. T. (2023). The use of advanced technology and statistical methods to predict and prevent suicide. *Nature reviews psychology*, 2(6), 347-359.
- Jiménez-Muñoz, L., Peñuelas-Calvo, I., Díaz-Oliván, I., Gutiérrez-Rojas, L., Baca-García, E., & Porras-Segovia, A. (2022). Suicide prevention in your pocket: a systematic review of ecological momentary interventions for the management of suicidal thoughts and behaviors. *Harvard review of psychiatry*, 30(2), 85-99.

REFERENCES II

- O'Connor, R. C. (2011). Towards an integrated motivational–volitional model of suicidal behaviour. *International handbook of suicide prevention: Research, policy and practice*, 1, 181-98.
- O'Connor, R. C., & Kirtley, O. J. (2018). The integrated motivational–volitional model of suicidal behaviour. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 373(1754), 20170268.
- Sedano-Capdevila, A., Porras-Segovia, A., Bello, H. J., Baca-Garcia, E., & Barrigon, M. L. (2021). Use of ecological momentary assessment to study suicidal thoughts and behavior: a systematic review. *Current psychiatry reports*, 23(7), 41.
- Van Orden, K. A., Witte, T. K., Cukrowicz, K. C., Braithwaite, S. R., Selby, E. A., & Joiner Jr, T. E. (2010). The interpersonal theory of suicide. *Psychological review*, 117(2), 575.

Can digital biomarkers accurately reflect the type of emotional content in a video?



Homan et al., in prep

1.1 PREDICT: PREDICTING SUICIDAL THOUGHTS AND BEHAVIORS



PUK Zurich, $N = 100$



UPK Basel, $N = 50$



NYU & Langone Hospital, $N = 50$

Screened

$n = 576$

$n = 64$

Inclusion

$n = 62$

BL completed

$n = 46$

EMA phase
completed

$n = 33$

FU1 completed

$n = 32$

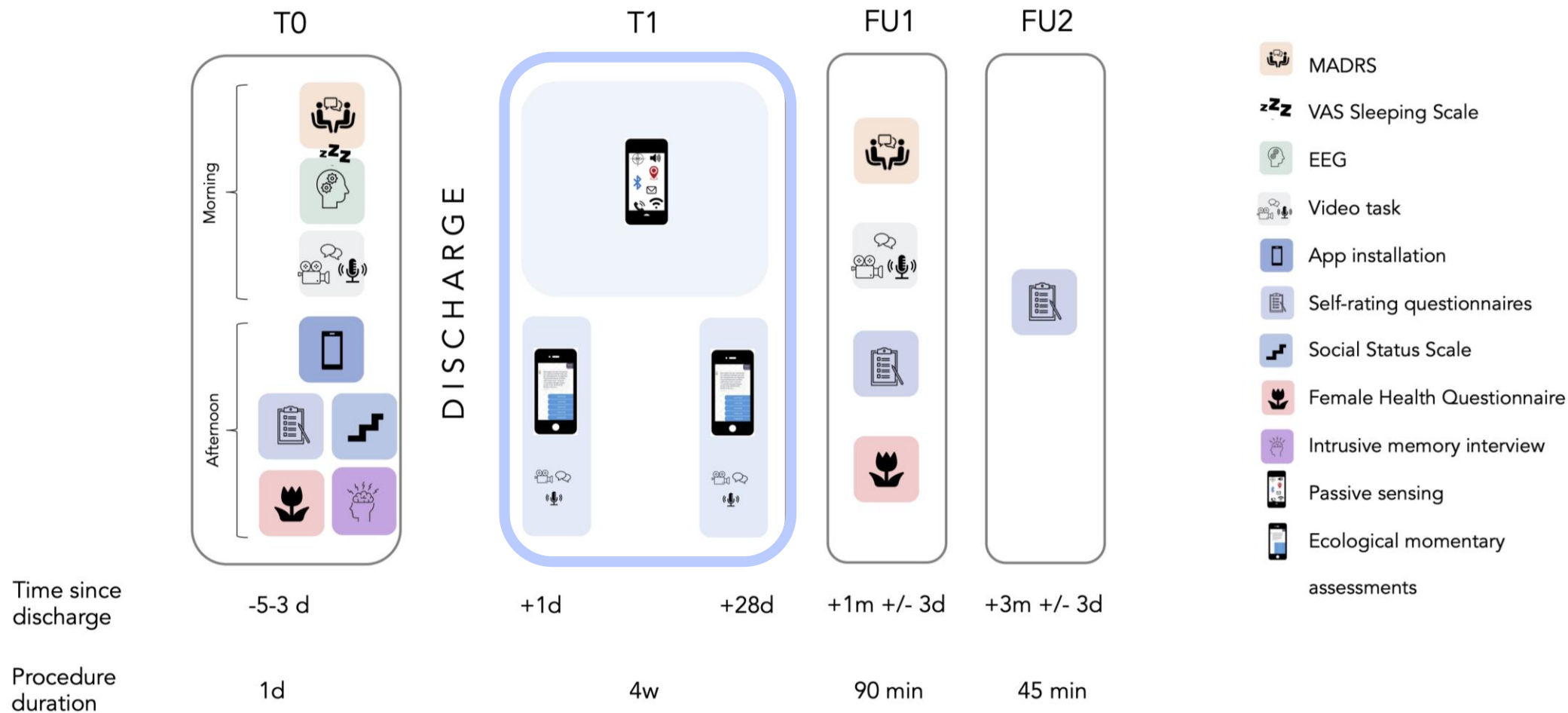
FU2 completed

$n = 24$

1.2 PREDICT: PREDICTING SUICIDAL THOUGHTS AND BEHAVIORS

Integrating passive sensing and EMA data

Target population: Transdiagnostic patients with suicidal thoughts and behaviors at hospital admission.



1.2 PREDICT: PREDICTING SUICIDAL THOUGHTS AND BEHAVIORS

Integrating passive sensing and EMA data

A prognostic model for suicidality

Burdensomeness

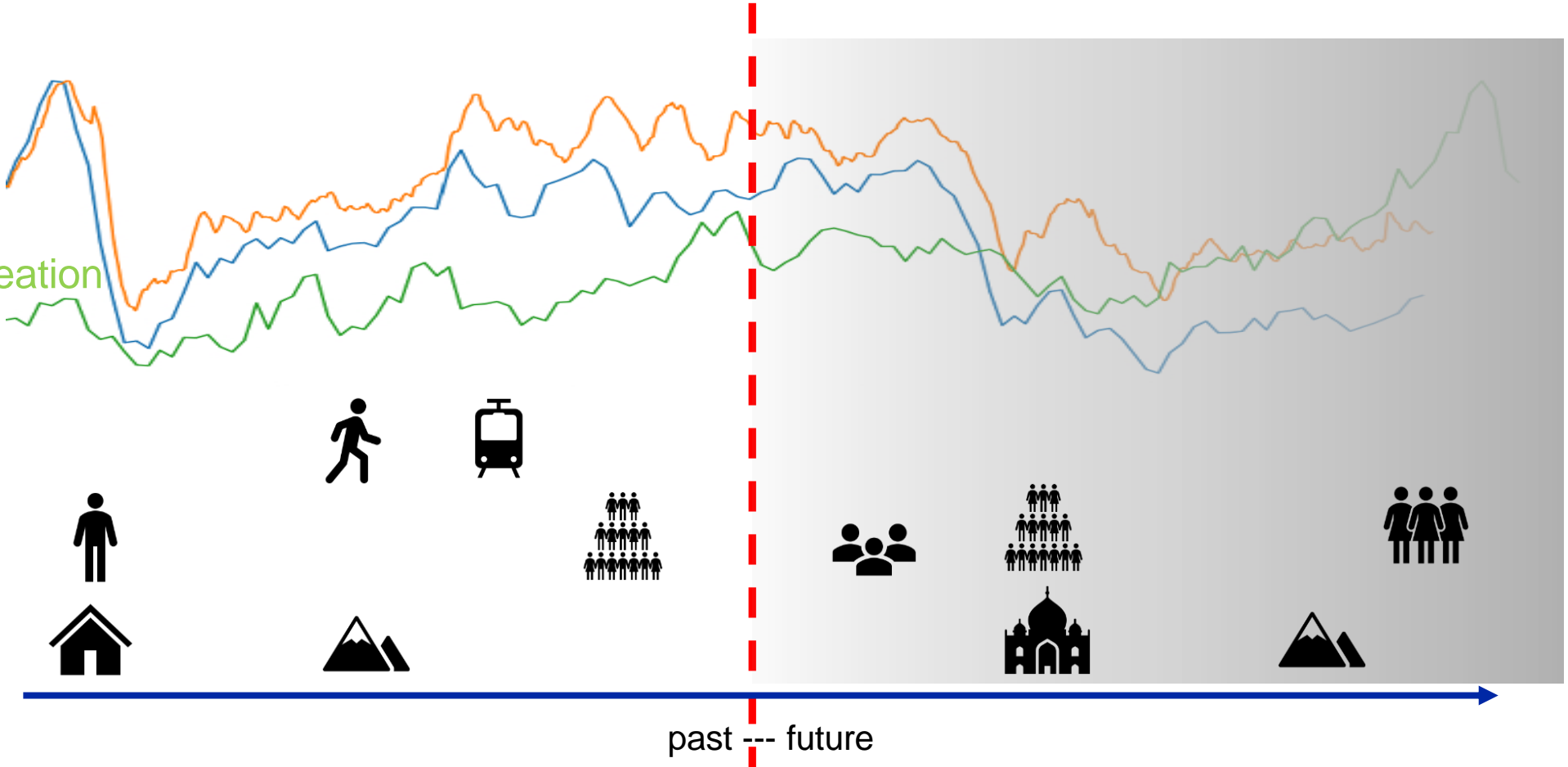
Entrapment

Passive Suicidal Ideation

Activity performed

Persons nearby

Place type



1.2 PREDICT: PREDICTING SUICIDAL THOUGHTS AND BEHAVIORS

Integrating digital health data



Performance in different scenarios

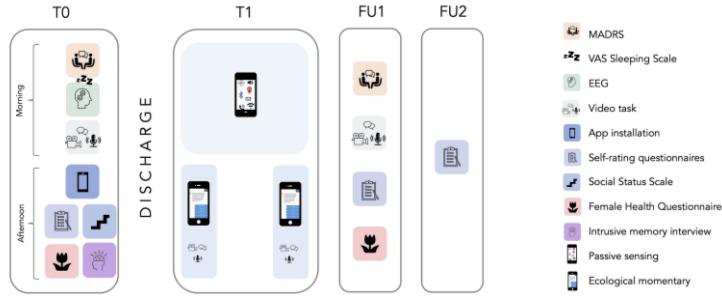
- Educational level, Income, age, gender
 - Baseline depression
 - History of suicide



Clinical Actionability

- Is symptom deterioration predicted enough in advance to intervene?
- What variables can be predicted reliably for the next day?
 - ...

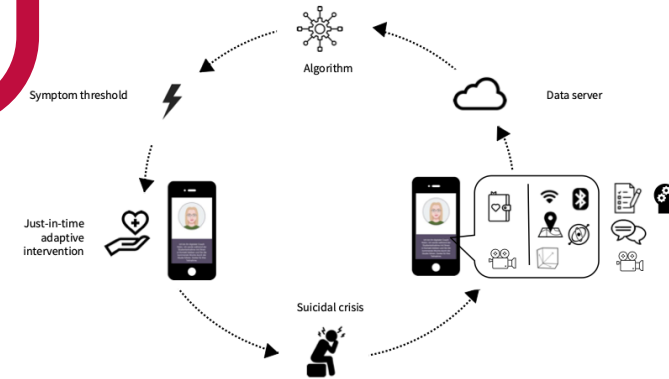
PREDICT



EXPERIMENT

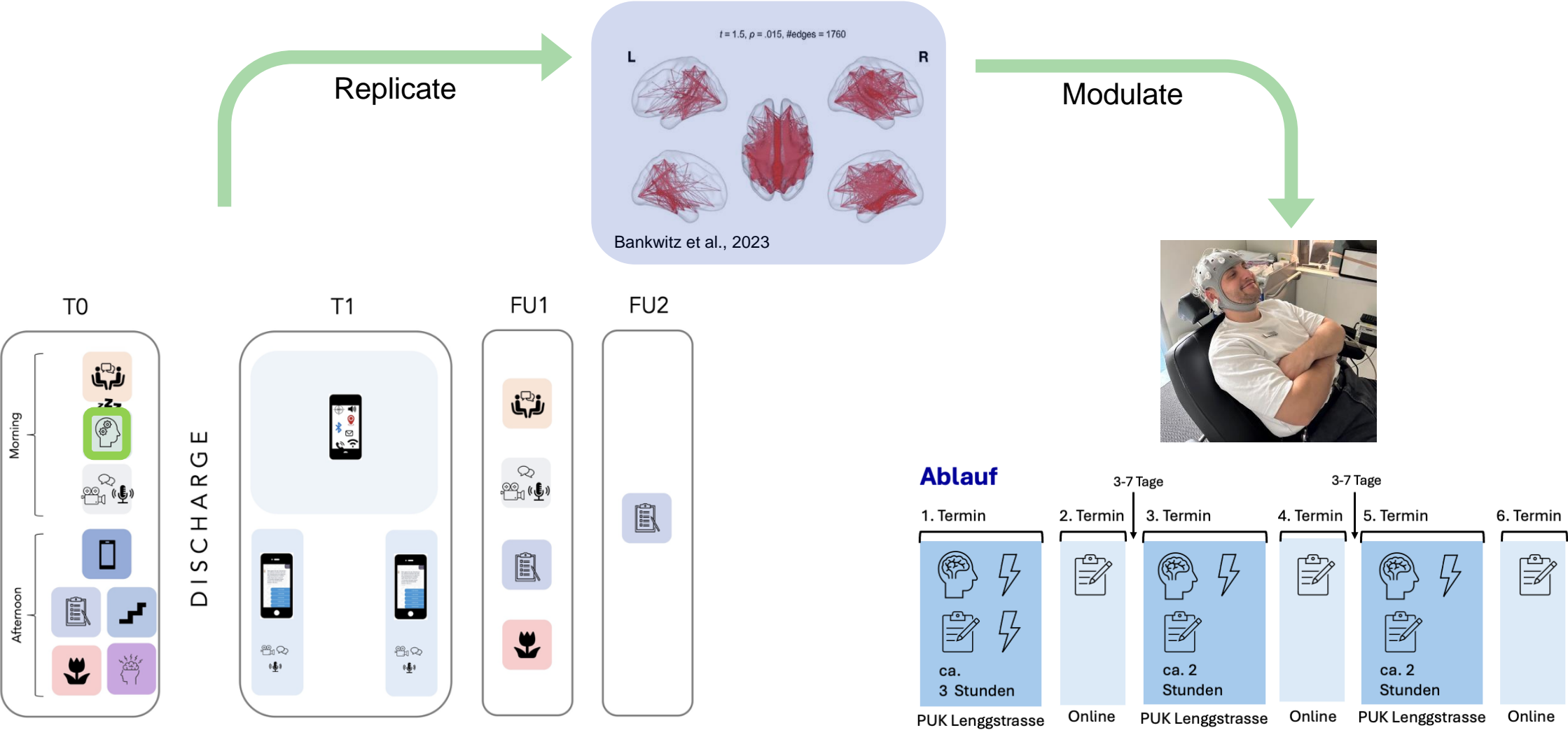


TREAT

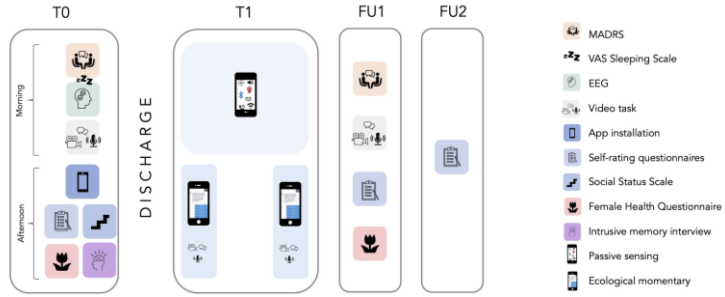


2.1 FROM PREDICT TO EXPERIMENT

Integrating and modulating brain activity patterns



PREDICT



EXPERIMENT



TREAT

