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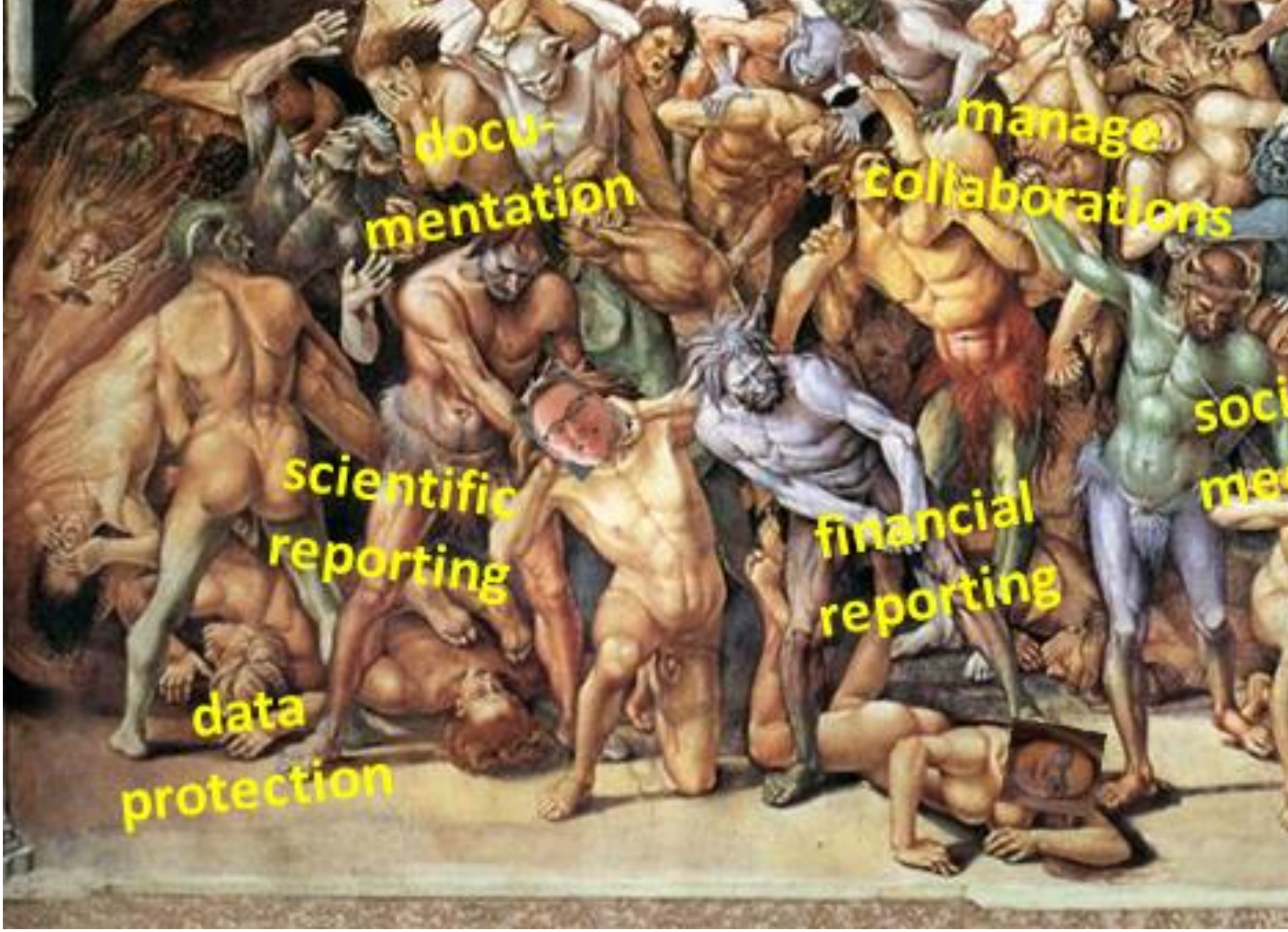
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Resilience

Raffael Kalisch

Leibniz Institute for Resilience Research (LIR), Mainz, Germany

Neuroimaging Center (NIC), Focus Program Translational Neuroscience (FTN), Johannes Gutenberg University Medical Center, Mainz, Germany

Leibniz-Institut für Resilienzforschung

NIC NeuroImaging Center

JG|U UNIVERSITÄTSmedizin. MAINZ

What is resilience?

How can we measure it?

Is resilience to chronic and everyday stressors different from resilience to major events?

What do we know about psychological mechanisms?

What do we know about biological mechanisms?

What can we do in FAMILY?

Why you should be in Mainz Sept 25-27?

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"Except for the main idea of facing challenges, it is somewhat difficult to guess that all of those definitions concern the same subject."
(M. Pecillo, 2016)

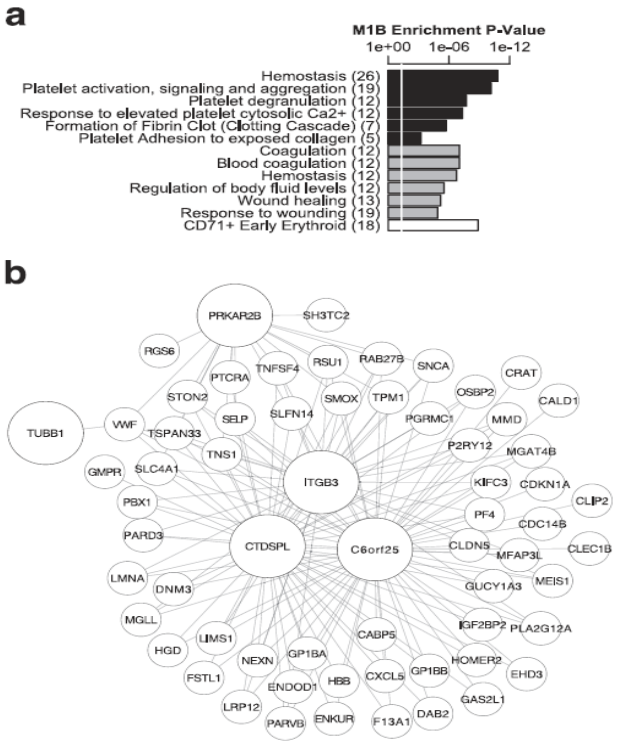
A (very) brief history of resilience research

Trait
- Hardiness (Kobasa, 1979)
- Ego resiliency (Block and Block, 1980)

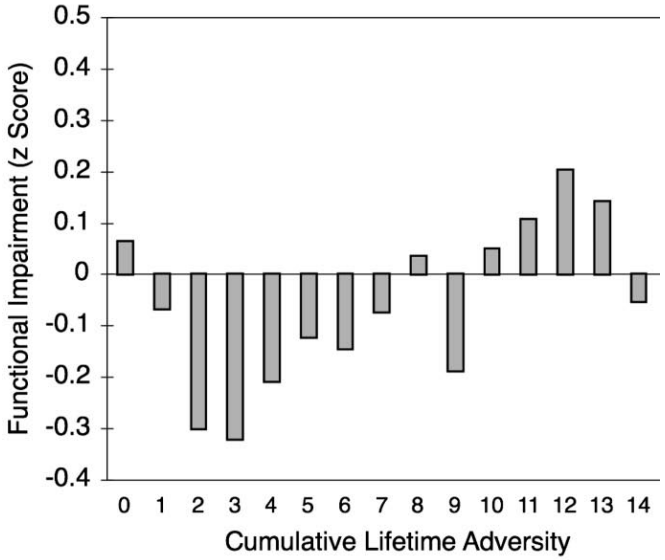
Multiple factors
- Various traits, skills, behaviors, beliefs, …
  (Masten & Garmezy, 1985; Werner & Smith, 1989)

Processes
- Person-environment transactions
- Individual change
  (Luthar et al., 2000; a.m.o.)

Processes of individual change (adaptation)



Gene expression
Breen et al., *Mol Psychiaty* 2015



Stress inoculation (steeling effect)
Seery et al., *J Pers Soc Psychol* 2010

Post-traumatic growth
Johnson and Boals, *Psychol Trauma* 2015

Animal models
→ Neural adaptations, causality

reviewed in Kalisch et al., *Nat Hum Behav* 2017

A (very) brief history of resilience research

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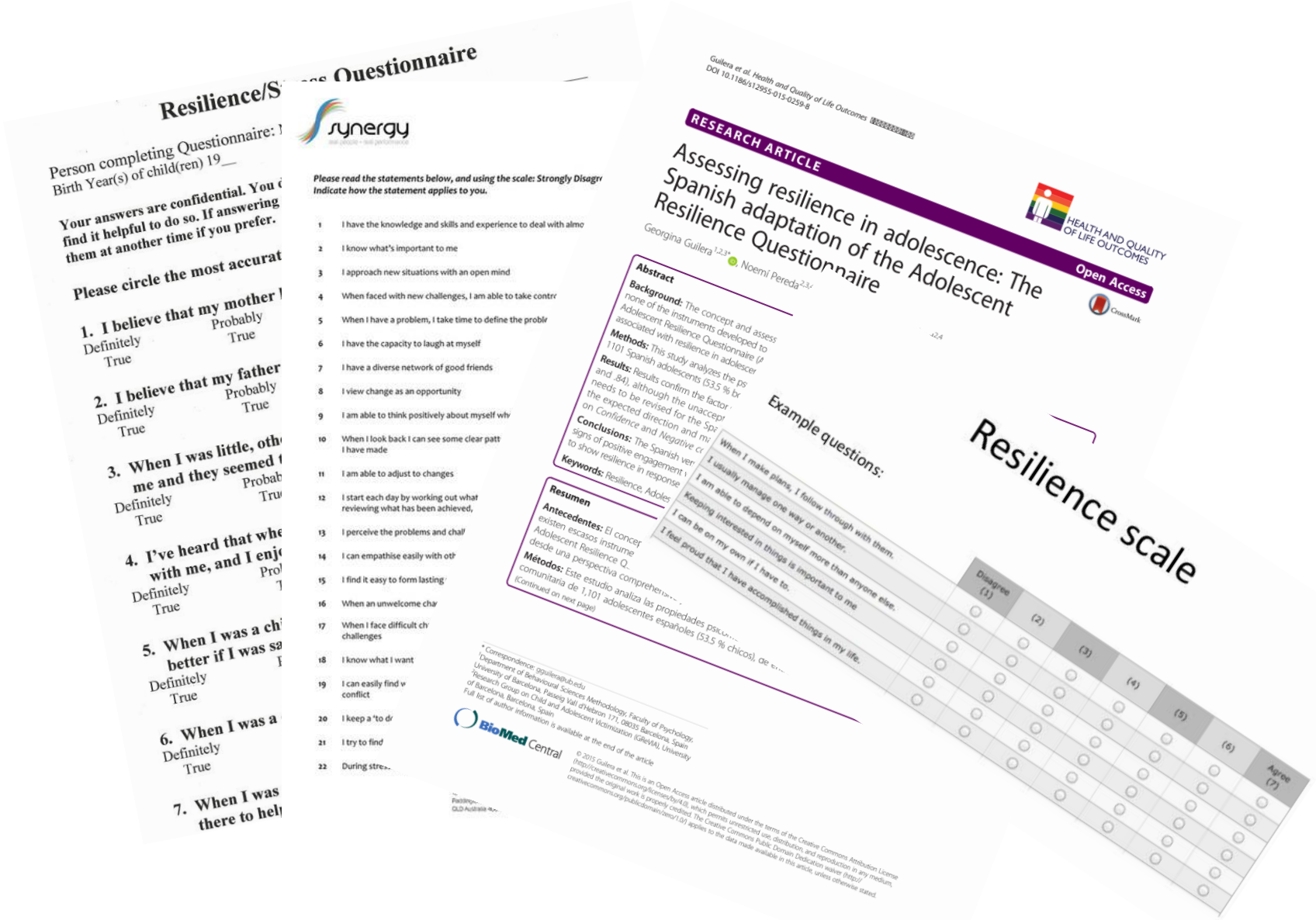
- Individual change
- Person-environment transactions
  (Luthar et al., 2000; a.m.o.)

Outcome
- Masten & Garmezy, 1985

The reality of resilience research



nature human behaviour

PERSPECTIVE

https://doi.org/10.1038/s41562-017-0200-8

The resilience framework as a strategy to combat stress-related disorders

Raffael Kalisch[1,2,3,4*], Dewleen G. Baker[5,6], Ulrike Basten[4,7], Marco P. Boks[8], George A. Bonanno[9], Eddie Brummelman[3,10,11], Andrea Chmitorz[1,3,12], Guillén Fernàndez[3,13], Christian J. Fiebach[4,7,14], Isaac Galatzer-Levy[15], Elbert Geuze[8,16], Sergiu Groppa[1,4,17], Isabella Helmreich[1,3,12], Talma Hendler[3,18,19], Erno J. Hermans[3,13], Tanja Jovanovic[20], Thomas Kubiak[1,3,21], Klaus Lieb[1,3,4,12], Beat Lutz[1,4,22], Marianne B. Müller[1,4,12], Ryan J. Murray[3,23,24,25], Caroline M. Nievergelt[5,6], Andreas Reif[3,4,26], Karin Roelofs[3,13,27], Bart P. F. Rutten[28], David Sander[3,24,25], Anita Schick[1,2,3], Oliver Tüscher[1,3,4,12], Ilse Van Diest[3,29], Anne-Laura van Harmelen[3,30], Ilya M. Veer[3,31], Eric Vermetten[16,32,33], Christiaan H. Vinkers[8], Tor D. Wager[34,35], Henrik Walter[3,31,36], Michèle Wessa[1,3,4,37], Michael Wibral[4,38] and Birgit Kleim[3,39]

If resilience is not a trait, what then?

Resilience is the maintenance or quick recovery of mental health during and after periods of adversity

(traumatizing events, challenging life circumstances or transitions, physical illness...)

If resilience is not a trait, what then?

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(traumatizing events, challenging life circumstances or transitions, physical illness...)

Resilience is NOT …

… any specific process or mechanism leading to the outcome (“resilience processes“, RPs)

… any baseline predictor or biomarkers (“resilience factors“, RFs)

… just the opposite of risk, or vulnerability

If resilience is not a trait, what then?

Resilience is the maintenance or quick recovery of mental health during and after periods of adversity

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… just the opposite of risk, or vulnerability

BUT:

You can ask which RFs predict the outcome or which RPs lead to the outcome

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Outcome-based definition is purely operational and atheoretical

Requires longitudinal studies

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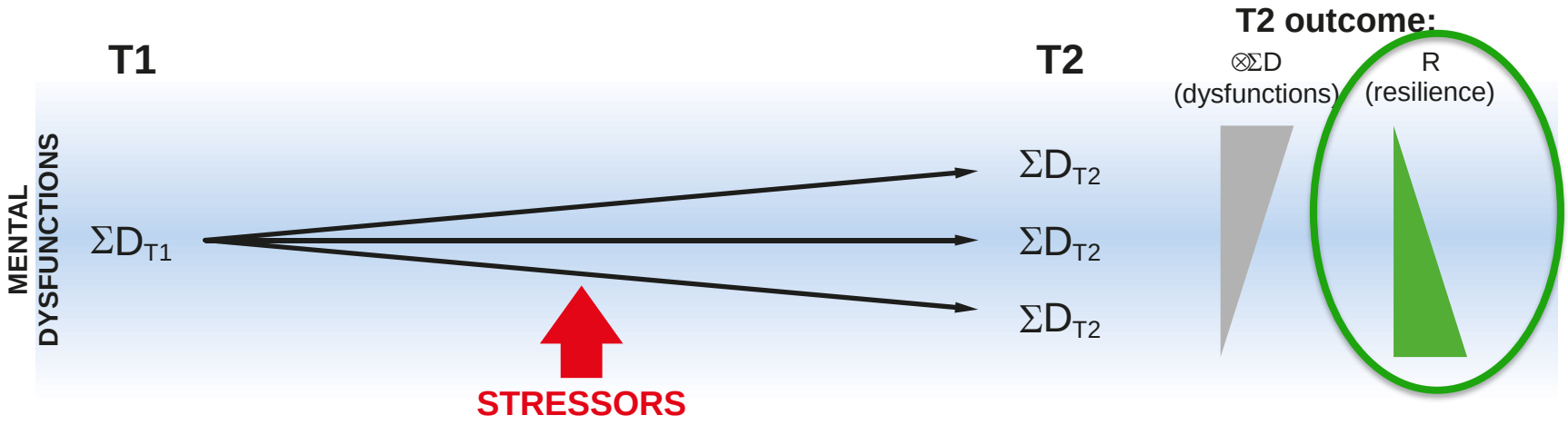
Resilience – outcome-based operationalization

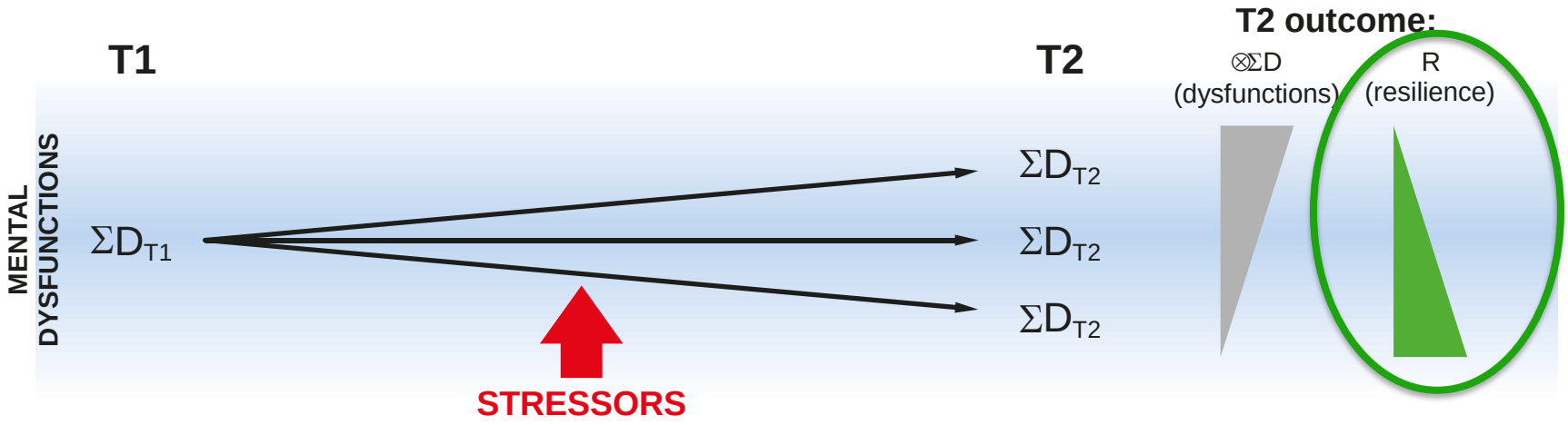


Normalization to stressors!

Resilience – outcome-based operationalization

Problem 1: unpredictability of stressors

Resilience – outcome-based operationalization



Normalization to stressors!

Resilience – outcome-based operationalization

Problem 1: unpredictability of stressors

Problem 2: heterogeneity of stressors

Resilience – outcome-based operationalization

Problem 1: unpredictability of stressors

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Problem 3: non-randomness of stressors

Resilience – outcome-based operationalization

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Problem 5: subjectivity of stressors

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"Except for the main idea of facing challenges, it is somewhat difficult to guess that all of those definitions concern the same subject."
(M. Pecillo, 2016)

What is resilience?

"Except for the main idea of having to quantify challenges, it is somewhat difficult to guess how all of those aspects could be satisfactorily addressed."
(R. Kalisch, 2023)

Resilience – outcome-based operationalization

Solution 1: take an at-risk population

Kalisch et al., *Front Psychol* 2021

Resilience – outcome-based operationalization

Transition from adolescence (school, family life) to adulthood (work life)
- Inclusion age: 18 – 19 yrs
- Significant past adverse life events (>=3)

Kalisch et al., *Front Psychol* 2021

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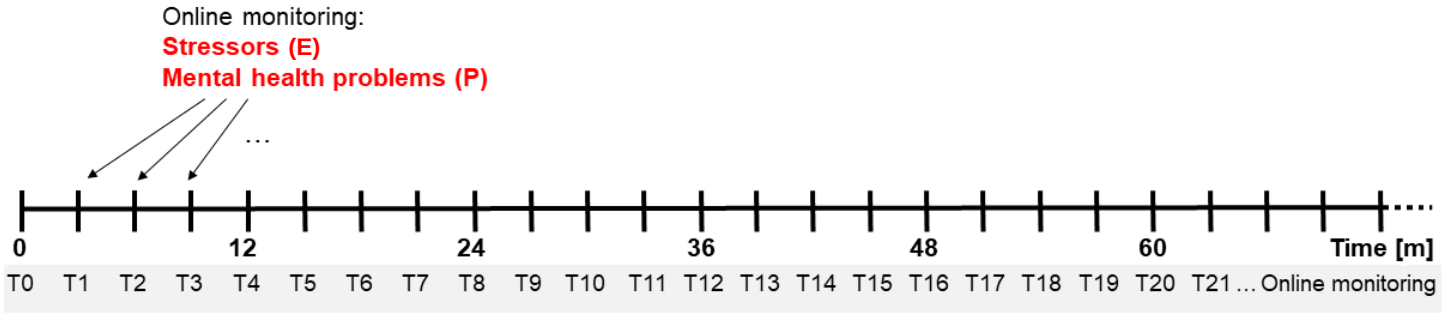
Solution 1: take an at-risk population

Solution 2: frequently monitor stressors and mental health

Kalisch et al., *Front Psychol* 2021

Resilience – outcome-based operationalization

Frequent Stressor and Health Monitoring paradigm (FRESHMO)



MARP RESILIENZ STUDIE

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Kalisch et al., *Front Psychol* 2021

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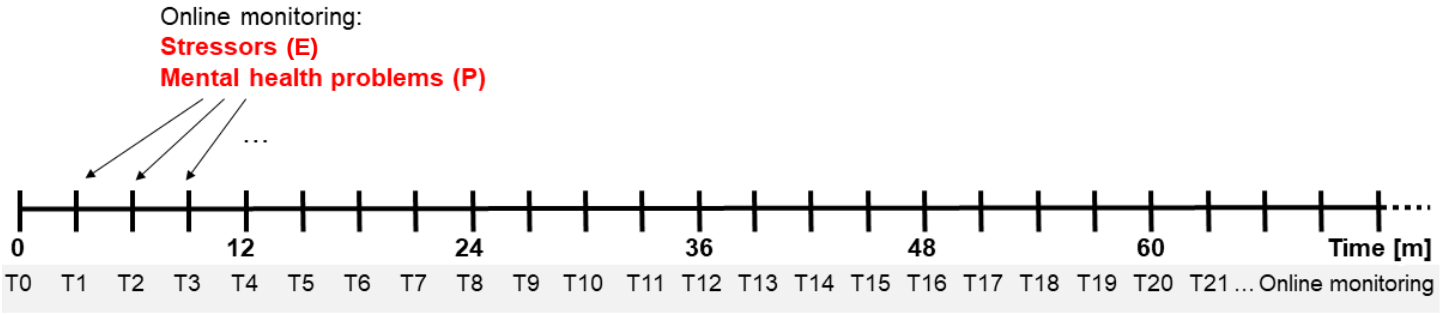

MARP RESILIENZ STUDIE

Transition from adolescence (school, family life) to adulthood (work life)
- Inclusion age: 18 – 19 yrs
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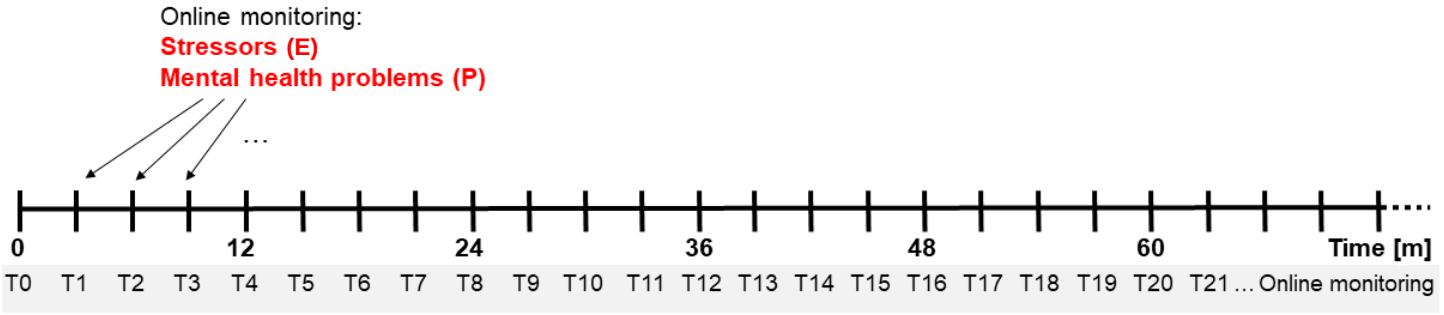
Stressors (E): **Life Events (LE) list**
- 27 items
- occurrence in past 3 months?
- how many times?
- severity (appraisal)?

Kalisch et al., *Front Psychol* 2021

Resilience – outcome-based operationalization

Frequent Stressor and Health Monitoring paradigm (FRESHMO)



MARP RESILIENZ STUDIE

Transition from adolescence (school, family life) to adulthood (work life)
- Inclusion age: 18 – 19 yrs
- Significant past adverse life events (>=3)

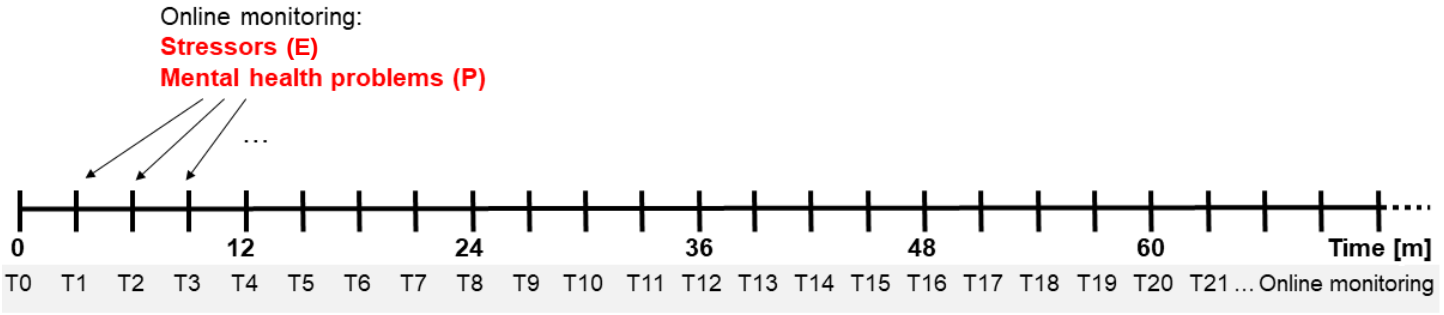
Stressors (E):

Life Events (LE) list
Daily Hassles (DH) list
- 58 items
- occurrence in past week?
- how many days?
- severity (appraisal)?

Kalisch et al., *Front Psychol* 2021

Resilience – outcome-based operationalization

Frequent Stressor and Health Monitoring paradigm (FRESHMO)



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- Inclusion age: 18 – 19 yrs
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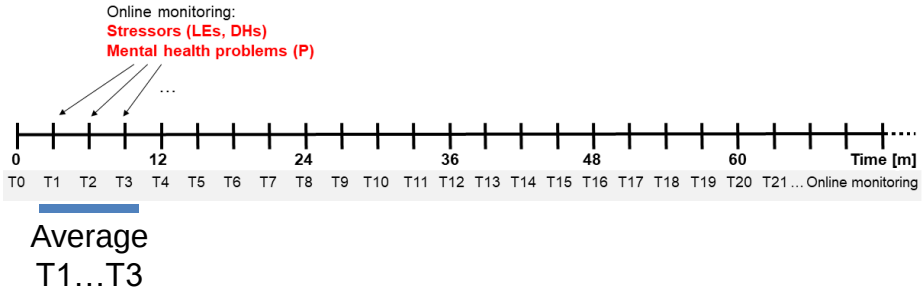
Stressors (E): **Life Events (LE) list**
Daily Hassles (DH) list

Mental health (P): **Internalizing symptoms**

Kalisch et al., *Front Psychol* 2021

Resilience – outcome-based operationalization



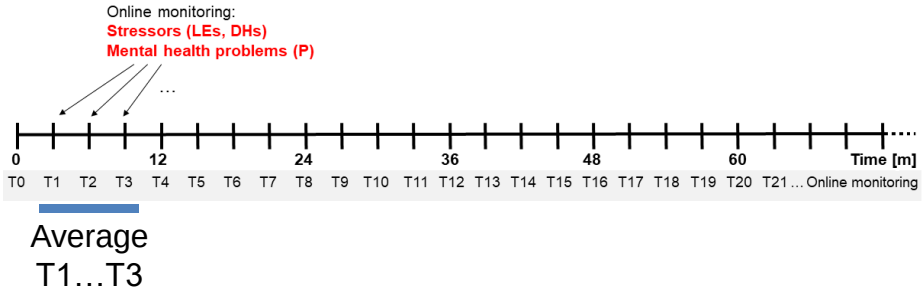
Occurrence of stressors:

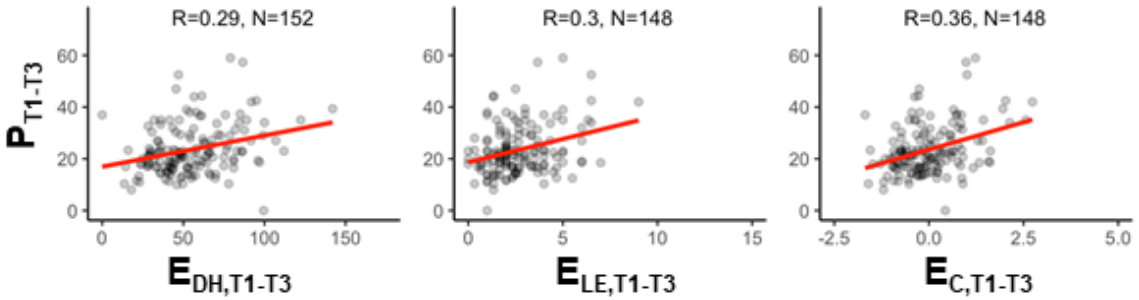
E_{DH} ~ E_{LE}: R=0.38, p=2e-06

(N=148)

Kalisch et al., *Front Psychol* 2021

Resilience – outcome-based operationalization





Kalisch et al., *Front Psychol* 2021

Resilience – outcome-based operationalization

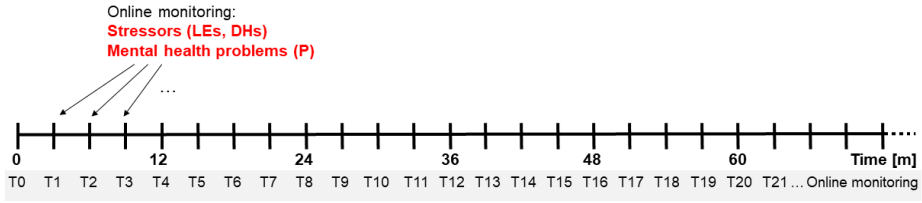
Solution 1: take an at-risk population

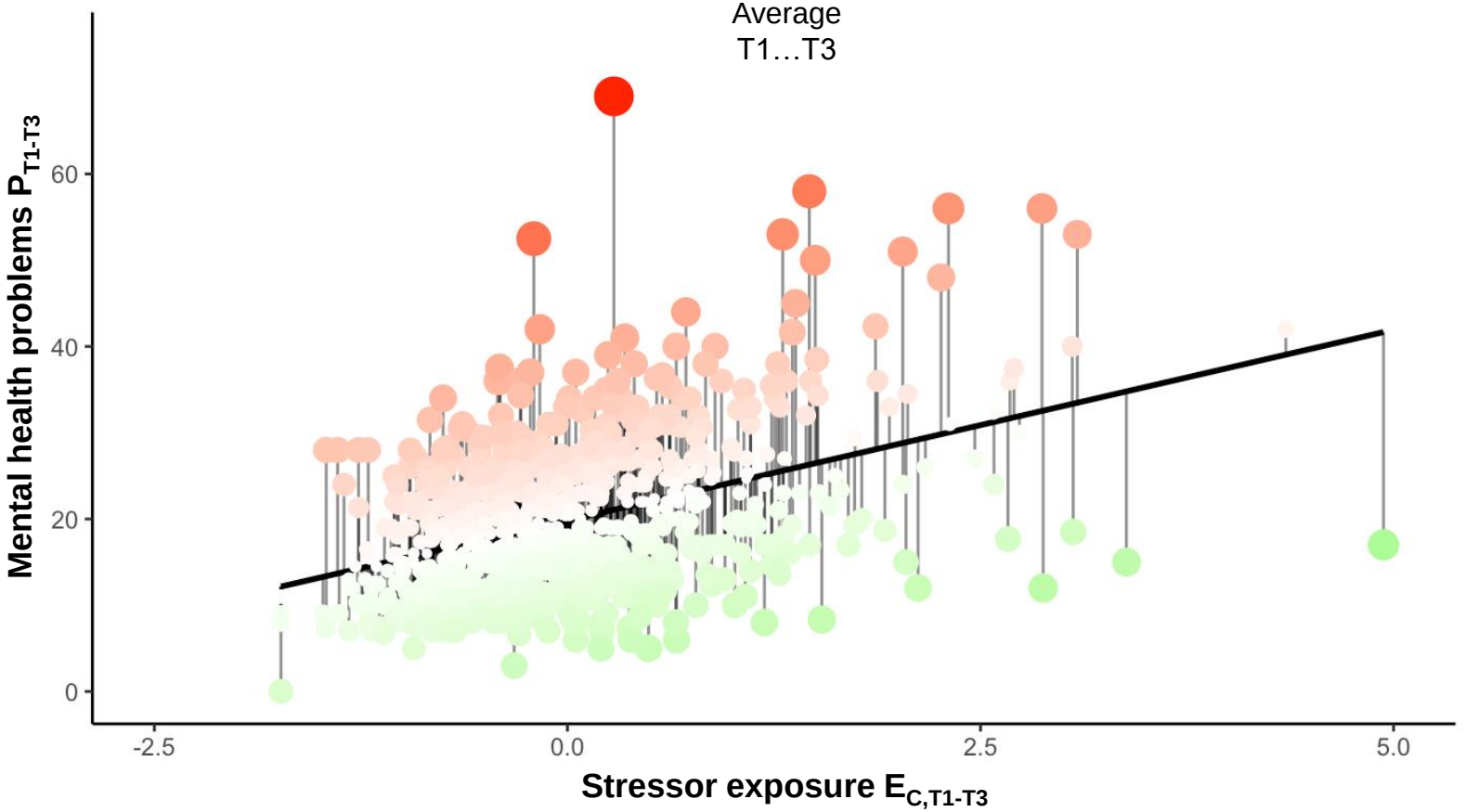
Solution 2: frequently monitor stressors and mental health

Solution 3: express mental health as a function of stressor exposure

Kalisch et al., *Front Psychol* 2021

Resilience – outcome-based operationalization





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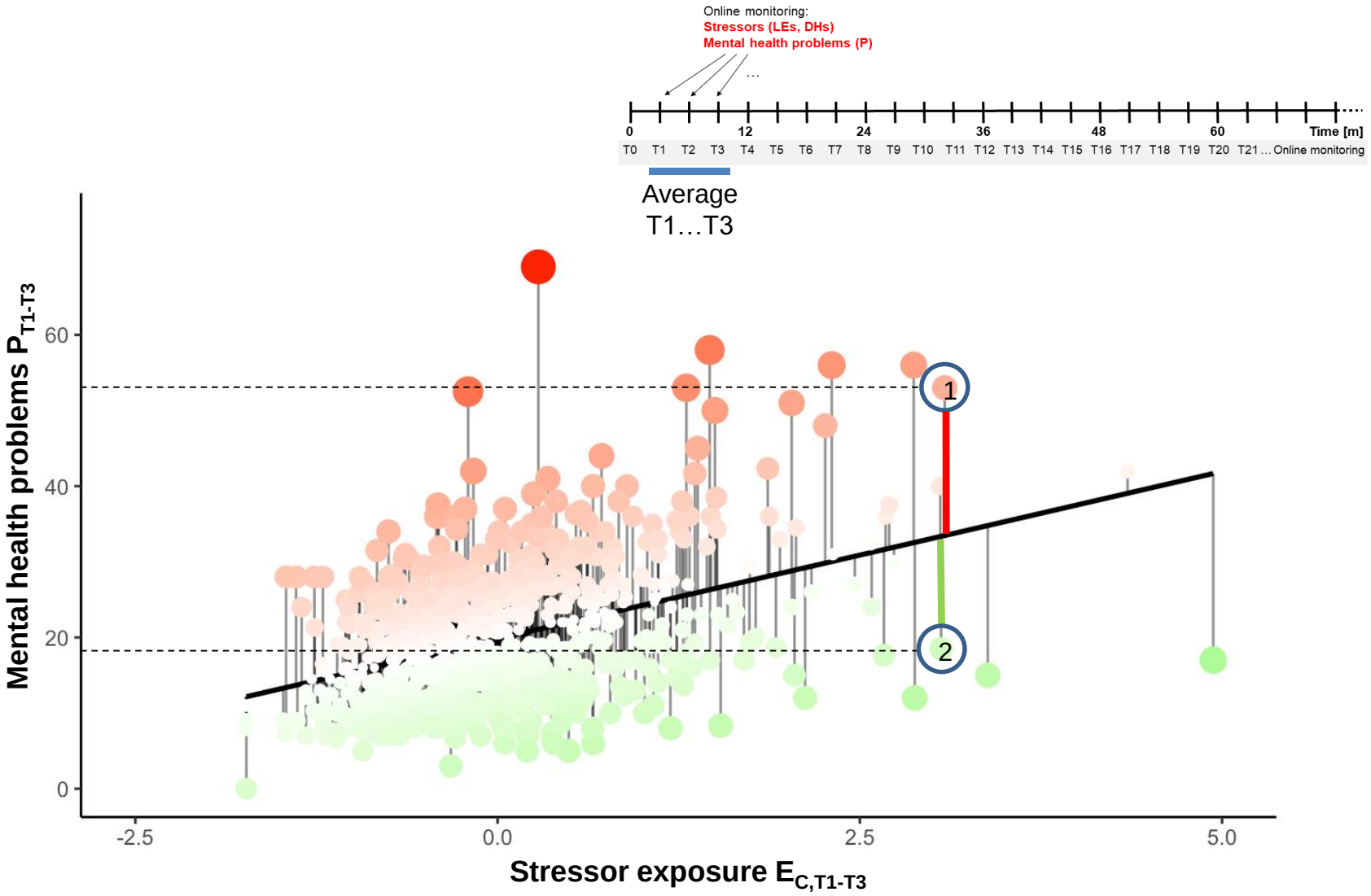

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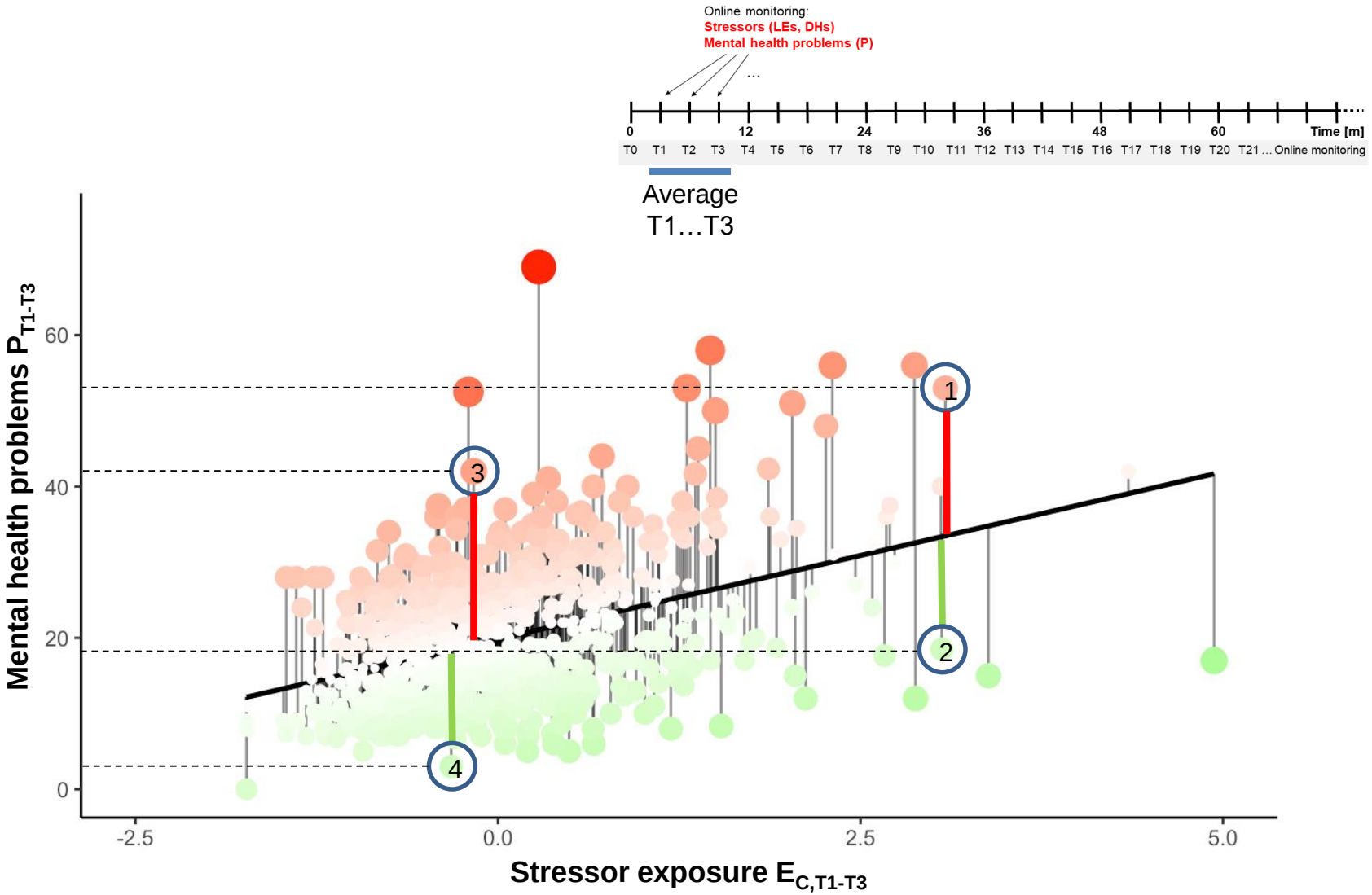

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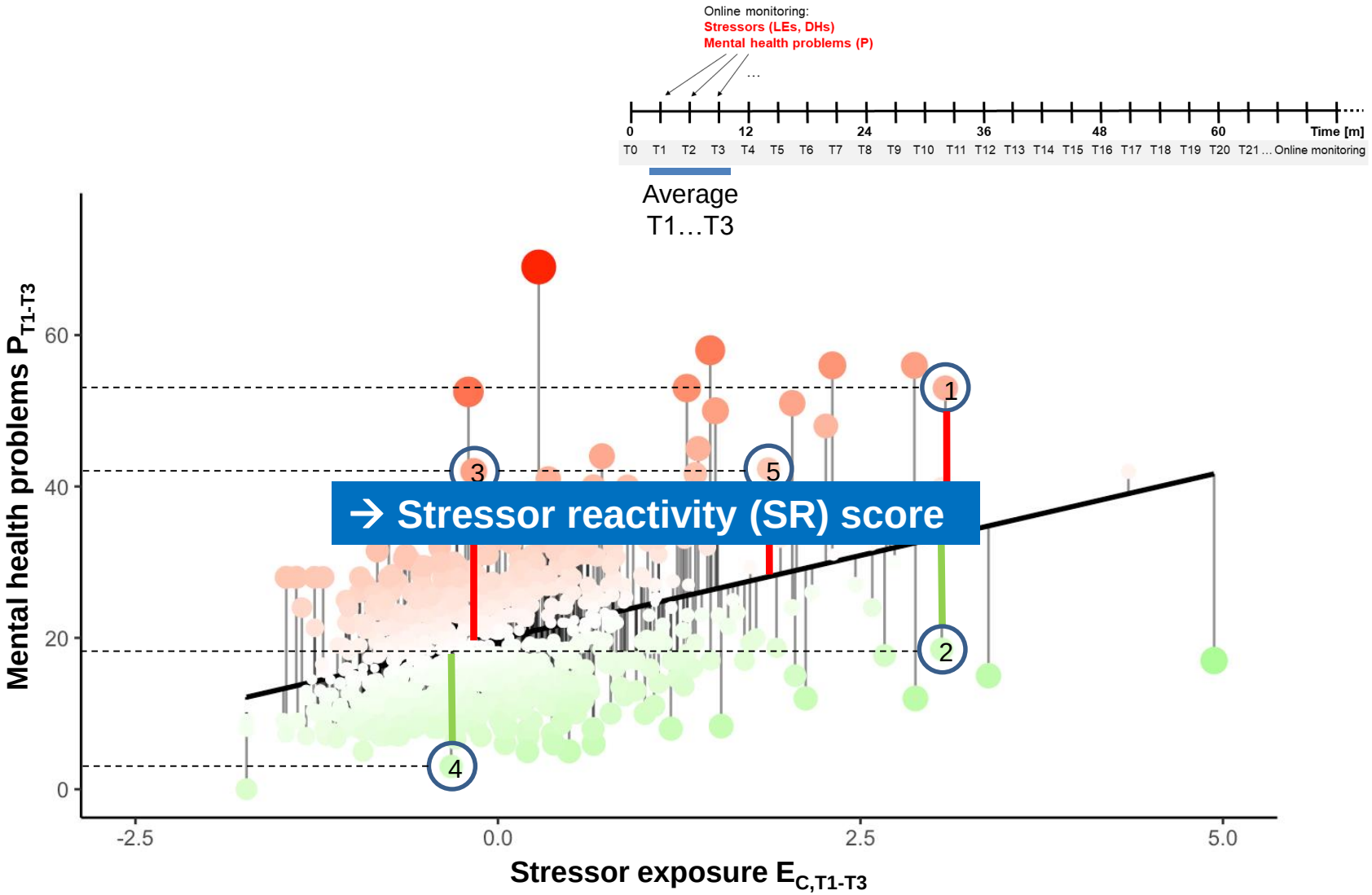
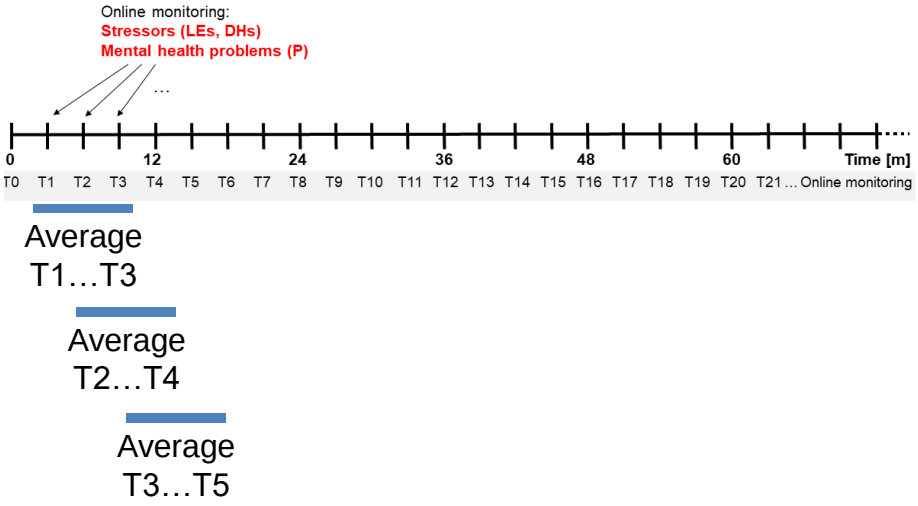


Kalisch et al., *Front Psychol* 2021

Resilience – stressor reactivity (SR) time course



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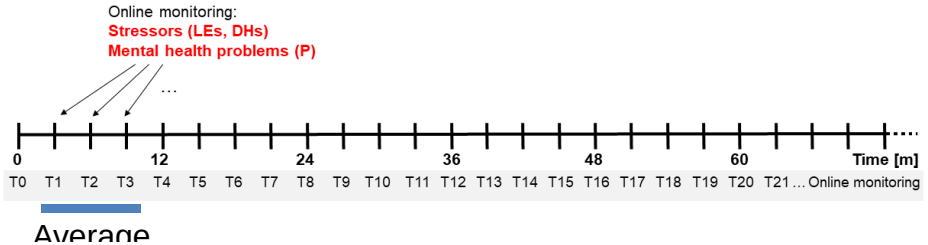

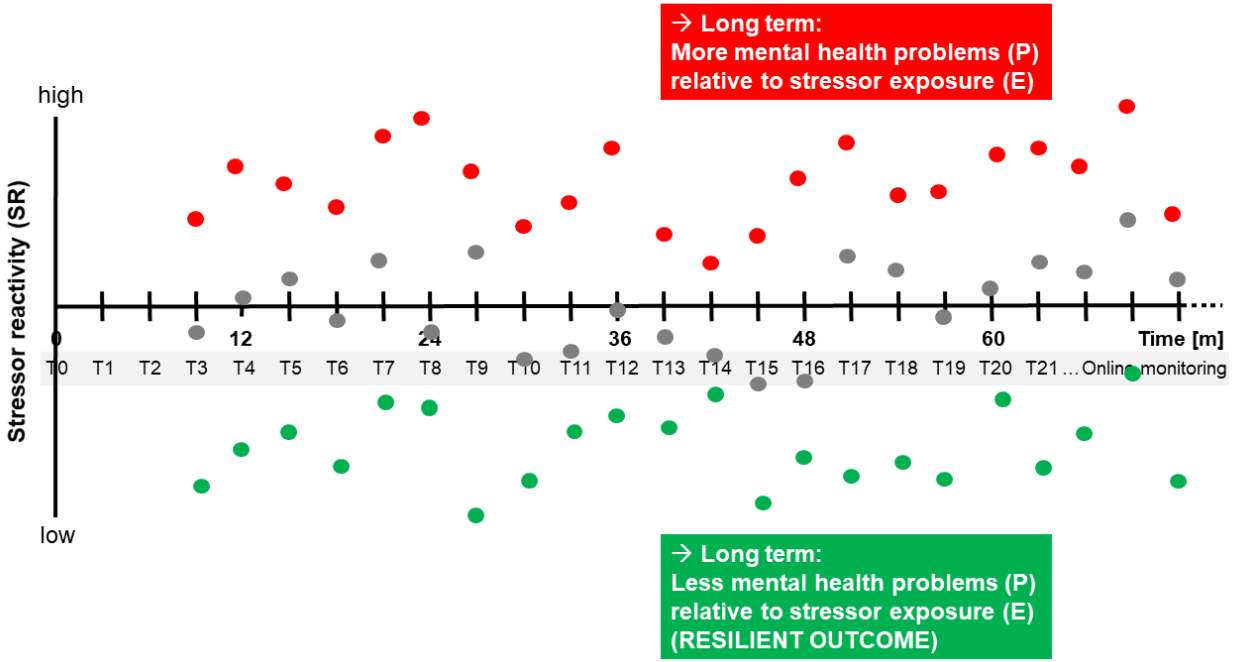

Kalisch et al., *Front Psychol* 2021

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Problem 1: unpredictability of stressors

Problem 2: heterogeneity of stressors

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Problem 5: subjectivity of stressors

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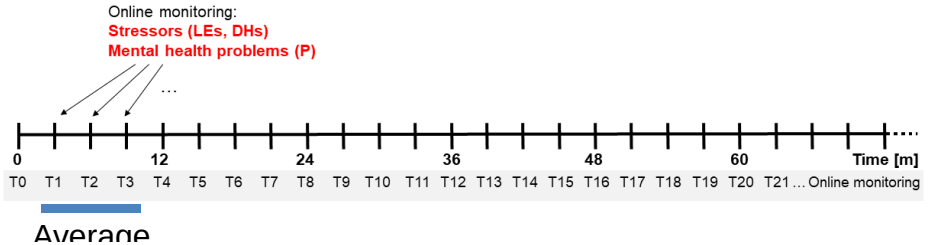

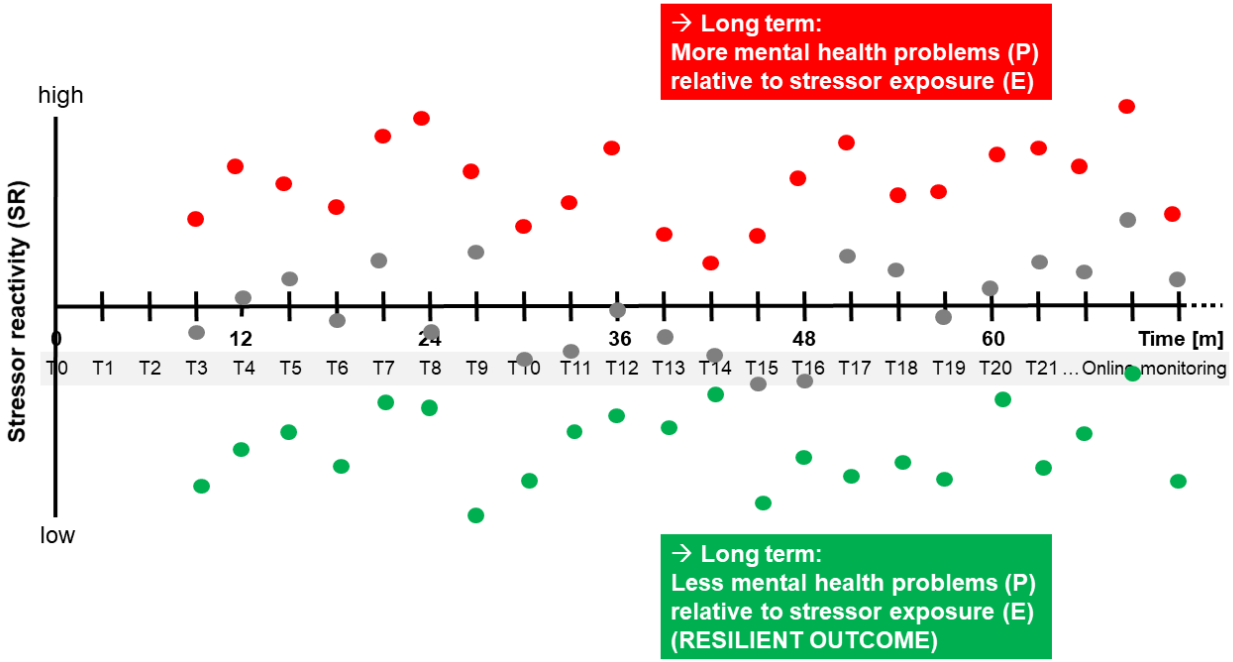

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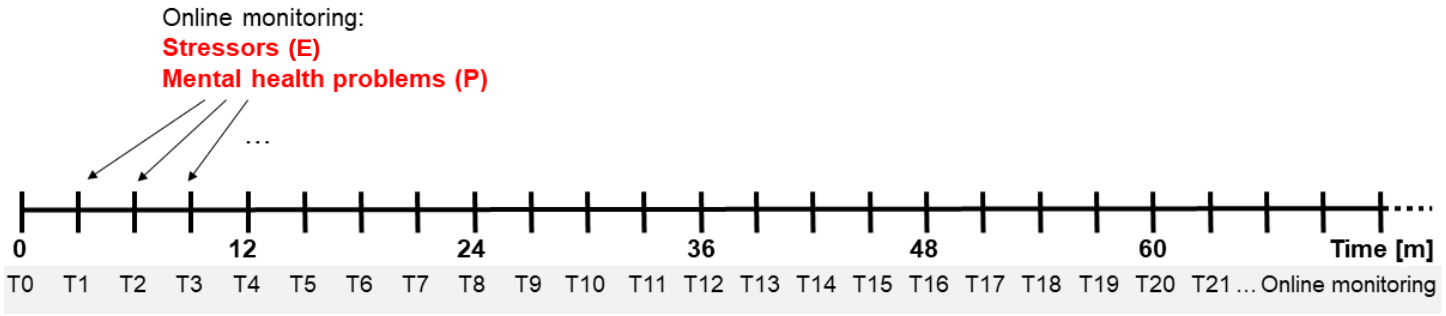

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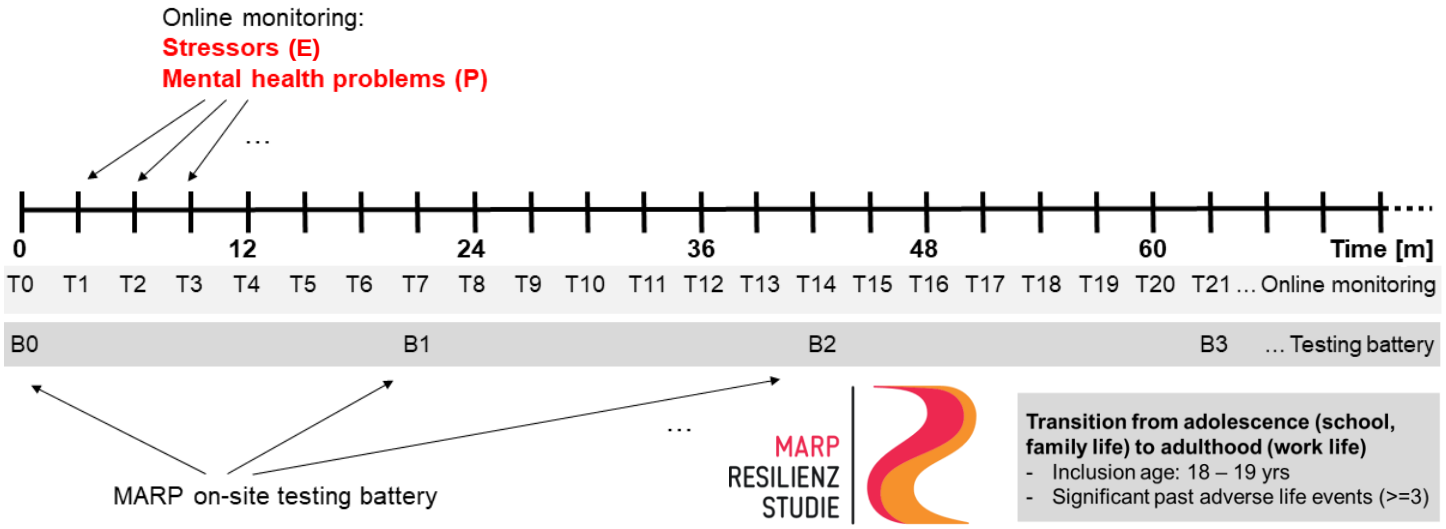

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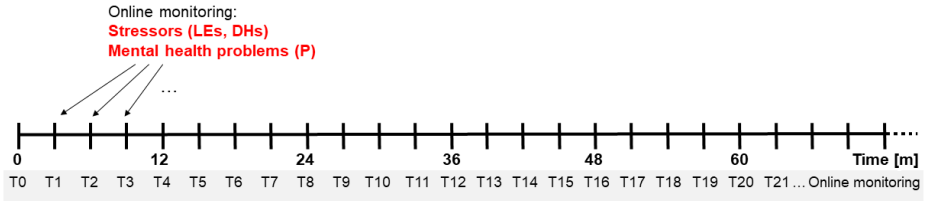
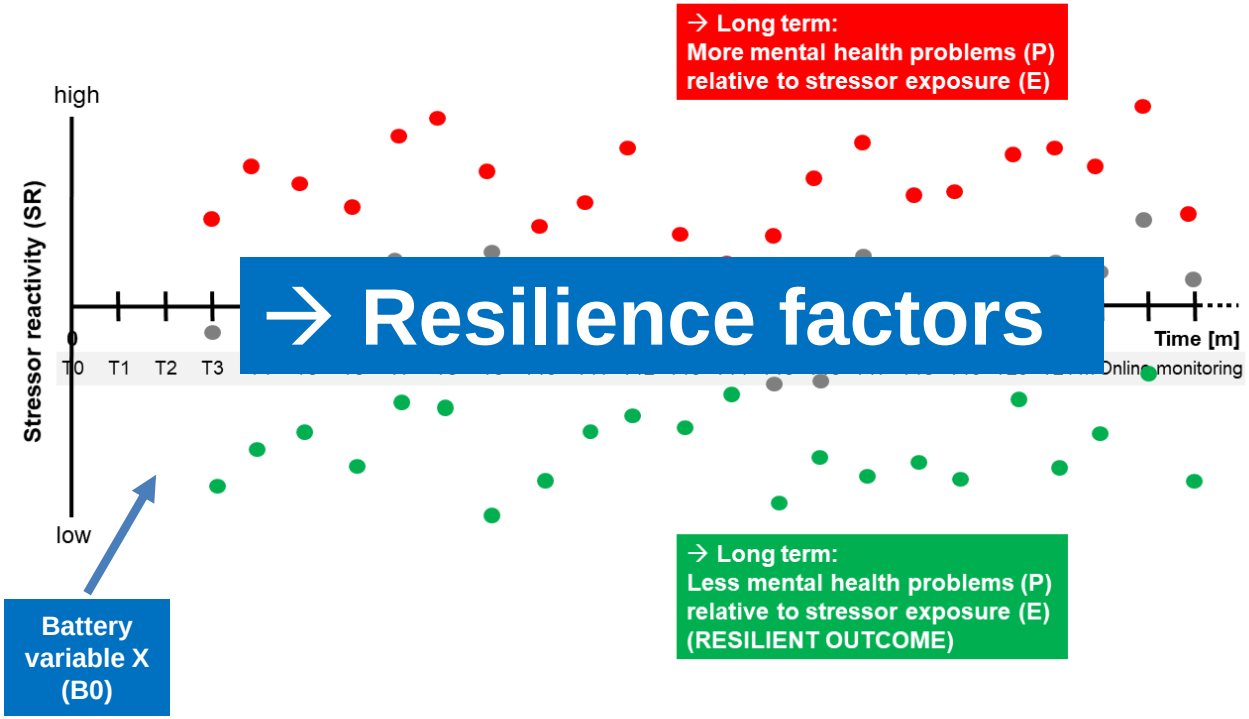
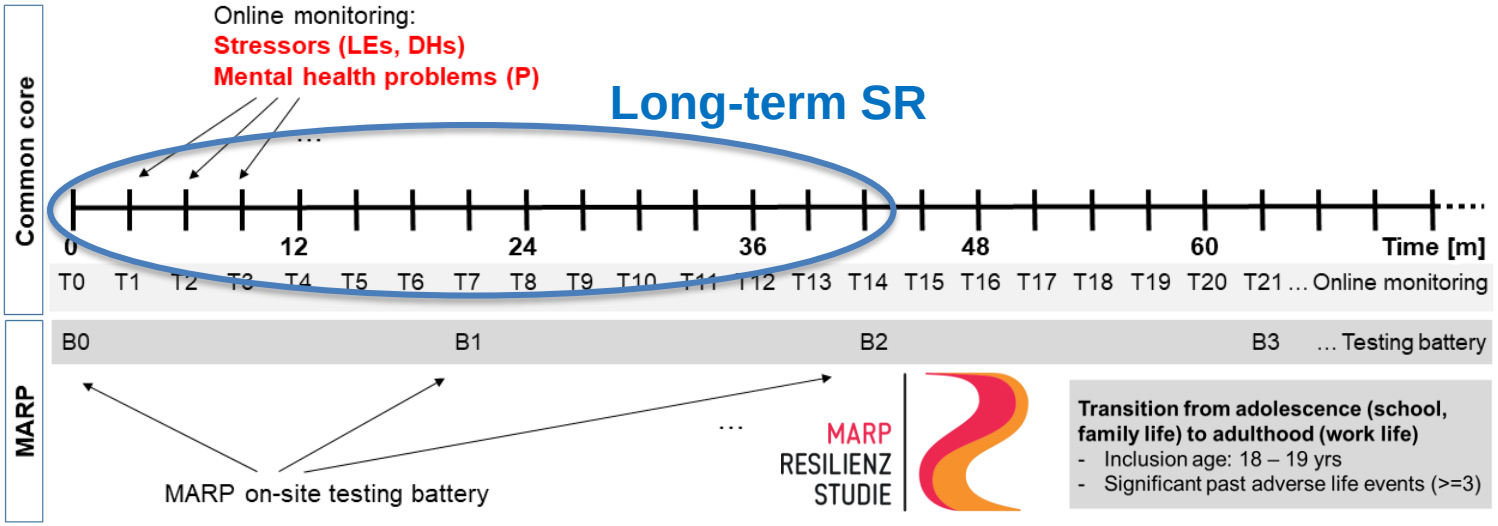




Kalisch et al., *Front Psychol* 2021

Resilience factor Positive Appraisal Style (PAS)

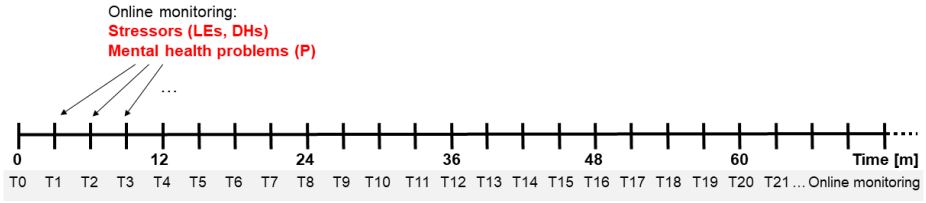


N=132
EV=19%

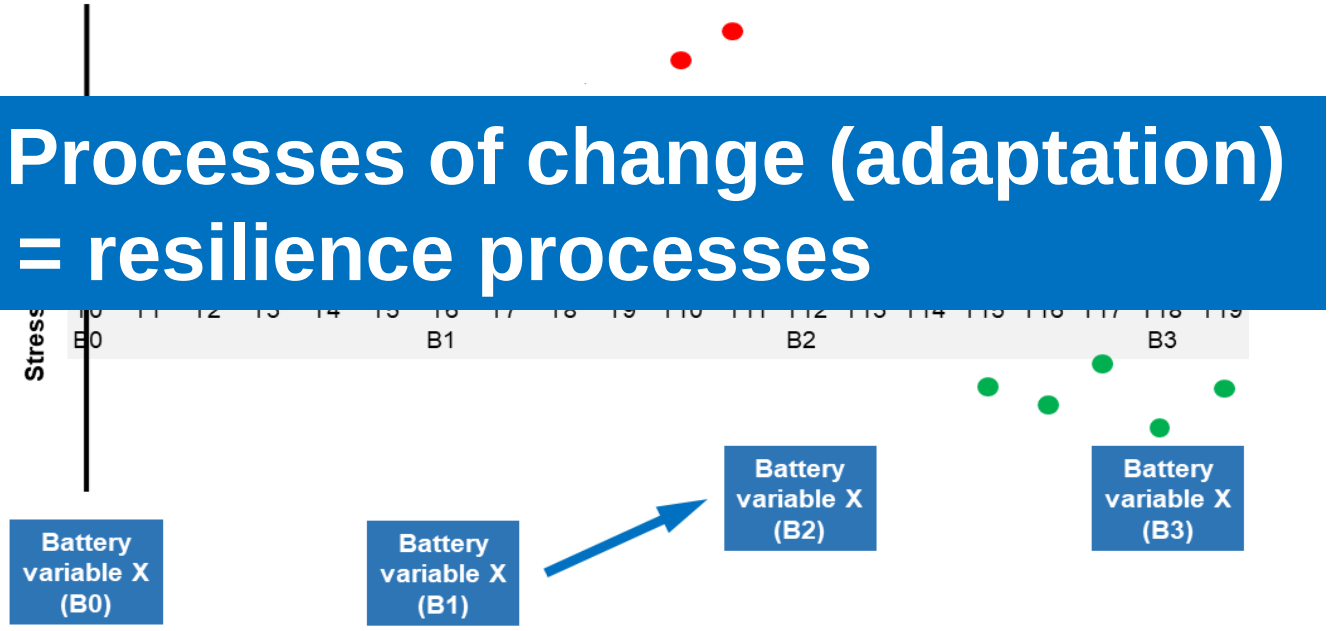
Battery Variable PAS(B0)

Petri-Romão et al., in prep.

Resilience – stressor reactivity (SR) time course



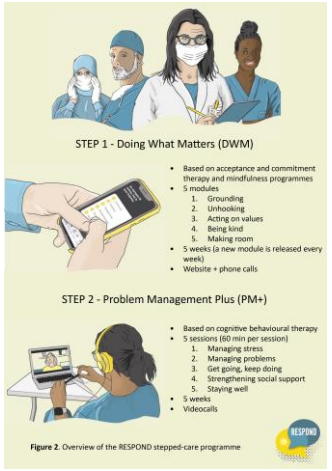
→Processes of change (adaptation) = resilience processes

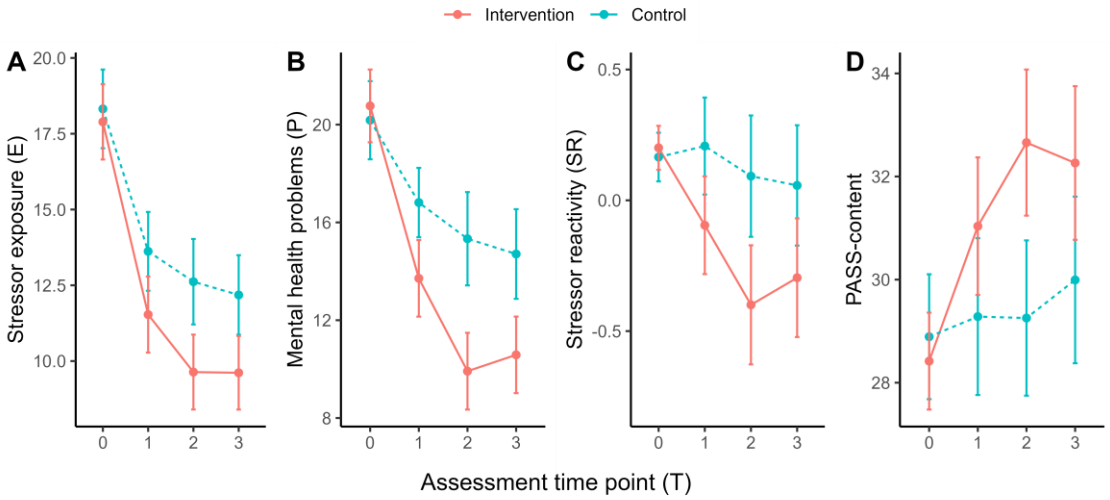


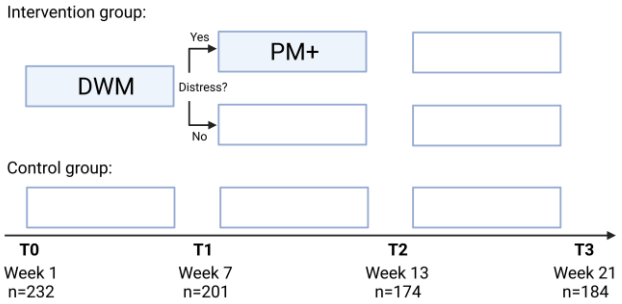
Kalisch et al., *Front Psychol* 2021

An induced resilience process

WHO Stress management training
(stepped care, peer support, digitalized)







Intervention → PAS (T2) → -SR (T3) (47%)

Spanish health care workers during COVID

Petri-Romão et al., in prep.

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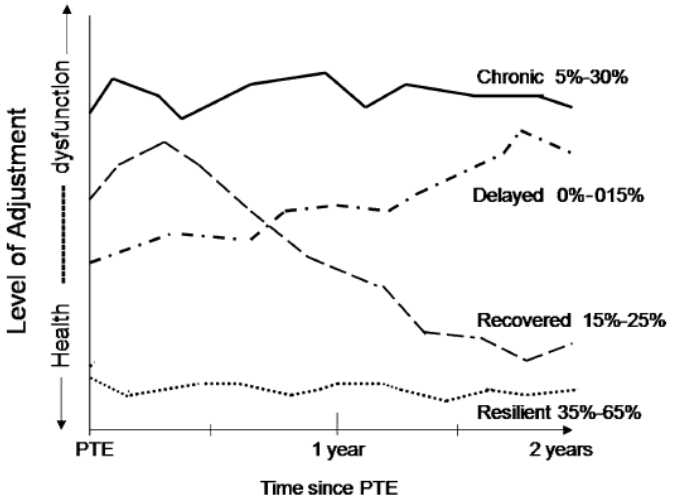
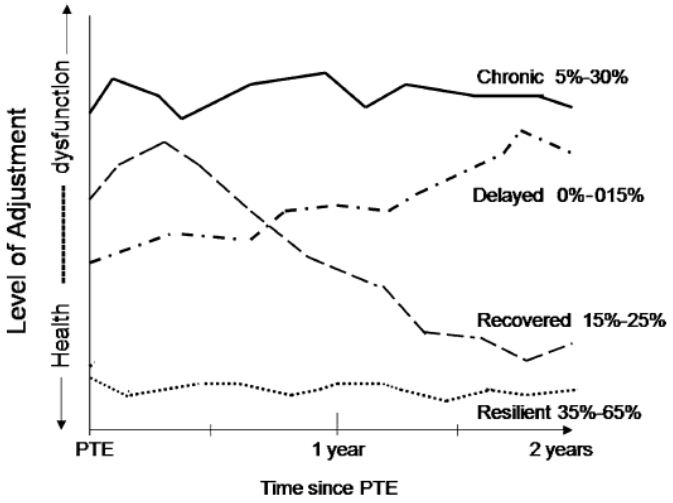
Resilience to major life events



Bonanno et al., *Annu Rev Clin Psychol* 2011

Resilience to major life events



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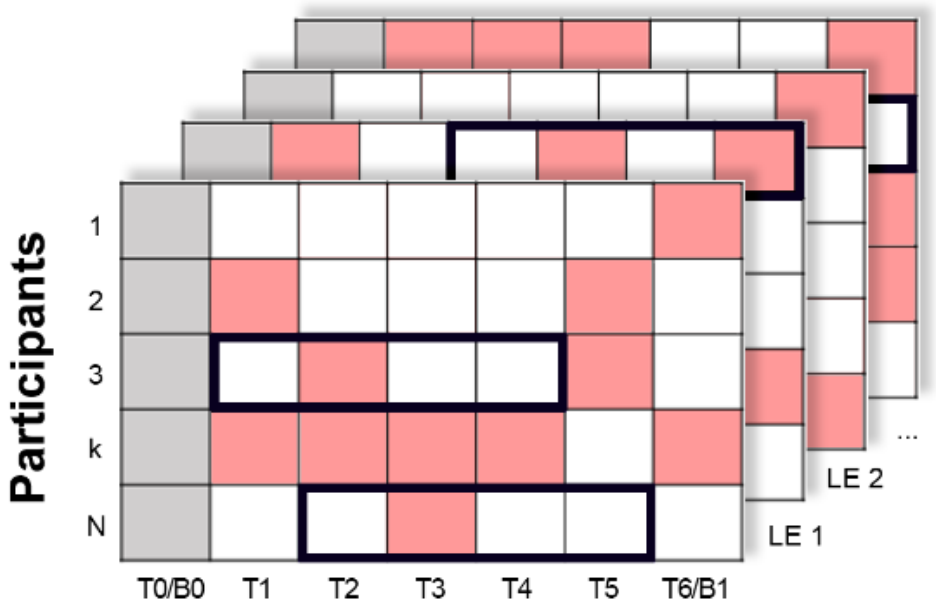

Ahrens et al., Am Psychol 2024

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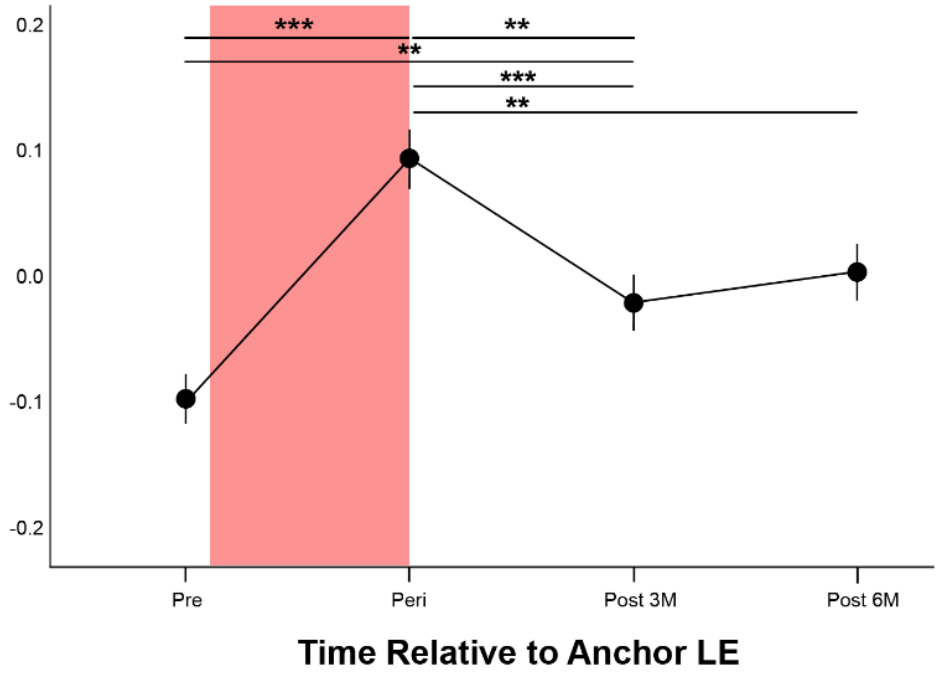

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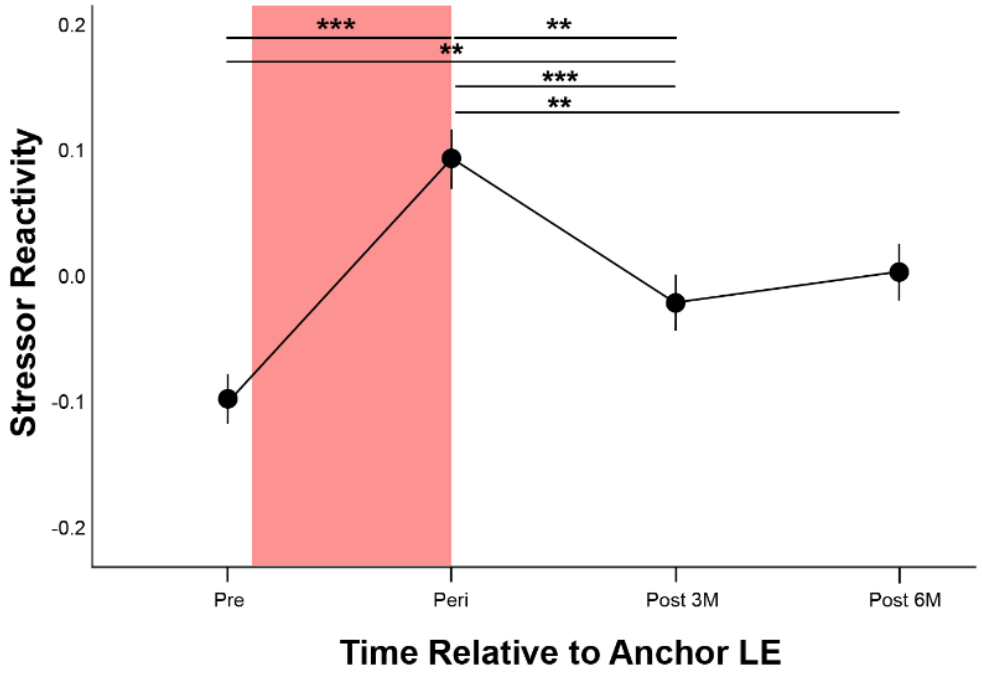

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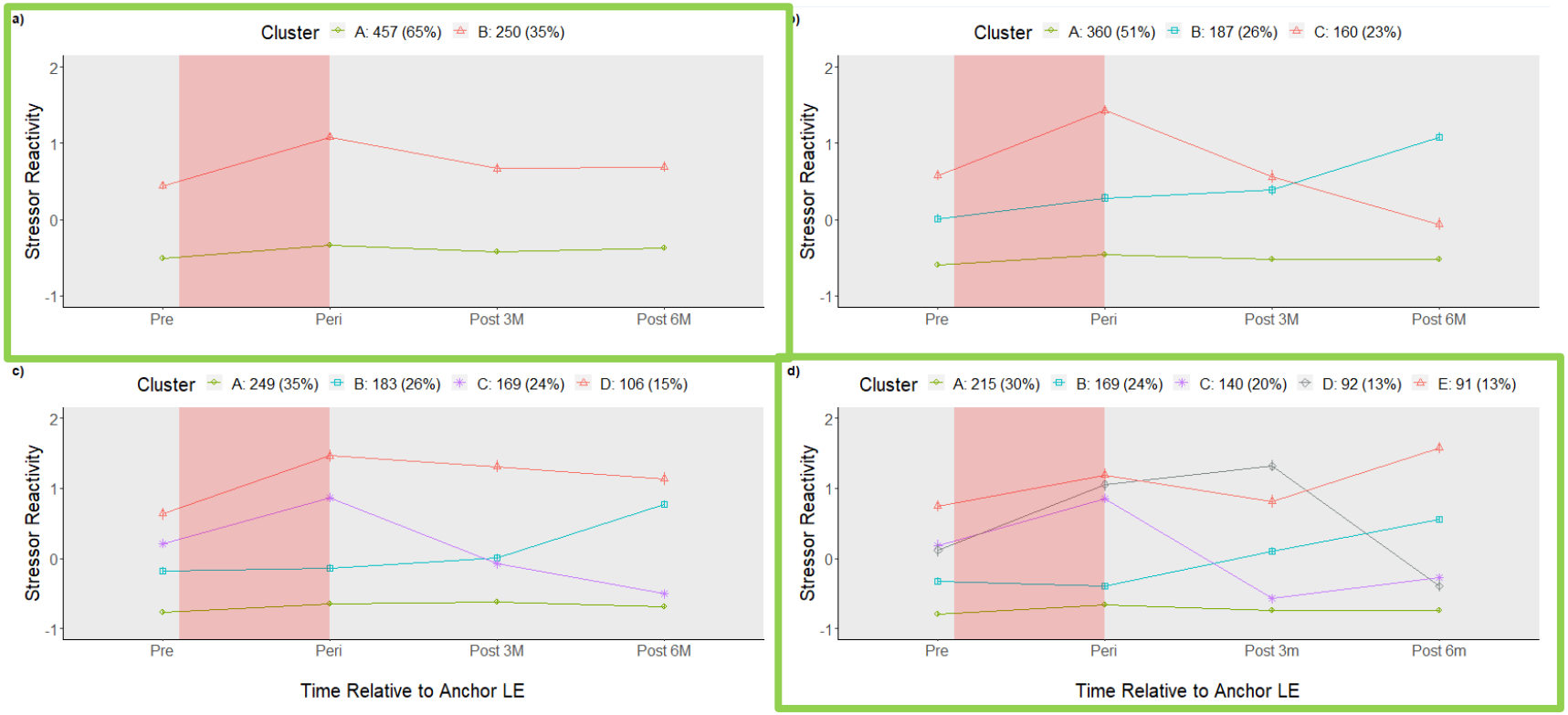

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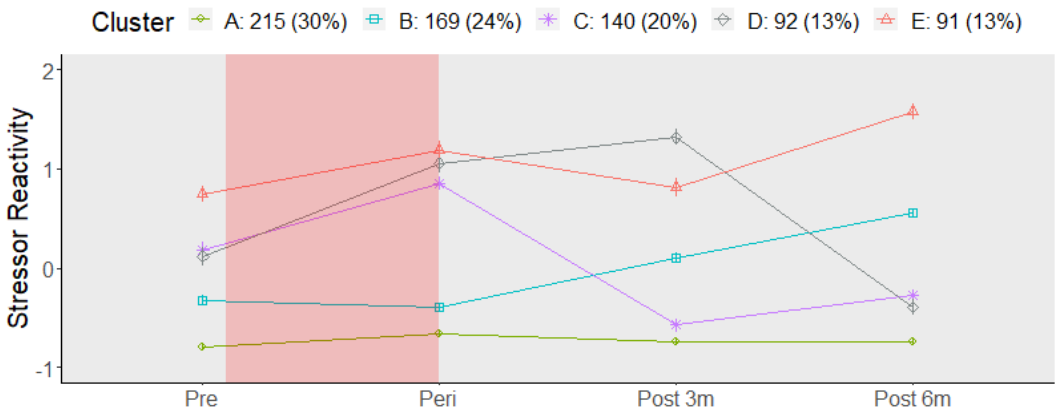

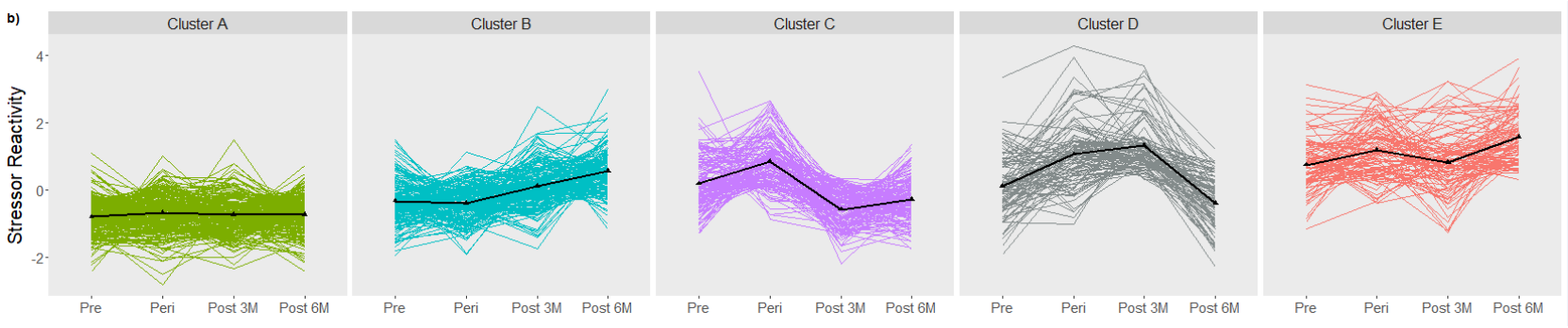

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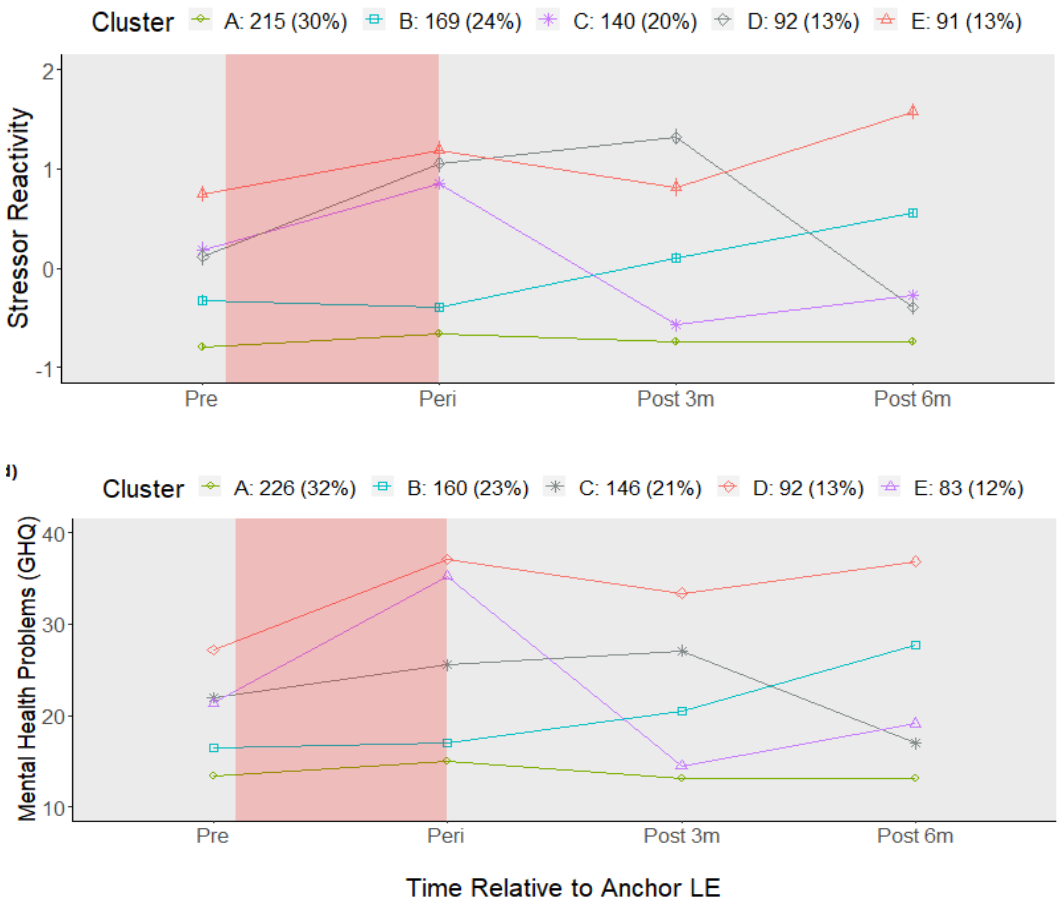

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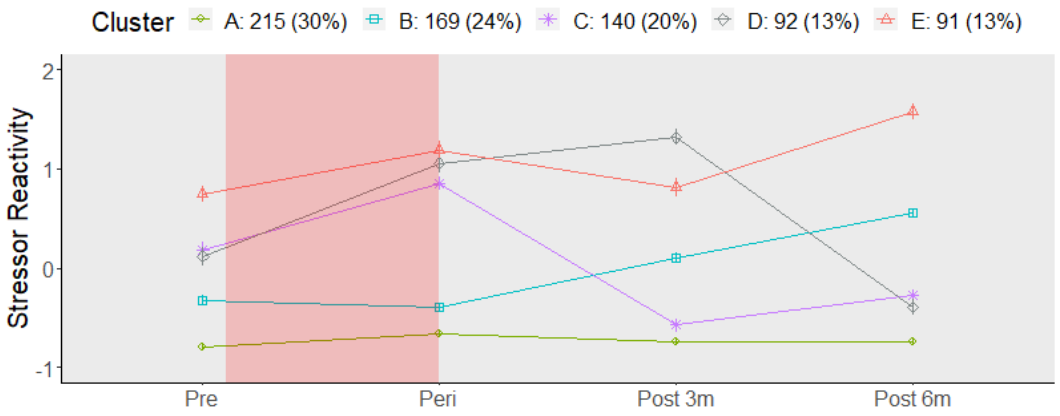

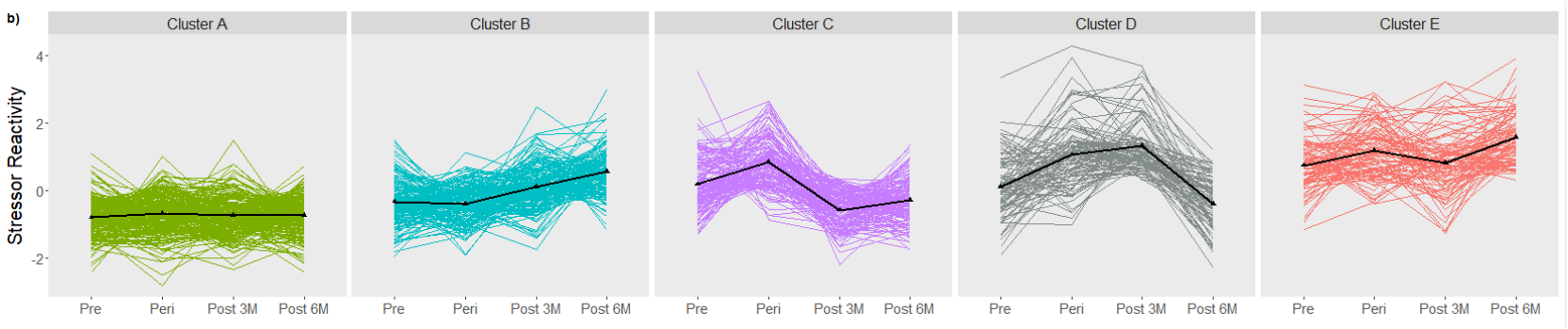

SOC (B0)

Ahrens et al., Am Psychol 2024

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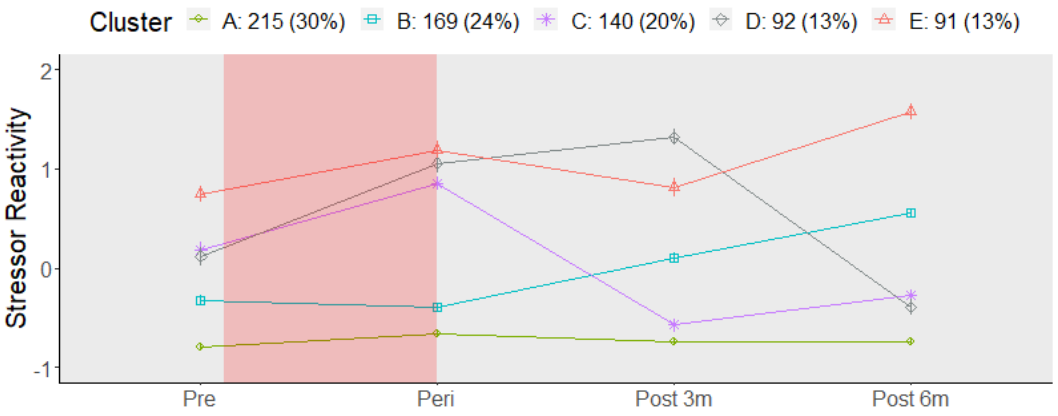

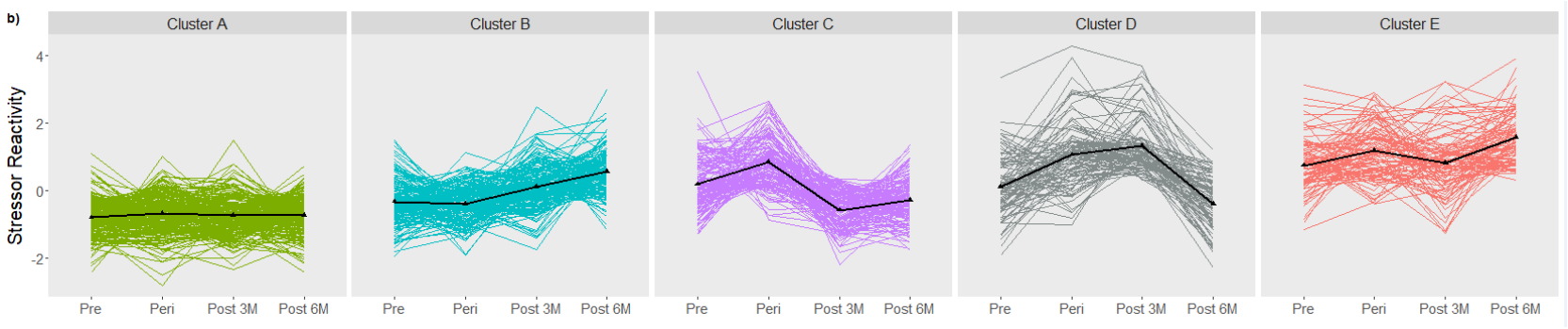

Diagnosis (later)

Ahrens et al., Am Psychol 2024

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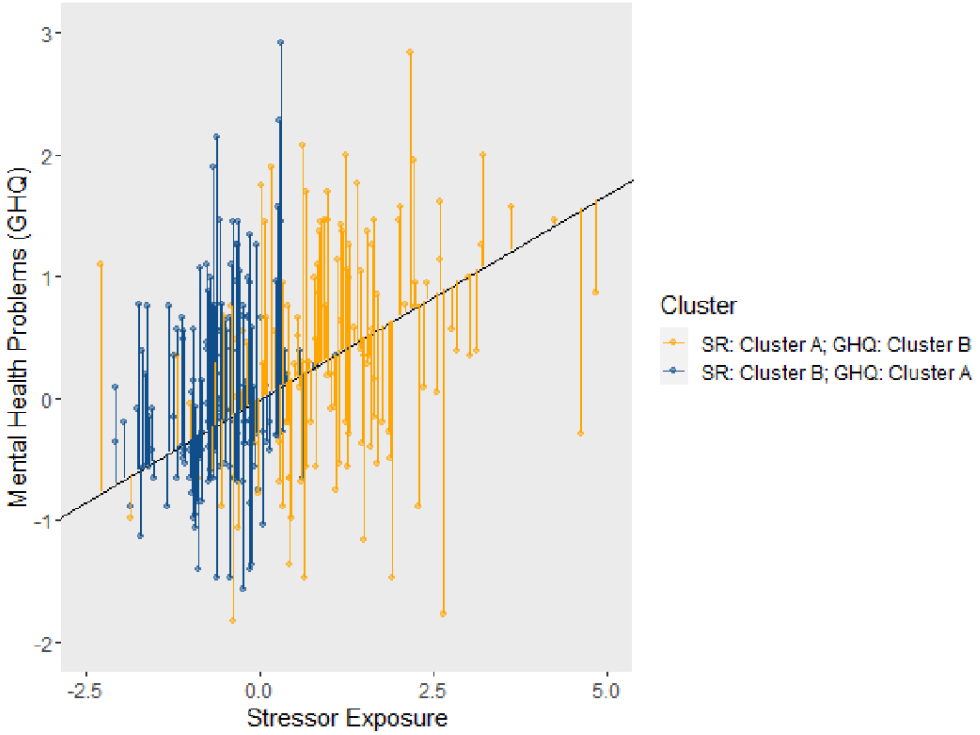

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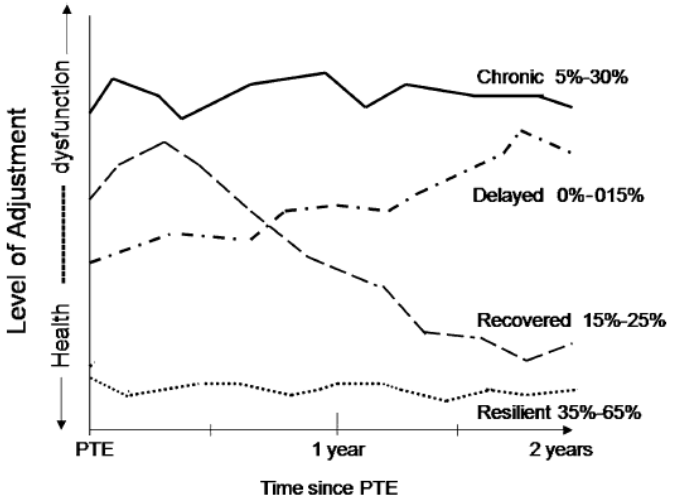

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Ahrens et al., Am Psychol 2024

Resilience – outcome-based operationalization

Problem 1: unpredictability of stressors

Problem 2: heterogeneity of stressors

Problem 3: non-randomness of stressors

Problem 4: individuality of stressors

Problem 5: subjectivity of stressors

Resilience – outcome-based operationalization

Solution 1: take an at-risk population

Solution 2: frequently monitor stressors and mental health

Solution 3: express mental health as a function of stressor exposure

Resilience – outcome-based operationalization

Possibility 1: identify resilience factors

Possibility 2: identify resilience processes

Possibility 3: quantify resilience to life events

Possibility 4: quantify effects of resilience interventions

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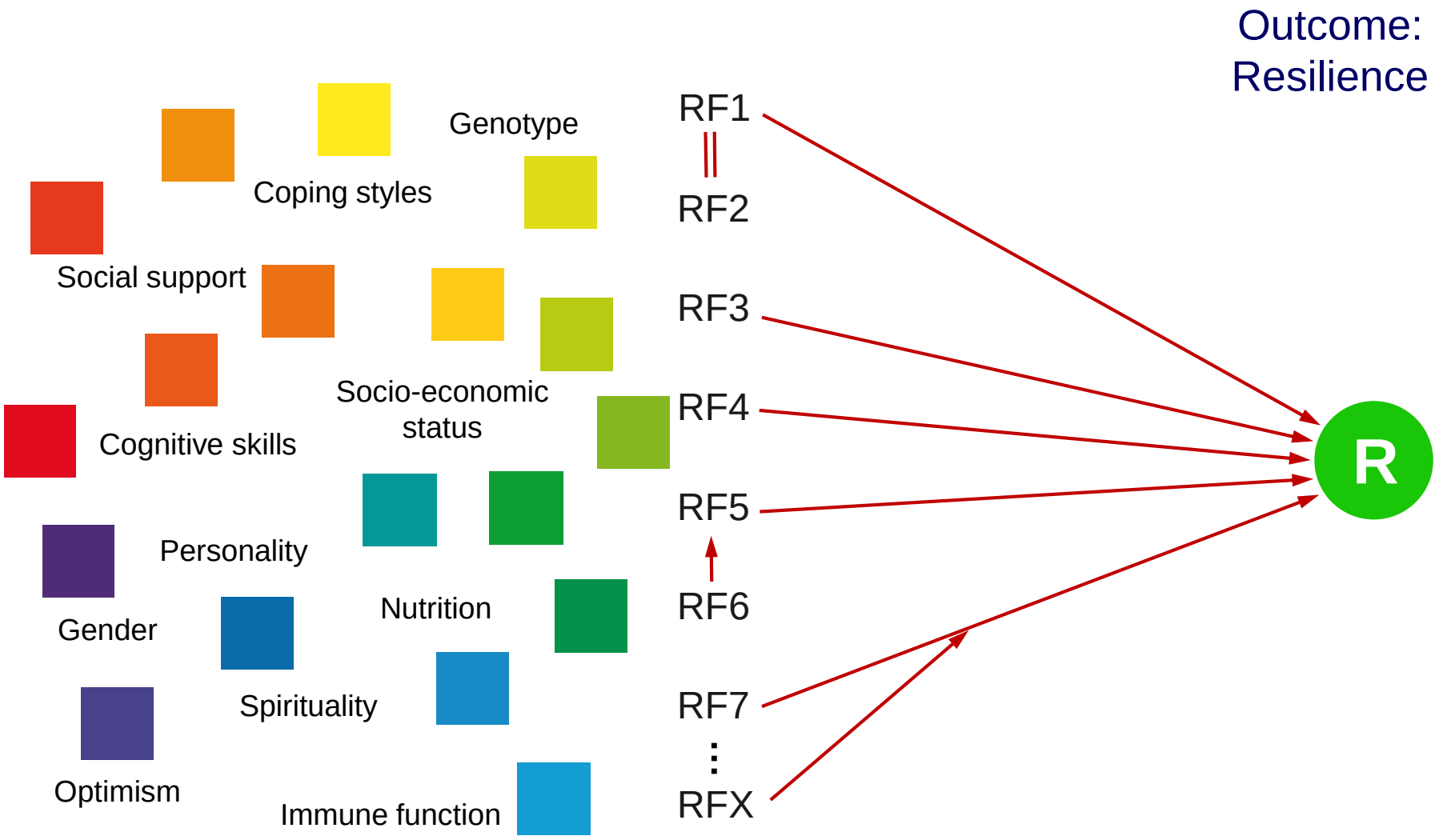
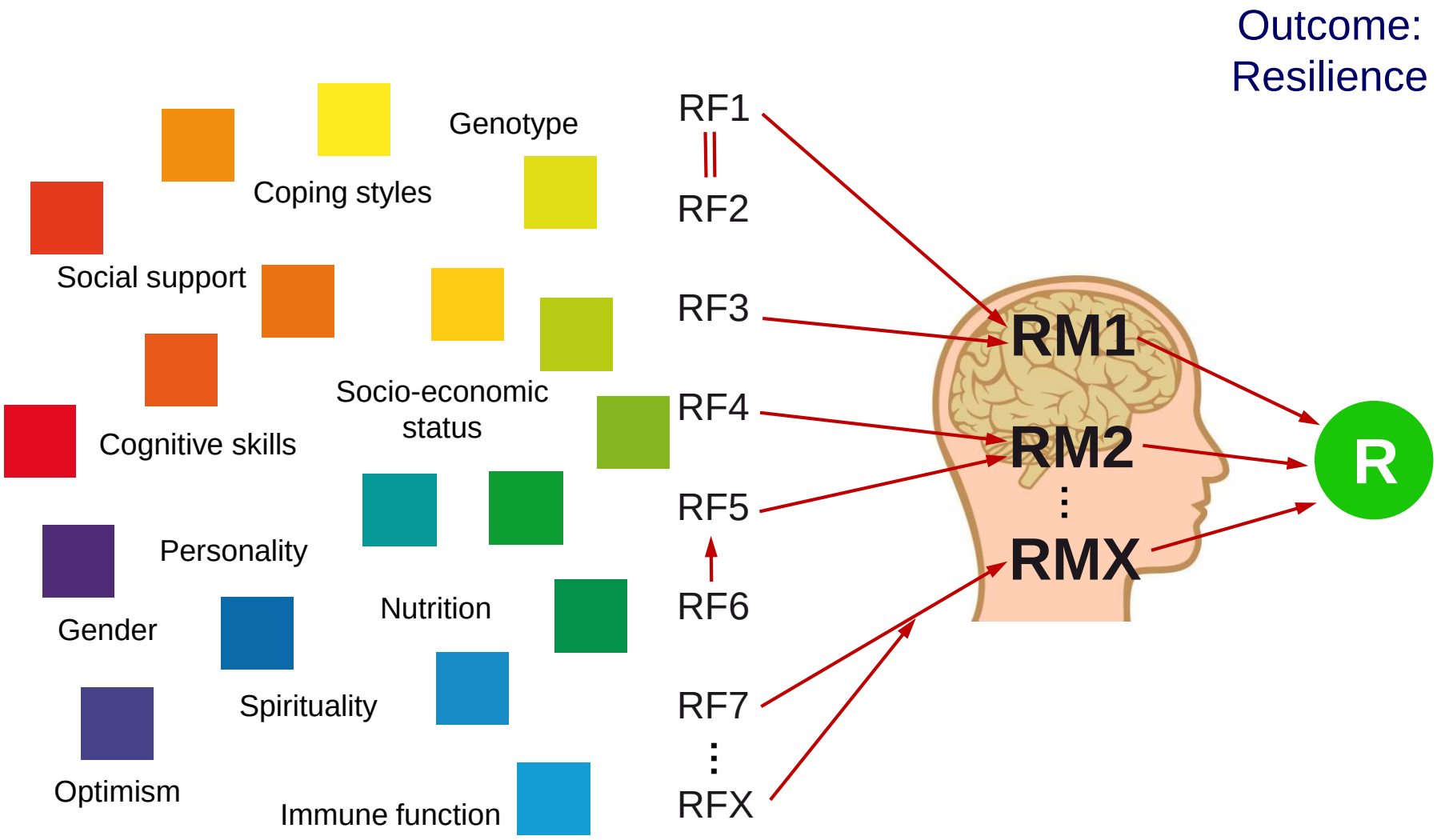
From many resilience factors to …



From many resilience factors to a few mediating mechanisms



Excursus: appraisal theory

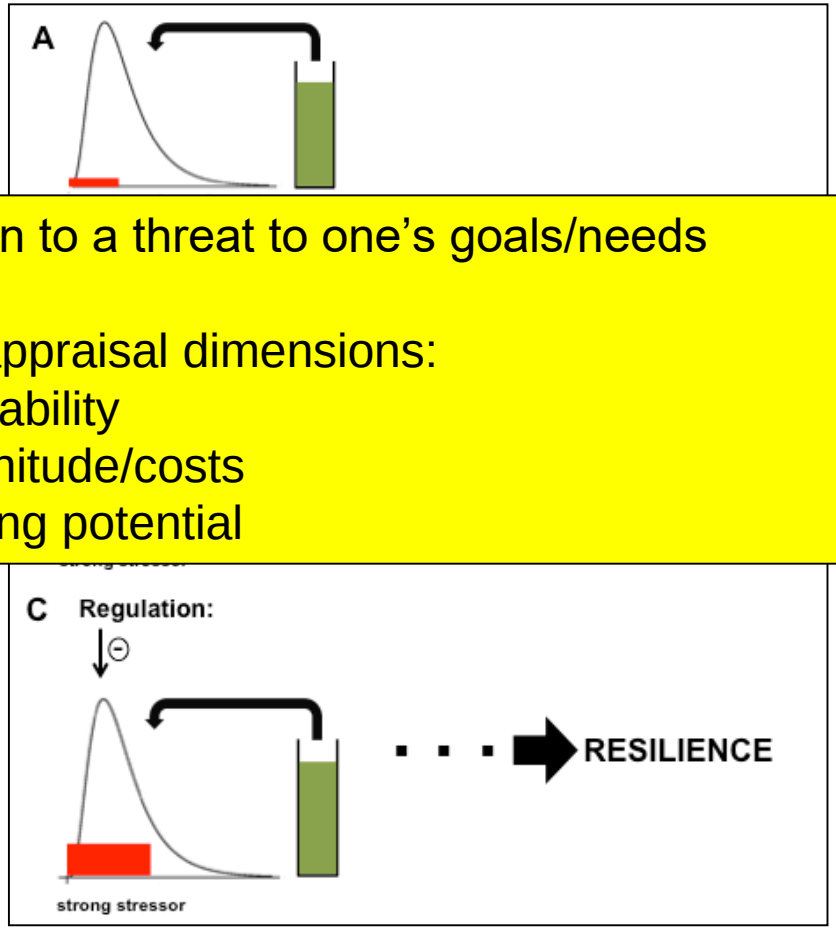
(Arnold, Lazarus, Frijda, Scherer, ...; Moors, *Cogn Emot* 2009)

Situation → Appraisal → Emotional response

- Evaluation of a stimulus in terms of its emotional-motivational significance (relevance to goals/needs)
- Causal in generating an emotional response (determines type and shape of emotional response)
- Context dependent
- SUBJECTIVE
- Multiple appraisal criteria/dimensions
- Heterogeneous processes, non-conscious/conscious, quick/effortful
- Continuous, iterative

Towards a mechanistic theory

Stress reaction (anger, fear, anxiety, sadness, …):



Reaction to a threat to one's goals/needs

Three appraisal dimensions:
- Probability
- Magnitude/costs
- Coping potential

Kalisch et al., *Behav Brain Sci* 2015

Towards a mechanistic theory

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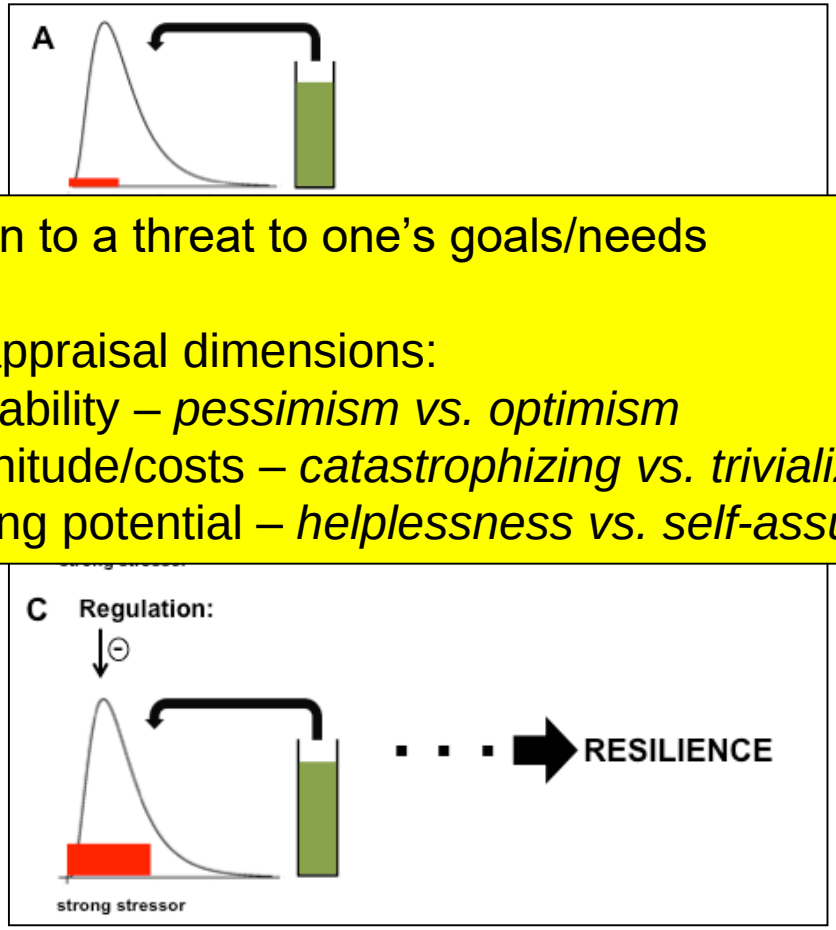

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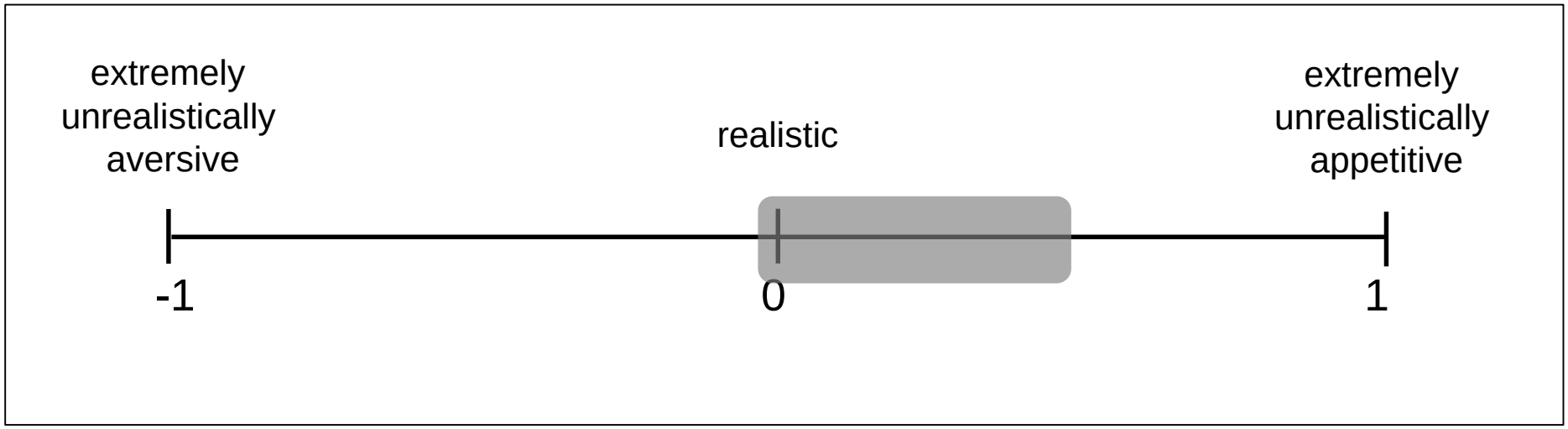

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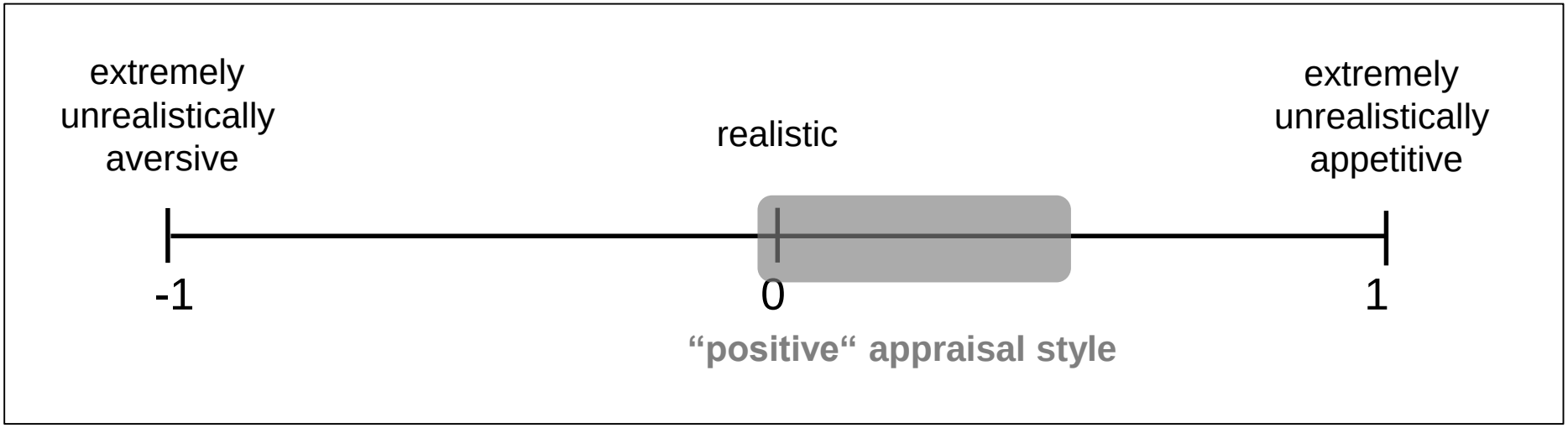

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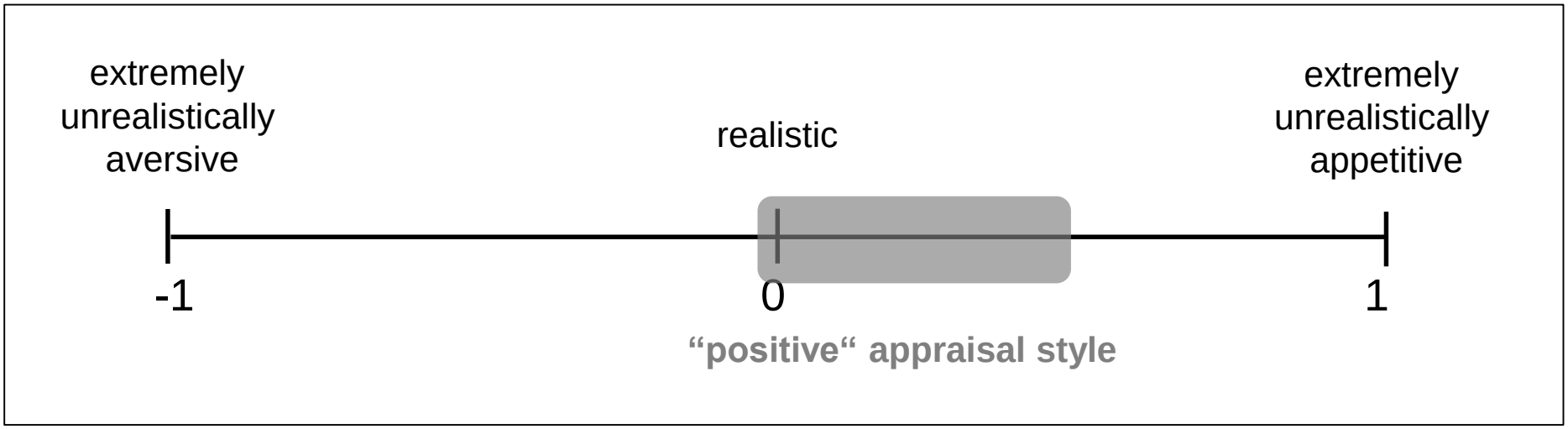
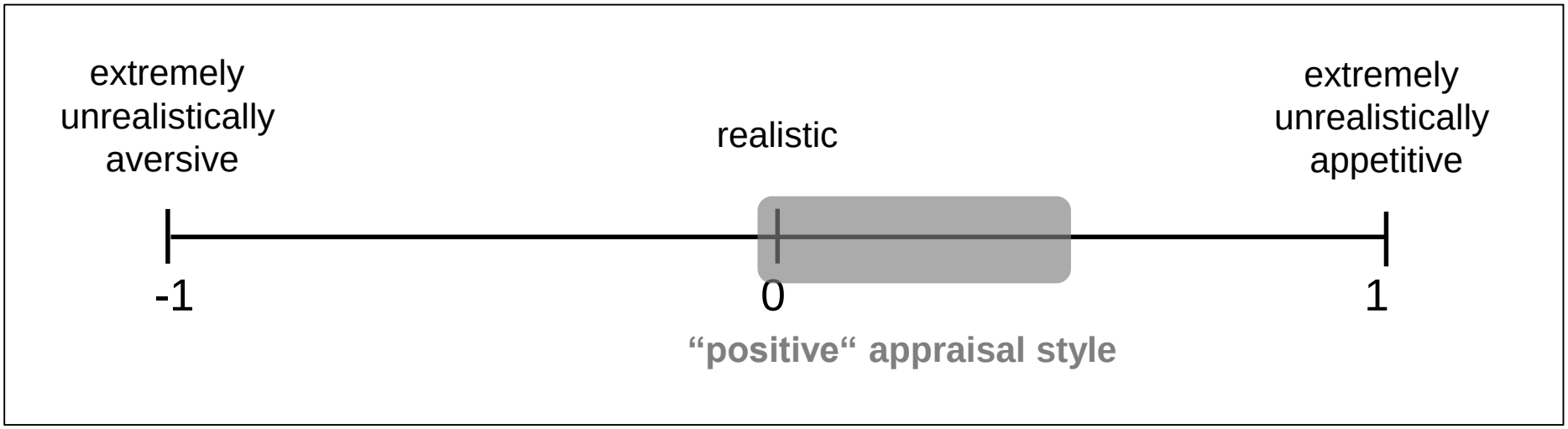


→ **Positive appraisal style theory of resilience (PASTOR)**

Kalisch et al., *Behav Brain Sci* 2015

Towards a mechanistic theory



→ Positive appraisal style theory of resilience (PASTOR)

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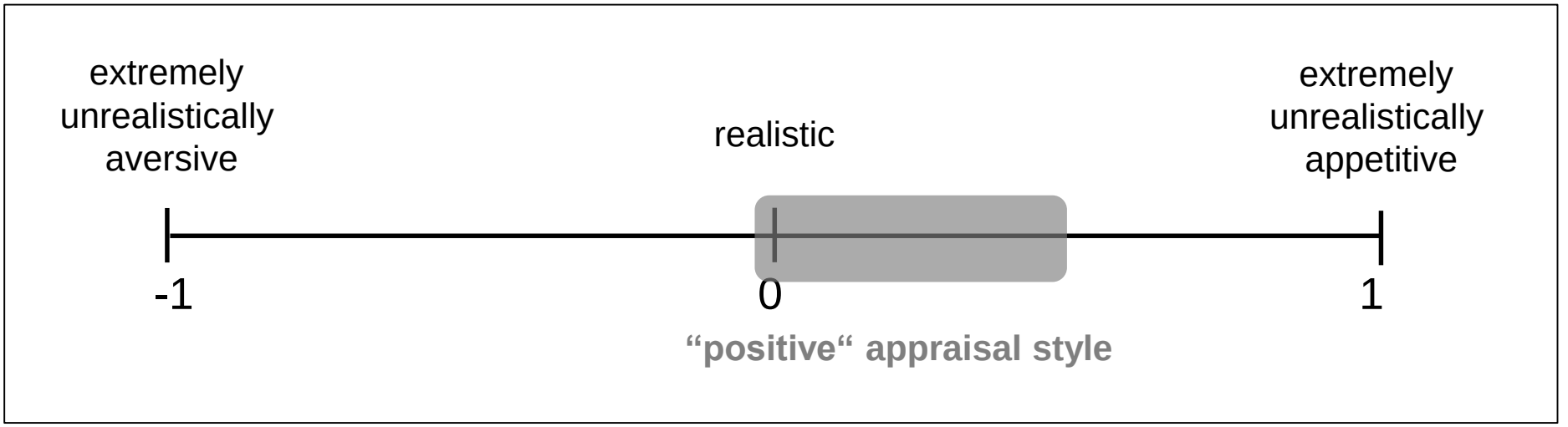

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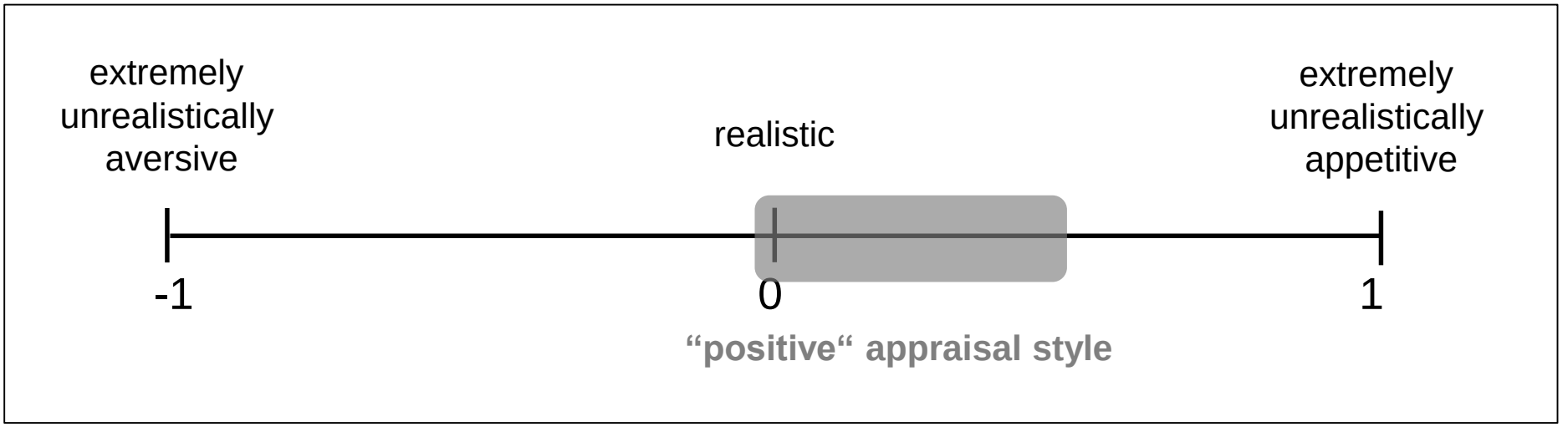
Kalisch et al., *Behav Brain Sci* 2015

Towards a mechanistic theory



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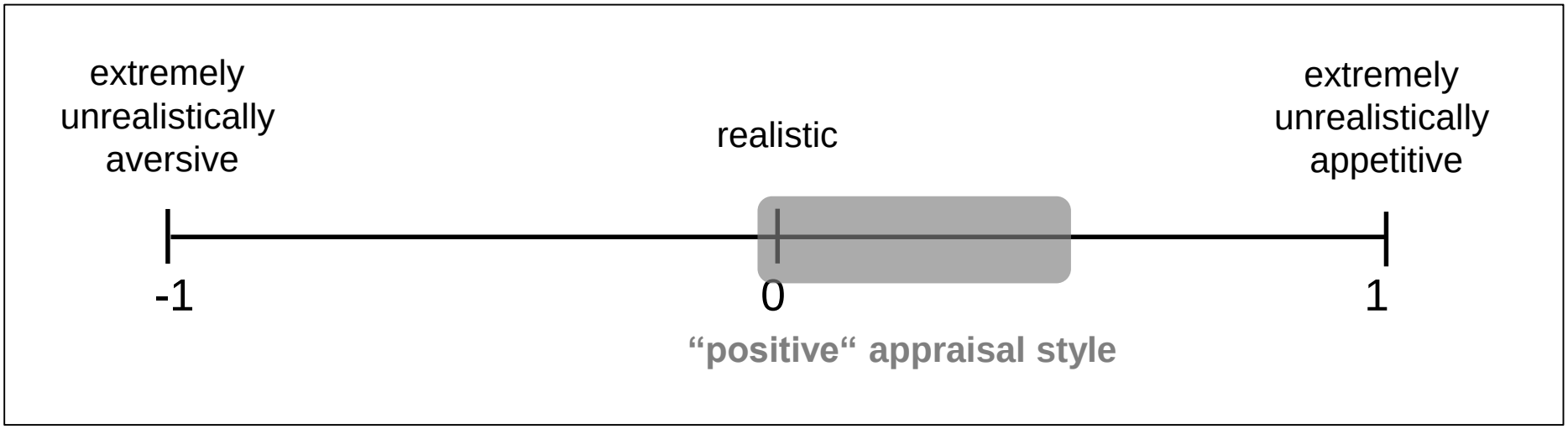

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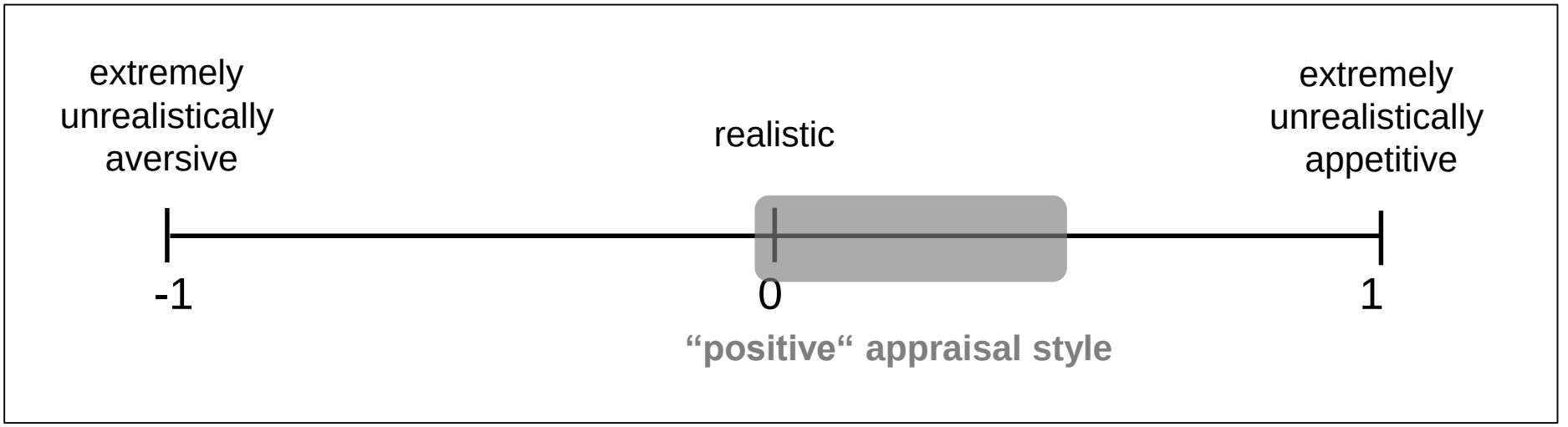

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- Partly determined by ind. diff. in life history, partly by efficiency of neural processes generating positive appraisals

Kalisch et al., *Behav Brain Sci* 2015

Positive Appraisal Style (PAS) Task

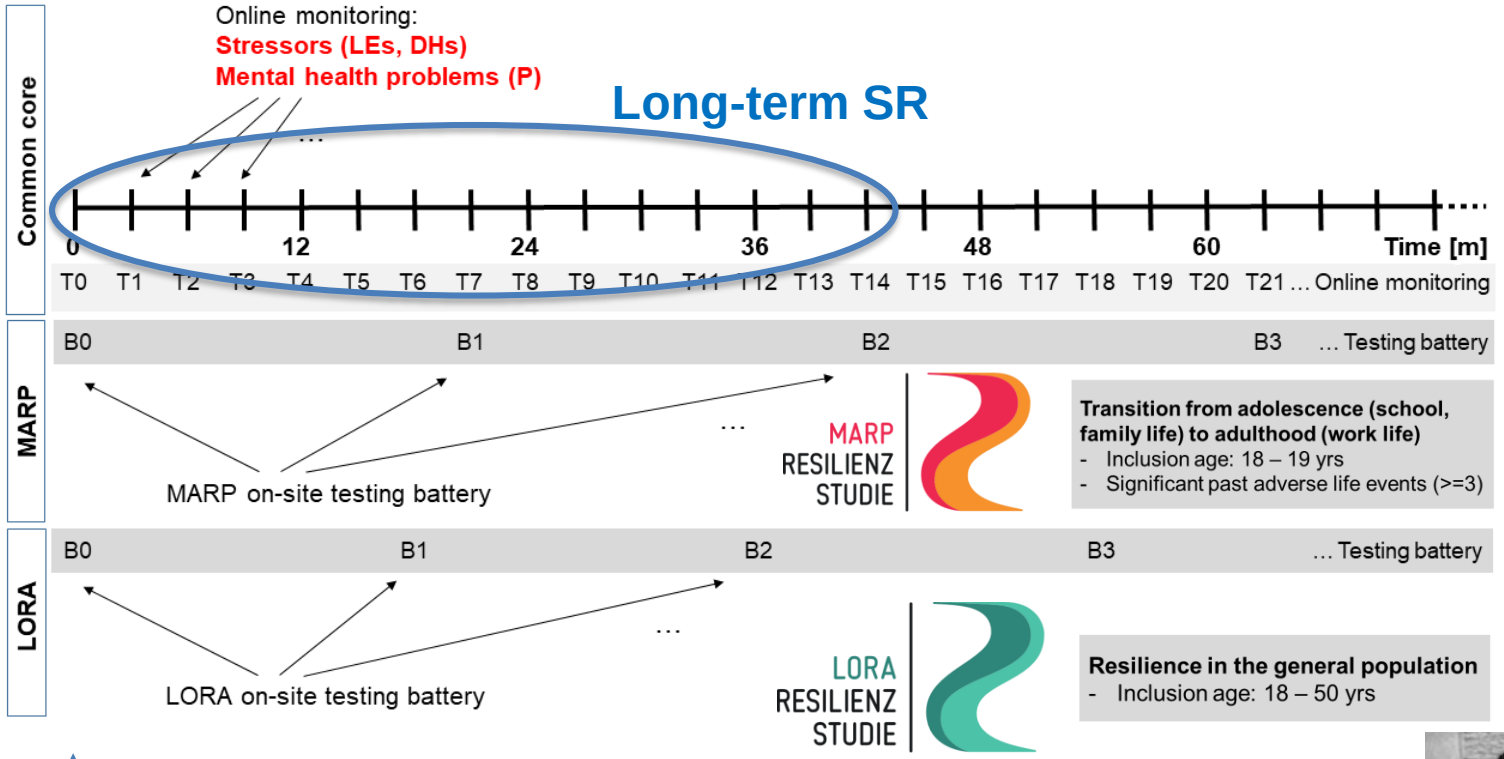
… under development

Positive Appraisal Style (PAS) Scale

Please think about how you usually act in difficult, uncertain, burdening, stressful or critical situations and what you usually feel and think. Please indicate if the statements below are valid never, sometimes, often or most of the times. There are no right or wrong answers. 1 = never, 2 = sometimes, 3 = often, 4 = almost always	
PASS-content_1	I think that every difficult situation will end eventually.
PASS-content_2	I think that I can deal successfully even with even the worst situation.
PASS-content_3	I think that even bad things have a meaning.
PASS-content_4	I think that you should not be rattled by small things.
PASS-content_5	I think that it is better to assume a good ending if you don't know what is coming.
PASS-content_6	I tend to see things rather optimistically.
PASS-content_7	I think that there is a solution for every problem.
PASS-content_8	I think that things will get better if you sit through them.
PASS-content_9	I think that life is wonderful after all.
PASS-content_10	I try to see things realistically, like they are.
PASS-content_11	I think that you shouldn't make mountains out of molehills.
PASS-content_12	For my goals and my ideals, I accept inconvenience.
PASS-content_13	I think that I somehow always manage to get what I need.
PASS-content_14	I think that things that initially seem bad often turn out well in the end.

Petri-Romão et al., *PLOS One* 2024

Resilience factor Positive Appraisal Style (PAS)



N=132
EV=19%

N=1034
EV=13%

Battery Variable PAS(B0)

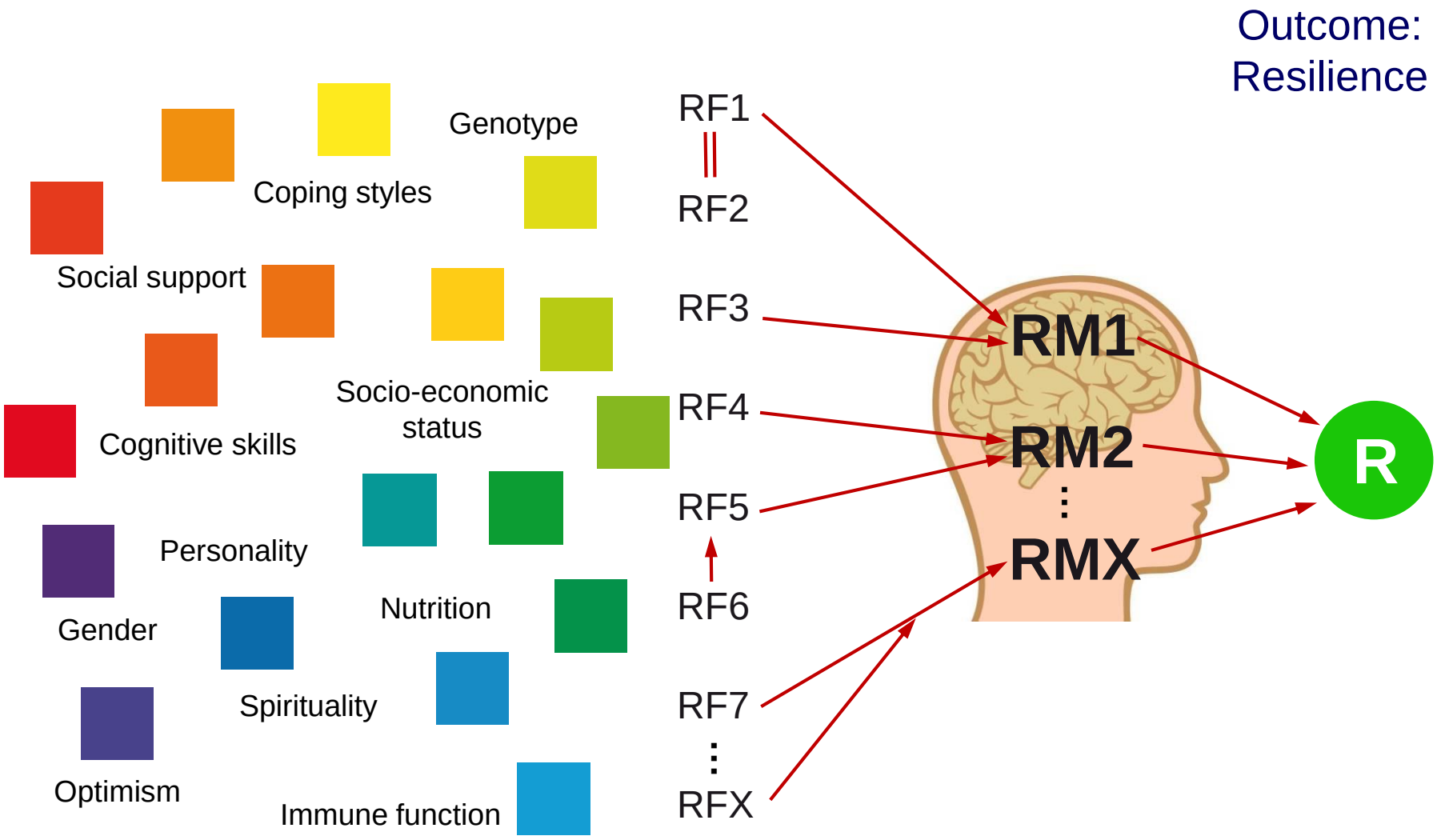
Mediations:

Social support → PAS → -SR

PAS → Good stress recovery → -SR

Petri-Romão et al., in prep.

From many resilience factors to a few mediating mechanisms



Towards a mechanistic theory

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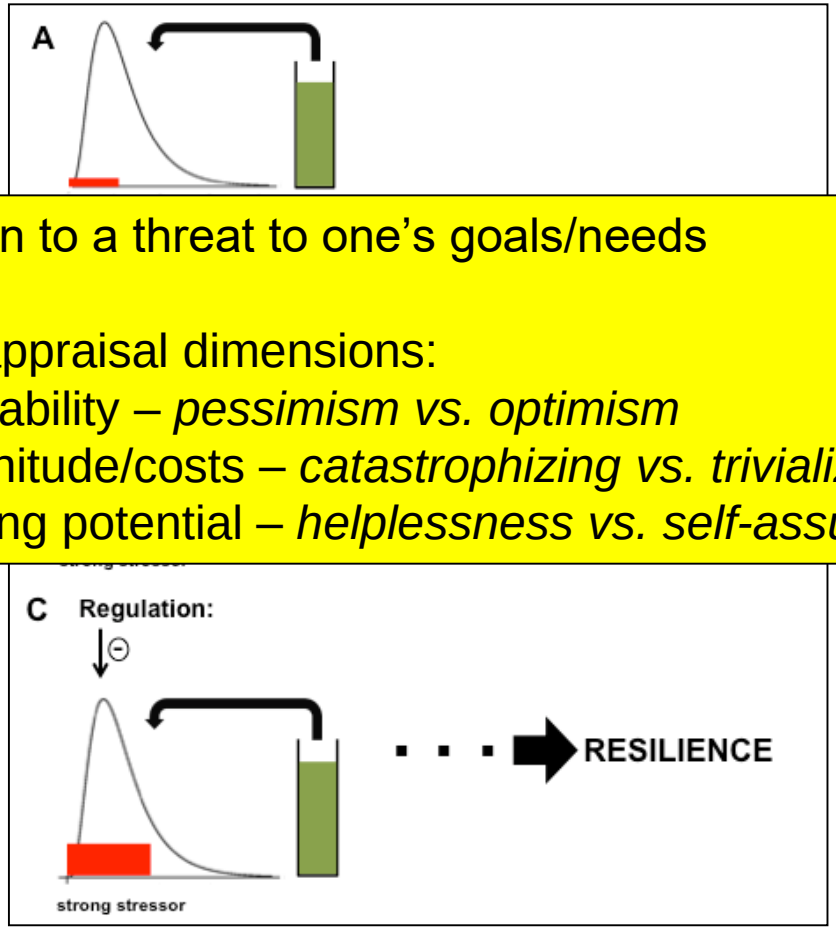

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- Coping potential – *helplessness vs. self-assurance*

Kalisch et al., *Behav Brain Sci* 2015

Resilience factor Positive Appraisal Style (PAS)

Association:
PAS → -SR

& Mediations:
Social support → PAS → -SR
PAS → Good stress recovery → -SR

Veer et al. *Translational Psychiatry* (2021)11:67
https://doi.org/10.1038/s41398-020-01150-4

Translational Psychiatry

ARTICLE Open Access

Psycho-social factors associated with mental resilience in the Corona lockdown

Ilya M. Veer[1], Antje Riepenhausen[1,2], Matthias Zerban[3], Carolin Wackerhagen[1], Lara M. C. Puhlmann[4,5], Haakon Engen[3,6], Göran Köber[7,8], Sophie A. Bögemann[9], Jeroen Weermeijer[10], Aleksandra Uścińko[11], Netali Mor[12,13], Marta A. Marciniak[14,15], Adrian Dahl Askelund[6], Abbas Al-Kamel[16], Sarah Ayash[4], Giulia Barsuola[17], Vaida Bartkute-Norkuniene[18], Simone Battaglia[19], Yaryna Bobko[20], Sven Bölte[21,22,23], Paolo Cardone[4], Edita Chvojková[24], Kaja Damnjanović[25], Joana De Calheiros Velozo[10], Lena de Thurah[10], Yacila I. Deza-Araujo[26,27], Annika Dimitrov[1], Kinga Farkas[28,29], Clémence Feller[30], Mary Gazea[31], Donya Gilan[4,32], Vedrana Gnjidić[33], Michal Hajduk[34,35,36], Anu P. Hiekkaranta[10], Live S. Hofgaard[37], Laura Ilen[30], Zuzana Kasanova[38], Mohsen Khanpour[39], Bobo Hi Po Lau[40], Dionne B. Le
Sofiia Muzych
Anna M. Rosi
Ana Teixeira[1]
Dorota Kobyl
Oliver Tüsche

JMIR MENTAL HEALTH Bögemann et al

Original Paper

Psychological Resilience Factors and Their Association With Weekly Stressor Reactivity During the COVID-19 Outbreak in Europe: Prospective Longitudinal Study

Sophie A Bögemann[1*], MSc; Lara M C Puhlmann[2,3*], PhD; Carolin Wackerhagen[4*], PhD; Matthias Zerban[5*], MSc; Antje Riepenhausen[4,6], PhD; Göran Köber[7,8], PhD; Kenneth S L Yuen[2,5], PhD; Shakoor Pooseh[8], PhD; Marta A Marciniak[9,10], PhD; Zala Reppmann[4], MSc; Aleksandra Uści ko[11], MSc; Jeroen Weermeijer[12], MSc; Dionne B Lenferink[1], MSc; Julian Mituniewicz[11], MSc; Natalia Robak[13], BSc; Nina C Donner[14], PhD; Merijn Mestdagh[15], PhD; Stijn Verdonck[15], PhD; Rolf van Dick[16], PhD; Birgit Kleim[9,10], PhD; Klaus Lieb[2,17], MD, PhD; Judith M C van Leeuwen[1], PhD; Dorota Kobylińska[11*], PhD; Inez Myin-Germeys[12*], PhD; Henrik Walter[4,6*], MD, PhD; Oliver Tüscher[2,17,18*], MD, PhD; Erno J Hermans[1*], PhD; Ilya M Veer[4,19*], PhD; Raffael Kalisch[2,5*], PhD

npj | parkinson's disease Article

Published in partnership with the Parkinson's Foundation

https://doi.org/10.1038/s41531-024-00692-4

Predictors of stress resilience in Parkinson's disease and associations with symptom progression

Anouk van der
Bastiaan R. Bl

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TYPE Original Research
PUBLISHED 18 December 2023
DOI 10.3389/fpsyg.2023.1272199

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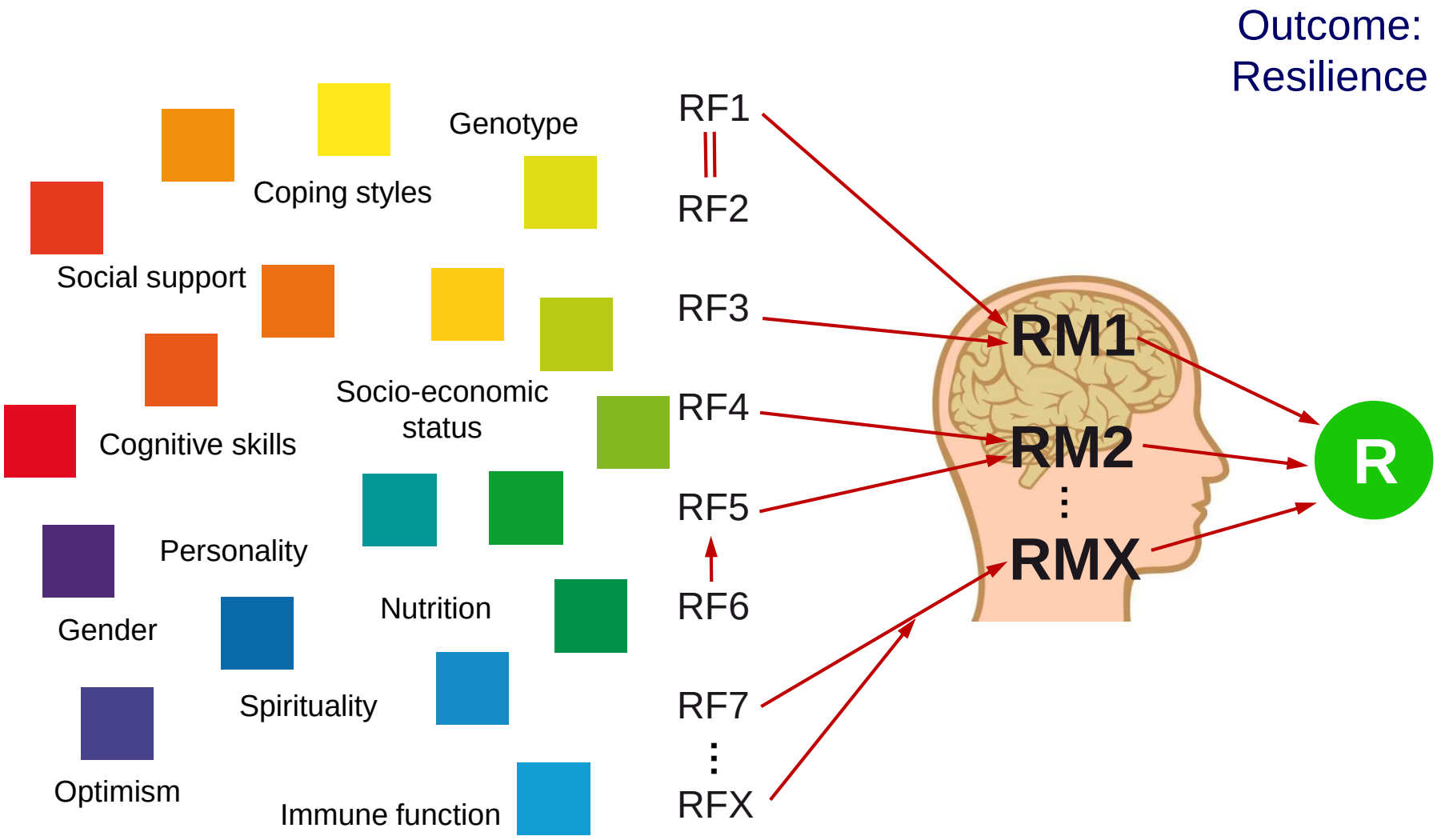
†These authors share first authorship

What helps the helpers? Resilience and risk factors for general and profession-specific mental health problems in psychotherapists during the COVID-19 pandemic

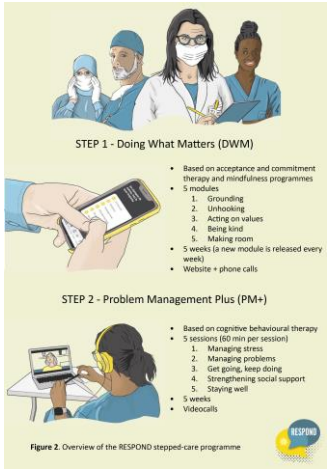
Matthias Zerban[1*†], Lara Marie Christine Puhlmann[2,3†], Dana Lassri[4,5], Peter Fonagy[4,6], P. Read Montague[7], Natalia Kiselnikova[8], Nicolas Lorenzini[4], Alex Desatnik[4,9], Raffael Kalisch[1,2] and Tobias Nolte[4,6]

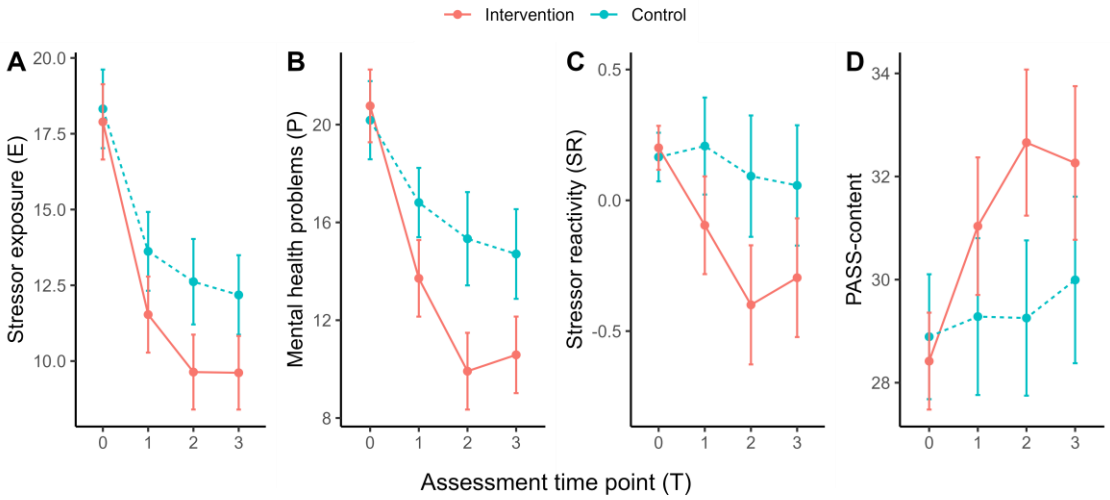
From many resilience factors to a few mediating mechanisms

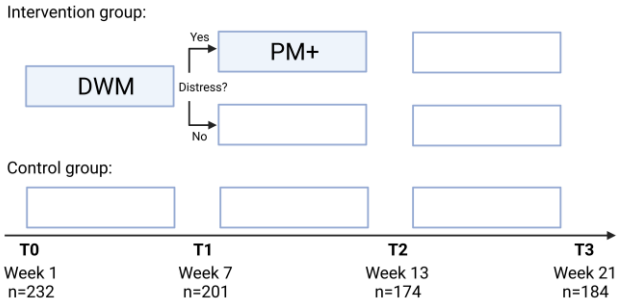


Resilience factor Positive Appraisal Style (PAS)

WHO Stress management training
(stepped care, peer support, digitalized)







Intervention → PAS (T2) → -SR (T3) (47%)

3 more RCTs ongoing

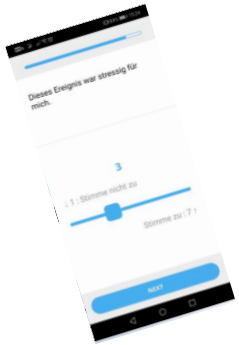
Spanish health care workers during COVID

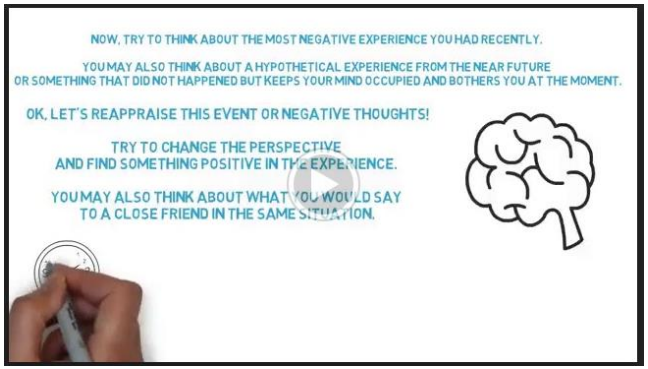
Petri-Romão et al., in prep.

Targeted enhancement of PAS

DynaMORE

Smartphone app to specifically train positive (re)appraisal





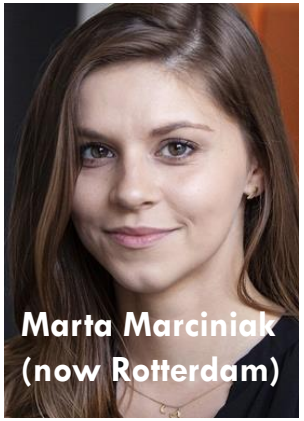
https://dynamore-project.eu/our-studies/reapp/
Marciniak et al., in prep.

Bögemann et al. BMC Psychology (2023) 11:245
https://doi.org/10.1186/s40359-023-01249-5
BMC Psychology
STUDY PROTOCOL
Open Access

Investigating two mobile just-in-time adaptive interventions to foster psychological resilience: research protocol of the DynaM-INT study

S. A. Bögemann[1*†], A. Riepenhausen[2,3†], L. M. C. Puhlmann[4,5†], S. Bar[6], E. J. C. Hermsen[1], J. Mituniewicz[7], Z. C. Reppmann[2], A. Uściłko[7], J. M. C. van Leeuwen[1], C. Wackerhagen[2], K. S. L. Yuen[4,8], M. Zerban[8], J. Weermeijer[9], M. A. Marciniak[10,11], N. Mor[6,12], A. van Kraaij[13], G. Köber[14,15], S. Pooseh[15], P. Koval[16], A. Arias-Vásquez[1], H. Binder[14,15], W. De Raedt[17], B. Kleim[10,11], I. Myin-Germeys[9], K. Roelofs[18,19], J. Timmer[15,20,21], O. Tüscher[4,22], T. Hendler[6,12,23,24†], D. Kobylińska[7†], I. M. Veer[25†], R. Kalisch[4,8†], E. J. Hermans[1†] and H. Walter[2,3†]

App → PAS?
App → PAS → -SR?



What is resilience?

How can we measure it?

Is resilience to chronic and everyday stressors different from resilience to major events?

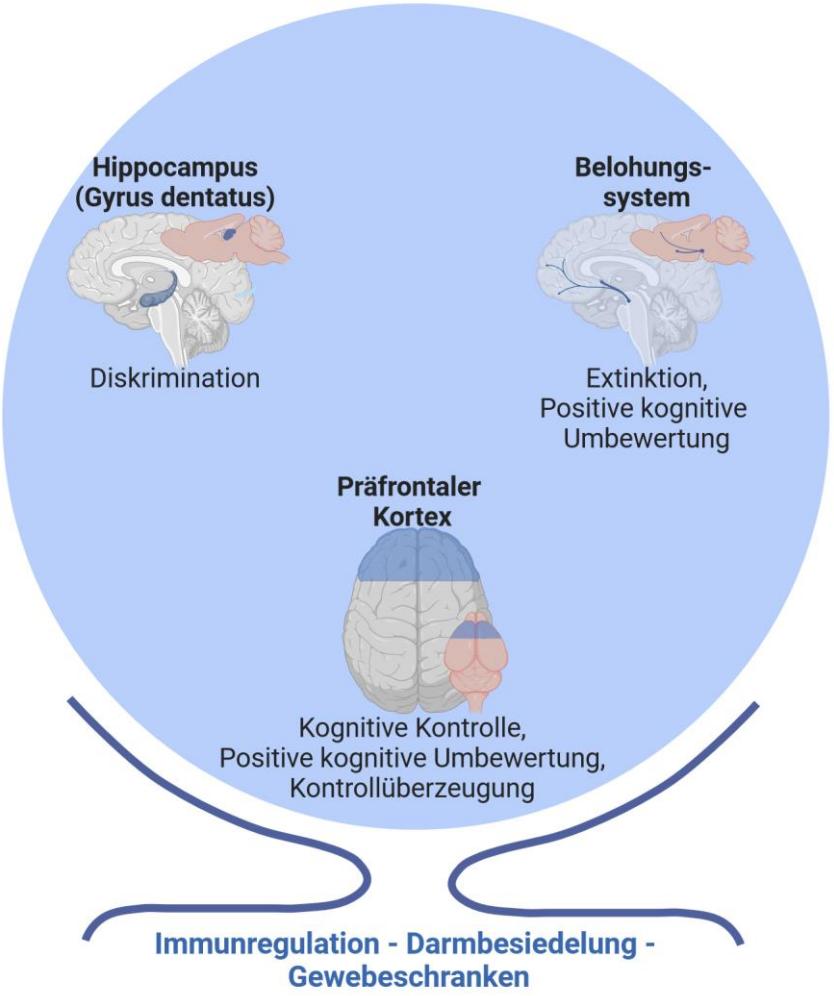
What do we know about psychological mechanisms?

What do we know about biological mechanisms?

What can we do in FAMILY?

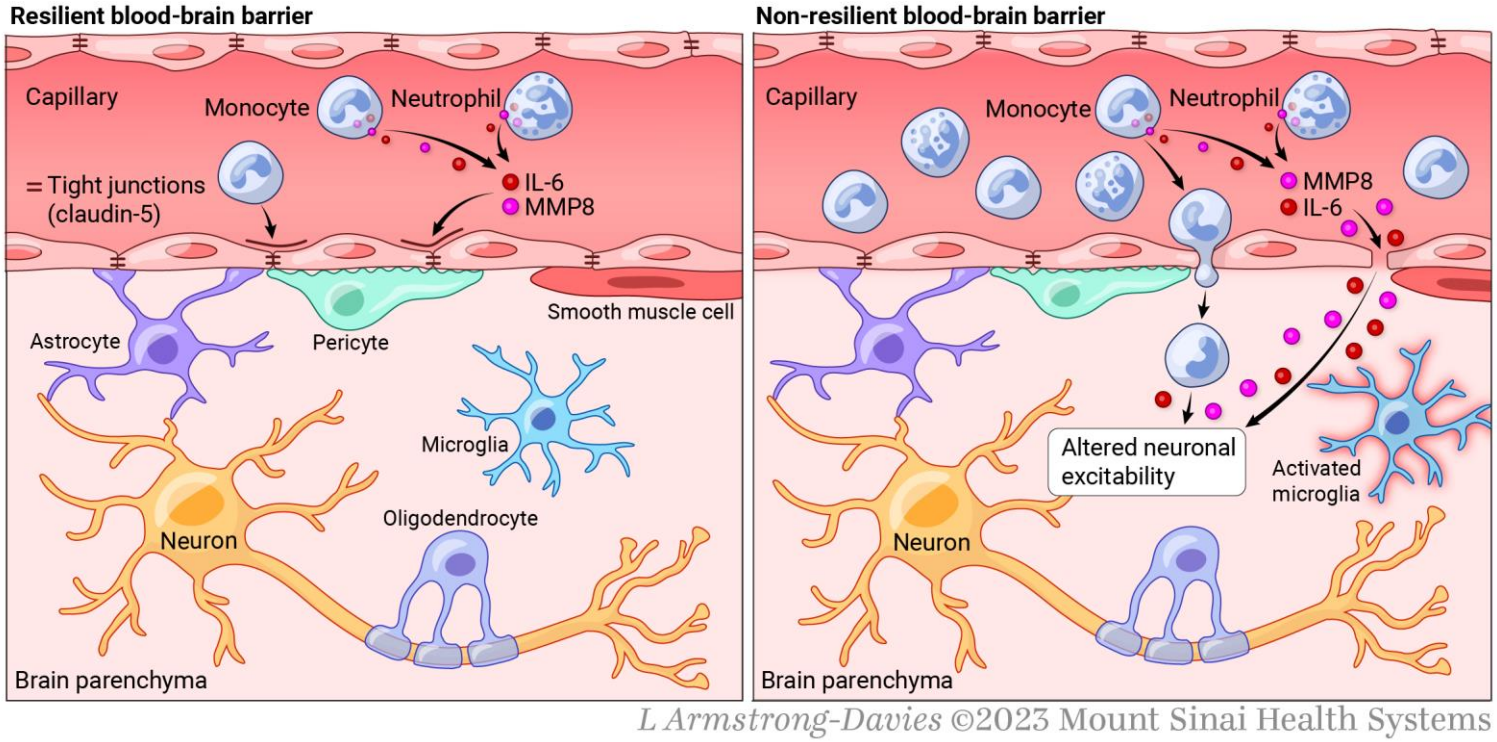
Why you should be in Mainz Sept 25-27?

Biological resilience factors: Brain



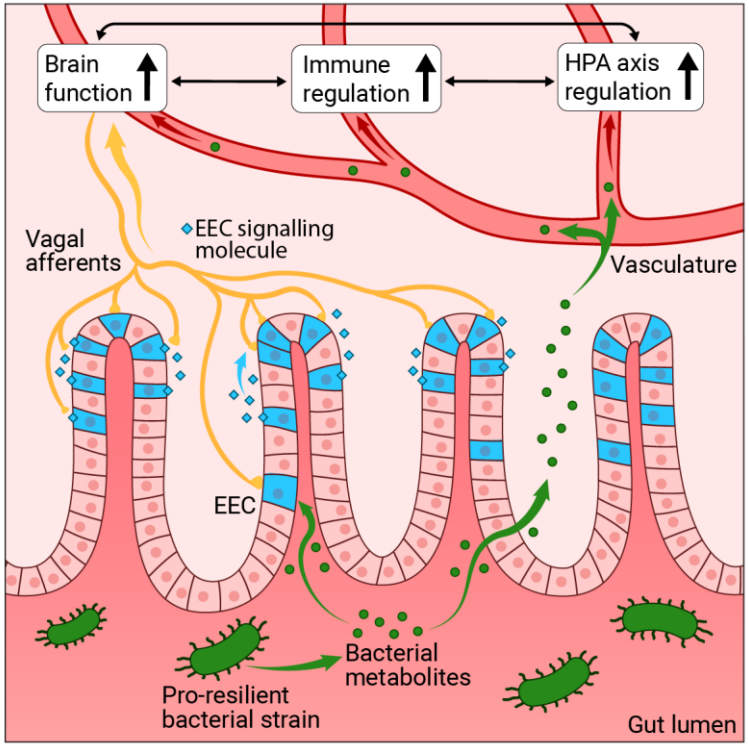
Kalisch et al., *Physiol Rev* 2024

Biological resilience factors: Body



Kalisch et al., *Physiol Rev* 2024

Biological resilience factorss: Body



L Armstrong-Davies ©2023 Mount Sinai Health Systems

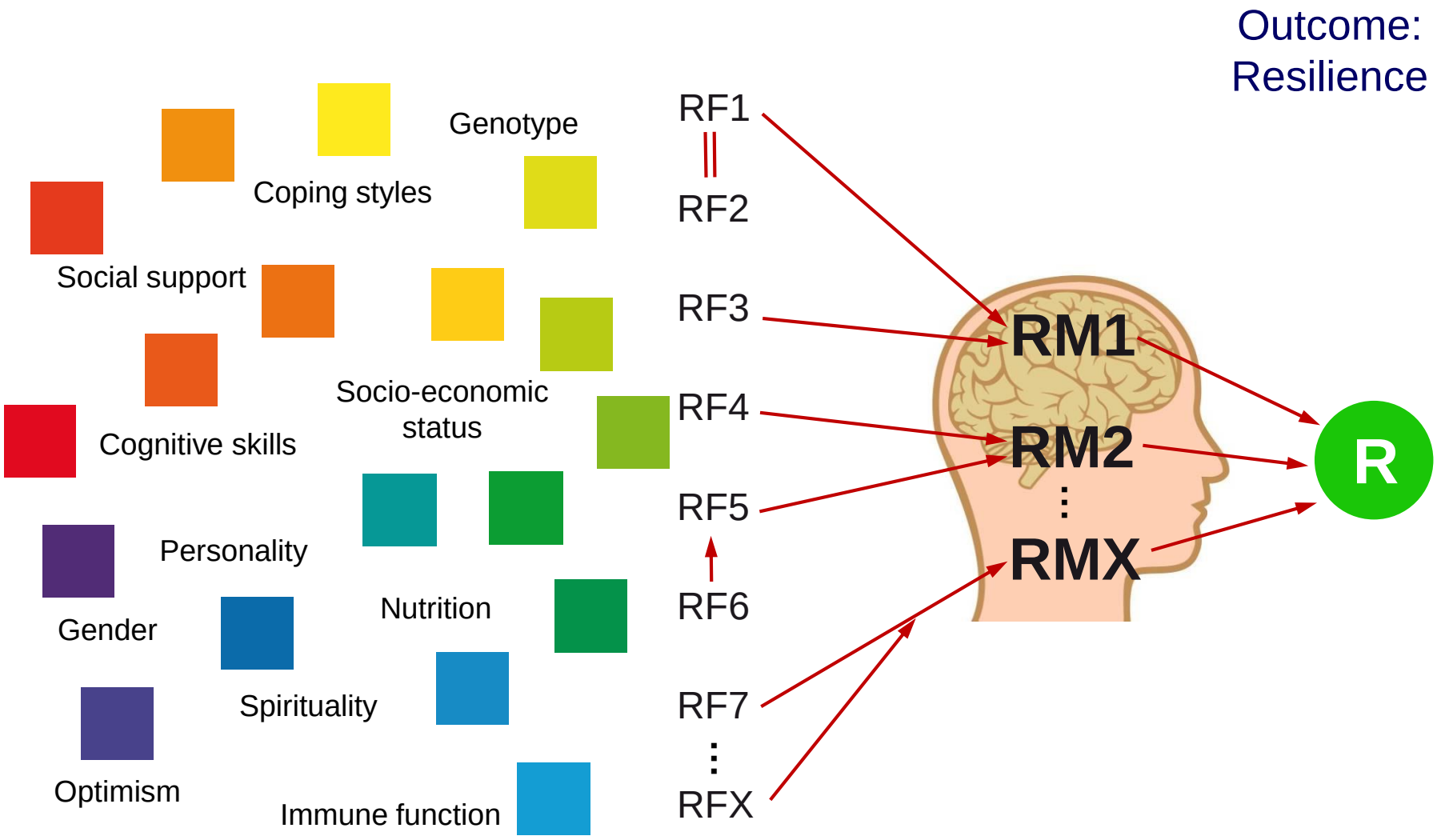
Kalisch et al., *Physiol Rev* 2024

Biological resilience factors: Genetics, epigenetics, miRNAs, …: ?

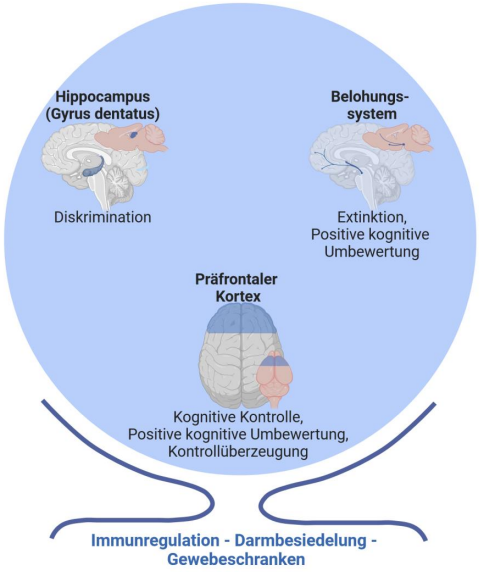
(some very early findings on proteome and microbiome)

Kalisch et al., *Physiol Rev* 2024

From many resilience factors to a few mediating mechanisms



Integration biology – psychology:



→ PAS → -SR?

Kalisch et al., *Physiol Rev* 2024

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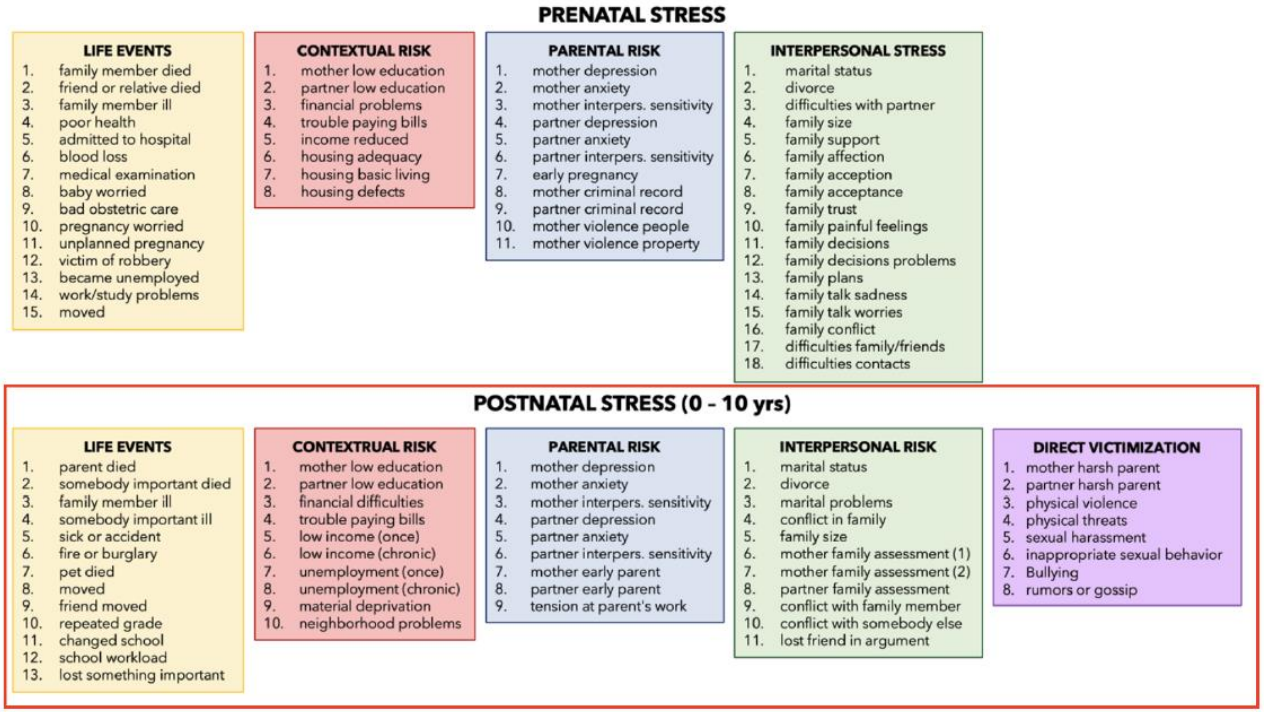
Resilience in FAMILY

GenR and ALSPAC Wiki (GitHub):
Cecil et al. (2014, ALSPAC), Rijlaarsdam et al. (2016, Gen R), Defina et al. (2024, ALSPAC+GenR)
Factor analysis:



- Pre- and postnatal sum scores correlated: continuity of risk
- Commonly explain variance in adolescent internalizing symptoms

Resilience in FAMILY

GenR and ALSPAC Wiki (GitHub):
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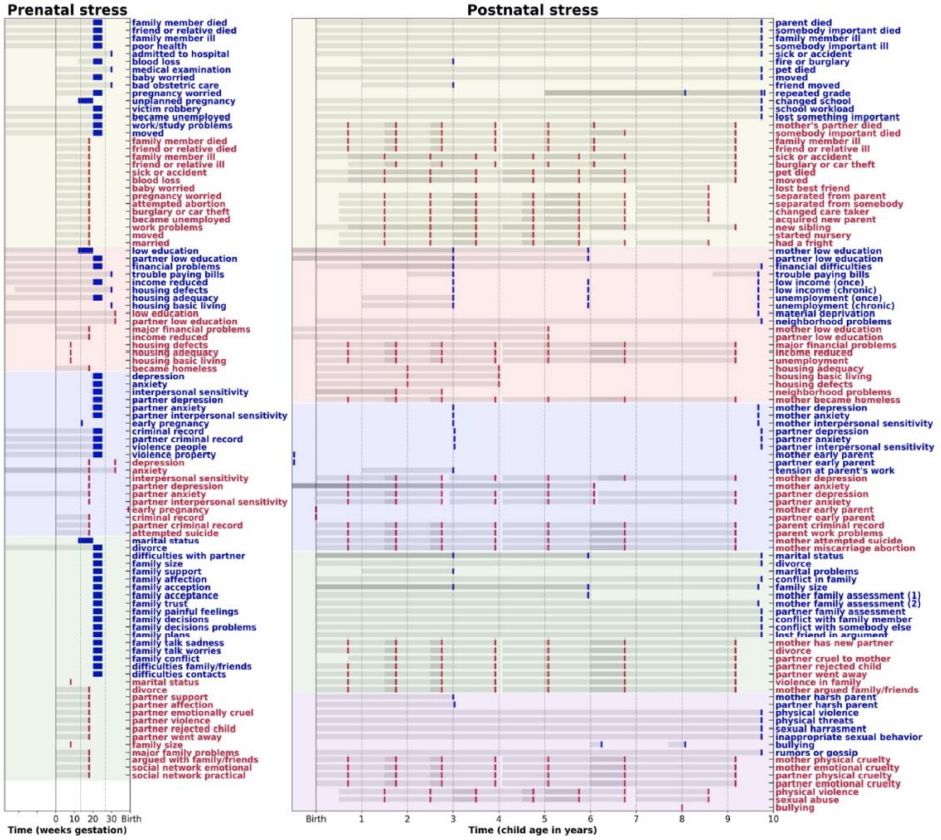

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Table S11 - Domain contribution analysis (internalizing and adiposity)

	Generation R					ALSPAC				
	Internalizing (R^2 = .12)					Internalizing (R^2 = .08)				
Effect	Estimate	SE	Statistic	Df	P	Estimate	SE	Statistic	Df	P
(Intercept)	-1.32	0.71	-1.85	262.3	.065	-2.81	1.37	-2.06	130.0	.042
Prenatal life events	0.54	0.18	2.99	473.7	.003	0.02	0.14	0.13	451.9	.897
Prenatal contextual risk	0.18	0.12	1.51	196.4	.132	0.02	0.10	0.19	567.5	.849
Prenatal parental risk	0.61	0.21	2.90	358.9	.004	0.58	0.13	4.63	146.8	<.001
Prenatal interpersonal risk	0.27	0.14	1.93	446.8	.055	0.04	0.15	0.26	285.8	.796
Postnatal life events	0.56	0.13	4.25	380.8	<.001	0.08	0.03	2.73	355.8	.007
Postnatal contextual risk	0.14	0.12	1.15	181.6	.250	0.09	0.04	2.27	279.4	.024
Postnatal parental risk	0.88	0.16	5.41	153.1	<.001	0.22	0.03	7.20	168.4	<.001
Postnatal interpersonal risk	0.67	0.15	4.56	334.0	<.001	0.00	0.03	-0.14	239.3	.892
Postnatal direct victimization	0.76	0.14	5.34	351.6	<.001	0.26	0.07	3.79	143.6	<.001
Female sex	0.13	0.03	3.76	436.3	<.001	0.23	0.02	9.65	431.0	<.001
Age	0.05	0.05	0.89	260.8	.373	0.16	0.10	1.60	132.1	.111
Ethnicity	0.12	0.04	2.85	579.8	.004	0.01	0.07	0.10	254.6	.923
Maternal BMI	0.01	0.00	2.23	211.2	.027	0.01	0.00	2.01	389.3	.045
Maternal smoking	-0.06	0.02	-2.56	335.1	.011	0.00	0.02	0.22	277.8	.823
Maternal alcohol c.	-0.01	0.02	-0.67	447.4	.501	-0.07	0.02	-3.90	402.9	<.001

- Pre- and postnatal sum scores correlated: continuity of risk
- Commonly explain variance in adolescent internalizing symptoms

Resilience in FAMILY

Outcome:

1. **In GenR & ALSPAC: Can we isolate a transgenerational psychosocial stressor/risk component? (parental pre- and post-natal exposure?)**
2. **Can we residualize adult mental health problems (int, ext) on this factor (tgSR)?**
3. **IF NOT: use general SR only within participants with familial high risk**

Predictor:

1. **Can we establish a parental psychosocial resilience factor (tgRF; e.g., parental warmth): parRF → - tgSR**
2. **IF NOT: test offspring psychosocial RF (early childhood): offRF → -tgSR**

Biology:

a) parBIOL → - tgSR

b) parBIOL → parRF → - tgSR

c) offBIOL → - tgSR*

d) parRF → offBIOL → - tgSR

PAS: Can we get it some adult offspring?

parRF → offBIOL → PAS → - tgSR

*some hypotheses (e.g., rsfMRI from current adult work)

Resilience in FAMILY

Side notes:

Resilience to single major life events (SR trajectories)

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#resilience2024

10th International Symposium on Resilience Research

September 25-27, Mainz, Germany

& Satellite Methods Workshop, Sept 24
& ECS formats

lir-mainz.de/symposium-2024
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Thank you!