Digitale Gesundheitsanwendungen zur Gesundheitsförderung in der Rehabilitation

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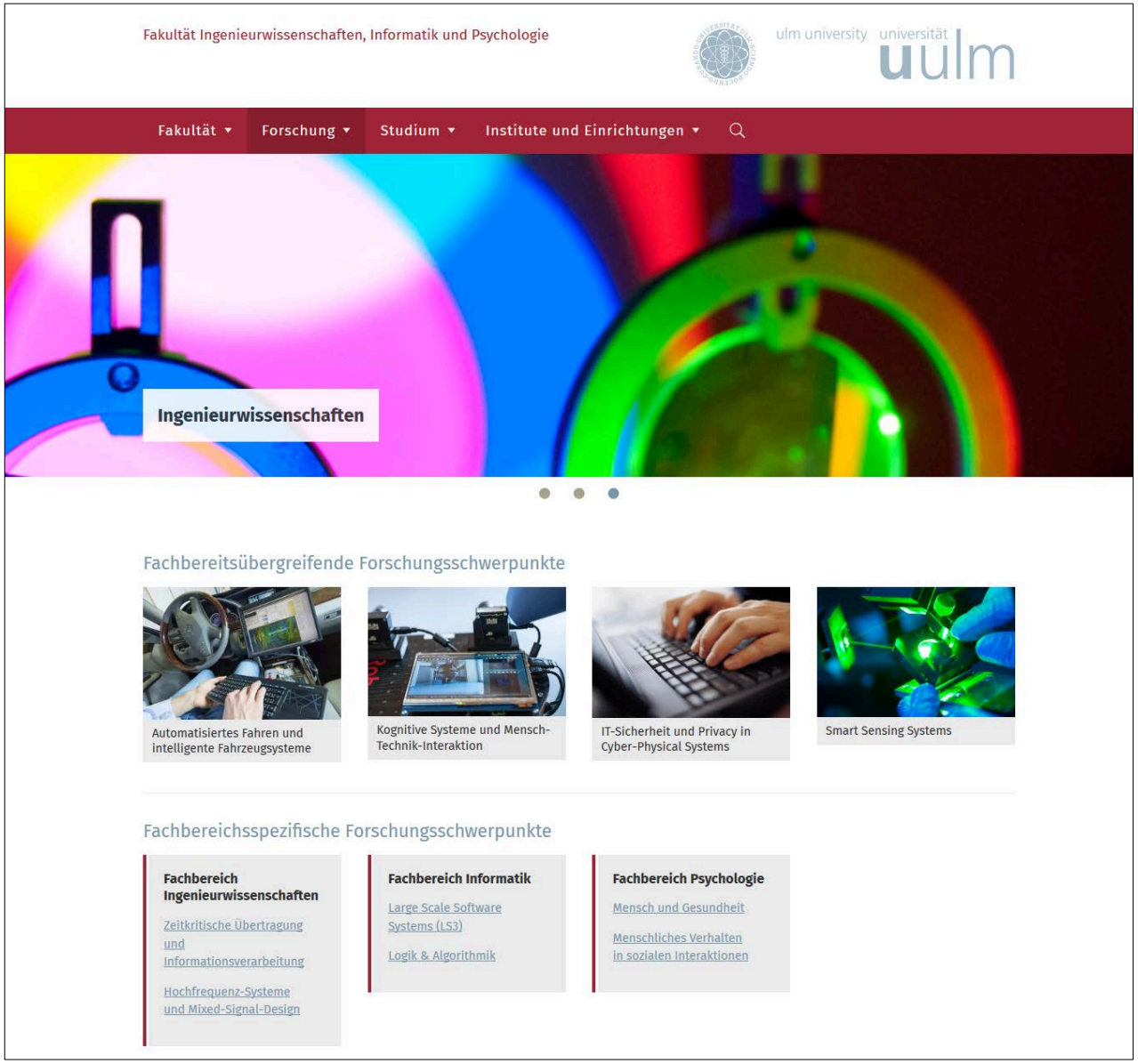
Abteilung für Klinische Psychologie und Psychotherapie

11. Fachtagung des ZePG

17. / 18. Juni 2021

Fakultät Ingenieurwissenschaften, Informatik und Psychologie



Interessenkonf ikt: Gremien, Beratung etc.

Unbezahlte und bezahlte Aktivitäten:

- Vorträge, Workshops, Symposien etc.
- Sprecher der Interessensgruppen „E-Health in der Klinischen Psychologie und Psychotherapie“ (DGPs), „Internet-based interventions in chronic medical conditions” (ISRII), Arbeitsgruppe E-Mental- und E-Behavioral-Health in der Rehabilitation (DGRW)
- Mitglied der Digitalen Agenda der BPtK, Mitglied E-/M-Health Arbeitsgruppe DNVF
- Vereinzelt Beratungsfunktionen für verschiedene Krankenkassen, Klinikkonzerne, öffentliche Institutionen etc.
- Projektleitung verschiedener E-Health-Drittmittelprojekte
- Autor verschiedener Beiträge, die u.a. in diesem Vortrag zitiert werden

Auswahl laufende e-Health Projekte

- StudiCare
- Mit uns im Gleichgewicht
- COACH
- RehaCAT
- PSYCHOnlineTHERAPIE
- IMI in the medically Ill
- Chatbot, Big Data and Machine-Learning
- GetSleep
- Child Health: CHIMPSnet, MeinKompass, ProTransition
- E/M-Health Plattformen
- Mechanisms of Change - IMIs

AWARE-App

Bundesministerium für Bildung und Forschung
DFG Deutsche Forschungsgemeinschaft
Sozialversicherung für Landwirtschaft, Forsten und Gartenbau
BARMER
Deutsche Rentenversicherung Bund
Gemeinsamer Bundesausschuss Innovationsausschuss

Relevanz des Themas

Medizinische Rehabilitation: „Change we need“

Raspe, Rehabilitation 2009

WIRKSAMKEIT

- Problem-, ziel- und prognoseorientierte Def nition von Rehabedarf
- Flexibilisierung der Rehaform, Individualisierung und Intensivierung der Rehaleistungen
- Behandlung und Befähigung
- Ausarbeitung von systematischen Nachsorgeprogrammen

RESSOURCEN

WIRKSAMKEIT INTERNET-BASIERTER INTERVENTIONEN

BEHAVIORAL AND MENTAL HEALTH 4.0

Anwenderfreundlichkeit

Internet- und Mobile-basierte Diagnostik

Internet- und Mobile-basierte Interventionen

Skalierbarkeit

Computer-adaptives Testen (CAT)

Akzeptanz

Ambulatory Assessment

Dissemination und Implementation

Wirksamkeit

„Smart“-Interventions

Ambulatory Intervention

Blended-Therapy

Gesundheitsökonomie

Wirkfaktoren

Stand der Forschung zu IMIs in der medizinischen Rehabilitation

Abb. 1: Modularisiertes Nachsorgekonzept

boRN - Gruppentraining

UNIVERSITÄTSmedizin. MAINZ

online-nachsorge.de
Gesundheitstraining Stressbewältigung am Arbeitsplatz

VIADUKT

(W-RENA)

- Wöchentliches Web-Entwicklungstagebuch
- Rückmeldungen durch den Therapeuten
- Virtuelles soziales Netz

Webbasierte Nachsorge

UNIVERSITÄT ZU LÜBECK

liveonline coaching
gesundheit & psychologie

IMI-Beiträge im Rahmen der Reha-Kolloquien 2008-2016 (Auswahl)

	Technische Umsetzung				Bereiche		Anwendungsgebiet			
Autoren/Jahr	Web-basiert	E-Mail, Chat, Video	Forum	Mobile	Psych. Störung	Lebens-stil	Prä-vention	Einlei-tung	Behand-lung	Nach-sorge
Arens et al. 2014, 2013		X			X					X
Baumeister et al. 2015, 2017	X				X					X
Bebenek et al, 2013	X					X	X			
Bischoff et al., 2014, 2013				X	X					X
Ebert et al, 2012, 2011, 2009	X				X					X
Gerzymisch et al. 2013a,b		X				X				X
Golkaramnay et al., 2010, 2009, 2008		X			X					X
Golla et al. 2013		X		X		X				X
Linden & Ubben, 2011			X		X					X
Pfaudler et al., 2014, 2013, 2012, 2011			X			X				X
Reiser et al. 2013, 2012	X				X					X
Richter et al., 2012				X		X				X
Stamm-Balderjahn et al, 2015, 2014	X					X				X
Schaller et al., 2015	X					X				X
Storm et al., 2016	X					X				X
Tallner, et al., 2013, 2012, 2011	X					X				X
Theissing et al. 2013, 2012		X				X				X
Zwerenz et al., 2017, 2016, 2015, 2014	X				X					X

Internet- und Mobile-basierte Interventionen (IMI)

Theoriebasierung
theoriefrei -- theoriebasiert

Technik
Web-Seiten
Email, SMS
Videokonferenz
Virtual Reality
Forum, Chat

IMI

Inhalt zielt auf
Psychoedukation

Veränderung

Menschlicher Kontakt
Selbsthilfe -- geringer Support -- hoher Support -- analog face-to-face
Therapeut, Arzt, Berater, Coach, Peer-Support

Lin et al., Rehabilitation 2013; Bendig et al. DÄB Internation 2018; Ebert et al. European Psychol 2018

Internet- und Mobile-basierte Intervention

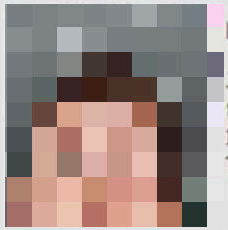
ACTonPain

	Lektion 1: Einführung in das Schmerztraining • Aufbau und Ablauf des Trainings • akute und chronische Schmerzen	Achtsamkeitsübungen
	Lektion 2: Kontrolle und Akzeptanz • Primäres und sekundäres Leiden • Lang- und kurzfristige Problemlösung	
	Lektion 3: Gedanken und Gefühle • Negative Gedanken und Gefühle • Defusion	
	Lektion 4: Ich und mein Selbstbild • Das Selbstbild • Selbst im Kontext	
	Lektion 5: Was ich im Leben wertschätze • Die Bedeutung von Werten • Der Wertekompass	
	Lektion 6: Engagiertes Handeln • Die ACT-Formel • Hindernisse	
	Lektion 7: Der Weg nach vorn • Rückschau auf die letzten Lektionen • An den Werten dranbleiben	

Lin et al. Deutsches Ärzteblatt International 2017

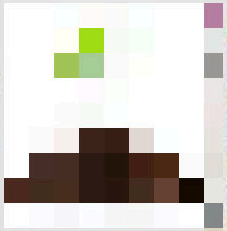
Internet- und Mobile-basierte Intervention

eSano
online-trainings



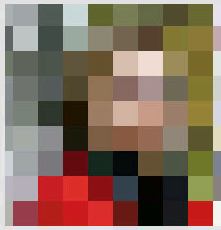
Informationen

Jede Lektion erhält für Sie Informationen zum Thema



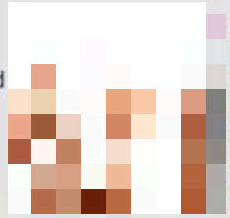
Übungen

Sie werden mithilfe verschiedener Übungen Ihre eigene Situation betrachten und die vorgestellten Techniken im Alltag einsetzen. So werden Sie selbst aktiv.



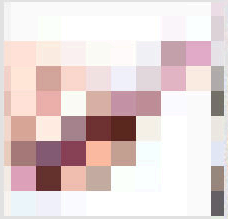
Beispielpatienten

Sophia, Markus und Maria werden Ihnen über ihre Erfahrungen berichten und Sie durch das Training begleiten. Wahrscheinlich können Sie sich in ihren Berichten mal mehr mal weniger wiedererkennen.



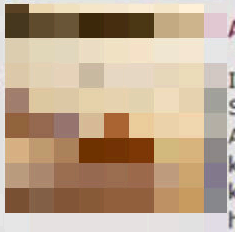
Feedback

Im Verlauf des Programmes werden Sie nach jeder Lektion von einem Online-Coach innerhalb von zwei Werktagen Feedback zu Ihren Übungen erhalten. Das Feedback ist nur für Sie persönlich bestimmt und nur von Ihnen einsehbar.



SMS-Coach

Sie können mithilfe des SMS-Coach bestimmte Übungen und Aufgaben durch SMS-Anleitungen immer wieder ausführen.



Achtsamkeitsübungen

In jeder Lektion werden Sie eine Achtsamkeitsübung kennenlernen. Diese können Ihnen dabei helfen, schwierige Situationen leichter zu akzeptieren.

Baumeister et al. Psychother Psychosom 2021

eSano IT-Platform

A. Software Architecture

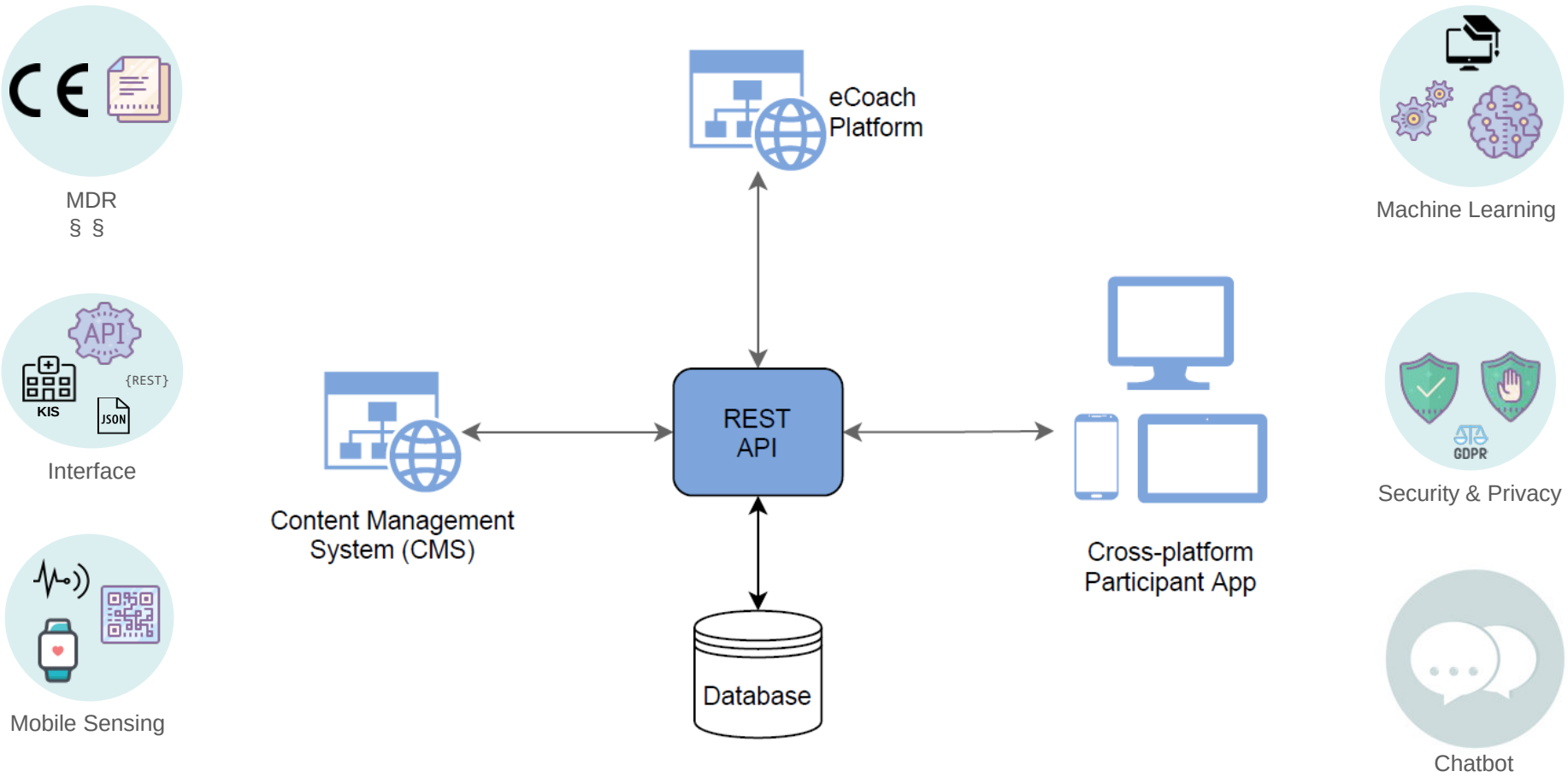


Fig. 1. Architecture of the eSano eHealth platform

Kraft et al. Submitted; https://esano.klips-ulm.de

Evidenzbasierung: Metaanalysen zu IMI

Zielpopulation	SMD	[95% KI]	N
Depressive Störungen[1]	0.90	[0.73-1.07]	10
Panikstörungen[2]	0.25-2.61		9
Agoraphobie[2]	1.15	[0.74-1.56]	6
Soziale Phobie[3]	1.38	[1.13-1.63]	8
Generalisierte Angst[3]	0.80	[0.42-1.19]	8
PTBS-Symptomatik[4]	0.71	[0.49-0.93]	10
Essstörungssymptomatik[5]	0.97	[0.63-1.30]	5
Schlafstörungssymptomatik[6]	1.09	[0.74-1.45]	8
Alkoholmissbrauch[7]	0.20	[0.13-0.27]	16
Zwangsstörungssymptomatik[8]	0.51	[0.41-0.61]	18
KiJu-Depression[9]	0.76	[0.41-1.12]	4
KiJu-Angst[9]	0.68	[0.45-0.92]	7
Schmerz[10]	0.40	[0.31-0.50]	19
Alkohol[11]	0.39	[0.23-0.57]	7
Rauchen[12]	0.14	[1.13-1.72]	9
Körperliche Aktivität[13]	0.14-0.37		34
Gewicht[14]	MD: 0.49kg	[0.95,0.03]	5

aus Baumeister et al., Enzyklopädie der Medizinischen Psychologie 2017; Paganini et al. Neurotransmitter 2016; Geirhos et al. InFo Neuro Psychiatrie 2019

1 Königbauer et al., 2017; 2. Domhardt et al., 2020; 3. Olthuis et al. 2015; 4. Sijbrandij et al., 2016; 5. Cheng et al., 2012; 6. Zachariae et al., 2015; 7. Riper et al., 2014; 8. Caitlin et al., 2018; 9. Ebert et al., 2015; 10. Macea et al., 2010; 11. Riper et al., 2011; 12. Rooke et al., 2010; 13. Buhrman et al., 2016; 14. Grunenberg et al., 2013

Evidenzbasierung: Internet vs. face-to-face (f2f)

Internet = f2f d = 0.05 [-0.09; 0.20]

Study	Weight	Std. Mean Difference IV, Random, 95% CI
Andersson et al. (2013)	5.3%	-0.39 [-0.87, 0.09]
Andersson et al. (2009)	3.0%	0.43 [-0.30, 1.15]
Andersson et al. (2013)	2.6%	0.62 [-0.17, 1.42]
Andrews et al. (2011)	3.4%	0.06 [-0.61, 0.72]
Bergström et al. (2010)	6.9%	0.00 [-0.37, 0.37]
Blom et al. (2015)	4.2%	0.25 [-0.32, 0.82]
Botella et al. (2010)	6.2%	0.03 [-0.38, 0.44]
Carlbring et al. (2005)	4.3%	0.05 [-0.51, 0.61]
Gollings et al. (2006)	3.7%	-0.26 [-0.88, 0.36]
Hedman et al. (2011)	7.1%	-0.40 [-0.75, -0.05]
Jasper et al. (2014)	5.9%	-0.13 [-0.55, 0.30]
Kaldo et al. (2008)	4.4%	-0.04 [-0.58, 0.51]
Kiropoulus et al. (2008)	6.0%	0.12 [-0.30, 0.54]
Lancee et al. (2016)	4.4%	1.16 [-0.61, 1.71]
Lappainen et al. (2014)	3.6%	0.16 [-0.48, 0.79]
Paxton et al. (2007)	5.7%	0.31 [-0.13, 0.76]
Schover et al. (2012)	5.8%	-0.14 [-0.58, 0.29]
Spek et al. (2007)	8.6%	0.07 [-0.21, 0.34]
Vallejo et al. (2015)	3.8%	-0.06 [-0.68, 0.56]
Wagner et al. (2014)	5.0%	0.01 [-0.49, 0.51]
Total (95% CI)	**100.0%**	**0.05 [-0.09, 0.20]**

Heterogeneity: Tau² = 0.04; Chi² = 32.91, df = 19 (P = 0.02); I² = 42%
Test for overall effect: Z = 0.75 (P = 0.45)

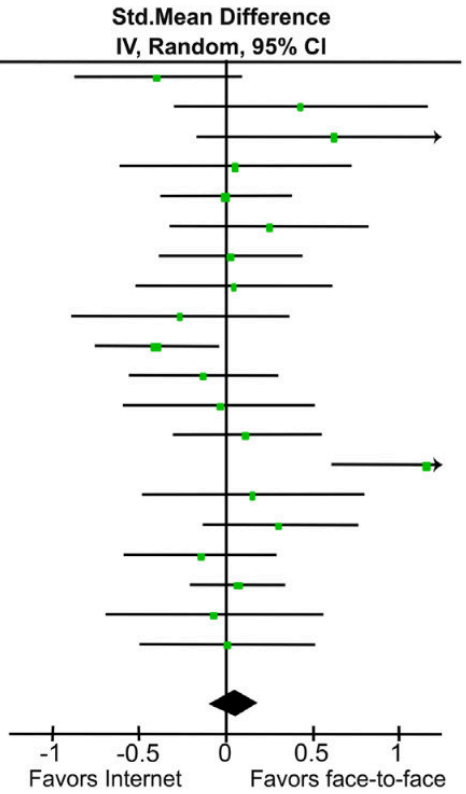


Figure 2. Forest plot displaying effect sizes of studies comparing internet-based treatment with face-to-face treatment.

Carlbring et al. Cognitive Behaviour Therapy 2018

Differentielle Indikationsstellung: Prädiktoren und Moderatoren

Für wen wirkt eine IMI wann und wie am Besten?

Psychologische Inf exibilität moderiert die Wirksamkeit

ACTonPain

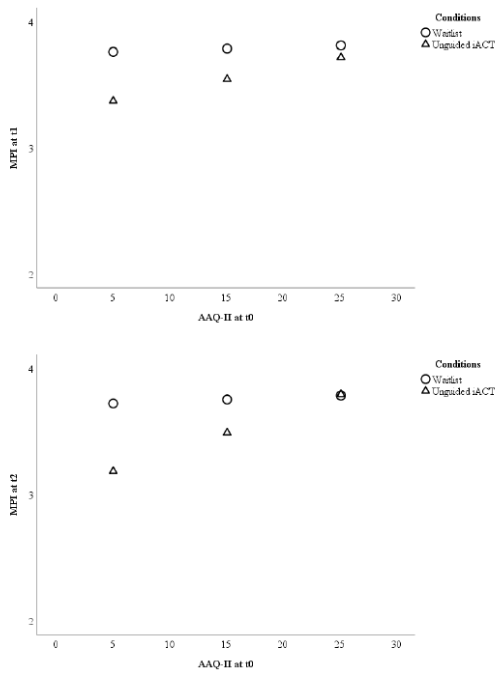


Figure 2. Visualizations of the results testing baseline psychological inflexibility as a moderator of the treatment outcome pain interference between waitlist and unguided Internet-based ACT. The outcome (*Y*-axis) is displayed for three different levels (sample mean ± 1 standard deviation) of psychological inflexibility (*X*-axis). Note: AAQ-II = Acceptance and Action Questionnaire; iACT = Internet-based Acceptance and Commitment Therapy; MPI = Pain interference scale of the Multidimensional Pain Inventory; t0 = baseline; t1 = 9-weeks after randomization; t2 = 6-months after randomization.

J. Clin. Med. **2019**, *8*, 24 5 of 10

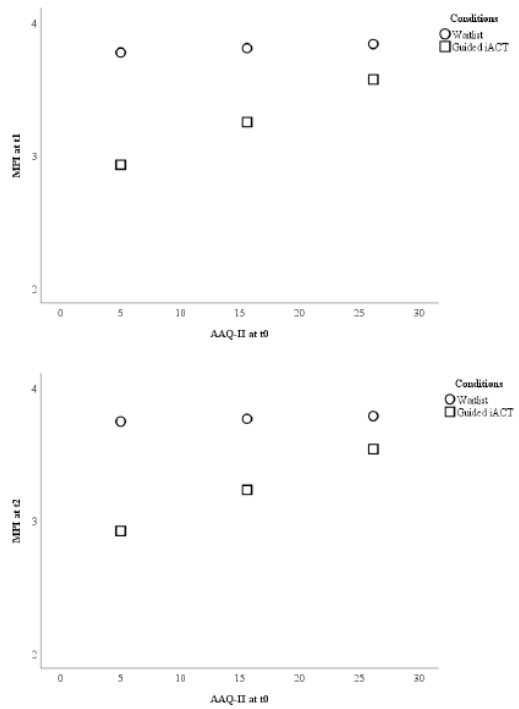


Figure 1. Visualizations of the results testing baseline psychological inflexibility as a moderator of the treatment outcome pain interference between waitlist and guided Internet-based ACT. The outcome (*Y*-axis) is displayed for three different levels (sample mean ± 1 standard deviation) of psychological inflexibility (*X*-axis). Note: AAQ-II = Acceptance and Action Questionnaire; iACT = Internet-based Acceptance and Commitment Therapy; MPI = Pain interference scale of the Multidimensional Pain Inventory; t0 = baseline; t1 = 9-weeks after randomization; t2 = 6-months after randomization.

Journal of *Clinical Medicine* MDPI

Article

Baseline Psychological Inflexibility Moderates the Outcome Pain Interference in a Randomized Controlled Trial on Internet-based Acceptance and Commitment Therapy for Chronic Pain

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Abstract: This study re-investigated data of a randomized controlled trial on Internet-based Acceptance and Commitment Therapy for chronic pain (ACTonPain). Baseline psychological inflexibility was examined as a moderator of the outcome pain interference. In the ACTonPain trial, participants with chronic pain were randomized to one of three conditions: guided Internet-based ACT (n = 100), unguided Internet-based ACT (n = 101), and waitlist (n = 101). Moderation analyses were performed with the SPSS macro PROCESS. Pain interference according to the Multidimensional Pain Inventory (MPI) was the primary outcome in this trial, and the potential moderator psychological inflexibility was measured with the Acceptance and Action Questionnaire (AAQ-II). Psychological inflexibility at baseline moderated the outcome between guided Internet-based ACT and waitlist 9-weeks as well as 6-months after randomization. (both $p < 0.05$). Between unguided Internet-based ACT and waitlist, psychological inflexibility moderated the outcome 6-months after randomization ($p < 0.05$). Internet-based ACT was superior to waitlist for participants with less psychological inflexibility at baseline, but Internet-based ACT became increasingly comparable to waitlist at higher AAQ-II baseline values. Future research should investigate whether the results can be replicated in more individualized and tailored face-to-face settings.

Keywords: acceptance and commitment therapy; psychological inflexibility; chronic pain

1. Introduction

Chronic pain (CP) is a disorder with a pooled prevalence rate of 31% [1] and it is constantly one of the top causes of years lived with disability [2]. Numerous psychological variables appear to contribute to the process of how pain leads to disability, including self-efficacy, emotional distress, and fear [3]. Psychological therapies have been shown to be effective to improve anxiety, depression, catastrophic thinking, disability, and sometimes also pain [4].

A psychotherapy increasingly gaining interest in the treatment of CP is Acceptance and Commitment Therapy (ACT), a contextual form of Cognitive and Behavioral Therapy (CBT). In ACT, psychological flexibility and its opposite psychological inflexibility are central concepts [5]. The six

Probst et al., J Clin Med 2019

Moderatoren von IMI in unterschwelliger Depression Ergebnisse einer IPD-MA

Table 4. Results from separate multilevel regression analyses on the effects of putative moderators on differential change in depression severity from baseline to posttreatment assessment

Baseline variable	Interaction: baseline variable × treatment condition					
	estimate	SE	*t* value	*p* (<|t|)	τ^2_0	τ^2_1
Age	−0.066	0.033	−2.002	0.045	2.812	1.972
Gender	−0.799	0.784	−1.02	0.308	2.568	1.998
Relationship	−0.549	0.707	−0.776	0.438	2.506	2.281
Employment	0.105	0.903	0.116	0.908	2.612	2.256
Previous psychotherapy	0.816	0.960	0.849	0.396	2.671	2.365
Depression medication	0.594	0.090	0.600	0.548	2.671	2.312
Comorbidities	−0.816	0.846	−0.965	0.335	2.825	1.904
Chronic medical conditions	−0.306	1.392	−0.22	0.826	2.639	2.197
Comorbid anxiety	−0.950	0.905	−1.049	0.295	2.996	2.086
Initial symptom severity	−0.182	0.069	−2.641	0.008	2.197	1.391
Format	−1.797	0.944	−1.905	0.057	2.655	0.786
Number of sessions	−0.001	0.256	−0.007	0.994	2.580	2.443
Education	−0.566	0.605	−0.936	0.350	2.597	2.621

All analyses were controlled for initial depressive symptom severity. SE, standard error; τ^2_0, intercept variance; τ^2_1, slope variance; gender (0 = male, 1 = female, 2 = other); relationship (0 = single/divorced/separated/widowed, 1 = married/in a relationship); employment (0 = no, 1 = yes); previous psychotherapy (0 = no, 1 = yes); depression medication (0 = no, 1 = yes), comorbidities (0 = no, 1 = yes), chronic medical conditions (0 = no, 1 = yes), comorbid anxiety (0 = no, 1 = yes), format (0 = unguided, 1 = guided); education (0 = no = 0–5 years, 1 = low = 6–9 years, 2 = middle = 10–12 years, 3 = high = 13–17 years, 4 = very high = 18+ years).

<- Older Age

<- Baseline Severity

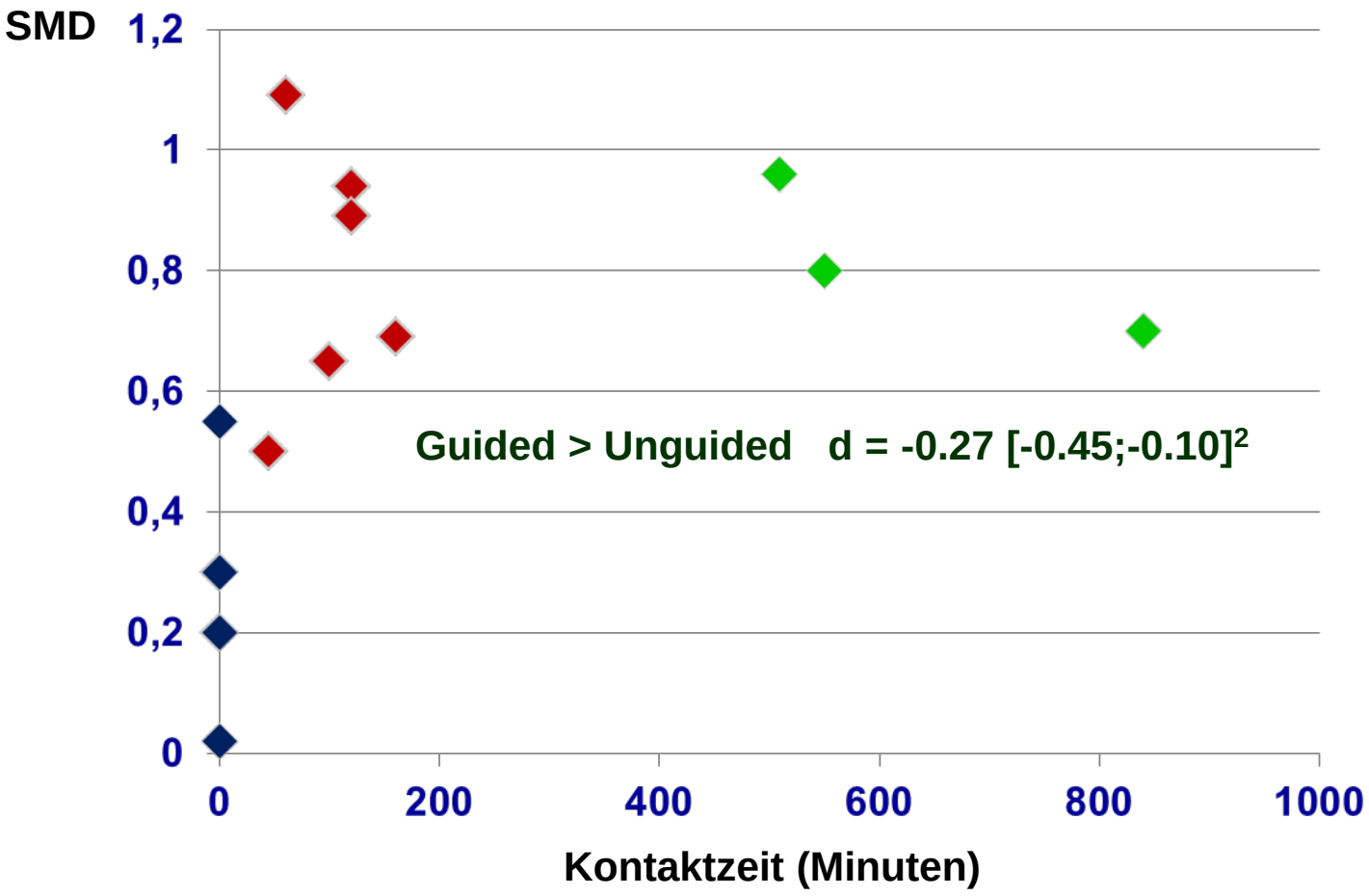
Reins et al., Psychother Psychosom 2020

Wirkmechanismen

- **Therapiebeziehung**
- **Evidenzbasierte Therapien**
- **Zielgruppenspezif scher Inhalt**
- **Menschlicher Support**
- **Erinnerungs-, Feedback- und Verstärkungsautomatismen**
- **Interventionsadhärenz und Drop-outs**

Baumeister et al., Internet Interv 2014; Domhardt et al., Depression & Anxiety 2019; Lin et al. Pain 2018; Domhardt et al. Clin Psychol. Rev 2021; Domhardt et al. Frontiers Psycholgy 2021

Menschlicher Support: Qualif kation



1 Titov Curr Psychiatry 2011; 2 Baumeister et al., Internet Interv 2014

Uptake of unguided IMI and Research Bias

4.06 times higher median program usage rate in studies than the real-world usage of the same program.

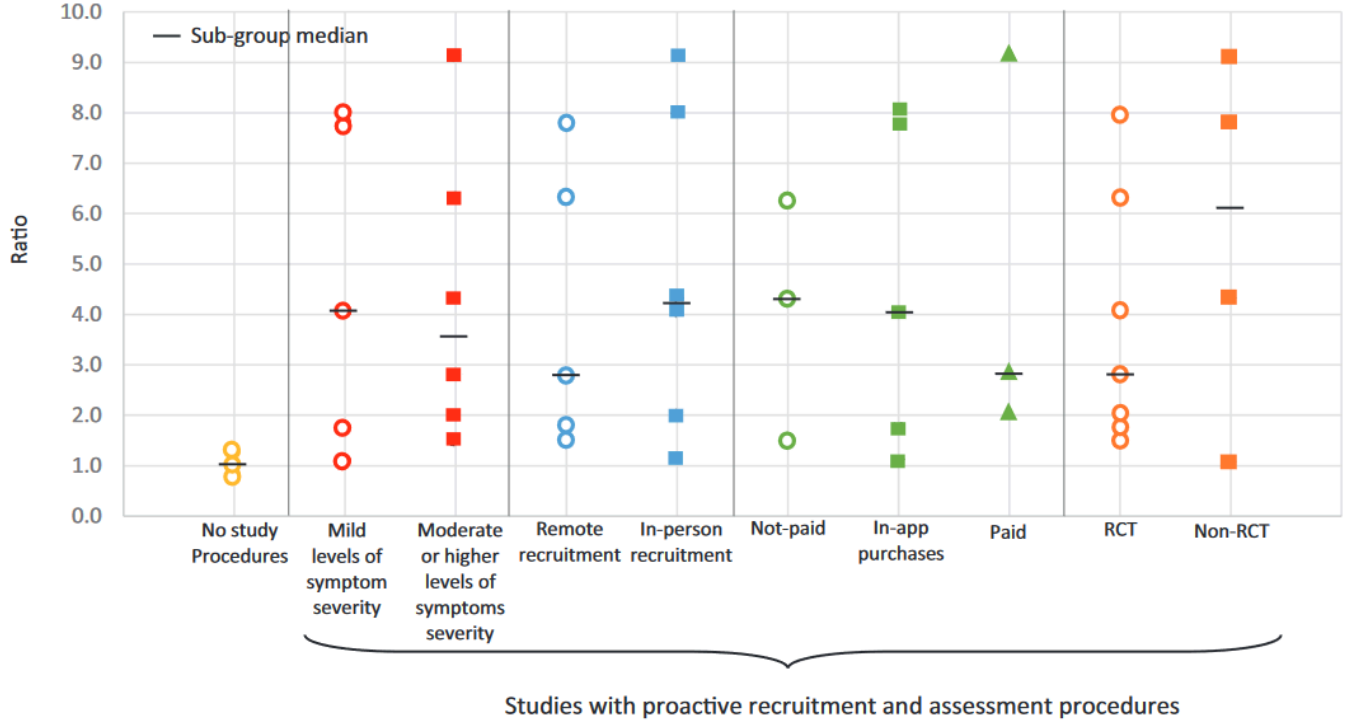


Fig. 2 | Usage ratios calculated between the two datasets by selected subgroups. y-Axis presents the ratio between data on user engagement in published studies and data in SimilarWeb. Y › 1 means that program usage was higher in the published article.

Baumel et al. TBM 2019

Wirkfaktoren bei Angst-DIGA – Meta-Analyse

(Domhardt et al., Depression & Anxiety 2019)

Study or Subgroup	CBT Mean	CBT SD	CBT Total	Other approach Mean	Other approach SD	Other approach Total	Weight	Std. Mean Difference IV, Random, 95% CI
Andersson et al. (2012b)	15.09	6.99	23	15.88	8.87	26	27.3%	-0.10 [-0.66, 0.46]
Carlbring et al. (2003)	15.2	13.1	11	11	7.6	11	12.0%	0.38 [-0.47, 1.22]
Dagöö et al. (2014)	14.79	10.97	27	20.02	11.56	25	28.3%	-0.46 [-1.01, 0.09]
Furmark et al. (2009)	10.9	7.86	29	11.66	7.79	29	32.4%	-0.10 [-0.61, 0.42]
Total (95% CI)			**90**			**91**	**100.0%**	**-0.14 [-0.43, 0.15]**

Heterogeneity: Tau² = 0.00; Chi² = 2.76, df = 3 (P = 0.43); I² = 0%
Test for overall effect: Z = 0.94 (P = 0.35)

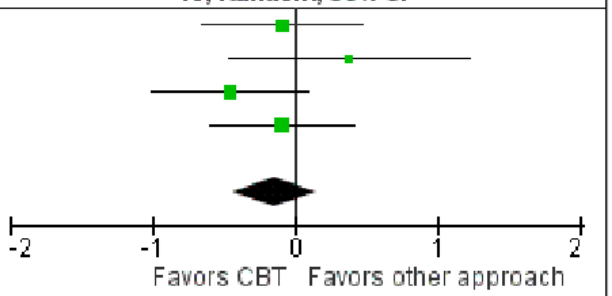


Abbildung 1: KVT vs. andere psychotherapeutische Ansätze

Study or Subgroup	Transdiagnostic Mean	Transdiagnostic SD	Transdiagnostic Total	Disorder-specific Mean	Disorder-specific SD	Disorder-specific Total	Weight	Std. Mean Difference IV, Random, 95% CI
Dear et al. (2015)	6.07	4.03	151	6.25	3.99	140	46.3%	-0.04 [-0.27, 0.19]
Dear et al. (2016)	6.36	3.2	100	6.18	3.17	106	32.8%	0.06 [-0.22, 0.33]
Fogliati et al. (2016)	7.23	5.79	64	7.36	5.94	68	21.0%	-0.02 [-0.36, 0.32]
Total (95% CI)			**315**			**314**	**100.0%**	**-0.01 [-0.16, 0.15]**

Heterogeneity: Tau² = 0.00; Chi² = 0.32, df = 2 (P = 0.85); I² = 0%
Test for overall effect: Z = 0.09 (P = 0.93)

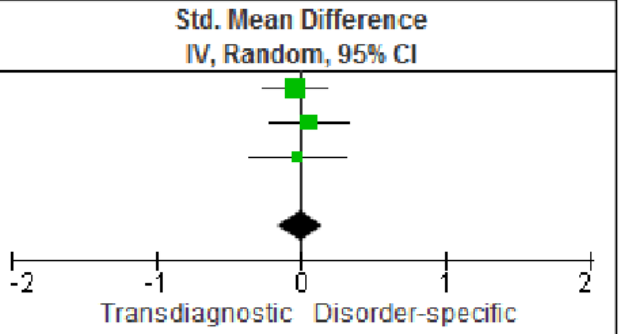


Abbildung 2: Störungsspezif sch vs. Transdiagnostisch

Wirkfaktoren – Netzwerkmetaanalyse iCBT Depression

	Depression severity (iMD of PHQ-9 scores), median (95% CrI)
Age	0·19 (–0·09 to 0·47)
Baseline depression, PHQ-9 scores	2·59 (2·32 to 2·85)
Gender*	–0·03 (–0·28 to 0·18)
Relationship†	–0·12 (–0·33 to 0·12)
Waiting component	0·42 (–0·75 to 1·53)
Non-specific treatment effects	–1·41 (–2·52 to –0·30)
Psychoeducation about depression	0·02 (–0·86 to 0·93)
Cognitive restructuring	0·30 (–0·87 to 1·41)
Behavioural activation	–1·83 (–2·90 to –0·80)
Interpersonal skills training	–0·54 (–1·59 to 0·52)
Problem solving	–0·64 (–1·41 to 0·09)
Relaxation	1·20 (0·17 to 2·27)
Third-wave components	–0·53 (–1·55 to 0·49)
Behaviour therapy for insomnia	–1·82 (–3·92 to 0·26)
Relapse prevention	0·35 (–0·69 to 1·32)
Homework required	0·31 (–0·69 to 1·35)
Initial face-to-face contact	0·85 (–1·80 to 3·41)
Automated encouragement to proceed with iCBT	–0·26 (–1·13 to 0·60)
Human encouragement to proceed with iCBT	–0·29 (–1·17 to 0·58)
Therapeutic guidance for iCBT	0·01 (–0·88 to 0·89)

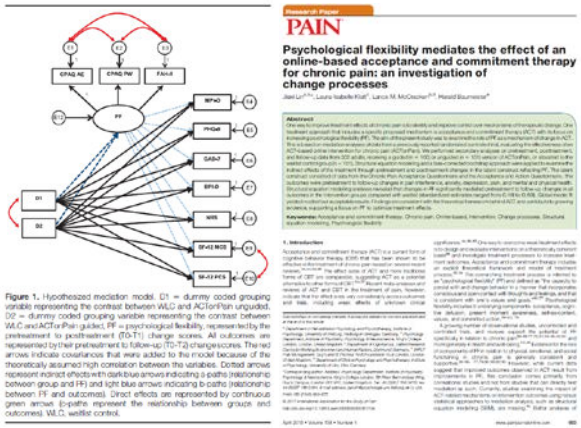
Furukawa et al., Lancet Psychiatry 2021

***Figure 3:* Individual participant data component network meta-analysis for depression severity**
Potentially beneficial components are shown in green (darker green for stronger statistical evidence) and potentially harmful components are shown in red according to an index similar to the Z-score (median of the posterior distribution divided by the corresponding standard deviation for Bayesian analyses), thus taking account of the magnitude of the effect estimates and their uncertainty.[32] More details about the colouring scheme are provided in the appendix (p 68). The specific efficacy for conventional drug treatment could not be estimated because this component was either present or absent in all comparisons in the network. Common heterogeneity τ was estimated to be 1·20 (95%CrI 0·89 to 1·57) in terms of the PHQ-9 scores. iCBT=internet cognitive behavioural therapy. iMD=incremental mean difference. CrI=credible interval. PHQ-9=Patient Health Questionnaire-9. *0=female and 1=male. †0=not in a relationship (single, separated, divorced, or widowed) and 1=in a relationship (married or having a stable partner).

Psychologische Flexibilität als Mediator für die Wirksamkeit von ACTonPain

- ACTonPain-Trial (N=302)
- Psychologische Flexibilität (PF) (AAQ-II / CPAQ)
- Mediierender Effekt von PF (Change Score T0-T1) auf alle Interventionsoutcomes (change scores T0-T2)

=> Ergebnisse konsistent mit ACT-Theorie bzgl. der Bedeutung von PF für psychische Gesundheit und dem postulierten ACT-Wirkmechanismus



Research Paper

PAIN

Psychological flexibility mediates the effect of an online-based acceptance and commitment therapy for chronic pain: an investigation of change processes

Figure 1. Hypothesized mediation model. D1 = dummy coded grouping variable representing the contrast between WLC and ACTonPain unguided, D2 = dummy coded grouping variable representing the contrast between WLC and ACTonPain guided, PF = psychological flexibility, represented by the pretreatment to posttreatment (T0-T1) change scores. All outcomes are represented by their pretreatment to follow-up (T0-T2) change scores. The red arrows indicate covariances that were added to the model because of the theoretically assumed high correlation between the variables. Dotted arrows represent indirect effects with dark blue arrows indicating a-paths (relationship between group and PF) and light blue arrows indicating b-paths (relationship between PF and outcomes). Direct effects are represented by continuous green arrows (c-paths represent the relationship between groups and outcomes). WLC, waitlist control.

Table 2

Parameter estimates (SE), significance tests, and confidence intervals for the model.

	Direct effects (a-, b-, and c-paths)		Indirect effects (ab-paths)	
	Standardized estimates (SD), *P*	95% CI	Standardized estimates (SD), *P*	95% CI
c-paths				
D1				
MPI-D	0.42 (0.28), 0.00	0.13 to 1.03	−0.54 (0.27), 0.00	−1.16 to −0.26
BPI-D	0.47 (0.30), 0.00	0.15 to 1.12	−0.57 (0.30), 0.00	−1.23 to −0.28
NRS	0.24 (0.26), 0.14	−0.05 to 0.80	−0.41 (0.24), 0.00	−0.98 to −0.18
PHQ-9	0.41 (0.29), 0.01	0.09 to 1.11	−0.60 (0.29), 0.00	−1.33 to −0.30
GAD-7	0.49 (0.27), 0.00	0.21 to 1.18	−0.54 (0.26), 0.00	−1.19 to −0.27
SF-12 MCS	−0.38 (0.22), 0.01	−0.90 to −0.11	0.44 (0.20), 0.00	0.04 to 0.95
SF-12 PCS	−0.07 (0.14), 0.57	−0.37 to 0.12	0.16 (0.13), 0.00	0.21 to 0.49
PF (a-path)	0.82 (0.13), 0.00	0.36 to 0.88		
D2				
MPI-D	0.36 (0.32), 0.02	0.04 to 1.06	−0.52 (0.31), 0.00	−1.31 to −0.31
BPI-D	0.46 (0.35), 0.01	0.11 to 1.21	−0.66 (0.35), 0.00	−1.39 to −0.34
NRS	0.22 (0.28), 0.17	−0.07 to 0.88	−0.43 (0.28), 0.00	−1.14 to −0.22
PHQ-9	0.49 (0.34), 0.01	0.13 to 1.26	−0.69 (0.33), 0.00	−1.47 to −0.36
GAD-7	0.54 (0.31), 0.00	0.21 to 1.28	−0.63 (0.30), 0.00	−1.34 to −0.32
SF-12 MCS	−0.39 (0.24), 0.01	−0.98 to −0.10	0.51 (0.23), 0.00	0.25 to 1.07
SF-12 PCS	−0.09 (0.17), 0.45	−0.44 to 0.12	0.19 (0.15), 0.00	0.05 to 0.56
PF (a-path)	0.72 (0.14), 0.00	0.44 to 0.97		
PF (b-paths)				
MPI-D	−0.87 (0.25), 0.00	−1.35 to −0.63		
BPI-D	−0.93 (0.28), 0.00	−1.43 to −0.68		
NRS	−0.67 (0.24), 0.00	−1.14 to −0.39		
PHQ-9	−0.97 (0.26), 0.00	−1.53 to −0.73		
GAD-7	−0.88 (0.25), 0.00	−1.37 to −0.58		
SF-12 MCS	0.71 (0.20), 0.00	0.39 to 0.1.05		
SF-12 PCS	0.27 (0.15), 0.00	0.07 to 0.57		

D1 = dummy coded grouping variable representing the contrast between WLC and ACTonPain unguided, D2 = dummy coded grouping variable representing the contrast between WLC and ACTonPain guided. Direct effects of D1 and D2 on PF represent a-paths; direct effects of PF on outcome measures represent the corresponding b-paths, and direct effects of D1 and D2 on outcome measures represent the corresponding c-paths. The product of a- and b-paths results in the respective indirect effect (ab).

BPI-D, Brief Pain Inventory, German version; CI, confidence interval; GAD-7, Generalized Anxiety Disorder Screener; MCS, mental composite score; MPI-D, Multidimensional Pain Inventory, German version; NRS, Numeric Rating Scale; PCS, physical composite score; PF, psychological flexibility; PHQ-9, Patient Health Questionnaire; SF-12, Short Form 12; WLC, waitlist control.

Lin et al., Pain 2018

Mediatoren: Metaanalyse mit 42 von 64 signif kanten Variablen

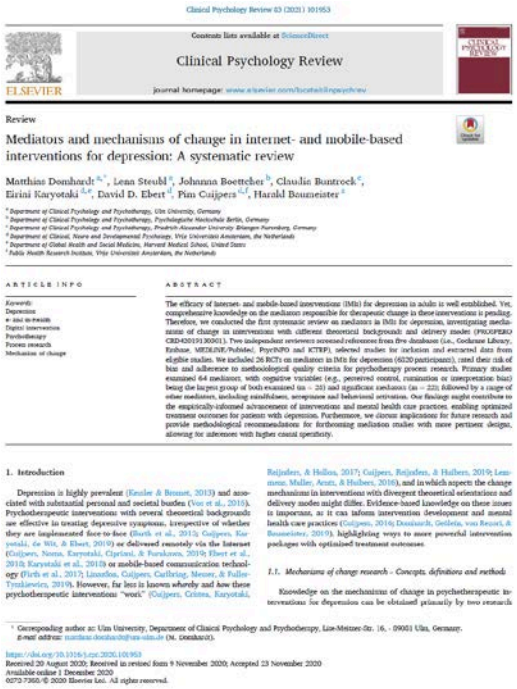
- **Kognitive Variablen:** kognitive Fähigkeiten, positive Annahmen, funktionale Metakognitive Annahmen, psychologische Flexibilität, wahrgenommene Kontrolle, Veränderung des Interpretationsbias, Rumination, repetitives negatives Denken, negative Gedanken, dysfunktionale Einstellungen, Sorgen, Selbstwirksamkeit, Wertschätzung gegenüber Leben, kognitive Defusion, Neubewertung.

- **Verhaltensbezogene Variablen:** Verhaltensaktivierung

- **Affektive Variablen:** Emotionsregulation

- **Fähigkeiten:** Achtsamkeit, KVT-Skillnutzung, Veränderung negativer Problemorientierung, Akzeptanz, Selbsthilfestrategien, Problemlösefähigkeit.

- **Sonstige Variablen:** Ego-Integrität, genießen schöner Ereignisse, Einschränkungsgrad, Angst, Autonomieorientierung, erneute Zielorientierung, Bildungswerte.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Review

Mediators and mechanisms of change in internet- and mobile-based interventions for depression: A systematic review

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ARTICLE INFO
Keywords:
Depression
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Digital intervention
Psychotherapy
Process research
Mechanism of change

ABSTRACT
The efficacy of internet- and mobile-based interventions (IMIs) for depression in adults is well established. Yet, comprehensive knowledge on the mechanisms responsible for therapeutic change in these interventions is pending. Therefore, we conducted the first systematic review on mediators in IMIs for depression, investigating mechanisms of change in interventions with different theoretical background and delivery modes (PROSPERO CRD42019130031). Two independent reviewers screened references from five databases (i.e., Cochrane Library, Embase, MEDline, PubMed, PsychINFO and ICTRP), selected studies for inclusion and extracted data from eligible studies. We included 26 RCTs on mediators in IMIs for depression (6220 participants), rated their risk of bias and adherence to methodological quality criteria for psychotherapy process research. Primary studies examined 64 mediators, with cognitive variables (e.g., perceived control, rumination or interpretation bias) being the largest group of both examined (n = 28) and significant mediators (n = 22) followed by a range of other mediators, including mindfulness, acceptance and behavioral activation. Our findings might contribute to the empirically-informed advancement of interventions and mental health care practices, enabling optimized treatment outcomes for patients with depression. Furthermore, we discuss implications for future research and provide methodological recommendations for forthcoming mediation studies with more pertinent designs, allowing for inferences with higher causal specificity.

1. Introduction

Depression is highly prevalent (Kessler & Bromet, 2013) and associated with substantial personal and societal burden (Vos et al., 2016). Psychotherapeutic interventions with several theoretical backgrounds are effective in treating depressive symptoms, irrespective of whether they are implemented face-to-face (Barth et al., 2013; Cuijpers, Karyotaki, de Wit, & Ebert, 2019) or delivered remotely via the Internet (Cuijpers, Noma, Karyotaki, Cipriani, & Furukawa, 2019; Ebert et al., 2018; Karyotaki et al., 2018) or mobile-based communication technology (Firth et al., 2017; Linardon, Cuijpers, Carlbring, Messer, & Fuller-Tyszkiewicz, 2019). However, far less is known *whereby* and *how* these psychotherapeutic interventions "work" (Cuijpers, Cristea, Karyotaki, Reijnders, & Hollon, 2017; Cuijpers, Reijnders, & Huibers, 2019; Lemmens, Muller, Arntz, & Huibers, 2016), and in which aspects the change mechanisms in interventions with divergent theoretical orientations and delivery modes might differ. Evidence-based knowledge on these issues is important, as it can inform intervention development and mental health care practices (Cuijpers, 2016; Dominiak, Gellein, von Rosen, & Baumeister, 2019), highlighting ways to more powerful intervention packages with optimized treatment outcomes.

1.1. Mechanisms of change research - Concepts, definitions and methods

Knowledge on the mechanisms of change in psychotherapeutic interventions for depression can be obtained primarily by two research

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Available online 1 December 2020
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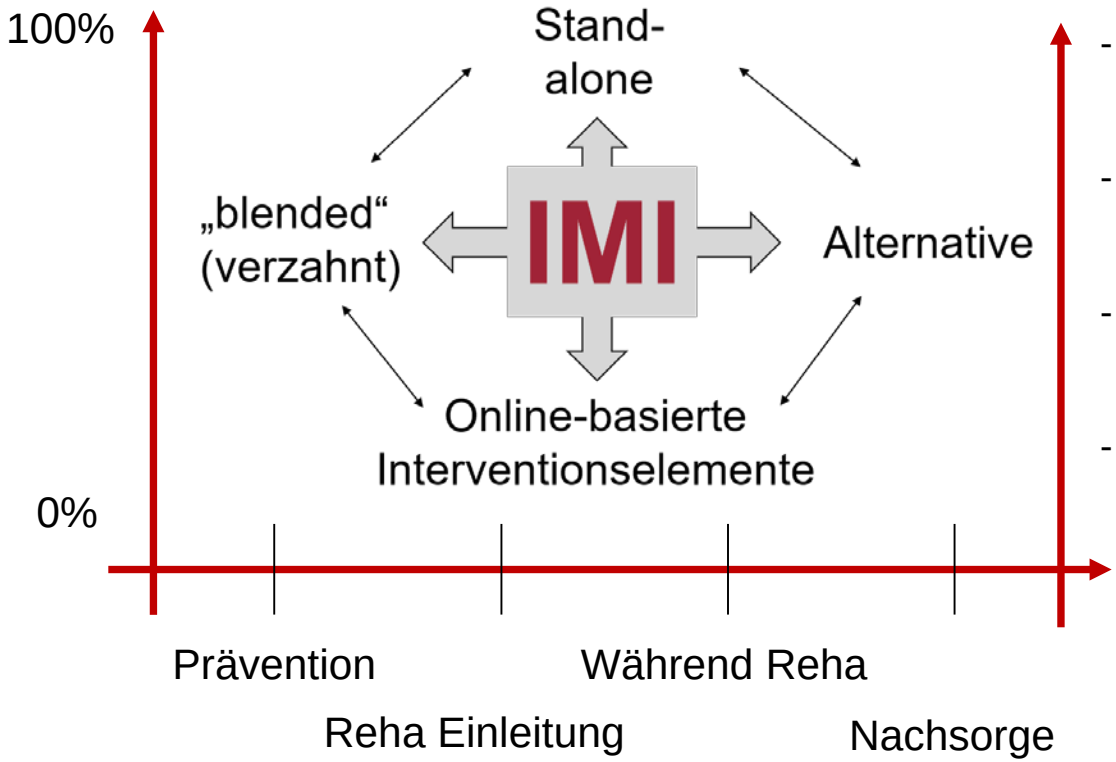
Domhardt et al., Clin Psychol Review 2021

IMIs in der Reha

Menschlicher Support



Einsatzmöglichkeiten im Reha-Prozess

Technologische Lösungen

- Synchrone Kommunikation via z.B.Videokonferenz / Chat
- Asynchrone Kommunikation via (gesicherter) z.B. Email
- Interventionsprogramme (Browser-/Mobile-basiert)
- Prompts / Computer-Algrithmus-basierte Interventionen via z.B. Chatbot / KI-Programme

Blended Therapy

Die Verzahnung von klassischer Psychotherapie mit technologiebasierten Verfahren

1. Sequentiell:

2. Integriert:

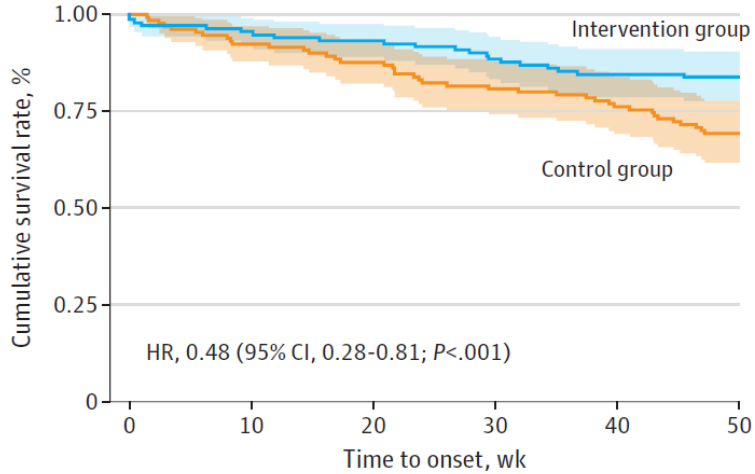
als Unterstützung

1 Baumeister et al., PID 2018

PROD

Prevention IMI in People with Chronic Back Pain and Subthreshold Depression

Figure 2. Kaplan-Meier Survival Curve of Time to Onset of Major Depressive Disorder



No. at risk						
Control group	146	120	114	105	99	90
Intervention group	149	122	119	113	108	105

Shading indicates 95% CI.

Incidence (12 months):

TAU = **28.1%**

TAU plus IMI = **14.1%**

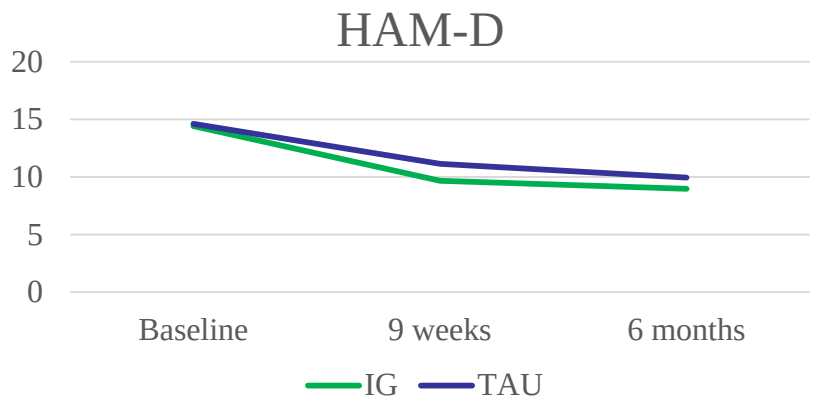
Hazard Ratio (N=295):

0.48 (95% CI 0.28 – 0.81)

NNT: 2.84 (95% CI 1.79-9.44)

Sander et al., JAMA Psychiatry 2020

WARDBP
Treatment IMI in People with Chronic Back Pain and Depression



	IG (n = 104)	CG (n = 105)	ITT ß
Baseline	14.4 (5.45)	14.61 (5.32)	
7 weeks	9.67 (6.41)	11.14 (7.26)	-0.19 (-0.43;0.05)
5 months	8.97 (6.44)	9.95 (7.13)	-0.14 (-0.40;0.12)

Baumeister et al., Psychother Psychosom 2020

Blended Therapy

Die Verzahnung von klassischer Psychotherapie mit technologiebasierten Verfahren

1. Sequentiell:

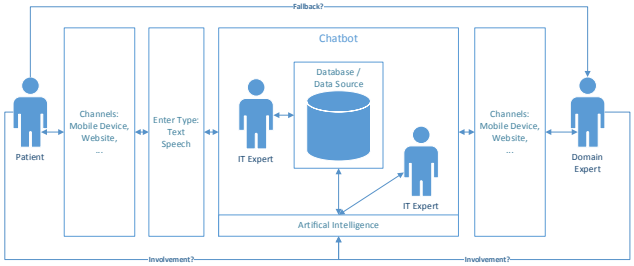
2. Integriert:

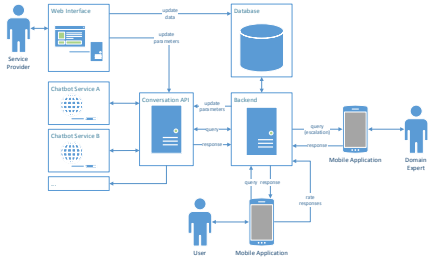
als Unterstützung

1 Baumeister et al., PID 2018

News
Kontakt
PSYCHOnlineTHERAPIE
Über das Projekt
Für Patient:innen
Für Therapeut:innen
Über uns
Forschung
https://psychonlinetherapie.de
Integriertes Blended Therapy Konzept
Das Beste aus zwei Welten
Psychische Erkrankungen können jeden treffen und die Lebensqualität von Betroffenen stark einschränken. Eine psychotherapeutische Behandlung kann dabei unterstützen, Krisenphasen zu bewältigen und so zu einer verbesserten psychischen Gesundheit zu gelangen. PSYCHOnlineTHERAPIE verbindet die psychotherapeutische Behandlung gemäß der Routineversorgung (im Sinne der psychotherapeutischen Einzelleistung) mit Online-Behandlungselementen. Diese neue Behandlungsform erlaubt Patient:innen und Therapeut:innen ein hohes Maß an Flexibilität sowie gleichzeitig eine Therapie angepasst an individuelle Bedürfnisse.
» Mehr Erfahren

Big Data, künstliche Intelligenz und digitalisierte Reha

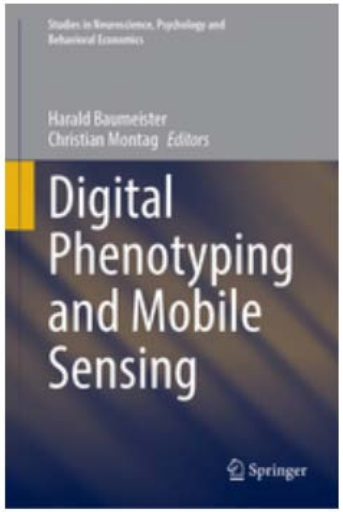




Interspeech 2018
2-6 September 2018, Hyderabad

The INTERSPEECH 2018 Computational Paralinguistics Challenge: Atypical & Self-Assessed Affect, Crying & Heart Beats

Björn W. Schuller[1,2,3], Stefan Steidl[4], Anton Batliner[2,4], Peter B. Marschik[5,6,7], Harald Baumeister[8], Fengquan Dong[9], Simone Hantke[2,10], Florian B. Pokorny[5,10], Eva-Maria Rathner[8], Katrin D. Bartl-Pokorny[5], Christa Einspieler[5], Dajie Zhang[5,6], Alice Baird[2], Shahin Amiriparian[2,10], Kun Qian[2,10], Zhao Ren[2], Maximilian Schmitt[2], Panagiotis Tzirakis[1], Stefanos Zafeiriou[1,11]



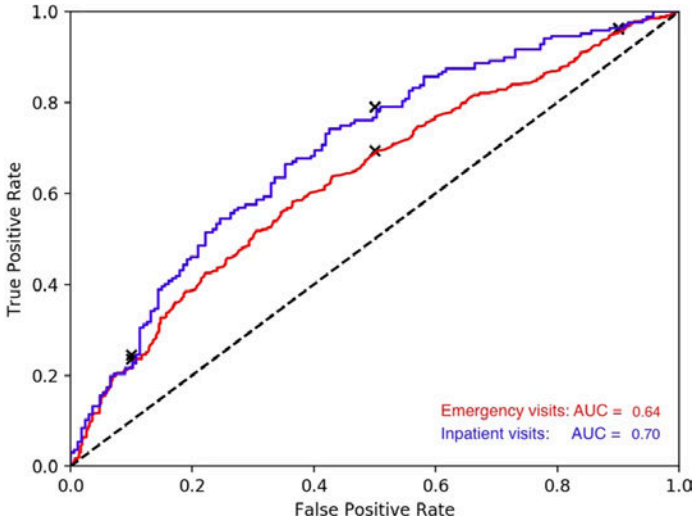
Baumeister & Montag, 2019; Bendig et al., 2019; Montag et al., 2019; Pryss et al., 2019

Facebookeinträge zur Vorhersage von Notaufnahmen

- 586 Patient:innen mit Notaufnahmen (Schmerz, Schwangerschaft, Atemnot, etc.) und Informed Consent zur Nutzung der Facebookeinträge
- Signif kante Steigerung Depression-bezogener Sprache (d=.24), geringerer Gebrauch informeller Sprache (d=.35), Schmerzbezug (d=.27) und weniger extrovertiert / sozial bezogen (d=.36)

Vorhersagemodell (ML-basiert):

- AUC .64 (Notaufnahme)
- AUC .70 (Stationäre Aufnahme)



Guntuku et al. Scientific Reports 2020

Gesichtserkennung-basierte Emotionsanalyse

Automatisierte Gesichtserkennung als diagnostische Information

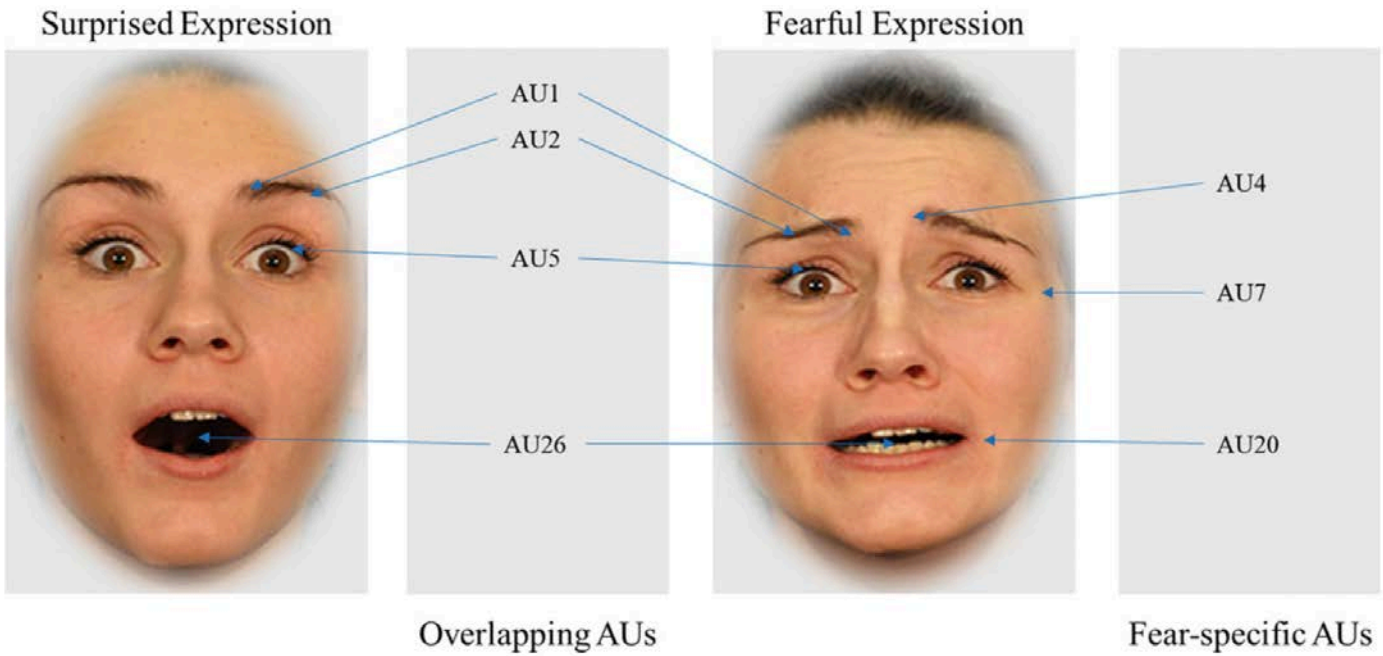


Fig. 3.1 An example of the Action Unit (AU) overlap of fearful and surprised expression, as described in the FACSAID (Ekman et al. 1998). AU1: inner brow raiser, AU2: outer brow raiser; AU4: brow lowerer; AU5: upper lid raiser; AU7: lid tightener; AU20: lip stretcher; AU26: jaw drop

Geiger & Wilhelm in Baumeister & Montag, Springer 2019

Stimm- und Sprachanalysen

Automatisierte Stimm- und Sprachanalysen (z.B. Valenz und Arousal)

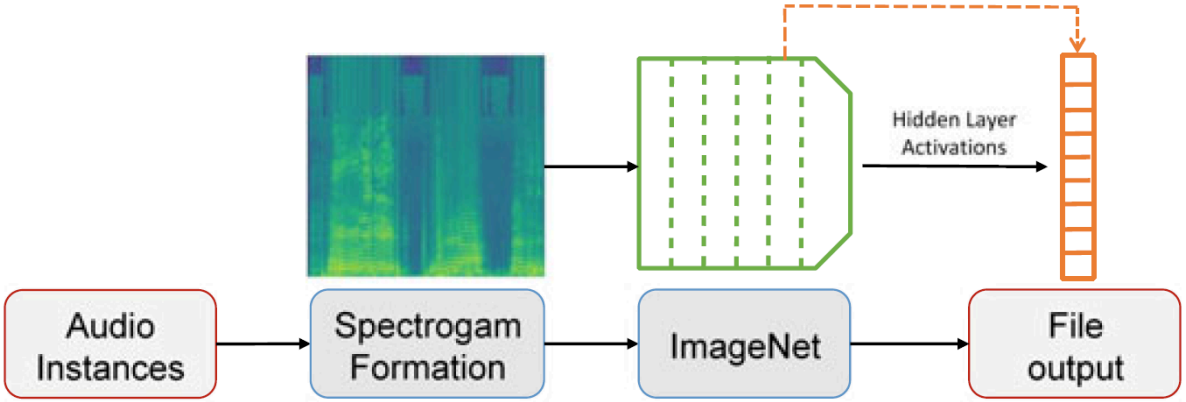


Fig. 9.3 An overview of extracting DEEPSPECTRUM features. Audio samples are converted to spectrogram images and then feed into a pre-train image classification Convolutional Neural Networks (CNNs); the activations of fully connected layers are then used as a feature representation for subsequent classification

Cummins & Schuller in Baumeister & Montag, Springer 2019

Vom Sensor zur Gesundheitsvorhersage

Garatva et al. Digital Phenotyping and Mobile Sensing (vol. 2), Springer, In press

Digital Phenotyping und Mobile Sensing

Proof-of-Concept Studien

- Depression:

  Variability of visited location (ß -.21), total sleep time (ß .24), time in bed (ß .26)[1]

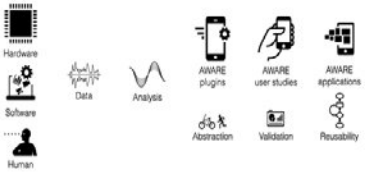
  Total smartphone usage time (-.019), call duration (-.016)[2]

  Higher use of word categories: I, we, negate, anxiety and eating[3]

- Angst:

  Wake after sleep onset (ß .23), HRV (ß .26)

AWARE-
Smart Sensing



Corona Health

PSYCHOnlineTHERAPIE

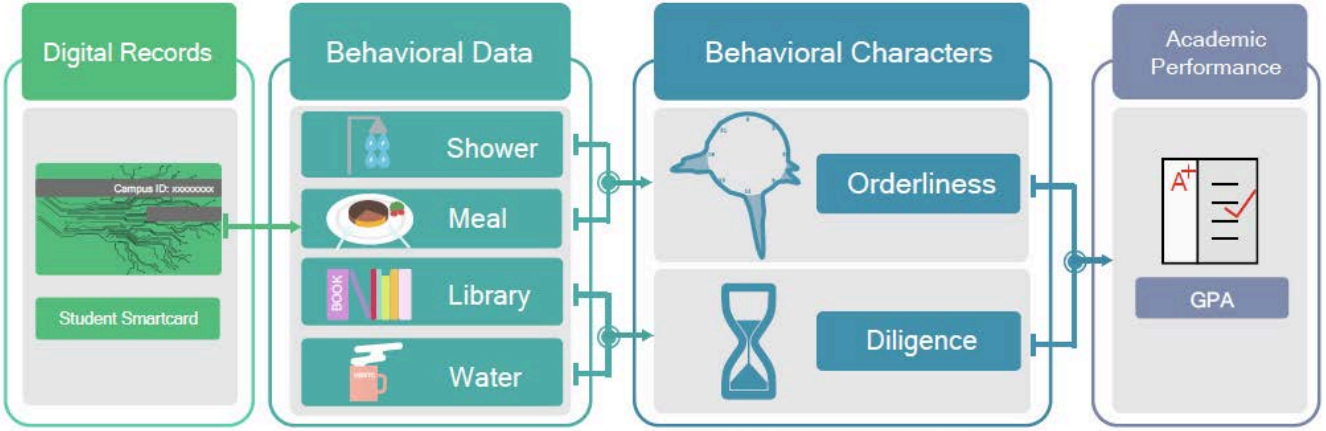
RehaCAT
Smarte Diagnostik in der Rehabilitation

Moshe et al. Frontiers Psychiatry 2021; Messner et al. Verhaltenstherapie 2019; Rather et al. Interspeech 2018

Ordentlichkeit und Gewissenhaftigkeit zur Vorhersage akademischer Leistungen

Ordentlichkeit und Akademische Leistung

18.860 Studierende einer Universität in China



- Vorhersage von studentischer Leistung (Notenrang in Semester 2-5): AUC = 0.668-0.685

Cao et al. in Baumeister & Montag Springer 2019

ANWENDUNGSFELDER

Server-based Computer-adaptive Testing Platform

MDR conform PROM/PREM-Assessment (PROMIS + further scales)

KI-basierte Expert:innensysteme

KIS-Daten

App-Daten vor der Behandlung

App-Daten während der Behandlung

App-Daten in der Nachsorge

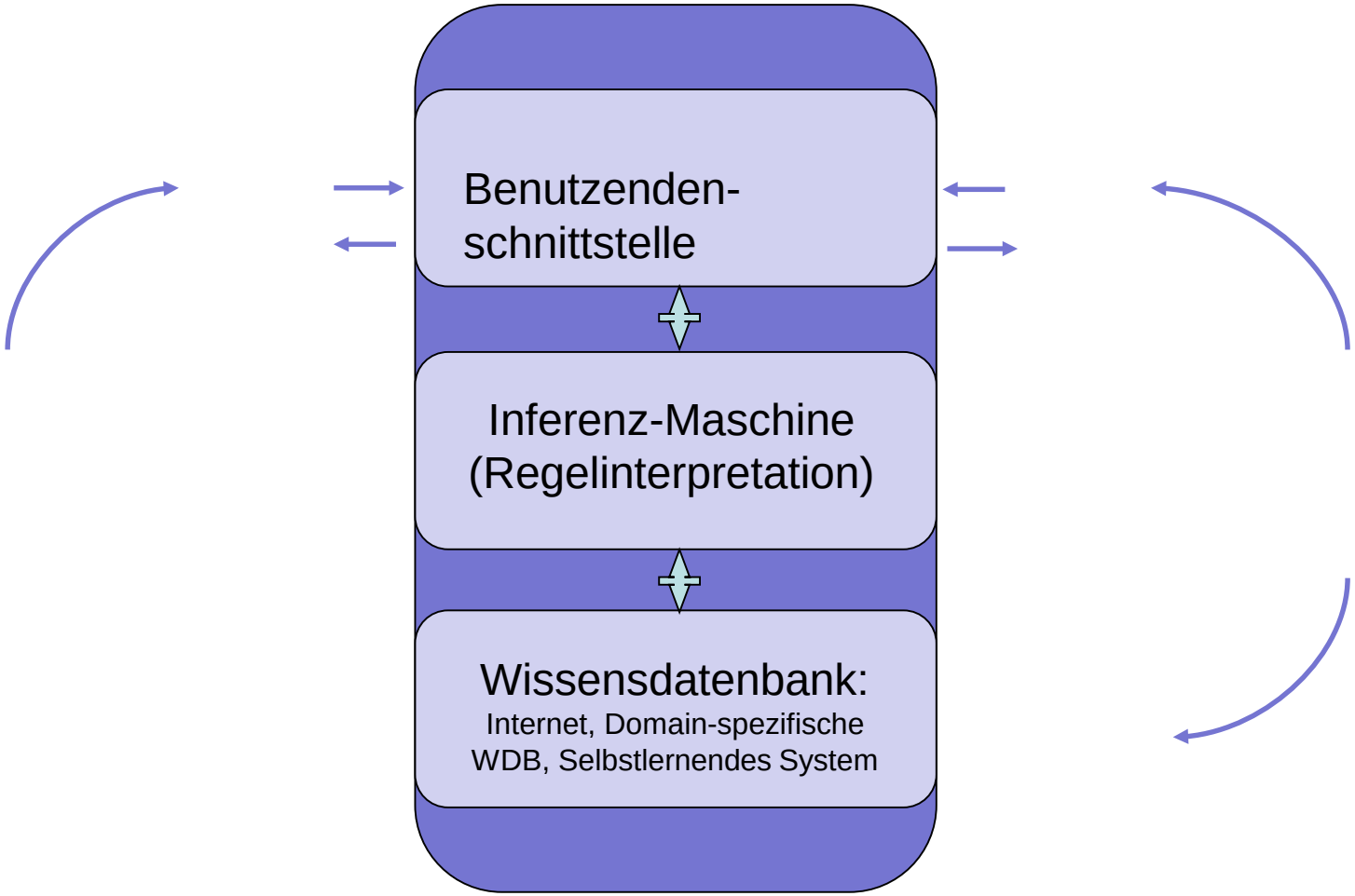
Datenbank

Optimierung der Behandlung zum Beispiel durch:

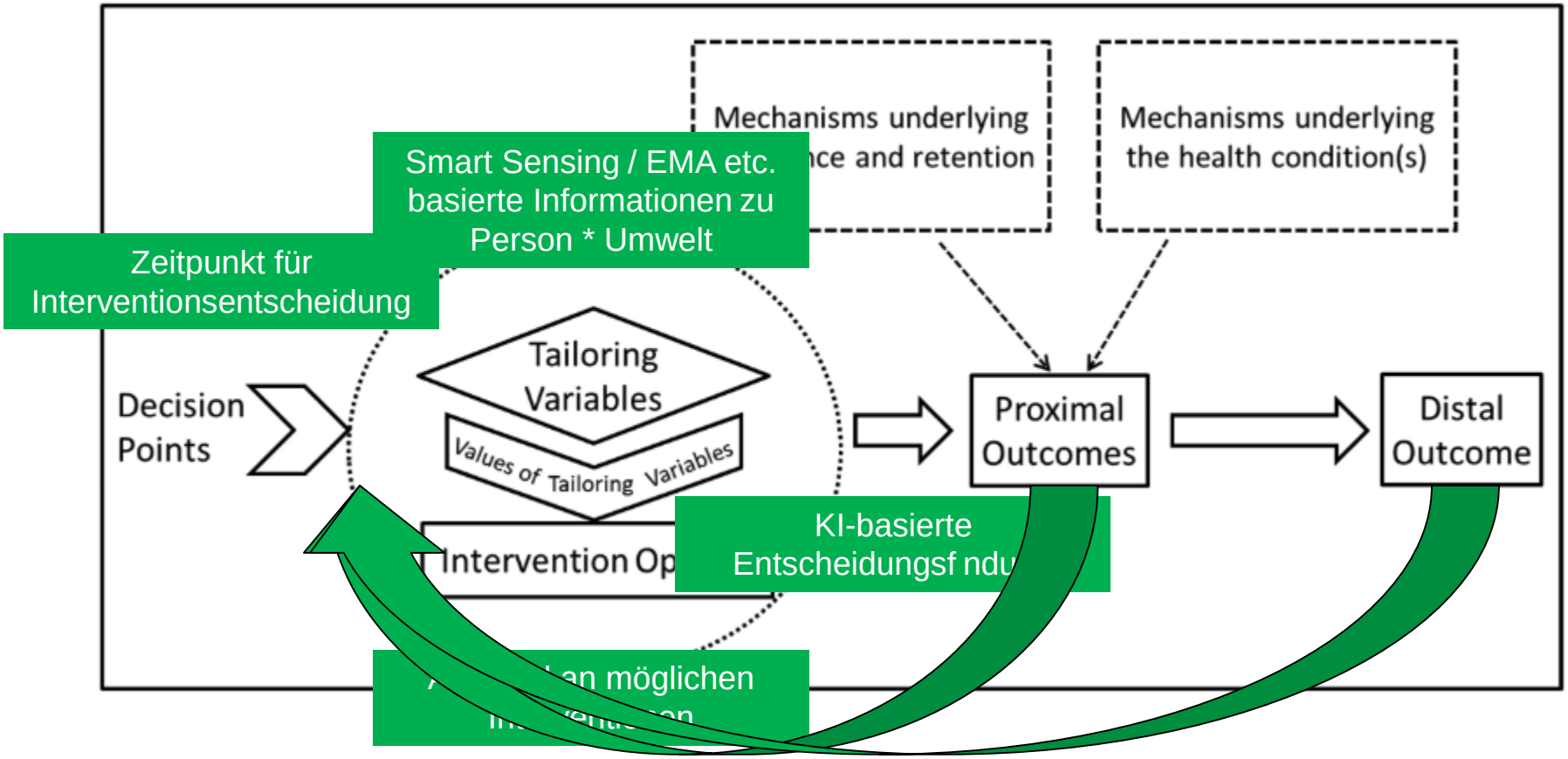
- Passung des Behandlungsplans auf Personeneigenschaften
- Verlaufsprognose → z.B. Anpassung der Behandlung bei fehlender Symptomverbesserung
  - Negativer Verlauf: Anpassung der Behandlung z.B. Dosissteigerung
  - Positiver Verlauf: Beibehalten, bzw. auch Dosissenkung denkbar
- Aufbau KI-Wissensdatenbank und Entwicklung automatisierte Assisstent:innen

Terhorst et al. Digital Phenotyping and Mobile Sensing (vol. 2), Springer, in preperation

KI-basierte Diagnostiksupport-Systeme



Just-in-time Intervention



Nahum-Shani et al. Ann Behav Med 2018

Digitalisierte Diagnostik und Intervention in der Rehabilitation

Versorgungsrealität ⟷ Digitalisierungsvision

Team ▾ Forschung ▾ Lehre ▾ Publikationen ▾

▶ Institut für Psychologie und Pädagogik

Vielen Dank für Ihr Interesse

…und ein Dankeschön an das gesamte Team!
…und ein Dankeschön an alle Kooperationspartner!

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