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Editorial

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From Broken Models to Treatment Selection: Active Inference as a Tool to Guide Clinical Research and Practice

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Computational theories have fundamentally changed the scientific understanding of how the mind works for both healthy and pathological experiences and behaviours. In this context, the active inference framework has gained considerable attention within the scientific community (Heins et al., 2022; Smith et al., 2022). As a process theory, it integrates complex phenomena, such as perception, learning, and action under a unified theory of Bayesian inference (Da Costa et al., 2020; Friston et al., 2017). Active inference has proven useful in modelling data from heterogeneous fields ranging from cognitive neuroscience to biology and general psychology (e.g., Friston et al., 2016, 2017). Its computational tractability and biological plausibility have also made it increasingly relevant to clinical psychology in recent years (e.g., Smith, Badcock, et al., 2021).

In active inference and related, Bayesian neurocomputational theories, it is assumed that individuals do not have direct access to the circumstances in their surroundings. Instead, they have to infer the (probabilistic) properties of their environment through action and perception by integrating prior information about their environment with ambiguous sensory input in a rational (i.e., Bayes-optimal) manner (Friston et al., 2016; Hohwy et al., 2008). The resulting "internal model of the world" (i.e., the agent's beliefs about how certain sensory information relates to environmental conditions) shapes future perception (Friston, 2010) and enables agents to leverage the past to predict the future in an ever-changing environment (Badcock et al., 2017). In accordance with this perspective, perception, action, and learning are all subject to inferential process-

es on different timescales (Smith et al., 2022). Individuals thus take an active role in constructing their experiences, which they can further alter by actively changing their environment.

Whereas accurate internal models provide good predictions about which action sequences lead to preferred sensory observations, distorted internal models can lead to aberrant experiences and behaviours that may hinder the organism from achieving its goals (Badcock et al., 2017; Schwartenbeck et al., 2015). There is evidence that the internal models of individuals with mental disorders show substantial deviations from each other and from the models of healthy individuals. For example, recent accounts of depression have conceptualised patients' tendency to reappraise or disregard positive information in terms of highly precise and hence tenacious negative prior beliefs (Kube et al., 2020). This computational perspective has inspired novel ideas for the treatment of depression (e.g., Chekroud, 2015). Similar reconceptualisations with relevance for psychological treatments have been suggested for numerous mental disorders and health conditions, including psychosis (Sterzer et al., 2018), persistent somatic symptoms (Paulus et al., 2019), and eating disorders (Barca & Pezzulo, 2020).

In this context, the active inference framework offers the opportunity to formalise deviations in a person's internal models, thus enabling a detailed description and operationalisation of relevant experiential and behavioural distortions (e.g., Montague et al., 2012). From our point of view, this could improve clinical research, diagnostics, and the treatment of mental disorders in several ways. Clinical research may benefit from a finely grained formalisation of deviant experiences and behaviours within the active inference framework because it opens up a possibility for studying aetiological mechanisms from a computational perspective (Stephan, Binder, et al., 2016). Because of their generative structure, computational theories enable the derivation of well-operationalised hypotheses about pathological processes in mental disorders and the computer simulation of aberrant experience and behaviour. In comparison with empirical data, researchers could thus rigorously formalise, simulate, and compare different mechanistic models of patients' experiential and behavioural symptoms. Moreover, the active inference perspective could inform the diagnostics of mental disorders (or rather the diagnostics of patients' implicit belief systems) by providing practitioners with individual estimates of their patients' internal model parameters in disorder-relevant situations (Stephan, Bach, et al., 2016). For example, using probabilistic gambling tasks that distinguish between goal-directed information seeking and random exploration behaviour could provide clinicians with individual parameter diagnostics regarding the relationship between information seeking, reward sensitivity, and psychopathology in substance abusers (Smith, Schwartenbeck, et al., 2021). Such applications could not only strengthen a more transdiagnostic perspective on mental disorders, but also have tangible implications for treatment development and treatment selection. If we assume that therapeutic interventions may have different effects on patients' model parameters, finely grained

operationalisation in the context of active inference could contribute to tailored interventions that target specifically these parameters. From the practitioner's perspective, it would be particularly important to investigate which tasks are likely to diagnose internal models that inform treatment selection and guide psychotherapy.

The active inference approach affords an improved mechanistic understanding of pathological processes in mental disorders. As a unifying process theory of brain and mind function, it brings together perception, learning, action, and decision making under the umbrella of a Bayesian principle, which predestines it for clinical application. Because of its high degree of formalisation and its flexibility, we believe that the active inference approach is well suited to functionally link heterogeneous clinical phenomena to patients' internal belief systems. This will enable researchers to better differentiate and operationalise underlying mechanisms and tailor the diagnosis, aetiology, and treatment of mental disorders.

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External Locus of Control but not Self-Esteem Predicts Increasing Social Anxiety Among Bullied Children

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Abstract

Background: Elevated social anxiety is more likely among bullied children than those who have not been bullied but it is not inevitable and may be influenced by cognitive factors. Lower self-esteem and more external locus of control are associated with bullying and social anxiety but the impact of these factors over time among bullied children is less clear.

Method: Children from the UK Avon Longitudinal Study of Parents and Children (ALSPAC) reported bullying experiences at age 8 (n = 6,704) and were categorized according to level of bullying exposure. The impact of self-esteem and locus of control on social anxiety was assessed up to age 13 across the bullying exposure groups using multi-group latent growth curve analysis. Complete data was available for 3,333 participants.

Results: More external locus of control was associated with a steeper increase in social anxiety among severely bullied children [B = .249, p = .025]. Although self-esteem at age 8 was associated with existing social anxiety it did not predict later increases in social anxiety.

Conclusion: These results indicate that beliefs about lack of personal control among severely bullied children may contribute to increasing social anxiety over time. Exploring related cognitions may be helpful in this potentially vulnerable group.

Keywords

ALSPAC, bullying, social anxiety, locus of control

Highlights

- Childhood bullying increases risk of social anxiety.
- For severely bullied children this risk is exacerbated by external locus of control.
- Exploring beliefs around lack of personal control may be helpful.

Social anxiety is characterised by excessive fears of coming across badly or being judged harshly by others in social situations (American Psychiatric Association, 2013; World Health Organisation, 1992) and can lead to avoidance and poorer performance in school, work, and relationships (e.g., Stein & Kean, 2000; Van Ameringen et al., 2003). It is a chronic treatable condition (Bruce et al., 2005) that is maintained by unhelpful cognitions (Clark & Wells, 1995). Childhood bullying increases the risk of developing social anxiety (Arseneault, 2018; Pontillo et al., 2019) with higher risk conferred by more frequent exposure (Copeland et al., 2013) but not all bullied children are socially anxious and identifying subgroups at risk may inform prevention and intervention. Previous cross-sectional research has identified locus of control (Reknes et al., 2019) and self-esteem (Wu et al., 2021) as modifiers of the relationship between bullying and mental health outcomes. In this longitudinal study, we evaluate the impact of locus of control and self-esteem on social anxiety over time among children with different levels of bullying exposure. Better understanding factors that contribute to the unfolding of social anxiety symptoms in young people over time could inform targeted and developmentally appropriate approaches to treatment.

Bullying is generally understood to include aggressive interpersonal acts that are intentional, repeated, and include a power imbalance between the victim and the aggressor (Olweus, 1994). Prevalence rates vary according to the measure of bullying used, setting and child age. One survey found rates of 8.7-14.4% for frequent bullying and 26.8-38.1% for occasional bullying over a 10-year period in England (Chester et al., 2015). Bullying experiences are classified as *overt* events like hitting, threatening or name calling, and *relational* events that use social power to inflict hurt by excluding, ignoring, gossiping or telling lies behind someone's back. Experiences like these can be socially traumatic (Wild & Clark, 2011) and contribute to the onset and maintenance of anxiety disorders (Norton & Abbott, 2017) including social anxiety (Hackmann et al., 2000). Of note, problematic social anxiety commonly arises during adolescence, with rates of onset peaking around age 13 (Kessler et al., 2005). Among adults with anxiety disorders, those suffering with social anxiety are particularly likely to report having been bullied or teased when they were younger (McCabe et al., 2003, 2010). Increased risk of elevated long-term anxiety after bullying is evident from retrospective studies (Gladstone et al., 2006) and prospective data (Copeland et al., 2013; Gladstone et al., 2006; Sourander et al., 2007; Stapinski et al., 2014). Therefore, it is well established that bullying increases risk of social anxiety. However, mechanisms are less well understood.

Locus of control (Nowicki & Duke, 1974) refers to the extent to which someone believes the outcomes of events or behaviours to be under personal control (internal) or down to luck or chance (external). Internal locus of control is associated with better wellbeing while external locus of control is associated with negative outcomes such as depression (Zhang et al., 2014) and higher levels of PTSD, for example among survivors of combat (Karstoft et al., 2015) and children exposed to stressful political life events (Hallis & Slone, 1999). It is possible that these outcomes are driven by associations with thinking and coping styles, such that internality is associated with positive thinking and help-seeking, while externality is associated with avoidance and helplessness (Reknes et al., 2019). Research has shown that adolescents who are victims of bullying generally have a more external locus of control compared with peers not involved in bullying (Radliff et al., 2016) and among severely bullied adolescents those with more external locus of control also had higher risk of psychotic symptoms (Fisher et al., 2013). Of note, Reknes et al. (2019) suggested that externality may contribute to a diminished sense of personal responsibility that is actually protective for adult victims of workplace bullying, as they may more readily attribute negative experiences externally. This may suggest a reduced risk of negative outcomes for bullied children who have a more external locus of control. However, no longitudinal studies have specifically investigated locus of control as a mechanism driving social anxiety among bullied children.

Low self-esteem refers to an unfavourable attitude towards the self (Rosenberg, 1979) and may be informed by negative social interactions including experiences of bullying that are internalised (van Geel et al., 2018). Cross-sectional studies show that lower self-esteem is associated with bullying (Brito & Marluce, 2013; O'Moore & Kirkham, 2001) and cyberbullying (Patchin & Hinduja, 2010) but cannot speak to the direction of the effect, such that although bullying may contribute to reducing self-esteem it is also possible that children with lower self-esteem are more likely to be targeted (van Geel et al., 2018). Wu et al. (2021) found that self-esteem explained some of the cross-sectional relationship between bullying and social anxiety among adolescents, but did not investigate causation due to the study design. In this study we investigate longitudinally whether lower self-esteem increases the risk of social anxiety among children who are bullied.

Cognitive models suggest that negative beliefs maintain social anxiety (Clark & Wells, 1995) and PTSD (Ehlers & Clark, 2000). For social anxiety, beliefs are commonly connected in meaning to past experiences of humiliation or rejection (Wild et al., 2007) and include themes of personal capacity to perform adequately and appear acceptable to other people (e.g., "*I am inadequate*"). For PTSD, beliefs are commonly connected with the traumatic event and its sequelae and include themes about loss of control in terms of personal reactions (e.g., "*I cannot handle stress*") and the environment more broadly (e.g., "*The world is completely dangerous*"). Of note, these maintaining cognitions related to self and past or future events are not limited to explicit thoughts, but rather include imagery

and "felt sense" that is highly emotional (Ehlers et al., 2004; Hackmann et al., 2000). Beliefs consistent with external locus of control and low self-esteem may be fruitful targets for cognitive interventions with bullied children if these factors negatively impact anxiety trajectories in this group.

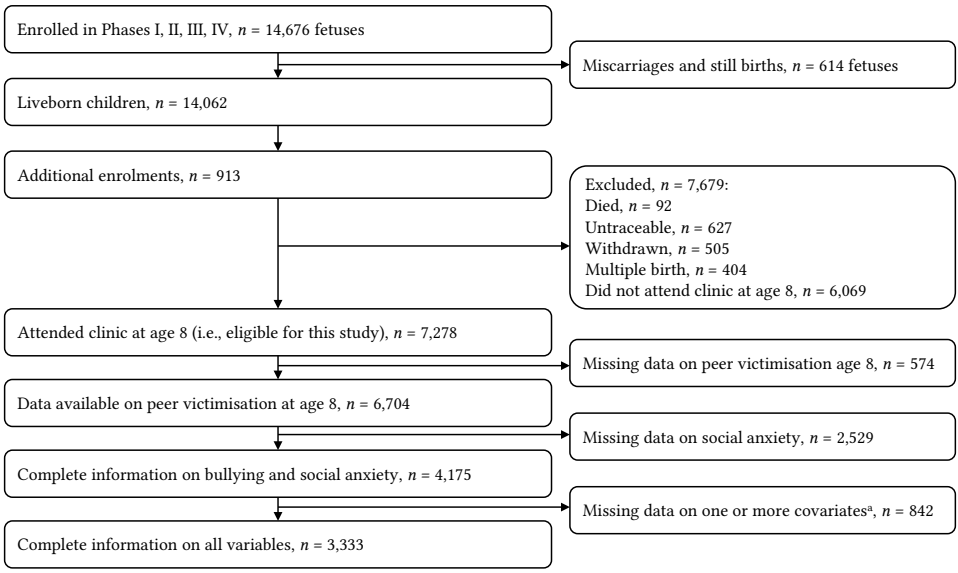
The current study assessed the moderating effects of locus of control and self-esteem on social anxiety among children using a three-wave longitudinal design over five-years, from age 7.5 to 13. The goal of this study was to assess whether externality of locus of control and self-esteem at age 8 influence the trajectory of social anxiety among children up to the age of 13, and whether the impact of these cognitive factors differs depending on bullying exposure. Therefore, this study hypothesized that (1) social anxiety will increase from age 7.5 to 13; (2) children exposed to more severe peer victimisation will have higher initial social anxiety and steeper increase in social anxiety over time; (3) lower self-esteem, and (4) more external locus of control will predict higher initial social anxiety and steeper increase over time for those with more severe victimization experiences.

Method

This sample was drawn from the Avon Longitudinal Study of Parents and Children (ALSPAC) which is a large prospective observational study of health and development in children. Pregnant women resident in Avon, UK during 1991-2 were invited to take part in the study. Of 14,541 pregnancies initially enrolled, there was a total of 14,676 foetuses, resulting in 14,062 live births and 13,988 children who were alive at 1 year of age. When the oldest children were approximately 7 years of age, an attempt was made to bolster the initial sample with eligible cases who had failed to join the study originally. The number of new pregnancies not in the initial sample (known as Phase I enrolment) is 913 (456, 262 and 195 recruited during Phases II, III and IV respectively). The phases of enrolment are described in more detail in the cohort profile paper and its update (Boyd et al., 2013; Fraser et al., 2013). The total sample size is therefore 15,454 pregnancies, resulting in 15,589 foetuses, of whom 14,901 were alive at 1 year of age. This includes multiple births. Participant flowchart shown in Figure 1. Informed consent for the use of data collected via questionnaires and clinics was obtained from participants following the recommendations of the ALSPAC Ethics and Law Committee at the time. Please note that the study website contains details of all the data that is available through a fully searchable data dictionary and variable search tool (http://www.bristol.ac.uk/alspac/researchers/our-data/). This project proposal received approval from ALSPAC executive committee [B2804].

Figure 1

Participant Flowchart



[a]Prior emotional problems (Strengths and Difficulties Questionnaire), locus of control (Nowicki-Strickland Internal-External Scale), self-esteem (Harter's Self-Perception Profile for Children). Data available at www.bristol.ac.uk/alspac/researchers/cohort-profile/

Participants

In total 7,278 participants attended clinic assessment at age 8 making them eligible for this study. Of these, 6,704 provided data on bullying exposure, of whom 2,529 were missing data on social anxiety at one or more time points and 842 were missing data on one or more covariates. Complete data was therefore available for 3,333 cases. The current sample includes singleton births only to reduce within family confounds.

Measures

Peer Victimisation

A modified version of the bullying and friendship interview (Wolke et al., 2001) was used to determine the frequency that children had experienced nine different types of relational and overt peer victimisation involving other children at school or to/from school in the past six months. Specifically, four relational behaviours (others wouldn't play with them to upset them, been made to do things didn't want to do, had lies/nasty things said about them, had games spoilt) and five overt behaviours (had personal belongings taken, been threatened/blackmailed, been hit/beaten up, been tricked in a nasty way,

been called bad/nasty names). For each type, participants responded "*no*", "*yes sometimes*" (less than four times), "*yes repeatedly*" (four or more times), or "*yes very frequently*" (at least once per week). Fisher et al. (2013) established an index of bullying severity in the same sample comprising three levels of bullying severity at age 8, such that children who reported exposure to both overt and relational victimization at least 4 times each or at least once per week were classed as severely bullied, those who had experienced only one of these types at this frequency were classed as occasionally bullied, and all remaining children were classified as not bullied. Internal reliability was acceptable (α = 0.73).

Locus of Control

An adapted version of the Nowicki-Strickland Internal-External scale (Nowicki & Duke, 1974) suitable for use with children was completed during in-person assessment at age 8 years, comprising 12 items answered yes/no. A sum score was calculated (Range 0-12), with higher scores indicating more external locus of control and lower scores indicating more internal locus of control.

Self-Esteem

The global self-worth subscale of Harter's Self Perception Profile for Children (Harter, 1985) was completed during in-person assessments at age 8 years, comprising 6 items each split into two components reflecting high and low self-esteem (e.g., some children are often unhappy with themselves, other children are pretty pleased with themselves). Each component was rated as "*sort of true for me*" or "*really true for me*" to produce a four-point scale for each item. A sum score was calculated (Range 6 – 24), with higher scores indicating higher self-esteem. Internal reliability was acceptable (α = 0.73).

Prior Emotional Problems

Parents rated their child's emotional wellbeing using the relevant subscale from the Strengths and Difficulties Questionnaire at age 6.75 years. A sum score was calculated (Range 0 – 10) with higher scores indicating more emotional difficulties. This variable was included as a covariate in the model.

Social Anxiety

Parents rated their child's fear of new people, lots of people, and eating, speaking, reading, or writing in front of others over the last month as either "*no*", "*a little*", "*a lot*", using the Development and Well-being Assessment (Goodman et al., 2000) six-item social fears subscale (DAWBA-SF) at age 7.5, 10, and 13. A total score was calculated (Range 0 – 12), with higher scores indicating more severe social anxiety. Internal reliability was good (α = 0.77 – 0.80).

Analytic Approach

First, the pattern of growth in social anxiety over time was modelled using a first-order latent growth curve model (LGCM), specifying initial severity (intercept) and shape of change (slope) using a repeated measure sum score of severity of social anxiety (DAWBA-SF). Data was collected at three time points so linear shape was assumed and loadings for time were fixed at 0 (baseline, age 7.5), 2 (age 10), and 5 (age 13) in order to allow interpretation of the intercept as severity at age 7.5 and slope as linear change over time (Hypothesis 1). Intercepts and slopes were allowed to vary between individuals. Good model fit was assessed using recommended indices (Hooper et al., 2008), namely standardized root mean square residual (SRMR) below 0.08, root mean square error of approximation (RMSEA) below 0.05, comparative fit index (CFI) above 0.95, and Tucker-Lewis Index (TLI) above 0.90. Models were run in Mplus using the MLR estimator (maximum likelihood estimation with robust standard errors) to minimize bias associated with missing data from study attrition and to account for non-normality of observations. Chi-square significance was not used to assess model fit as it is unreliable in large samples and is not estimated when using MLR. All measures were assumed to be influenced by random measurement error.

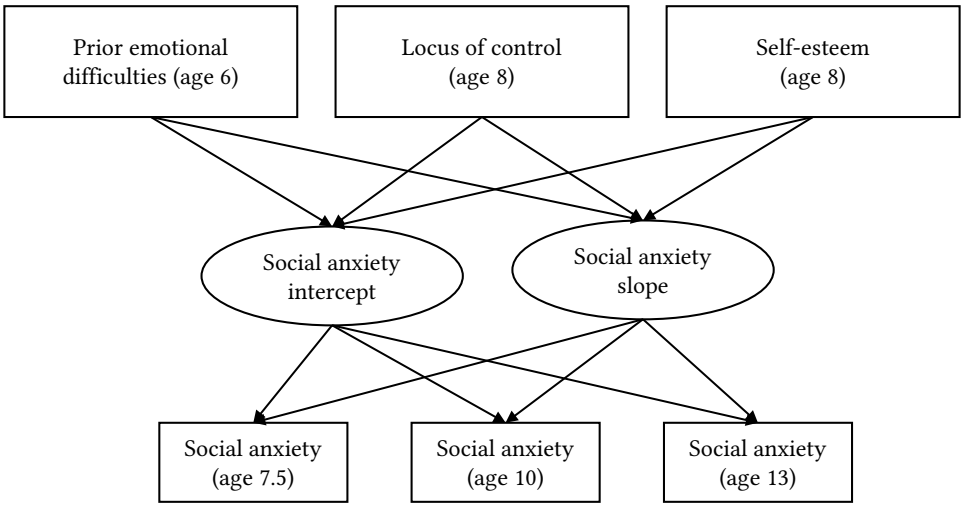
Second, to test the hypothesis that trajectory of social anxiety differs by level of exposure to victimisation (Hypothesis 2), exposure to victimisation was tested as a predictor of social anxiety overall, and in addition initial level and slope was compared between not bullied (n = 4,037), occasionally bullied (n = 1,955), and severely bullied (n = 712) groups in a multi-group LGCM grouped by exposure to victimisation. Presence of additional variance in social anxiety trajectory was also assessed within each victimisation exposure group, with and without adjustment for prior emotional problems.

Third, to test the contribution of cognitive predictors (Hypothesis 3, 4) locus of control and self-esteem were entered into the model to determine their ability to explain variance in initial level and slope in the full sample, in each bullying exposure group, and between bullying exposure groups (see Figure 2).

Univariate Anova suggested no evidence of a differential relationship between bullying and social anxiety according to sex so analyses were conducted on the group as a whole. Data was inspected in SPSS27 and analysed in Mplus 8.

Figure 2

Diagram of Multigroup Latent Growth Curve Model, Grouped by Bullying Severity ("Not", "Occasionally", "Severely")



Results

Sample Characteristics

Enrollment and participation flowchart is shown in Figure 1. At age 8, over a third of participants (n = 2,667, 39.8%) reported exposure to either relational or overt victimization at least four times over the last six months, and of these over a quarter (n = 712, 26.7%) experienced both types and were classified as severely bullied.

Severity of bullying exposure at age 8 was not associated with level of social anxiety but was associated with lower self-esteem and more external locus of control. Those exposed to bullying also had higher prior emotional difficulties compared to those not exposed to bullying. Characteristics are shown in Table 1.

Missing Data

Among the sample with data on bullying at age 8, missing data on social anxiety at age 13 was more likely among those who were severely bullied, $\chi^2(2, n = 6{,}704) = 9.89$, $p = .007$ and those whose parents had a lower socio-economic status, $\chi^2(1, n = 5{,}601) = 29.84$, $p < .001$. Missingness did not differ by sex, $\chi^2(1, n = 6{,}704) = 0.241$, *ns*.

Table 1

Sample Characteristics by Severity of Bullying Victimisation at Age 8

	Severity of Bullying at age 8, *M* (*SD*) or *n* (%)			
Variable	**Not bullied (*n* = 4,037)**	**Occasional (*n* = 1,955)**	**Severe (*n* = 712)**	***F*, χ^2**
Gender Female (*n*, %)	2,136 (52.9)	910 (46.5)	341 (47.9)	17.68[a]
Social Anxiety				
Age 7.5	0.83 (1.50)	0.81 (1.44)	0.86 (1.67)	0.31 (ns)
Age 10	0.89 (1.57)	0.92 (1.62)	1.01 (1.76)	1.49 (ns)
Age 13	1.12 (1.75)	1.17 (1.80)	1.32 (1.97)	3.23[a]
Self-Esteem	19.67 (3.18)	18.98 (3.51)	18.02 (3.72)	80.14[b]
Locus of Control	5.71 (2.05)	6.21 (2.00)	6.67 (2.12)	78.69[b]
Prior emotional difficulties	1.43 (1.58)	1.57 (1.74)	1.59 (1.71)	5.06[c]

Note. Self-reported severity of bullying victimisation using Bullying and Friendship Interview and categorized following Fisher et al. (2013); Social anxiety = DAWBA Social Fears subscale (Range 0 – 12; higher is more social anxiety); Self-esteem = Harter's Self Perception Profile for Children: Shortened Form (Range 6 – 24; higher is better self-esteem); External locus of control = Nowicki-Strickland Internal External Scale (Range 0 – 12; higher is more external); Prior emotional difficulties = relevant subscale from Strengths and Difficulties Questionnaire age 6.75 (Range 0 – 10; higher is more emotional difficulties). Significant group difference between, a. "*not bullied*" and "*severe*", $p < .05$, b. all groups, $p < .01$, c. "*not bullied*" and both bullied groups ($p < .05$).

Trajectory of Social Anxiety

A single linear growth curve model of social anxiety over time had a good fit for the data, CFI = .992, TLI = .977, SRMR = .010, RMSEA = .037, 90% CI [0.018, 0.060]. Across the sample, the social anxiety variable was highly positively skewed but mean levels increased slightly from age 7.5 (Range 0 – 12, $M = 0.83$, $SD = 1.51$), to age 10 (Range 0 – 12, $M = 0.91$, $SD = 1.60$), to age 13 (Range 0 – 11, $M = 1.15$, $SD = 1.79$), confirmed by small but significant positive slope ($M = 0.07$, $SE = .005$, $p < .001$). There was also significant variability in social anxiety intercept ($M = 1.27$, $SE = .090$, $p < .001$) and slope ($M = 0.55$, $SE = .008$, $p < .001$) indicating individual differences around the mean trajectory.

Model fit improved when level of prior emotional difficulties, which are expected to be associated with social anxiety at age 7.5, was included in the model, CFI = .996, TLI = .987, SRMR = .009, RMSEA = .024, 90% CI [0.010, 0.040]. Prior emotional difficulties predicted initial social anxiety ($M = 0.39$, $SE = .021$, $p < .001$) but did not impact on the rate of subsequent change in social anxiety over time ($M = -0.02$, $SE = .030$, *ns*).

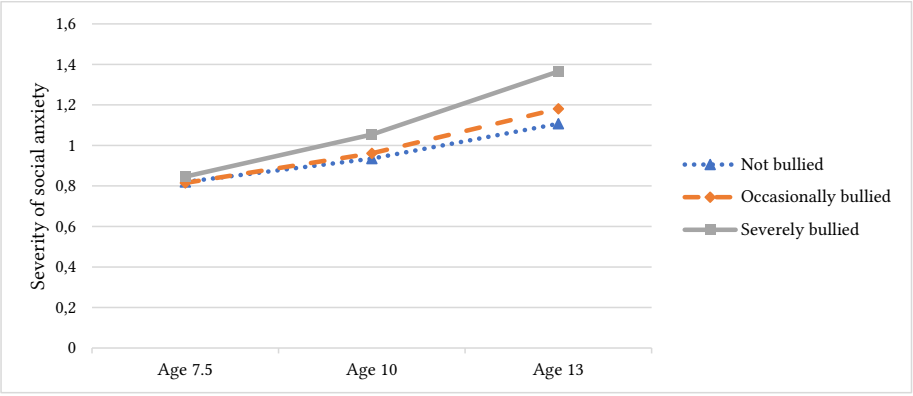
Trajectories of Social Anxiety by Severity of Bullying Exposure

When severity of bullying exposure at age 8 was added as a predictor of overall social anxiety trajectory alongside prior emotional problems, the expected effect of bullying on social anxiety was shown, such that higher bullying exposure at age 8 predicted a slightly steeper increase in social anxiety over time (M = 0.06, SE = 0.02, p = .014). However, bullying exposure at age 8 was not associated with concurrent social anxiety (M = -0.01, SE = 0.02, *ns*).

In order to test the impact of cognitive factors on social anxiety in the context of differing bullying exposure, the sample was split following Fisher et al. (2013) into three groups of bullying severity, namely "*not bullied*", "*occasional*", and "*severe*". Model fit for this grouped model was good, CFI = .995, TLI = .986, SRMR = .011, RMSEA = .025, 90% CI [0.007, 0.042]. All three groups had significant positive slope indicating increasing social anxiety over time ("*not bullied*": M = .063, SE = 0.01, p < .001; "*occasional*": M = .075, SE = .01, p < .001; "*severe*": M = .102, SE = .02, p < .001) but Hypothesis 2 was not supported as there were no significant differences in mean initial social anxiety severity or mean slope between bullying exposure groups. See Figure 3. Of note, there was significant variance in slope within each group indicating that other factors are responsible for explaining individual differences in trajectory.

Figure 3

Estimated Mean Social Anxiety (Age 7.5 – 13) Grouped by Bullying Exposure at Age 8



Note. Grouped by self-reported level of bullying victimisation in Bullying and Friendship Interview. Social anxiety assessed at three time points (age 7.5, 10, 13) using DAWBA Social Fears subscale (Range 0 – 12; higher is more social anxiety). At age 10, group differences in social anxiety are not significant. At age 13, social anxiety was significantly higher in the severe group compared with the not bullied group (p = .013) but not the occasionally bullied group (p = .090).

Cognitive Predictors of Social Anxiety by Severity of Bullying Exposure

The final model including hypothesized predictors (locus of control, self-esteem, and prior emotional difficulties) had good model fit, CFI = .995, TLI = .986, SRMR = .010, RMSEA = .019, 90% CI [0.004, 0.032]. Contrary to Hypothesis 3, lower self-esteem at age 8 was not independently associated with concurrent social anxiety or rate of change in social anxiety over time in any group. In contrast, while more external locus of control at age 8 was not associated with concurrent social anxiety in any group, it predicted a moderate increase in anxiety in the severely bullied group (B = .167, p = .011) with smaller effects for those who were never bullied (B = .095, p = .005) and occasionally bullied (B = .097, *ns*). Prior emotional problems strongly predicted social anxiety at age 7.5 in all groups but did not impact the rate of change in social anxiety over time. See Table 2.

Table 2

Predictors of Social Anxiety Trajectory From Age 7.5 to 13 Grouped by Age 8 Bullying Exposure

Trajectory components and predictors	Not bullied, n = 4,037		Occasional, n = 1,955		Severe, n = 712	
	Coefficient (*SE*)	*p*	Coefficient (*SE*)	*p*	Coefficient (*SE*)	*p*
Intercept (social anxiety age 7.5)	**0.816 (.024)**		**0.810 (.035)**		**0.846 (.066)**	
Predictors of intercept						
Self-Esteem	-0.041 (.023)	*ns*	-0.059 (.034)	*ns*	0.009 (.055)	*ns*
Locus of control	0.039 (.024)	*ns*	0.038 (.034)	*ns*	0.075 (.049)	*ns*
Prior emotional problems	0.393 (.026)	< .001	0.412 (.043)	< .001	0.344 (.063)	< .001
Slope (social anxiety over time)	**0.057 (.007)**		**0.073 (.010)**		**0.102 (.018)**	
Predictors of slope						
Self-Esteem	-0.021 (.033)	*ns*	0.027 (.048)	*ns*	-0.031 (.069)	*ns*
Locus of control	0.095 (.034)	< .05	0.097 (.051)	*ns*	0.167 (.065)	< .05
Prior emotional problems	-0.033 (.040)	*ns*	-0.013 (.057)	*ns*	-0.008 (.081)	*ns*
Intercept x Slope	**-0.061 (.023)**		**-0.067 (.035)**		**-0.081 (.070)**	

Note. Cells contain unstandardized coefficients for intercept and slope estimated without predictors, standardized coefficients for predictors, with standard errors (*SE*) and probabilities (p; two-tailed). Social Anxiety = DAWBA Social Fears subscale; Self-esteem = Harter's Self Perception Profile for Children: Shortened Form; Locus of control = Nowicki-Strickland Internal External Scale; Prior emotional problems = mother report relevant subscale from Strengths and Difficulties Questionnaire.

Discussion

Children who were bullied at age 8 were more likely to have a more external locus of control than other children and higher externality among severely bullied children was associated with steeper increases in social anxiety up to the age of 13. Of note,

exposure to bullying at age 8 was not associated with existing social anxiety at age 7.5 but was associated with subsequent increases social anxiety, and this increase was larger for those with external locus of control. This pattern was not observed in relation to self-esteem. This suggests that external locus of control in early childhood could be a risk factor for later anxiety among severely bullied children and is a potential target for intervention.

External locus of control describes a tendency to consider events and experiences as outside personal control. In this sample, the effect of externality on negative outcomes was small overall but larger in the severely bullied group, such that external locus of control was associated with steeper increases in social anxiety for severely bullied children. Beliefs around bullying that are consistent with external locus of control may include thoughts such as, "*being picked on is inevitable*", or "*others will always target me*". Evidence from personal experiences that contradict these types of beliefs related to bullying may be accessible for those who are not bullied or bullied occasionally. In contrast, beliefs about lack of control over a threatening and unpredictable social environment may be strengthened by repeated confirmatory evidence for children who are severely bullied and therefore more likely to persist. In line with existing literature suggesting that external locus of control is a risk factor for psychopathology (Hallis & Slone, 1999; Karstoft et al., 2015; Zhang et al., 2014), there was some indication of a dose response relationship between external locus of control and social anxiety, but with only minimal effects among children who were never or occasionally bullied. Reknes et al. (2019) suggested that external beliefs were protective against general psychological strain for adult victims of workplace bullying, enhancing acceptance and enabling external attribution of negative experiences towards negative characteristics of the perpetrator or bad luck instead of taking personal blame. However, the current study suggests that while external control beliefs do not confer additional risk of social anxiety for occasionally bullied children there is an additional risk for severely bullied children. For children who are severely bullied and have a tendency towards externality, promoting personal control beliefs may be one route towards encouraging more constructive coping strategies.

The cognitive model of social anxiety disorder (Clark & Wells, 1995) posits that those suffering with social anxiety hold unhelpful beliefs about their ability to perform well in social situations that, when triggered in a social situation, lead to increased self-consciousness and self-monitoring. In an effort to mitigate the perceived risks, the person then engages in "safety-seeking" behaviors that are intended to keep them safe (e.g. looking down and avoiding eye contact). However, these behaviors can also have unintended consequences (e.g. looking unfriendly or disinterested) which negatively impact the social interaction. Therefore, it is possible that excessive perception of threat may persist even in the absence of an ongoing objectively threatening environment and that perceiving threat may encourage children to act in ways that could inadvertently

increase likelihood of ongoing bullying. In this analysis, social anxiety at age 7.5 was not associated with higher bullying exposure at age 8, so it is not necessarily the case that more fearful children were being targeted or perceived that they were being targeted. However, appraisals associated with external locus of control may contribute to excessive perceptions of ongoing social threat and to passive or unhelpful forms of coping that contribute to increasing social anxiety over time.

It is interesting to note that early self-esteem did not influence the trajectory of social anxiety to age 13 among any bullying exposure group. As such, it is possible that early cognitive processes related to self-esteem could be less important in terms of predicting future anxiety (Sowislo & Orth, 2013) despite evidence of cooccurrence (Lee & Hankin, 2009). In fact, these results support cross-sectional associations between bullying, self-esteem and social anxiety (Gómez-Ortiz et al., 2018; Núñez et al., 2021) but our findings suggest that children who are bullied and have low self-esteem are not necessarily at increased risk of social anxiety over time. Similarly, although our analyses showed the expected association between prior emotional problems and social anxiety at age 7.5, there was no ongoing impact of early emotional problems on increasing social anxiety over time. This indicates that early emotional problems and self-esteem may be less important indicators of ongoing adjustment compared with external locus of control, a feature that has been largely overlooked in this domain but which may be an important clinical target for assessment and intervention.

This study has important clinical implications. It is notable that long-term anxiety associated with bullying can persist even in the absence of current threat, that is, even after bullying has stopped. Cognitive theories of anxiety after stressful experiences (Clark & Wells, 1995; Ehlers & Clark, 2000) suggest that cycles develop between unhelpful beliefs, particular memory characteristics, and behavioral and cognitive coping strategies to maintain anxiety. Maladaptive beliefs associated with bullying may contribute to social anxiety that increases over time and children who have been bullied may be supported with cognitive behavioural approaches (Pontillo et al., 2019). This study suggests that particularly among children who have been severely bullied, beliefs associated with external locus of control may be relevant to maintaining and exacerbating social anxiety. More specific investigation of these beliefs could inform targeted and developmentally appropriate approaches to treatment among young people. In addition, these findings underline the importance of repeated measurement of social anxiety during adolescence in order to recognize differential trajectories of change. It appears that the differentiated trajectories in social anxiety were not visible prior to age 10 and rather became apparent first between age 10 and 13. This underscores the importance of developmental models of psychopathology that can be linked to a developmental clinical approach.

Some limitations in this study should be kept in mind. The sample suffered from attrition but this is common in prospective studies of this duration. Although higher exposure to bullying was associated with dropout, this would have if anything likely

attenuated findings rather than increased them, such that effect sizes may have been greater if these participants had been retained. Small effect sizes indicate that substantial variance in the model remains unexplained, perhaps due to cognitive or social factors that were not measured, or due to biological or genetic factors. Observed effects between bullying and social anxiety accounted for early internalizing problems, but these were measured after starting school (age 6), so the possibility that very early bullying triggered anxiety cannot be ruled out. It is also possible that past or ongoing bullying may negatively impact self-esteem later, but this is not measured in this study. Of note, the locus of control and self-esteem measures used in this study were not developed within the cognitive model framework but can provide a useful proxy for the meaning of the constructs within this model. Future research should assess whether the observed effect of external locus of control on social anxiety is indeed replicated for cognitions that are consistent with this construct and tailored to perceptions of bullying experiences.

Overall, it is well known that bullying contributes to increased risk of anxiety among children. It is also known that this is a critical developmental stage for increasing social anxiety symptoms and onset of social anxiety disorder, a mental health problem with severe consequences which once chronic rarely abates in the absence of specific interventions. It is also widely recognized that cognitive factors are central to the onset and maintenance of anxiety disorders including social anxiety. The present study aimed to understand the impact of specific cognitive factors, namely locus of control and self-esteem, on trajectories of social anxiety among children aged 8 to 13. Results suggest that children who are severely bullied at age 8 are particularly at risk of increasing social anxiety if they also hold an external locus of control. However, self-esteem does not appear to have the same moderating effect. It is possible that beliefs consistent with external locus of control contribute to further reduced perception of control over the environment in the context of bullying, which leads to more passive or ineffective coping strategies. The results of this study offer new insight into potentially modifiable factors that increase risk of social anxiety among bullied children and suggest that external control beliefs could be useful targets for cognitive interventions.

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Supplementary Materials: Materials [see Index of Supplementary Materials]

Abstract

Background: Functional Somatic Symptoms (FSS; i.e. symptoms without sufficient organic explanation) often begin in childhood and adolescence and are common to this developmental period. Emotion regulation and parental factors seem to play a relevant role in the development and maintenance of FSS. So far, little systematic research has been conducted in childhood and adolescence on the importance of specific emotion regulation strategies and their links with parental factors.

Method: In two studies, children and adolescents (Study 1/Study 2: N = 46/68; 65%/60% female, Age M = 10.0/13.1) and their parents completed questionnaires on children's FSS and adaptive and maladaptive emotional regulation (in Study 2, additionally parental somatization and child/parental alexithymia).

Results: In both studies, child-reported FSS were negatively associated with children's adaptive emotion regulation ($r = -.34/-.31$, $p < .03$; especially acceptance) and positively with children's maladaptive emotion regulation and alexithymia ($r = .53/.46$, $p < .001$). Moreover, children's maladaptive emotion regulation ($\beta = .34$, $p = .02$) explained incremental variance in child-reported FSS beyond children's age/sex, parental somatization and emotion regulation. In contrast, parental somatization was the only significant predictor ($\beta = .44$, $p < .001$) of parent-reported FSS in children/adolescents.

Conclusion: Our results suggest that particularly rumination and alexithymia and parental somatization are important predictors of FSS in children/adolescents. Overall, the results showed a dependence on the person reporting children's FSS (i.e., method-variance). So, for future studies it is relevant to continue using the multi-informant approach.

Keywords

adolescents and children, alexithymia, emotion regulation, functional somatic symptoms, parents, transgenerational

Highlights

- Two Studies found negative associations between child-reported FSS and adaptive emotion regulation.
- We found positive associations between child-reported FSS and maladaptive emotion regulation.
- Parental somatization was the only significant predictor of parent-reported FSS.
- Dependence on the rater stresses the importance of the multi-informant approach.

About 10–25% of children and adolescents suffer from Functional Somatic Symptoms (FSS), i.e. bodily complaints such as abdominal pain or headaches that cannot be sufficiently explained by an underlying physical condition (Berntsson & Köhler, 2001; Rask et al., 2009). These bodily complaints interfere with daily activities and potentially impair academic and psychosocial functioning. Children and adolescents suffering from bodily complaints report frequent absences from school, absent-mindedness, impaired leisure behavior, and lower levels of life quality (Beck, 2008; Hoftun et al., 2011; Malas et al., 2017), FSS represent a key feature of Somatoform Disorders (according to ICD-10; World Health Organization, 1993) or Somatic Symptom Disorders (according to DSM-5; American Psychiatric Association, 2013), (functional) somatic symptoms also co-occur with a variety of other disorders and are thus of transdiagnostic relevance (Aldao et al., 2010; Dufton et al., 2009; Tegethoff et al., 2015).

According to the *perseverative cognition hypothesis* (Brosschot et al., 2006), a preoccupation with stressful events or chronic stress may increase the likelihood to experience bodily symptoms through physiological activation. In adulthood, the importance of affect-regulatory processes to FSS and Somatoform Disorders is well established (Bailer et al., 2017; Schwarz et al., 2017). Previous studies found that negative affect or depression and anxiety disorders are associated with reports of bodily symptoms (Bekhuis et al., 2015; Watson & Pennebaker, 1989; Wessely et al., 1999). Moreover, difficulties in emotion processing, expression, and regulation have been reported to be related to higher levels of FSS (Okur Güney et al., 2019; Schwarz et al., 2017). Adaptive emotion regulation strategies such as reappraisal were negatively and maladaptive strategies such as expressive suppression and alexithymia were positively associated with FSS (Brooks et al., 2017;

Erkic et al., 2018). The construct alexithymia describes difficulties in recognizing and describing one's own feelings and is associated with deficits in emotional processing and dysfunctional emotion regulation (Bagby et al., 1994; Luminet et al., 2021).

Less attention has been paid to the relationship between emotional dysregulation and FSS in childhood and adolescence. For instance, in a sample of youth with recurrent abdominal pain (7–18 years), coping strategies including regulating attention or cognitions ("secondary control engagement" such as e.g., acceptance and distraction) were associated with fewer bodily symptoms, and involuntary engagement (including e.g., rumination and intrusive thoughts) with higher levels of bodily symptoms (Thomsen et al., 2002). Regarding emotion-focused (dealing with the emotional experience) and body-focused (dealing with bodily experience, e.g. taking a pill) regulation strategies, children with functional abdominal pain (8–13 years) showed the highest level of body-focused regulation compared to children with no/few and many bodily symptoms, whereas the three groups did not differ in emotion-focused regulation (Rieffe et al., 2007). Gilleland, Suveg, Jacob, and Thomassin (2009) found that child-reported FSS were associated with reduced emotional awareness. Mother-reported FSS in children/adolescents, in addition, was associated with low emotion regulation abilities including low emotion expression, empathy, and self-awareness. While there are hardly any studies on specific emotion regulation strategies in the context of FSS in children and adolescents, some previous studies have focused on emotion awareness and alexithymia. A further study (Jellesma et al., 2006) found that children with many somatic symptoms (highest 30% of a symptom scale) as well as a clinical group of children with functional abdominal pain (8–13 years) reported significantly stronger negative affect and more difficulties in differentiating and communicating feelings compared to children with few somatic symptoms (whereas the first two groups do not differ in that regard). According to a recent systematic review, seven of eight identified studies on self-reported alexithymia showed that children with FSS reported significantly higher levels of alexithymic traits compared to healthy controls (Hadji-Michael et al., 2019).

In terms of a development perspective it is important to consider the development and maintenance of youth FSS in interaction with parental and family factors (Beck, 2008). Models of transgenerational transmissions of psychopathology (Hosman et al., 2009) and particularly those with a focus on pain or emotion regulation (Morris et al., 2007; Stone & Wilson, 2016) suggest that parenting (especially e.g., regarding coping with affect) and children's emotion regulation might account for the relationship between parental emotional dysregulation/psychopathology and children's psychological outcomes. Gilleland et al. (2009) found that parental somatization and youth deficits in emotion regulation were significant predictors of mother-reported child somatization and only parental somatization was a significant predictor of father-reported child somatization. In line with the transmission model (Stone & Wilson, 2016), the association between

parental pain catastrophizing and adolescent symptom-related impairment was shown to be mediated by the pain catastrophizing of adolescents (Wilson et al., 2014).

So far, there is relatively little research on the relationship between emotion regulation and FSS in the field of clinical child and adolescent psychology. In particular, there is hardly any study on concrete emotion regulation strategies (e.g., reappraisal, suppression, see findings above in adulthood) and very little on the role of parental somatization. Therefore, to narrow this gap in the literature, in two studies we aimed at systematically investigating the relationships between parent and child emotion regulation and parent and child somatization (parental somatization only assessed in Study 2).

Study 1 was designed as a pilot study and investigated relationships between child and parental emotion regulation and children's FSS. We hypothesized that child and parental reappraisal and acceptance would be negatively associated and rumination and catastrophization would be positively associated with children's FSS. Based on the transgenerational model (Stone & Wilson, 2016) and previous findings, suggesting that female gender and increasing age in youth are associated with FSS (Lieb et al., 2000; Stone & Wilson, 2016), it was assumed that beyond age and gender and parental emotion regulation, child emotion regulation is a significant predictor of FSS in children and adolescents.

Study 2 aimed at replicating the results of Study 1 in a second sample of youth and their parents (and child and parental alexithymia and parental somatization were assessed). In addition to the hypotheses in Study 1, we expected a positive relationship between child and parental alexithymia and FSS. To expect a specific relationship between emotion regulation and FSS, we also hypothesized that beyond parental somatization, parental and child emotion regulation would explain additional variance in FSS in children and adolescents.

In line with current dimensional-hierarchical approaches to psychopathology (Hierarchical Taxonomy of Psychopathology; HiTOP; Conway et al., 2019) and the preference for the dimensional view especially of somatic symptoms (Jasper et al., 2012), FSS were investigated in the general population.

Method

Participants

The participants of Study 1 and 2 were recruited in the general population using flyers posted in schools in German cities. The inclusion criteria were an age of the children and adolescents between 7-14 (Study 1)/8-17 years (Study 2) and a consent of a parent or guardian. There was no drop-out in Study 1. In Study 2 (conducted online), originally $N = 79$ children and parents (each) participated. Due to incorrect completion of the child version by parents and unassigned codes of child and parent, $N = 11$ cases had to be

excluded. The socio-demographic data of both samples ($N = 46/N = 68$) are shown in Table 1.

Table 1

Sociodemographic Characteristics of Children/Adolescents and Their Parents for Study 1 (N = 46) and Study 2 (N = 68)

	Study 1		Study 2	
Sociodemographic variables	***N* (%)**	***M* (*SD*)**	***N* (%)**	***M* (*SD*)**
Age				
Children		9.96 (1.58)		13.09 (2.22)
Parents		44.74 (4.63)		44.97 (6.19)
Sex				
Children (female)	30 (65.2%)	–	41 (60.3%)	–
Parents (female)	40 (87.0%)	–	62 (91.2%)	–
Children: Type of school				
Elementary school	29 (63.0%)	–	6 (8.8%)	–
Grammar school	15 (32.6%)	–	25 (36.8%)	–
Secondary school			1 (1.5%)	–
Comprehensive school	–	–	35 (51.5%)	–
Other school type/no statement	2 (4.3%)	–	1 (1.5%)	–
Parents: native language[a]				
German	34 (73.9%)	–	61 (89.7%)	–
Others/no statement	12 (26.1%)		7 (10.3%)	
Parents: Family status				
Married or partnership	34 (73.9%)	–	57 (83.8%)	–
Single/Divorced/Widowed	6 (13.0%)	–	11 (16.2%)	–
No statement	6 (13.0%)	–	–	–
Parents: Education (% higher education)	24 (52.2%)	–	29 (42.6%)	–
Parents: Occupation				
Unemployed	1 (2.2%)	–	1 (1.5%)	–
In training	–	–	1 (1.5%)	–
Employee/civil servant	30 (65.2%)	–	53 (77.9%)	–
Self-employed	2 (4.3%)	–	5 (7.4%)	–
Housewife/-husband	10 (21.7%)	–	7 (10.3%)	–
Retired	–		1 (1.5%)	
No statement	3 (6.5%)	–	–	–

[a]Study 2 also asked for nationality: 95.6% German or dual citizenship including German (e.g. Czech, Romanian, Croatian), 1.5% American, 1.5% Bulgarian and 1.5% Czech.

Procedure

The data collection of *Study 1* was part of a larger project on the behavioral assessment of psychopathology in children and adolescents from the general population (in 2017-2018). The study took place on a single date in a research laboratory of the Psychological Institute. The study design required the accompaniment of one parent, which one was not pre-determined by the study, but according to the time capacity of the parents (in 87% of the cases the mother as accompaniment). As compensation, the children received a small game (e.g., board game) and the parents 10€ per hour. *Study 2* was an online study about body awareness and dealing with feelings (over 8 weeks in 2019). In both studies, parents and children/adolescents gave informed consent prior to participation. As compensation for their participation, children and parents were given the opportunity to take part in a lottery for 5 x 15 € gift vouchers. The study protocols of both studies were approved by the institutional review board of the Psychological Institute.

Measures

Children and Adolescents

The *Screening for Somatoform Disorders in Children and Adolescents* (SOMS-CA; Winter et al., 2018) is a validated self-reported measure for assessing FSS. The *SOMS-CA* was used in *Study 1 and 2*. Participants report on 33 somatic symptoms (pain, gastrointestinal, cardiorespiratory, and pseudo-neurological symptoms) that have occurred in the last 6 months and for which the doctor has not found a clear medical explanation. A total number of complaints is calculated from the sum of the 33 bodily symptoms. This score showed high internal consistencies in both studies (Cronbach's α = .91/.84). Additionally, the *SOMS-CA* assesses further characteristics of FSS, such as illness-related behavior (e.g., doctor visits) and functional impairments. An additional score can be calculated including these factors, whereby an earlier study (Jungmann & Witthöft, 2020) showed that this score can be ambiguous due to jump rules, so this study focused on the above-mentioned total number score of FSS.

The *Questionnaire to assess Emotion Regulation in Children and Youths* (Fragebogen zur Erhebung der Emotionsregulation bei Kindern und Jugendlichen, FEEL-KJ; Abler & Kessler, 2009) is a validated 90-item self-report measure for assessing different strategies of emotion regulation when children and adolescents feel sad, anxious, and angry. Emotion regulation can be divided into the superordinate scales "adaptive" (e.g., acceptance and reappraisal), "maladaptive" (e.g., rumination), and "other strategies" (e.g., social support). A five-point Likert scale (1 = *almost never* to 5 = *almost always*) is used to indicate the degree of agreement with each statement. The *FEEL-KJ* showed acceptable to high reliability as well as construct and external validity (Cracco et al., 2015). Both studies focused on "adaptive" (α = .95/.85), "maladaptive emotion regulation" (α = .91/.77), and

the individual strategies of "acceptance" (α = .75/.56), "reappraisal" (α = .76/.52), and "rumination" (α = .77/.46). Based on previous studies on the links between depression, emotion regulation, and bodily complaints (Allen et al., 2011), *Study 2* focused only on strategies in response to sadness (each strategy with two items).

Additionally, *Study 2* used the *Alexithymia Questionnaire for Children* (AQC; Rieffe et al., 2006), a 20-item self-report questionnaire for assessing alexithymia in children/adolescents. The items (e.g., "I don't know what's going on inside me.") are rated on a three-point Likert scale (0 = *not true* to 2 = *often true*). The internal consistency was α = .82.

Parents

The *Screening for Somatoform Disorders in children and adolescents for parents* (SOMS-P; Voß, 2013) measures the severity of children's FSS from the parents' perspective. The structure and scoring are analogous to the SOMS-CA (α = .82/.81).

The *Cognitive Emotion Regulation Questionnaire* (CERQ; Loch et al., 2011) assesses cognitive emotion regulation strategies used in the context of negative experiences or life events. The frequency of using the different strategies is measured with a five-point Likert scale (1 = *almost never* to 5 = *almost always*). Based on our hypotheses, both studies focused on the superordinate scales "adaptive" (α = .93/.80) and "maladaptive emotion regulation" (α = .81/.72) and on the individual strategies "acceptance" (α = .84/.82), "reappraisal" (α = .85/.63), "rumination" (α = .66/.53), and "catastrophizing" (α = .65/.73). Following Garnefski and Kraaij (2006), *Study 2* used a shortened version with two items per strategy.

Additionally, *Study 2* included the *Toronto Alexithymia Scale* (TAS; Bagby et al., 1994; Popp et al., 2008) and the *Brief Symptom Inventory* (BSI; Franke, 2000). The *TAS-20* is a 20-item self-report measure for assessing alexithymia in adults and comprises a five-point Likert scale from 1 = *not at all true* to 5 = *completely true* (α = .85). The *BSI* is a 53-item screening questionnaire assessing various psychopathological characteristics within the last 7 days in adulthood. The items are rated on a scale from 0 = *not at all* to 4 = *very strong*. Based on our hypotheses, we have focused on the subscale of somatization (7 items, α = .62).

Statistical Analyses

Statistical analyses were carried out with SPSS 23.0. For Study 2, an a priori power analysis using G*Power with ρ H1 = .4, an alpha error = .05, and a statistical power = .90 for bivariate correlations resulted in a minimum sample size of $N = 61$ (not for Study 2 due to a pilot study as a part of a larger project). In the online study (Study 2), the survey response was set so that no questions could be omitted. In Study 1, the pairwise deletion method was used for individual missing items. To test the relationships, we first calculated Pearson correlation coefficients (most variables were approximately normally

distributed). To examine the incremental variance explained by parental/child emotion regulation, multiple hierarchical regression models were computed for the dependent variable FSS (once for child-reported/parent-reported FSS). For regression analyses, first multicollinearity was checked (correlations of the predictors were each below $r = .70$; Tabachnick & Fidell, 1996). In *Study 1*, sex and age were controlled for in Step 1, parental adaptive and maladaptive emotion regulation were entered in Step 2 (CERQ), and child emotion regulation in Step 3 (FEEL-KJ) (order in line with the transgenerational model; Stone & Wilson, 2016). In *Study 2*, parental somatization was added in Step 2 and parental/child emotion regulation in Steps 3 and 4 (CERQ, FEEL-KJ) (order in line with Gilleland et al., 2009).

Results

Participant Characteristics Regarding FSS and Emotion Regulation

In *Study 1*, boys and girls did not differ significantly in FSS and emotion regulation ($p \geq .23$, $d \leq 0.40$). With regard to age of the children, significant positive correlations were found with children's maladaptive emotion regulation ($r = .38$, $p = .011$) and children's rumination ($r = .33$, $p = .030$).

In *Study 2*, girls showed higher scores compared to boys in reporting maladaptive emotion regulation, $t(66) = -2.97$, $p = .004$, $d = 0.73$, and rumination, $t(66) = -3.18$, $p = .002$, $d = 0.78$. Children's age correlated positively with the child-reported gastrointestinal symptoms ($r = .30$, $p = .015$) and maladaptive emotion regulation ($r = .32$, $p = .008$). Appendix A (see Supplementary Materials) shows the participant characteristics of *Study 1* and *2*.

Relationships Between FSS and Emotion Regulation

Study 1

As expected, in *Study 1* we found a negative correlation between children's adaptive emotion regulation and child-reported FSS ($r = -.34$, $p = .026$). At the level of individual strategies, there were no significant associations with reappraisal ($r < .01$, $p > .99$) and acceptance ($r = -.26$, $p = .096$). As hypothesized, there were significant positive correlations between children's maladaptive emotion regulation ($r = .53$, $p \leq .001$) and rumination ($r = .41$, $p = .001$) with child-reported FSS. No significant correlations were found between children's emotion regulation and parent-reported FSS in children/adolescents ($r \leq |.20|$, $p \geq .198$). Concerning parental emotion regulation, as expected, parental rumination was significantly positively associated with child-reported FSS ($r = .34$, $p = .028$) and parental maladaptive emotion regulation ($r = .37$, $p = .011$) was well as parental rumination ($r = .37$, $p = .011$) were significantly positively correlated with parent-reported FSS. Appendix

B (see Supplementary Materials) describes the correlations between child and parental somatization and child and parental emotion regulation.

Study 2

As in Study 1, *Study 2* found a significant negative correlation between children's adaptive emotion regulation and child-reported FSS (r = -.31, p = .011). At the level of individual strategies, there was a significant negative association between children's acceptance and child-reported FSS (r = -.36, p = .003). Children's maladaptive emotion regulation (r = .46, $p \leq .001$) and alexithymia (r = .39, p = .001) were significantly positively correlated with child-reported FSS. Additionally, children's acceptance was significantly negatively correlated with parent-reported FSS (r = -.25, p = .047). Regarding parental emotion regulation, parental acceptance showed a significant negative correlation with child-reported FSS (r = -.30, p = .018). In addition, parental maladaptive emotion regulation (r = .29, p = .018) and alexithymia (r = .29, p = .018) were positively correlated with parental somatization (see Appendix B in the Supplementary Materials).

Regression Analyses for Predicting FSS in Children and Adolescents

Study 1

In *Study 1*, children's emotional regulation (ΔR^2 = .34, p = .001) explained variance in child-reported FSS over and above children's age/gender and parental emotional regulation (Appendix C, Supplementary Materials). As the correlations showed, both child adaptive (β = -.30, p = .040) and maladaptive emotion regulation (β = .50, p = .002) were significant predictors of child-reported FSS. To investigate specific regulation strategies, this multiple hierarchical regression was repeated by using the specific hypothesized emotion regulation strategies (acceptance, reappraisal, and rumination) instead of general adaptive and maladaptive emotion regulation. Child acceptance (β = -.36, p = .028) was found to be a negative predictor and rumination a positive predictor (β = .46, p = .007) of child-reported FSS.

The same analyses were carried out for the dependent variable parent-reported FSS (Appendix D, Supplementary Materials). In this model, children's emotional regulation showed no incremental explanation for variance in parent-reported FSS (ΔR^2 = .01, p = .892) in addition to age/gender, and parental emotional regulation. Parental emotion regulation provided a significant explanation of variance in parent-reported FSS (ΔR^2 = .22, p = .010), which can be attributed to maladaptive emotion regulation as a significant predictor (β = .37, p = .025). Including individual strategies (catastrophization and rumination), parental rumination (β = .48, p = .017) was found to demarcate a significant predictor of parent-reported FSS.

Study 2

As in Study 1, in *Study 2* children's emotion regulation explained incremental variance in child-reported FSS (ΔR^2 = .14, p = .009) beyond age/sex, parental somatization, and parental emotion regulation (Appendix C, Supplementary Materials). Maladaptive emotion regulation (β = .34, p = .020) was shown to be a significant predictor of child-reported FSS, whereby the assumed individual strategy rumination did not prove to be a significant predictor (β = .04, p = .777)

This analysis was repeated for the dependent variable parent-reported FSS in children/adolescents (Appendix D, Supplementary Materials). As in Study 1, in *Study 2* children's emotion regulation did not explain significant incremental variance in parent-reported FSS (ΔR^2 = .014, p = .594) beyond age/sex, parental somatization, and parental emotion regulation. In this model for predicting parent-reported FSS, parental somatization was the only significant predictor (β = .44, p < .001).

Discussion

Two studies were conducted to investigate the relationships between child and parental emotional regulation and child and parental somatization. Based on previous research and the transgenerational model for the development of FSS in children/adolescents (Gilleland et al., 2009; Stone & Wilson, 2016), we hypothesized that children's emotion regulation should explain additional variance in children's FSS beyond parental somatization and emotional regulation. We tested our hypotheses in a pilot sample, and then replicated the findings in an independent sample.

To evaluate the levels of FSS in our studies, we have set them in relation with a previous study among children/adolescents in the general population (Jungmann & Witthöft, 2020). Compared to the study by Jungmann and Witthöft (2020), in the present studies the total number of child-reported FSS was higher (d = .31/.66). Regarding socio-demographic data, the children in our two studies were on average younger (M = 10.0/13.1 vs. M = 14.2 in Jungmann & Witthöft, 2020), the gender distribution was comparable (59 – 65% female). There are inconsistent findings on the relationship between FSS and age, Lieb et al. (2000), for example, describe a steep increase between the ages of 8 and 12, other studies found no relationship between age and FSS in children and adolescents (Cerutti et al., 2017; Dhossche et al., 2001). Also, only Study 2, but not Study 1, found a significant correlation between age and gastrointestinal symptoms. Presumably, additional factors or an interaction of factors can better explain the level of FSS. Since Jungmann and Witthöft's (2020) study used the same measuring instrument to record FSS, situational factors (e.g., holidays), the type of survey (laboratory/at home), and/or parent-child interactions (e.g., parents' reactions to child's symptoms) would be conceivable. The latter point could also be in line with the transgenerational model

(Stone & Wilson, 2016), which assumes that the parental influence on the perception and expression of body symptoms is greater in younger children.

In accordance with the hypothesis and consistently in both studies, significant negative correlations were found between children's adaptive emotion regulation and child-reported FSS. This is also compatible with previous studies on bodily complaints in children and adolescents, whereby the present studies have examined more specifically adaptive emotion regulation in comparison with coping processes (Thomsen et al., 2002) and emotion regulation abilities such as empathy and self-awareness (Gilleland et al., 2009). As assumed, Study 2 also found a negative association between acceptance and child-reported FSS, in accordance with the study by Thomsen et al. (Thomsen et al., 2002) in which acceptance represented a kind of secondary control engagement. Possible reasons why Study 1 missed the significance level for this association (p = .096) could be the smaller sample, but also, for example, the younger age. Possibly, younger children may use this strategy less or have less understanding of what it meant (e.g., "I accept what makes me angry."). In contrast to the study by Erkic et al. (2018), which showed a reduced level of the reappraisal strategy in adults with SSD, no significant correlations between children's reappraisal and child-reported FSS were found in both studies. On the one hand, this strategy could be less developed in childhood, which is also shown by the fact that the mean scores for reappraisal were lower than those for acceptance; on the other hand, this correlation could also only become apparent in the pathological manifestation of SSD.

As expected and consistent in both studies, positive associations between childhood maladaptive emotional regulation and child-reported FSS were also found. Only Study 1 showed a significant positive correlation with rumination. In Study 2, the subscale rumination showed a low internal consistency (α = .46), which could possibly be due to the fact that rumination in terms of the shortened version of the FEEL-KJ was recorded with only two items. In addition, our study also confirmed the positive correlation between alexithymia and child-reported FSS (Hadji-Michael et al., 2019).

In comparison to the relationships between the child reports, only a significant association was found between child acceptance and parent-reported FSS. This association might indicate that when children show higher acceptance, parents perceive or report less body symptoms of their children. Moreover, in line with previous studies (De Los Reyes et al., 2015), this finding also suggests that the child's and parent's judgements can differ more significantly in the case of personal experiences and internalizing symptoms, and consequently it is relevant (even if the children are younger) to question the children themselves.

Explaining child-reported FSS, children's emotional regulation consistently showed the highest variance explanation in both studies (14–34%) and explained additional variance in addition to age/gender and parental emotional regulation. Especially maladaptive emotion regulation was found to be a significant predictor. This suggests the

importance of children's emotional regulation for children's FSS and confirms findings in adults (Erkic et al., 2018). Like first approaches in adulthood (Kleinstäuber et al., 2019), the promotion of adaptive emotion regulation/reduction of dysfunctional emotion regulation could be a promising approach for the psychotherapeutic treatment of FSS in childhood and adolescence. For variance explanation of parent-reported FSS, parental emotion regulation (22%), especially parental maladaptive emotion regulation, showed a significant incremental variance explanation in Study 1, but when parental somatization was also included in Study 2, it was the only significant predictor. Thomsen et al. (2002) also found only parental somatization as a significant predictor of father-reported physical complaints in children. This result could indicate that the estimation/perception of childhood FSS depends on the parents' own experience of physical complaints, which should also be taken into account, for example, when exploring/treating FSS in children. The findings could also be consistent with current interoceptive predictive coding models of symptom perception (e.g., Van den Bergh et al., 2017) which assume that the perception and evaluation of body symptoms is influenced by previous experience. This could be the case not only for the perception of one's own body symptoms, but also for those of children.

Some limitations should be mentioned. The samples of both studies are rather small (especially Study 1, see also power analysis) and not representative in terms of socio-demographic data (e.g., parents' high education, 80–90% mothers). Our cross-sectional design does not allow us to draw any causal conclusions; longitudinal studies would also be of interest, e.g., to examine the temporal course of deficits in the emotion regulation of FSS and the transgenerational model more closely. The survey conditions (Study 1/2: laboratory/Online), samples (age), and, in some cases, the measuring instruments differ between Study 1 and 2. We cannot exclude the influence of these factors on our results. For example, the partly found divergences of Study 1 and Study 2 might have resulted from different survey conditions. In Study 2, the shortened version of the FEEL-KJ found partially low internal consistencies of the individual strategies, which should be examined in further studies. In this context, it should also be mentioned that some questionnaires for children are not validated in German or for an age below 10/11 years. Validation studies are needed here in the future. This could contribute to biases (e.g., too low scores) because the items are still too difficult for younger children (8-10 years).

Conclusion

In summary, our studies indicate that in childhood and adolescence, emotion regulation is related to FSS. Thus, the promotion of functional emotion regulation/reduction of maladaptive emotion regulation likely represents a promising complementary approach for the treatment of FSS in children and adolescents. In predicting parent-reported FSS, parental somatization was the only significant predictor. This finding highlights the dependence on the perspective and previous experience with body symptoms of the

person making the assessment. Therefore, the consideration of parental factors is also relevant in the treatment of FSS in children. Furthermore, it shows the importance of multidimensional approaches, whereby in addition to a multi-informant approach the inclusion of experimental procedures could present a key source of information in future studies (e.g., promoting adaptive emotion regulation in children with FSS).

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Supplementary Materials

The Supplementary Materials contain the following items (for access see Index of Supplementary Materials below).

- **Appendix A.** Participant characteristics regarding functional somatic symptoms (FSS) and emotion regulation.
- **Appendix B.** Pearson correlations between FSS and emotion regulation.
- **Appendix C.** Multiple hierarchical regression analyses for predicting *child-reported FSS* in children and adolescents.
- **Appendix D.** Multiple hierarchical regression analyses for predicting *parent-reported FSS* in children and adolescents.

Index of Supplementary Materials

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Social Media Use and Mental Health in Young Adults of Greece: A Cross-Sectional Study

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Abstract

Background: Social media use has vastly increased during the past few years, especially among young adults. Studies examining the relationship of social media use with mental health have yielded mixed findings. Additionally, such studies are extremely limited in Greece. The present study aimed to investigate the association between social media use, depressive symptoms and self-esteem among Greek young adults.

Method: A total of 654 individuals (50.5% male) aged 18-30 years (M = 23.62, SD = 2.71) completed self-reported questionnaires regarding social media use, depressive symptoms and self-esteem.

Results: Increased daily use of YouTube (more than five hours) showed a significant association with higher depressive symptomatology, b = 2.99, 95% CI [.78, 5.20], p = .008, while daily use of Facebook between two and five hours was related to significantly higher self-esteem, b = 1.61, 95% CI [.78, 2.44], p < .001, after adjusting for participants' gender, age, educational level and employment status. The association of increased daily use of YouTube with depressive symptoms was more pronounced in males than in females. Moreover, self-reported active use of Facebook and Instagram were linked with significantly lower depressive symptoms and higher self-esteem compared to passive involvement.

Conclusion: The results suggest that social media use is closely related to self-esteem and depressive symptomatology in young adults. These findings may contribute to a deeper clinical understanding of the association between electronic social networking and mental health.

Keywords

social media, mental health, self-esteem, depressive symptoms, young adults

Highlights

- Increased daily time spent in YouTube (more than five hours) was significantly associated with higher depressive symptomatology.
- YouTube daily use of more than five hours showed a stronger association with depressive symptoms for males than for females.
- Daily use of Facebook between two and five hours was related to significantly higher self-esteem.
- Self-reported active use of Facebook and Instagram were linked with significantly lower depressive symptoms and higher self-esteem compared to passive involvement.

Electronic social networking is undoubtedly a worldwide technological phenomenon with various extensions in modern human life. Through social media people are able to communicate and interact with each other, while they also have the opportunity to develop and share electronic data (Ellison et al., 2007; Kaplan & Haenlein, 2010). During the past few years, social media have become extremely popular, especially among young adults (Pew Research Center, 2015). Specifically, 90% of U.S. adults aged 18-29 are frequent users of at least one online social network, while YouTube and Facebook are the most popular platforms (Pew Research Center, 2019). In Greece, almost 60% of total population are involved in social media use (Hootsuite & We Are Social, 2020), while young adults constitute the vast majority of users (Belenioti, 2015). Similarly to other countries, Facebook and YouTube are the two most widely used social networks in Greece (Drosos et al., 2015).

Due to the fast and constantly increasing penetration of social media in everyday life, their association with mental health has gained considerable attention within the scientific community. Recent studies have provided mixed results, either indicating harmful effects of social networks on users' psychological well-being (e.g. Rasmussen et al., 2020; Sujarwoto et al., 2019) or suggesting non-significant associations (e.g. Coyne et al., 2020). Social media users facing mental health difficulties appear to experience both benefits, such as easy social interaction, access to peer support, increased involvement in various services, and negative consequences, including increased symptoms and exposure to aggressive online behaviour (Naslund et al., 2020). Overall, international research has showed that social networking can affect mental health both positively and negatively (Sharma et al., 2020).

Depression is a mood disorder considered as the primary cause of disability and one of the most common causes of death between the ages of 15 and 29 years, since it is responsible for more than 800,000 annual suicides (World Health Organization, 2020). The relationship between social media use and depression has been in the spotlight of research for about a decade, with many studies suggesting that increased involvement in online social networking is associated with higher levels of depressive symptomatology (Ivie et al., 2020; McDougall et al., 2016; Pantic et al., 2012; Woods & Scott, 2016). Elon-

gated daily time spent in social media has been linked to higher odds of depression in young adults (Lin et al., 2016), while the use of multiple social networking platforms has been related to increased depressive symptoms (Primack et al., 2017). In a recent study, the reduction of time spent in social networks was linked to significantly less negative mental health outcomes, including less depressive symptoms, in young adults (Hunt et al., 2018). Social comparison has often mediated the aforementioned associations (e.g. Brown & Tiggemann, 2016; Lup et al., 2015), while envy has displayed a mediating effect on the relationship between social comparison and adult users' depressive symptoms (Wang et al., 2020). Finally, addiction to social media has been significantly associated with depression (Donnelly & Kuss, 2016).

Despite what appears to be evidence for a negative association between social media and depressive symptomatology, other studies have showed that social media use can have positive effects on individuals' well-being. Communication and interaction through these networks have been found to contribute to an increase in social capital and, thus, a reduction in depressive symptoms (Bessière et al., 2010; de la Peña & Quintanilla, 2015; Ellison et al., 2007). Platforms such as Snapchat, Twitter, Instagram and Facebook provide opportunities for participation in positive social interactions among various sources of social support, which can alleviate depressive symptoms (Bessière et al., 2010). Moreover, these platforms may help people form connections with other individuals suffering from stigmatised health conditions such as depression (Merolli et al., 2014). In a similar vein, active use of social networks (e.g. sharing content and communicating with other users) has been linked with decreased depressive symptoms and pertinent outcomes compared to passive use (e.g. avoiding posting new content, visiting other users' profiles and following their posts) (Escobar-Viera et al., 2018; Verduyn et al., 2015). In general, the relationship between social media use and depressive symptoms appears to be complicated and influenced by various individual and psychosocial factors (Baker & Algorta, 2016).

Previous studies have suggested a negative association between depressive symptoms and self-esteem (Conti et al., 2014; Franck et al., 2007). Self-esteem is defined as the subjective way in which individuals perceive their personal value (MacDonald & Leary, 2012). With respect to the association between social media use and self-esteem, findings appear to be mixed. Specifically, recent research indicates that increased involvement in social networks is linked to lower self-esteem in adolescents and young adults (e.g. Bergagna & Tartaglia, 2018; Vogel et al., 2014; Woods & Scott, 2016). On the contrary, some researchers have found that social media use is related to higher self-esteem (e.g. Gonzales & Hancock, 2011; Wilcox & Stephen, 2013). Two mechanisms that seem to explain or mediate such relationships include the kind of feedback that users receive from online social networks (Valkenburg et al., 2017; Valkenburg et al., 2006) as well as social comparison (Bergagna & Tartaglia, 2018; Vogel et al., 2014). Moreover, cyberbullying through social media has been related to lower self-esteem levels (Palermiti et al., 2017).

Little research has been conducted so far regarding electronic social networking and aspects of mental health in the Greek population. Recent findings suggest that almost 34% of Greek adolescent users report intense activity in social networks, while approximately 10% display problematic use, which refers to addictive behaviour (Boer et al., 2020). With regard to Greek young adults, excessive social media use has been linked with higher levels of loneliness and decreased life satisfaction (Vasilikou, 2016). In addition, excessive use of social networking sites has been significantly associated with personality factors, such as neuroticism, along with increased depressive symptomatology in young Greeks (Giota & Kleftaras, 2013). Although little research has been conducted, recent findings have suggested that the frequency of social media use, such as Facebook, is not associated with self-esteem in adolescents (Botou & Marsellos, 2018). However, cyberbullying has been related to low self-esteem in university students of Greece (Giovazolias & Malikiosi-Loizos, 2016).

There is considerable evidence that social media use is linked with mental health, including depressive symptomatology and self-esteem, positively or negatively (e.g. Bessière et al., 2010; Lin et al., 2016). However, approximately half of previous studies have examined social media use in general (Schønning et al., 2020), and many of them as a single variable, without providing results regarding the use of different platforms (e.g. Escobar-Viera et al., 2018; Lin et al., 2016; Woods & Scott, 2016). Studies assessing the use of specific social networks in relation to mental health outcomes have focused mainly on Facebook (e.g. Bergagna & Tartaglia, 2018; Wilcox & Stephen, 2013). Furthermore, the amount of Greek data concerning the relationship between social networks and human behaviour is extremely limited. Taking into consideration the above-mentioned gap in the literature, the aim of the present study was to investigate the association of different popular social media with self-esteem and depressive symptoms in a large Greek sample of emerging adults. We hypothesised that increased time of social media use was significantly associated with higher depressive symptoms and lower self-esteem in young adults. We, also, hypothesised that active social media users would have lower symptoms of depression and higher self-esteem compared to passive social media users.

Method

Participants

To be eligible for inclusion in the study, participants had to meet the following criteria: (i) to be between 18 and 30 years old, (ii) to use at least one electronic social network, and (iii) to have a good understanding of the Greek language. The sample included 654 young adults (50.5% male and 49.5% female) aged 18-30 years (M = 23.62, SD = 2.71). The vast majority of them were Greek (98.9%) and residents of urban areas (94.3%). The sample composition of participants' highest level of education completed was: 58.3%

high school/vocational education and training, 33.9% university/college degree, and 7.8% postgraduate studies. Furthermore, 98.6% of the participants were unmarried and 59.9% reported a low monthly income (up to 500€). Regarding employment status, 59.5% of participants were not working. The sociodemographic characteristics of the participants are presented in Table 1.

Table 1

Sociodemographic Characteristics of Participants and Associations With Depressive Symptoms and Self-Esteem (N = 654)

Sociodemographic variables			Depressive symptoms			Self-esteem		
	N	***%***	***M***	***SD***	***p***	***M***	***SD***	***p***
Gender					**.330**			**.140**
Male	330	50.5	9.24	7.98		30.86	4.59	
Female	324	49.5	9.85	8.18		30.31	4.97	
Nationality					**.514**			**.079**
Greek	647	98.9	9.50	7.99		30.62	4.79	
Other	7	1.1	13.29	14.44		27.43	3.74	
Place of origin					**.086**			**.496**
Urban	527	80.6	9.28	8.09		30.65	4.78	
Rural	127	19.4	10.65	7.96		30.33	4.81	
Place of residence					**.167**			**.483**
Urban	617	94.3	9.43	8.11		30.62	4.81	
Rural	37	5.7	11.32	7.27		30.05	4.43	
Educational level					**.396**			**.610**
High school/V.E.T.	381	58.3	9.85	8.25		30.67	4.61	
University/College	222	33.9	8.94	7.49		30.36	5.01	
Postgraduate studies	51	7.8	9.88	9.19		30.98	5.09	
Employment status					**.191**			**.448**
Working	265	40.5	10.04	8.23		30.76	5.03	
Non-working	389	59.5	9.20	7.96		30.47	4.62	
Net monthly income					**.396**			**.051**
0 € - 500 €	392	59.9	9.70	8.35		30.29	4.73	
> 500 €	249	38.1	9.15	7.49		31.05	4.86	
Marital status					**.097**			**.814**
Unmarried	645	98.6	9.60	8.10		30.59	4.81	
Married	9	1.4	5.11	5.09		30.78	2.28	
	M	***SD***	***Min-max***	***r***	***p***		***r***	***p***
Participants' age	23.62	2.71	18–30	-.043	.273		.058	.139

Note. *t*-test and ANOVA were used for differences between continuous variables; Pearson's *r* was used for correlation between continuous variables.

Measures

Sociodemographic Characteristics

Sociodemographic variables included participants' gender, age, nationality (Greek or other), place of origin and residence (urban vs. rural), educational level that each participant had completed (high school/vocational education and training, university/college degree, postgraduate studies), employment status (working vs. non-working), marital status (unmarried vs. married), and net monthly income (0-500€ vs. 501€ and above).

Social Media Use

We assessed participants' social media involvement based on daily time use and type of user (active/passive user), influenced by recent studies (Escobar-Viera et al., 2018; Lin et al., 2016). Due to the lack of Greek standardised psychometric tools concerning the above-mentioned variables, we designed a brief self-reported questionnaire consisting of three items based on a previous study about internet and social media use in relation to consumer behaviour (Koutsogiannopoulou, 2013). First, participants were asked whether they had been using social media ("Do you use social media?"), responding to an alternative form question ("yes" or "no"), and provided estimates about their daily use of specific popular platforms, including Facebook, Twitter, Instagram, YouTube, Tumblr, LinkedIn, Skype, and blogs. Four response choices were offered in a Likert-type scale ("not at all", "less than two hours", "two to five hours", "more than five hours"). Moreover, individuals were asked to characterise their involvement on each one of these networks as "passive" or "active" after explanation of these two terms was offered. Specifically, passive users were considered those who maintained activities such as limited communication and sharing of electronic content, along with passive following of other users' posts. Conversely, individuals who engaged more in interaction with others and sharing of various types of content were considered as active users. To ensure participants' best comprehension of these patterns of activity, we used definitions and examples based on previous studies (e.g. Escobar-Viera et al., 2018).

Self-Esteem

Self-esteem was measured by means of the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965). The RSES consists of 10 items in form of statements which are related to self-esteem (e.g. "I feel I do not have much to be proud of"). Of these statements, five are positively graded (1, 2, 4, 6, 7) and five are negatively graded (3, 5, 8, 9, 10). Each individual is asked to respond to a four-point Likert scale, ranging from 1 ("strongly disagree") to 4 ("strongly agree"). Total score ranges from 10 to 40 with higher scores indicating higher levels of self-esteem. High self-esteem scores suggest that individuals have self-respect and consider him or herself worthy. Low self-esteem scores suggest an unfavorable opinion of oneself and self-dissatisfaction. The scale has been translated and

validated for the Greek population by Tsagarakis et al. (2007). In the present study, the scale demonstrated satisfactory internal consistency (α = .84).

Depressive Symptoms

Depressive symptomatology was measured using the Beck Depression Inventory-II (BDI-II; Beck et al., 1996). The BDI-II is a 21-item, self-report rating inventory that measures characteristic attitudes and symptoms of depression (Beck et al., 1996), while it taps major depression symptoms according to diagnostic criteria listed in the Diagnostic and Statistical Manual for Mental Disorders (American Psychiatric Association, 2000). Each item is assessed on a four-point scale (0–3). The total score indicates whether the individual presents a mild, moderate or major depression (possible range 0-63). The BDI-II has been translated and validated in Greek by Giannakou et al. (2013). In the present study, the scale showed satisfactory internal consistency (α = .86).

Procedure

Participants were recruited through the research team contacting different academic departments, and disseminating a web link to each student which provided details of the study. Moreover, non-university student participants were recruited via online posts at social media groups. Information about anonymous and voluntary participation was provided to participants prior to data collection. Confidentiality was assured and informed consent was obtained from the participants. Finally, participants were given written instructions for filling out the questionnaires and were informed about the estimated time needed for completing the measures (approximately 15 minutes). The study was conducted in accordance with the ethical standards delineated in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Ethical approval was granted by the Psychology Department's Research Ethics Committee. Informed consent was obtained from all individual participants included in the study.

Data Analysis

With regard to descriptive data, we computed percentages of sociodemographic variables, daily time use of social networks and type of social media use (active and passive use). In terms of descriptive indices, we calculated means (*M*) and standard deviations (*SD*) in order to better frame our results. Social media use was not assessed as a single numeric variable, since we focused our analyses on daily time of use (less than two hours, two to five hours, more than five hours) and self-reported type of use (passive vs. active). Considering that YouTube, Facebook and Instagram showed by far the highest percentages of daily users, our analyses were focused on the specific platforms.

t-test and ANOVA were used for the comparison of independent groups. Specifically, we employed one-way ANOVAs, including post-hoc comparisons using Tukey, to sepa-

rately investigate differences in depressive symptomatology and self-esteem between categories regarding daily use of YouTube, Facebook and Instagram (less than two hours, two to five hours, more than five hours). Moreover, we used independent samples *t*-tests to assess differences in depressive symptoms and self-esteem between categories concerning self-reported type of YouTube, Facebook and Instagram use (active and passive). Pearson's *r* correlation coefficient was used to estimate the strength of the association between self-esteem and depressive symptoms. Multiple linear regression models were also implemented to further and separately examine the associations of YouTube, Facebook and Instagram use (daily time and type of use) with depressive symptoms and self-esteem, after adjusting for confounding variables. Potential confounders related with both the outcome and/or the independent variables in group comparisons with a *p*-value < .2 were included in the models. Therefore, each model was adjusted for participants' gender, age, educational level and employment status, while estimated associations were described in terms of *b*-coefficients (beta). We were also able to examine effect modification stratifying by gender. For interaction terms, we considered *p*-value < .05 as nominally significant. All other hypotheses testing was conducted assuming a .05 significance level and a two-sided alternative hypothesis. All analyses were conducted by means of the IBM SPSS Statistics 26 software.

Results

Prevalence of Social Media Use

In terms of daily time of engagement in social media, YouTube was the most popular platform with respect to users (97.6%), followed by Facebook (93.3%), Instagram (81.8%), blogs (15.9%), Skype (12.1%), LinkedIn (10.9%), Twitter (4.3%) and Tumblr (3.1%). Only 17.7% of the participants reported using some other platform except for the specific ones. Overall, 99.4% of the participants were found to use more than one platform daily. Concerning the self-reported type of social media use, 65.8% of daily YouTube users reported being passive, while 51.3% of daily Facebook users mentioned being active. Instagram demonstrated the highest self-reported active online engagement (75%). Additionally, more than 50% of daily users of blogs, Skype, LinkedIn and Twitter stated passive involvement in these platforms, whereas half of Tumblr everyday users reported being active.

Associations Between Sociodemographic Characteristics and Study Variables

Tables 1 and 2 show associations between participants' sociodemographic characteristics and the outcome variables of our study. Specifically, non-significant relationships were found between sociodemographic variables, depressive symptomatology and self-esteem

at a level of p-value < .05 (Table 1). According to Table 2, significant differences between men and women were found in terms daily use of YouTube, $\chi^2(2, N = 638) = 10.11$, $p = .006$, and Instagram, $\chi^2(2, N = 535) = 11.74$, $p = .003$, as well as self-reported type of Instagram use, $\chi^2(1, N = 535) = 9.20$, $p = .002$. In addition, participants' age was significantly related to all social media use variables, while educational level showed significant associations with self-reported type of YouTube, Facebook and Instagram use. Employment status was linked with daily use of YouTube, $\chi^2(2, N = 638) = 11.17$, $p = .004$, along with self-reported type of YouTube, Facebook and Instagram use. Individuals' net monthly income was significantly associated with daily use of YouTube, $\chi^2(2, N = 625) = 6.59$, $p = .037$.

Table 2

Participants' Sociodemographic Characteristics and Social Media Use (N = 654)

	Social media daily use						Social media user type					
Sociodemographic variables	**YouTube[a]**		**Facebook[a]**		**Instagram[a]**		**YouTube[b]**		**Facebook[b]**		**Instagram[b]**	
	χ^2	p^c	χ^2	p^c	χ^2	p^c	χ^2	p^c	χ^2	p^c	χ^2	p^c
Gender	10.11	.006**	4.50	.105	11.74	.003**	3.79	.053	1.51	.219	9.20	.002**
Nationality	1.58	.455	1.02	.602	1.05	.592	.00	.965	1.99	.160	.00	1.000
Place of origin	2.48	.289	.01	.995	1.38	.501	.04	.837	.69	.406	1.36	.244
Place of residence	2.07	.356	.16	.923	1.20	.548	.22	.638	.47	.494	.70	.404
Educational level	5.41	.247	6.18	.186	5.09	.278	40.78	< .001***	18.02	< .001***	16.91	< .001***
Employment status	11.17	.004**	1.26	.532	1.55	.461	9.54	.002**	4.78	.029*	4.22	.040*
Net monthly income	6.59	.037*	1.72	.422	1.81	.405	1.04	.307	2.40	.121	3.11	.078
Marital status	2.19	.700	1.00	.911	6.14	.189	.62	.733	1.68	.431	5.72	.057
	F	p^d	F	p^d	F	p^d	t	p^e	t	p^e	t	p^e
Participants' age	3.78	.023*	5.33	.005**	4.78	.009**	4.77	< .001***	3.93	< .001***	4.94	< .001***

[a]Includes daily use of less than 2 hours, 2-5 hours, and more than 5 hours. [b]Includes self-reported active user and passive user. [c]p value derived using chi-square analysis. [d]p-value derived using one-way ANOVA. [e]p-value derived using independent samples t-test.
*p < .05. **p < .01. ***p < .001.

Differences in Depressive Symptomatology and Self-Esteem by Social Media Groups

Table 3 shows differences in depressive symptomatology and self-esteem by social media groups. One-way ANOVA results indicated a statistically significant difference in the mean score of self-esteem between the different categories of Facebook daily use, $F(2, 607) = 6.88$, $p = .001$, $\eta^2 = .02$. Particularly, a post-hoc Tukey test showed that individuals who reported two to five hours of Facebook everyday use had significantly higher self-esteem ($N = 185$, $M = 31.62$, $SD = 4.87$) compared to those who had been using Facebook for less than two hours daily ($N = 365$, $M = 30.04$, $SD = 4.51$, $p = .001$).

Table 3

Group Differences in Depressive Symptomatology and Self-Esteem by Social Media Use (N = 654)

Social media use	Depressive symptomatology[a]						Self-esteem[a]				
	N	*M*	*SD*	*F*	*p*[b]	η^2	*M*	*SD*	*F*	*p*[b]	η^2
YouTube daily use				**2.94**	**.053**	**.01**			**.35**	**.703**	**.00**
Less than 2 hours	316	9.23	7.59				30.63	4.69			
2-5 hours	262	9.33	7.87				30.73	4.68			
More than 5 hours	60	11.90	10.31				30.15	5.67			
Facebook daily use				**.94**	**.391**	**.00**			**6.88**	**.001****	**.02**
Less than 2 hours	365	9.59	7.98				30.04	4.51			
2-5 hours	185	9.03	7.60				31.62	4.87			
More than 5 hours	60	10.62	8.56				30.72	5.33			
Instagram daily use				**.74**	**.477**	**.00**			**1.00**	**.370**	**.00**
Less than 2 hours	215	9.37	8.07				30.33	4.59			
2-5 hours	254	9.69	7.91				30.95	4.91			
More than 5 hours	66	10.74	8.35				30.86	5.30			
	N	*M*	*SD*	*t*	*p*[c]	*d*	*M*	*SD*	*t*	*p*[c]	*d*
YouTube user type				**.47**	**.641**	**.04**			**-1.56**	**.119**	**.13**
Active users	218	9.32	7.97				31.03	4.96			
Passive users	420	9.63	8.05				30.41	4.68			
Facebook user type				**2.55**	**.011***	**.21**			**-4.30**	**< .001*****	**.35**
Active users	313	8.73	7.27				31.18	4.75			
Passive users	297	10.36	8.51				29.75	4.61			
Instagram user type				**3.33**	**.001****	**.32**			**-2.32**	**.021***	**.23**
Active users	401	9.03	7.61				30.97	4.81			
Passive users	134	11.67	8.91				29.86	4.84			

[a]Depressive symptomatology and self-esteem were treated as continuous numeric variables. [b]*p*-value derived using one-way ANOVA. [c]*p*-value derived using independent samples *t*-test.
*$p < .05$. **$p < .01$. ***$p < .001$.

According to *t*-test results, a significant mean difference was found between self-reported active Facebook users ($N = 313$, $M = 8.73$, $SD = 7.27$) and passive Facebook users ($N = 297$, $M = 10.36$, $SD = 8.51$), $t(583) = 2.55$, $p = .011$, $d = .21$. There was also a significant difference in depressive symptoms between self-reported active Instagram users ($N = 401$, $M = 9.03$, $SD = 7.61$) and passive Instagram users ($N = 134$, $M = 11.67$, $SD = 8.91$), $t(533) = 3.33$, $p = .001$, $d = .32$. A significant difference was observed in self-esteem between self-reported active Facebook users ($N = 313$, $M = 31.38$, $SD = 4.75$) and passive Facebook users ($N = 297$, $M = 29.75$, $SD = 4.61$), $t(608) = -4.30$, $p < .001$, $d = .35$. Likewise, there was a significant difference in self-esteem between active Instagram users ($N = 401$, $M = 30.97$, $SD = 4.81$) and passive Instagram users ($N = 134$, $M = 29.86$, $SD = 4.84$), $t(533) = -2.32$, $p = .021$, $d = .23$. Finally, self-esteem was significantly and negatively correlated with depressive symptomatology, $r(652) = -.55$, $p < .001$.

Multivariable Associations of Social Media Daily Use and User Type With Depressive Symptomatology and Self-Esteem

According to multiple linear regression results (Table 4), daily YouTube use of more than five hours was associated with significantly higher BDI-II scores, after controlling for gender, age, educational level and employment status, b = 2.99, 95% CI [.78, 5.20], p = .008. The model explained 2% (adjusted 1.1%) of the variance in BDI-II scores (R^2 = .02). Daily use of Facebook and Instagram showed non-significant associations with depressive symptoms.

Table 4

Adjusted Associations of Social Media Daily Use and User Type With Depressive Symptomatology and Self-Esteem (N = 654)

	Depressive symptomatology[b]				Self-esteem[b]			
Models[a]	***B*[c]**	***SE B***	**95% CI[c]**	***p***	***B*[c]**	***SE B***	**95% CI[c]**	***p***
YouTube daily use								
2-5 hours vs. < 2 hours[d]	.30	.67	[-1.01, 1.62]	.652	.09	.40	[-.70, .88]	.819
> 5 hours vs. < 2 hours[d]	2.99	1.13	[.78, 5.20]	.008**	-.45	.68	[-1.78, .89]	.512
Facebook daily use								
2-5 hours vs. < 2 hours[d]	-.60	.71	[-1.99, .80]	.402	1.61	.42	[.78, 2.44]	< .001***
> 5 hours vs. < 2 hours[d]	.70	1.11	[-1.47, 2.87]	.525	.83	.66	[-.46, 2.12]	.205
Instagram daily use								
2-5 hours vs. < 2 hours[d]	.01	.75	[-1.46, 1.47]	.995	.82	.45	[-.06, 1.70]	.068
> 5 hours vs. < 2 hours[d]	1.04	1.13	[-1.17, 3.26]	.356	.81	.68	[-.53, 2.14]	.236
YouTube user type								
Active vs. passive[d]	-.60	.69	[-1.96, .75]	.383	.64	.41	[-.17, 1.45]	.122
Facebook user type								
Active vs. passive[d]	-1.92	.65	[-3.18, -.65]	.003**	1.74	.38	[.99, 2.49]	< .001***
Instagram user type								
Active vs. passive[d]	-3.25	.81	[-4.83, -1.66]	< .001***	1.45	.49	[.49, 2.41]	.003**

[a]All models adjusted for participants' gender, age, educational level, and employment status. [b]Depressive symptomatology and self-esteem were treated as continuous numeric variables. [c]*b*-coefficients and 95% CI of *b* retained from linear regression. [d]Reference variable.
*p < .05. **p < .01. *** p < .001.

Daily Facebook use of two to five hours was associated with significantly higher self-esteem, after controlling for gender, age, educational level and employment status, b = 1.61, 95% CI [.78, 2.44], p < .001. The model explained 2% (adjusted 1%) of the variance in depressive symptoms (R^2 = .02). Daily use of YouTube showed non-significant results regarding self-esteem.

Active Facebook use was significantly associated with lower BDI-II scores, after controlling for gender, age, educational level and employment status, b = -1.92, 95% CI [-3.18, -.65], p = .003. The model explained 2% (adjusted 1.5%) of the variance in depressive symptoms (R^2 = .02). Likewise, self-reported active Instagram use was related to significantly reduced depressive symptoms, after controlling for gender, age, educational level and employment status, b = -3.25, 95% CI [-4.83, -1.66], p < .001). The model explained 4% (adjusted 3.4%) of the variance in BDI-II scores (R^2 = .04). Self-reported type of YouTube use showed non-significant results concerning depressive symptoms.

Active Facebook use was associated with significantly increased levels of self-esteem, after controlling for gender, age, educational level and employment status, b = 1.74, 95% CI [.99, 2.49], p < .001. The model explained 4% (adjusted 3.4%) of the variance in depressive symptoms (R^2 = .04). Similar results were also found concerning active use of Instagram, after controlling for gender, age, educational level and employment status, b = 1.45, 95% CI [.49, 2.41], p = .003). The model explained 3% (adjusted 2.5%) of the variance in depressive symptoms (R^2 = .03). Self-reported type of YouTube use showed non-significant results regarding self-esteem.

Interaction Effect Analyses

YouTube daily use of more than five hours showed a stronger association with depressive symptoms for males than for females (p for interaction = .026).

Discussion

The present study investigated the association of social media use with self-esteem and depressive symptomatology in young adults. According to the results, increased daily time spent in YouTube (more than five hours) showed a significant association with higher depressive symptoms, while daily use of Facebook between two and five hours was related to significantly increased self-esteem, after adjusting for gender, age, educational level and employment status. YouTube daily use of more than five hours showed a stronger association with depressive symptoms for males than for females. Additionally, self-reported active use of Facebook and Instagram were associated with significantly lower depressive symptoms and higher self-esteem as compared to passive use.

In accordance with previous findings from Greece (Drosos et al., 2015), YouTube and Facebook displayed the highest percentages of everyday involvement with regard to our sample. Moreover, in line with our first hypothesis and previous studies (e.g. Lin et al., 2016; Pantic et al., 2012), daily YouTube use of more than five hours was associated with increased depressive symptomatology. Recent research has suggested that YouTube, unlike Facebook and Instagram, has been linked to increased perceived information

overload for users due to the great amount of available video content. In addition, information overload in social media has been associated with higher depressive symptoms overtime (Matthes et al., 2020). On the other hand, depression is often associated with social withdrawal (Girard et al., 2014), hence it is possible that individuals with high depressive symptomatology tend to use YouTube more in comparison with other platforms, as it encourages less interactive involvement (Burgess & Green, 2009).

We also found that the association of increased daily time use of YouTube with depressive symptoms was more pronounced in males than in females. Conversely, Twenge and Martin (2020) have recently indicated that the relationship between increased time of social media use and low levels of psychological well-being is stronger in females. Women appear to use social media more in order to sustain their existing relationships compared to men (Muscanell & Guadagno, 2012), which has been associated with higher self-esteem (Wilcox & Stephen, 2013). Therefore, female users could exhibit lower depressive symptomatology compared to male, given that self-esteem is negatively related to depressive symptoms (Conti et al., 2014). Additionally, men with increased depressive symptoms have been found to be more susceptible to internet overuse compared to women (Liang et al., 2016), which could also apply to social media use.

In contrast with our first hypothesis and recent studies (Bergagna & Tartaglia, 2018; Woods & Scott, 2016), our results showed that increased daily use of Facebook is significantly related to higher self-esteem, although the effect size is small. According to Walther's hyperpersonal model of computer-mediated communication (Walther, 2007) and previous research (Gonzales & Hancock, 2011), selective self-presentation on Facebook can lead to higher self-awareness and, therefore, an increase in users' self-esteem. Moreover, individuals focusing on close friendly relationships on social networks have exhibited higher levels of self-esteem (e.g. Wilcox & Stephen, 2013). A possible mechanism explaining this relationship could be the positive feedback that users receive from their online friends, as it has been related to increased self-esteem levels (Valkenburg et al., 2017; Valkenburg et al., 2006).

This study also indicated that self-reported active use of Facebook and Instagram are linked with significantly lower depressive symptoms and higher self-esteem compared to passive use. These results correspond to recent findings (Escobar-Viera et al., 2018; Verduyn et al., 2015) and align with our second hypothesis. According to previous research, passive use of social networks has been related to feelings of envy and decreased life satisfaction (Krasnova et al., 2013), while envy on social media, such as Facebook, has significantly predicted depressive symptoms (Tandoc et al., 2015). On the other hand, higher self-esteem has been linked with increased life satisfaction (Moksnes & Espnes, 2013), and decreased feelings of envy (Vrabel et al., 2018). Thus, it appears that social comparison as a mechanism might provide explanation concerning our findings, since it could induce feelings of envy, while being related to passive activity in social media (Rozgonjuk et al., 2019). Furthermore, it is possible that high self-esteem encourages

active behaviour in social media, as previous data has suggested a significant association between decreased feelings of self-worth and passive activities on platforms such as Facebook (Tazghini & Siedlecki, 2013).

Strengths and Limitations

To our knowledge, the present study was one of the few focusing on the investigation of the association between social media use and mental health in a Greek sample of young adults. The large sample size along with the equal distribution of men and women provided adequate power to detect small effects. Additionally, self-esteem and depressive symptomatology were measured via standardised, valid and reliable psychometric tools displaying good psychometric properties with regard to our sample. Finally, the simultaneous assessment of different social networking platforms, instead of examining social media as a whole or focusing exclusively on a specific platform, was an additional strength of this study. Our fine-grained assessment of multiple platforms likely improved our measurement of overall frequency of social media use.

We acknowledge that there are also some limitations in our study. Given the cross-sectional design of the study, we are not able to establish the direction of the observed associations. Furthermore, even though both university students from various academic departments and non-university students from different regions in Greece were included in our study, generalizability in the Greek population may be limited. Moreover, due to the lack of a standardised Greek scale assessing social media use we used three items with specific artificial categories to measure daily time of social media involvement, which could be a noteworthy limitation as well. A number of methodological studies highlight a substantial loss of information as well as biased estimates when a continuous measure is broken up in artificial categories. It is also important to note that there are many different types of interactions that can be observed over social media, and our study assessed only overall time spent and type of use (active vs. passive) to social media sites. The type of social media use in terms of activity/passivity was examined only through self-reported questions, which could have relied our results and deductions exclusively on participants' understanding of the terms "passive use" and "active use". Additionally, the assessment of self-esteem and depressive symptomatology through self-reported scales instead of interviewing techniques, combined with our focus on non-clinical population, could restrict the possible clinical extensions of our findings. Furthermore, the small effect size reported was obtained in a sample of the general population which is expected to underestimate the effect size expected to occur in a clinical sample comprising persons displaying higher variability in self-reported symptom scales such as the BDI-II and RSES, and are in principle more vulnerable to social stressors. Additionally, the results from the multivariate linear regression analyses should be interpreted with caution given that the explained variance ranges between 1% and 4%; thus, if reported the other way around 96% to 99% of variance is not explained by the predictors

in that model. Finally, although in our regression models we were able to adjust for a large number of confounding factors, because of the observational study design, residual confounding of other unmeasured confounders such as home environment or negative life events may still occur.

Conclusion

The present study showed that there is a significant association between social media use and young adults' mental health in terms of self-esteem and depressive symptomatology. Overall, our results add strength to previous research and could contribute to a deeper understanding of the association between social networks and human behaviour. However, a longitudinal investigation of this association is required to fully understand the temporal relationships aiding early identification of youth at risk and thus effective management of the social media use that lead to negative outcomes in mental health. In addition, future research could further explore gender differences concerning the relationship between social networking and young adults' mental health. Moreover, upcoming studies could investigate the potential moderating or mediating effect of different patterns of use (e.g. passive and active involvement) on the relationship between time of social media use and mental health.

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Acute Effect of Physical Exercise on Negative Affect in Borderline Personality Disorder: A Pilot Study

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Supplementary Materials: Data, Materials [see Index of Supplementary Materials]

Abstract

Background: Physical exercise is an evidence-based treatment to reduce symptoms and negative affect in several psychiatric disorders, including depressive, anxiety, and psychotic disorders. However, the effect of physical exercise on negative affect in patients with borderline personality disorder (BPD) has not yet been investigated. In this pilot study, we tested the safety, acceptability, and potential acute effects on negative affect of a single session of aerobic physical exercise in adults with BPD.

Method: After completing a negative mood induction procedure, 28 adults with BPD were randomly assigned to a 20-minute single session of stationary bicycle or a control condition (emotionally neutral video).

Results: No adverse effects attributed to the physical exercise were reported and it was considered acceptable to patients. Following the negative mood induction, both conditions decreased the level of negative affect with a medium effect size but there was no significant difference between them.

Conclusion: The results suggest that a single 20-minute session of physical exercise does not produce a reduction of negative affect in BPD. Future research should consider the duration and intensities of physical exercise with the greatest potential to reduce negative affect both acutely and in a more prolonged manner in this patient group.

Keywords

physical activity, emotion regulation, affect, emotion dysregulation, emotion induction

Highlights

- Adults with BPD have potential to benefit physical exercise.
- In this pilot study, no adverse effects were attributed to physical exercise.
- Physical exercise was as effective as a neutral video in decreasing negative affect.

Borderline personality disorder (BPD) is characterized by an instability of self-image, goals, interpersonal relationships, and affect (Gunderson et al., 2018). The one-year and lifetime prevalence rates of the diagnosis in the general population are estimated at 1.6% and 5.9%, respectively (American Psychiatric Association, 2013). Among pathogenesis models of BPD (D'Agostino et al., 2018), the biosocial developmental model proposes that emotion dysregulation is the core of BPD and underlies many characteristic behaviors (Crowell et al., 2009). This model is based on three main components: heightened sensitivity to emotional stimuli, intense reactions to emotional stimuli, and a delayed return to an emotional baseline (Crowell et al., 2009; Linehan, 1993). Difficulties regulating emotions in BPD are linked to maladaptive behaviors, which presumably function to reduce negative affect (Daros, Guevara, et al., 2018). A higher level of emotion dysregulation has also been associated with lower quality of life and daily functioning (Gratz et al., 2016) and a poorer therapeutic relationship (Gunderson et al., 2018). Emotion dysregulation has also been identified as a mechanism in other psychopathologies such as major depression and bipolar disorder, but seems to be present at a higher level in BPD than in these disorders (Gratz et al., 2016). Moreover, little is known regarding the specific dimensions of emotion dysregulation to BPD and its development compared to those of other disorders and psychopathology in general (Gratz et al., 2016). Therefore, finding diagnosis specific interventions to improve emotion regulation and help regulate negative emotions should be among the priorities for research on BPD.

From this perspective, a single session of physical exercise (PE) could be useful to help individuals with BPD regulate their emotions in the short term. The effect of a single bout of PE on affect has been the subject of two meta-analyses synthesizing the results of more than 150 studies totaling 13,000 adults in the general population (Ekkekakis et al., 2011; Reed & Ones, 2006). These meta-analyses show that a single bout of PE significantly increases positive affect with a moderate effect size (d = 0.47) and that this effect is higher for individuals with a lower initial level of positive affect (d = 0.63). Additionally, self-selected exercise intensity is more effective in increasing positive affect than an imposed intensity. The effects were moderated by cardiovascular capacity, obesity, and exhaustion tolerance (Ekkekakis et al., 2011). Similar results but with higher effect sizes have been demonstrated in adults with generalized anxiety disorder (d = 1.01;

Herring et al., 2019), major depressive disorder (d = 1.25; Meyer, Koltyn, et al., 2016) and obsessive-compulsive disorder (d = 0.76; Abrantes et al., 2009). Another study (Stanton et al., 2016) also measured the effect of a 20-minute PE session on core affect (valence and arousal) in individuals with anxiety, bipolar, and depressive disorders and reported an increase in arousal for individuals with depressive and bipolar disorders, and an increase in valence (more positive affect) across all participants.

When studying the impact of PE on affect (Bernstein & McNally, 2017a, 2017b, 2018), researchers often experimentally induce an emotion to produce similar levels of affect across participants before exercising, or to modify affect after exercising (Barrett et al., 2007; Barrett & Bliss-Moreau, 2009; Kuppens et al., 2013; Posner et al., 2005). Different strategies are used to induce negative emotions, including frustrating tasks (Gratz et al., 2006; Sauer & Baer, 2012), electric shocks (Seibert-Hatalsky & Wilson, 2011), videos of sexual abuse or domestic violence (Chapman et al., 2010; Daros, Williams, et al., 2018; Elices et al., 2012; Jacob et al., 2011), remembering negative memories (Sauer & Baer, 2012), music (Diedrich et al., 2016) or emotionally charged images (Sloan et al., 2010). Of these approaches, presenting videos that induce negative emotions has been shown to be the easiest, most acceptable, and most frequently used strategy (for a review, see Gilet, 2008).

To our knowledge and according to two recent reviews (Hall et al., 2019; Mehren et al., 2020; St-Amour et al., 2021), no study has yet examined the acute effects of PE on negative affect in BPD. In the present pilot study, our goal was to assess the acceptability and safety of a single session of 20 minutes of PE and quantify the effect size of the impact of such an intervention on core affect (valence and arousal) in patients with BPD following a negative emotion induction, compared to a control condition. We hypothesized that the PE session would be well accepted by the participants and that no adverse effects would be attributed by the participants to the PE condition. Based on the research conducted on participants drawn from the general population and those with psychiatric disorders, we additionally hypothesized that the PE condition would increase the valence and decrease the arousal of their core affect with a moderate effect size after the negative emotion induction procedure.

Method

Participants

Patients from the Relational and Personality Disorders service from the Mental Health University Institute of Montreal gave their consent to their healthcare professionals to be contacted for research. Thereafter, healthcare professionals referred patients to researchers based on their established BPD diagnosis. Researchers then contacted patients by

phone and/or email and planned an appointment after a short screening of inclusion and exclusion criteria.

To be included in the study, participants were required to meet the following criteria: 18 years or older; previously diagnosed with BPD by two convergent psychological measures—Borderline Personality Questionnaire (Larivière et al., 2021) and Structured Clinical Interview for DSM-IV Axis II Disorders (BPD interview; Lobbestael et al., 2011)—by a psychiatrist from the Relational and Personality Disorders service from the Mental Health University Institute of Montreal; outpatient status at the Mental Health University Institute of Montreal; physically inactive (i.e., engaging in less than 150 minutes of physical activity weekly as measured with the SIMple Physical Activity Questionnaire [SIMPAQ]; Rosenbaum et al., 2020); and have a sufficient written and oral comprehension of French for the completion of the study. Participants were excluded if they had an active psychotic episode, a functional limitation preventing them from using a stationary bicycle, or a severe substance use disorder other than tobacco and cannabis. Since active individuals in general population seem to better regulate their negative affects (Bernstein et al., 2019), by recruiting inactive individuals only, we isolated the acute effect of PE from its chronic effect.

All participants gave their informed consent by reading and signing a consent form. The research protocol was approved by the ethics board committee from the University Integrated Center of Health and Social Services of Montreal. Participants were given $50 CAD compensation at the end of the protocol.

Safety and Acceptability

At the end of the PE session, the participants reported how they felt and were asked to call or write to the research assistant to report any adverse effects that may have occurred in the following days. At the end of the session, the researcher asked each participant: "How did you feel about the physical exercise you just did?" The answer to this question was written on the participant's results sheet. The psychiatrist from the Mental Health University Institute of Montreal (co-investigator in this study) who referred the participants was asked to report any adverse effects he noticed with his patients to the rest of the research team.

Baseline Measures

Upon completion of the consent form, participants filled out questionnaires about sociodemographic, physical activity, and mental health information. The sociodemographic questionnaire included questions on sex, age, education level, marital status, height, weight, household income, psychiatric history, and current medications. Additional measures were used to assess physical activity, depression, BPD, and substance use symptoms. The SIMPAQ is a validated five-item physical activity questionnaire for use

with adults with severe mental health disorders with good reliability, although it has not been validated in adults with BPD (Rosenbaum et al., 2020). The *Beck Depression Inventory-Short Form* (BDI-SF) is a 13-item questionnaire that provides a rating of depression symptom severity (Steer et al., 1997) and has been used in adults with BPD (Hasler et al., 2014). For each item, answers are rated using a score from 0 to 3, producing a total score ranging from 0 to 39, with a score over 9 indicating a risk of moderate-to-severe depressive episode (Furlanetto et al., 2005). This questionnaire has been thoroughly validated in adults with psychiatric illness with Cronbach's α ranging from 0.83 to 0.96; however, the measure has not been validated specifically in adults with BPD (Wang & Gorenstein, 2013). The short form of the *Borderline Symptom List* (BSL-23) is a self-rating scale that assesses the severity of BPD symptoms and has been validated in adults with BPD, with a Cronbach's α of 0.94 (Nicastro et al., 2016). Each item is answered on a 5-point Likert scale ranging from 0 to 4, generating a total score ranging from 0 to 92. The questionnaire instructions were adapted in our protocol: participants self-reported their symptom severity for the day preceding the study and not the previous month (note that the validity of this form has not been tested).

Since there is a high prevalence of substance use disorder in adults with BPD (Kienast et al., 2014) and substance use is linked to less PE (Abrantes & Blevins, 2019; Lisano et al., 2018; Martens et al., 2006; Werneck et al., 2019), three questionnaires were administered to assess substance use in our sample. The *Cigarette Dependence Scale* (CDS) evaluates cigarette addiction with 5 items answered on a 5-point Likert scale from 1 to 5. A global score of at least 16 indicates addiction. This questionnaire has been validated with individuals with BPD with a Cronbach's α of 0.89 (Etter et al., 2009). The *Cannabis Abuse Screening Test* (CAST) is a 6-item questionnaire assessing cannabis use (Legleye et al., 2007). A score of at least 3 is associated with a problematic use risk. The questionnaire has good validity (Cronbach's α = 0.81) but has not been specifically validated in adults with BPD. The *Alcohol Use Disorder Identification Test* (AUDIT) short form (3-item) was used to assess risk for alcohol use disorder. A score of at least 3 for women and 4 for men indicates a high risk of alcohol use disorder. This questionnaire has been validated in adults with personality disorders with an estimated sensitivity of 87.1% (Dawson et al., 2005).

The *Difficulties in Emotion Regulation Scale* (DERS) is a 36-item questionnaire that was used to measure different aspects of emotion regulation difficulties. Each item is answered on a 5-point Likert scale ranging from 1 to 5, with the total score of the questionnaire ranging from 36 to 180. The DERS has been validated in individuals with BPD with a Cronbach's α of 0.94 (Côté et al., 2013). We used four items from the *Dimensions of Openness to Emotions* (DOE-IT) questionnaire, with each item representing an emotion regulation strategy regrouped into two categories: relaxation and physical activation. For these four items, participants were asked to report how frequently they engaged in the strategy, and to what extent the strategy was effective (or how effective

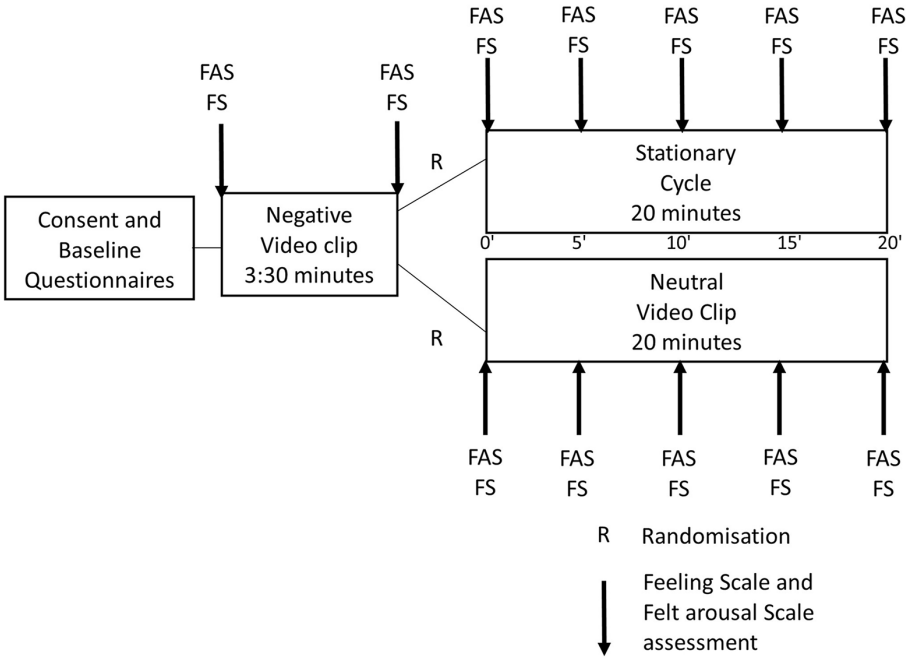
they think it would be) on two 5-point Likert scales from 0 to 4. The four items were: "1-Listen to music corresponding to my affective state (e.g., that soothes me when I'm anxious or wakes me when I'm asleep); 2-Let the different feelings, impressions or noises act on me without directing them; 3-Let all the impressions and sensations go as they are; 4-Get physically active, move, walk a few steps." The original full questionnaire has been validated with adults with BPD with Cronbach's α ranging from 0.67 to 0.83, depending on the subscales (Haymoz & Reicherts, 2015).

Experimental Procedure

Figure 1 describes the experimental procedure, including the administration of the questionnaires, negative emotion induction, and randomization to experimental conditions. Participants attended the session individually between 4p.m. and 6p.m. Participants were not instructed to refrain from using psychotropic substances (coffee, tobacco, cannabis, etc.) before the experiment. In the negative mood induction procedure, participants watched a scene lasting 3 minutes and 30 seconds from the movie *Silence of the Lambs* showing a pursuit in a dark and dirty basement. This movie clip has been shown to induce negative emotions in adults with BPD (Chapman et al., 2010; Kuo & Linehan, 2009). After the scene, participants were randomized with a heads or tails phone app to a condition, either 20 minutes of PE or an emotionally neutral video of 20 minutes (control). Fourteen participants were randomized to each condition. The PE session consisted of 20 minutes of stationary bicycle (*Life Fitness* Life Cycle 9500HR recumbent bicycle). Participants were instructed to cycle at an intensity they can maintain with pleasure for 20 minutes (Meyer, Ellingson, et al., 2016). They were also suggested the target of 11-13 on the *Borg Scale* (Borg, 1998), which was used to measure PE intensity, to help them find a low-moderate intensity in which they could be comfortable. The *Borg Scale* ranges from 6 to 20 and includes visual cues to help participants rate their PE intensity. Participants were allowed to change the load and cycling speed at will to maintain the desired intensity. There was no practice run and the participants did not receive any encouragement through the session, but they were supervised by a member of the research team in case they needed something or had a problem. The control condition consisted of the first 20 minutes of the movie *Baraka*, which has been validated to be emotionally neutral (Liu & McNally, 2017). This is a video documentary showing images of landscapes, people, and cultural rituals from around the world, with a soothing musical background and without dialogue or commentaries.

Figure 1

Research Protocol Schema



Note. Negative emotion induction was presented after baseline questionnaires but before randomization to unify participants' affects before the protocol. Time of the measurements is indicated in minutes from the beginning of the protocol between the boxes representing both groups.

Affect Measurement

An experimental procedure was implemented to induce a state of negative affect, which is a common approach in affective science research (Barrett et al., 2007; Barrett & Bliss-Moreau, 2009; Kuppens et al., 2013; Posner et al., 2005). Consequently, core affect was selected as the main outcome of our study. *Core affect* refers to any mental state of pleasure or displeasure with a degree of arousal (Russell, 2003). The properties of core affect (i.e., pleasure/displeasure and arousal) are brain representations of changes in autonomic and hormonal systems of the body and regulation efforts (Barrett, 2009; Ekkekakis, 2013; Kuppens et al., 2013), and are continuously changing over time. Core affect was measured before and after the induction procedure, at the beginning of the experiment, at 5, 10 and 15 minutes into the experiment, and again at the end of each experimental condition, using two 11-point analog scales for a total of 7 measurements. The *Feeling Scale* (FS; Hardy & Rejeski, 1989) was used to measure affective valence (positive or negative). The instructions were to "estimate how good or bad you feel right

now." Anchors are provided at 0 (neutral) and odd integers, ranging from -5 (very bad) to +5 (very good). The *Felt Arousal Scale* (FAS; Svebak & Murgatroyd, 1985) was used to measure arousal. It ranges from 1 to 6 with half points. The instructions were to "estimate how aroused you feel right now" (low arousal meaning calm or fatigued and high arousal meaning anxious or energized). Anchors are provided at 1 (low arousal) and 6 (high arousal). The FS and FAS items have been used in numerous studies, including with adults who have severe psychiatric illness (Bernstein & McNally, 2017b; Edwards et al., 2018; Herring et al., 2019; LeBouthillier & Asmundson, 2015; Meyer, Ellingson, et al., 2016; Schuch et al., 2014), and are strongly correlated with the *Self-Assessment Manikin* (Unick et al., 2015).

Statistical Analysis

Participants' characteristics were compared between experimental conditions. Quantitative variables were compared between conditions using *t*-tests for Gaussian variables (according to the Shapiro-Wilk test) and Mann-Whitney tests otherwise. FS scores were transformed by adding 5 to produce only positive scores for the analysis. FAS scores were also transformed by multiplying them by 2 and subtracting 1 to create whole numbers only. A paired-samples *t*-test was used to examine the effects of the emotion induction. Linear mixed effect models were fitted to examine the effects of acute PE on affective valence and arousal measures. Participants were included as a random effect. All the prerequisites were met for conducting t-tests and linear mixed models. All statistical analyses were carried out with R 4.0, and the nlme and ggplot2 packages (Pinheiro & Bates, 2006). Data and analysis coding are available in open access in the Open Science Framework account of the first author (https://osf.io/ncd6r/). Post hoc achieved power analysis were carried out with G*Power 3.1.9.7 (Faul et al., 2007).

Results

Sample Characteristics

Twenty-eight adults (21 women) with BPD participated in the study. They were aged 19 to 56 with a mean of 36.8 (SD = 11.5). Sixteen participants were considered smokers (8 in each group) and 19 cannabis users (9 in the PE group and 10 in the control group). After randomization, our control group had a significantly lower household income, $\chi^2(4) = 15.6$, $p = .004$, and higher DERS, $t(25) = 2.42$, $d = 0.93$, $p = .023$, score than the PE group. Participant characteristics are reported in Table 1.

Table 1

Sample Characteristics at Baseline

Variables	PE (*n* = 14)	Control (*n* = 14)
Age (*SD*)	37.29 (10.79)	36.35 (12.51)
Female (male)	8 (5)	13 (1)
Marital Status		
Single/divorced/widow	11	12
Married	3	2
Body mass index (*SD*)	32.75 (10.26)	26.37 (6.83)
Antidepressant user	9	6
Antipsychotic user	6	9
Other psychotropic user	4	4
Education		
Elementary school	3	4
High School	2	1
Professional school	5	6
College	3	3
University	1	0
Household income*		
< 20,000$	0	7
20,000$-39,999$	11	4
40,000$-59,999	0	3
60,000$ and over	1	0
Do not know	2	0
BDI score (*SD*)	14.15 (6.91)	16.46 (5.11)
Min	1	9
Max	26	26
BSL-23 score (*SD*)	20.69 (16.26)	25.46 (17.55)
Min	5	0
Max	54	58
DERS score (*SD*)*	103.08 (29.49)	122.92 (15.54)
Min	50	97
Max	137	164
DOE-IT		
1- Listen to music		
Frequency (*SD*)	3.00 (1.18)	2.71 (1.44)
Efficiency (*SD*)	3.00 (1.04)	2.46 (1.13)
2- Let the feeling act on me		
Frequency (*SD*)	1.36 (1.45)	1.86 (1.29)
Efficiency (*SD*)	1.57 (1.40)	2.23 (0.73)

Variables	PE (*n* = 14)	Control (*n* = 14)
3- Let the feeling go		
Frequency (*SD*)	1.07 (1.27)	1.50 (1.35)
Efficiency (*SD*)	1.36 (1.45)	1.62 (1.26)
4- Get physically active		
Frequency (*SD*)	2.14 (1.23)	2.57 (1.34)
Efficiency (*SD*)	2.50 (1.29)	3.08 (0.76)
CDS score/Smokers (*SD*)	16.13 (1.25)	15.63 (1.51)
CAST score/Cannabis users (*SD*)	15.00 (6.61)	14.00 (6.88)
AUDIT score (*SD*)	6.15 (3.11)	6.00 (2.48)

Note. BDI = Beck Depression Inventory; BSL-23 = Borderline Symptoms List short version; DERS = Difficulties in Emotional Regulation Scale; DOE-IT = Dimension of Openness to Emotions; CDS = Cigarette Dependence Score; CAST = Cannabis Abuse Screening Test; AUDIT = Alcohol Use Disorder Identification Test.
$^{*}p < .05$ when comparing both groups.

Safety and Acceptability

An adverse effect was reported in two participants. Both participants attributed this adverse effect to the negative emotion induction procedure, which reportedly triggered psychotic symptoms (hallucinations and distress) in one participant, leading to a need for psychiatric care immediately after completion of the protocol. However, the data collected for this participant was similar to those collected for other participants. Therefore, we kept these data for analyses. It also reminded another participant of an aggression that person had reportedly experienced, which produced a drastic increase in the participant's anxiety. It forced the participant to take a break at the 10-minute mark of the PE session and led the person to increase their alcohol consumption in the following week to a point where they sought emergency psychiatric care. Given that the participant interrupted the experiment, that individual was excluded from our analyses of the effect of the PE session. On the other hand, there were no reported adverse effects related to either the PE or control condition in the days following the protocol. All participants responded to the question, "How did you feel about the physical exercise you just did?" with positive answers (felt great, made them feel good, enjoyed exercising, etc.). However, three participants also expressed a slight discomfort related to PE (exhaustion, muscular fatigue, breathlessness).

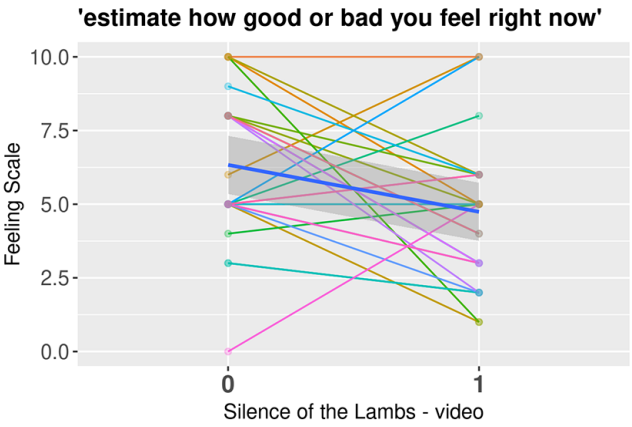
Mood Induction

The valence of affect was significantly more negative (*FS*) after (M = -0.36, SD = 2.59) the mood induction than before (M = 1.29, SD = 2.49), $t(26) = 2.41$, $p = .023$, $d = 0.46$, but the clip did not impact arousal (*FAS*), $t(26) = -1.79$, $p = .086$. However, there were individual differences in these effects: the emotion induction succeeded in increasing negative

affect in 18 participants, whereas 10 participants reported no change or a decrease in negative affect. The FS and FAS data for each participant from the emotion induction are presented in Figures 2 and 3, respectively.

Figure 2

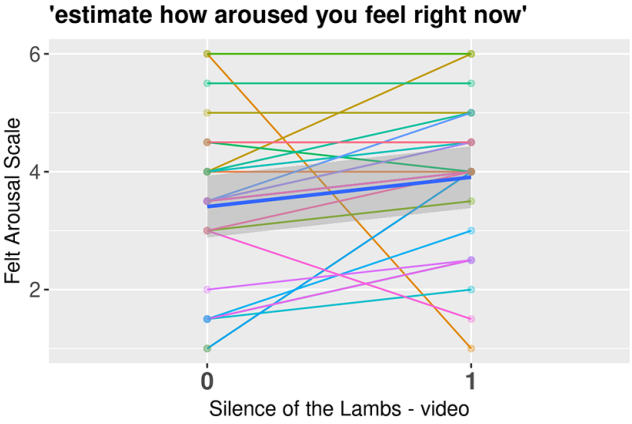
Negative Emotion Induction's Effect on the Feeling Scale by Participants



Note. Spaghetti plot with each line representing a participant. The bold blue line indicates the mean value of affect surrounded by a darker gray area representing the confidence interval.

Figure 3

Negative Emotion Induction's Effect on the Felt Arousal Scale by Participants



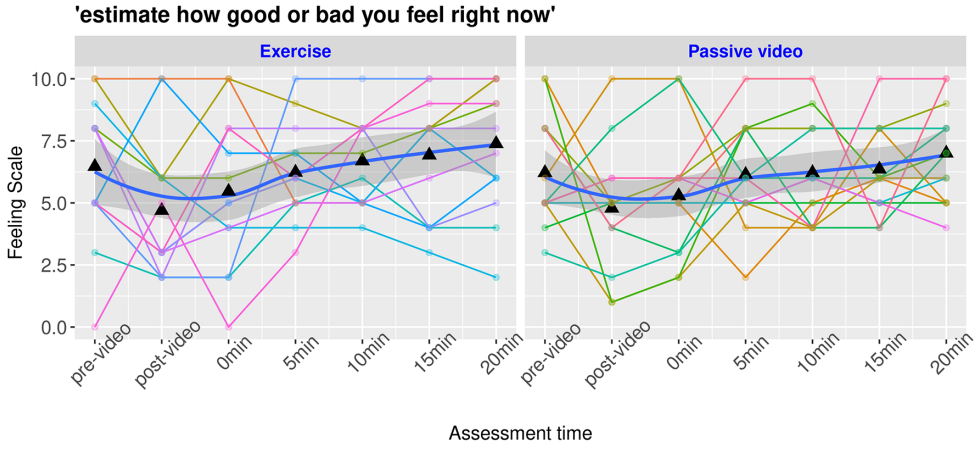
Note. Spaghetti plot with each line representing a participant. The bold blue line indicates the mean value of arousal surrounded by a darker gray area representing the confidence interval.

Effects of PE on Negative Affect

The level of negative affect (*FS*) decreased in our sample during the 20 minutes of our protocol, $t(106) = 2.79$, $b = .45$, $d = .54$, $SE = .16$, $p = .006$. The post hoc power analysis revealed a power of 0.85. However, the PE session did not decrease negative affect more than the control condition over time, $t(106) = -0.40$, $b = -.09$, $SE = .22$, $d = -.07$, $p = .70$, as shown in Figure 4. The post hoc power analysis revealed a power of 0.07. The arousal (*FAS*) did not change over time, $t(106) = -0.31$, $b = 0.04$, $SE = 0.15$, $d = 0.05$, $p = .80$, and the PE and control groups were not significantly different, $t(106) = 0.09$, $b = .02$, $SE = .21$, $d = .01$, $p = .92$, as shown in Figure 5. The post hoc power analysis revealed a power of .08 and .05 respectively. However, some participants were observed almost sleeping while watching the control video. Each participant presented different patterns of FS and FAS and reacted differently in both groups (PE and control).

Figure 4

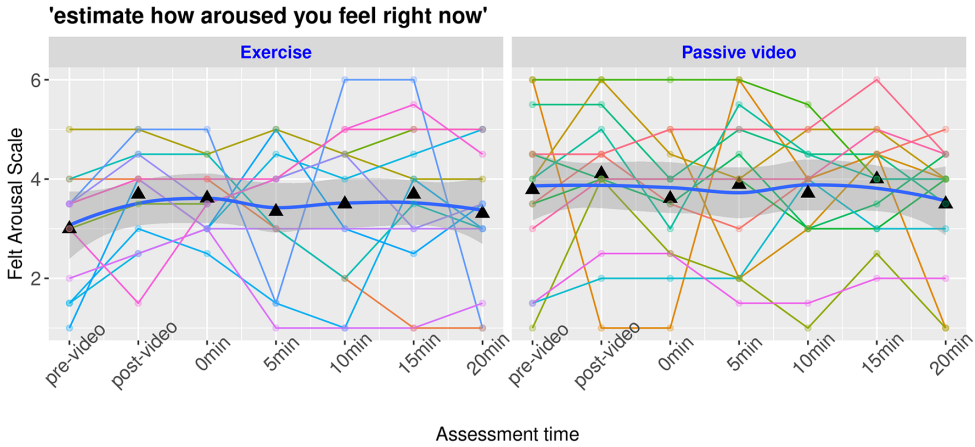
Protocol's Effect on the Feeling Scale by Participants



Note. Spaghetti plots with each curve representing a participant with a smooth representation of the group effect with confidence intervals of the curve. The bold blue line indicates the mean value of affect valence surrounded by a darker gray area representing the confidence interval. Pre- and post video marks indicate evaluation before and after emotion induction. 0min through 20min marks indicate the time from the beginning of the condition (exercise or control).

Figure 5

Protocol's Effect on the Felt Arousal Scale by Participants



Note. Spaghetti plots with each curve representing a participant with a smooth representation of the group effect with confidence intervals of the curve. The bold blue line indicates the mean value of arousal surrounded by a darker gray area representing the confidence interval. Pre- and post video marks indicate evaluation before and after emotion induction. 0min through 20min marks indicate the time from the beginning of the condition (exercise or control).

Discussion

This pilot study is the first to our knowledge to examine the acute effects of PE on negative affect in adults with BPD. We hypothesized that PE would be safe, well accepted, and more effective than an emotionally neutral film in decreasing negative affect and arousal. Our findings show that PE is safe and well accepted, and participants in both conditions had a decrease in negative affect with a medium effect size, although the effect did not differ between the groups and arousal did not decrease during the protocol. However, the effects of PE on affect have been extensively studied and a meta-analysis shows its efficacy in increasing positive affect (Ekkekakis et al., 2011). The absence of a difference between the groups in our study is therefore unexpected. Moreover, we met many obstacles during this study that might explain the absence of group difference and therefore make it difficult to draw conclusion on our hypothesis.

One of the main reasons why our results were not significant was because this pilot study was underpowered to detect group effect. Indeed, the between-group analysis of affect valence difference had a power of .07 which is weak. According to the a priori analysis we made with the effect size we found, a sample size of 70 would have been

sufficient to detect a significant group difference. However, because of the reasons detailed below, this effect size might be biased.

Despite the unanticipated findings, this experiment is useful and informative for future research investigating the acute effects of physical exercise on emotion regulation in BPD. First, no adverse effect was reported from the exercise sessions in this study, which indicates the safety of such an intervention. Second, every participant declared having appreciated the PE session with few negative feelings or discomfort toward it. However, this acceptability measure might not be the most valid and might be subject to biases. Third, the validated emotion induction procedure had unexpected effects. As reported by Chapman et al. (2010) and Kuo and Linehan (2009), it increased the mean level of negative affect in our sample. However, for nearly half of our sample, it had no effect or decreased the participants' negative affect, as they either liked the thriller kind of movie or recognized the scene as being part of a movie they liked, suggesting that other mood induction content should be considered for future research of this nature. According to Rottenberg et al. (2018), non-response to mood induction is frequent and may affect the validity of a study. To avoid nonresponse, researchers might use multiple induction strategies at once, an instruction to strengthen the induction, or a longer induction. On the other hand, two participants reacted enough to the emotion induction such that they needed psychiatric care after the protocol. Those incidents indicate that this strategy might not be the safest available to induce negative affect in patients with BPD or that comorbid disorders (such as psychotic disorder) or previous traumas should be considered when selecting an induction strategy. Therefore, further research might attempt other induction strategies that better suit this population. For example, viewing negative emotional photos from the International Affective Picture Set paired with negative emotionally charged music (Lynn et al., 2012), reading emotionally charged sentences from the Velten validated battery (Velten, 1968), and/or vividly imagine personal negative situations (especially those relevant to BPD, such as abandonment experiences) triggered by a verbal script (Barnow et al., 2012). Finally, the neutral video that served as a control had a meditative effect on participants. Some participants were observed as almost sleeping while watching the video regardless of being probed every 5 minutes to rate their affect. Some participants also reported they meditated or used mindfulness strategies while looking at the video. Therefore, this control video might have had a meditating effect and effectively decreased the self-reported arousal level and increased the self-reported valence of affect. Indeed, meditation and mindfulness have been found to reduce negative affect (Goyal et al., 2014; Sathyanarayanan et al., 2019) and is currently used in Dialectic Behavioral Therapy (Linehan, 2014) to help reduce negative affect. Therefore, the control condition should not give participants the opportunity to use these techniques. For example, participants could be directed to do light stretching or articular warm-up for the same period as the PE session (Oberste et

al., 2017). These results may be informative for researchers who are considering mood induction in experimental studies of PE in BPD.

Apart from the induction strategy and the control video, other factors might explain the absence of a difference between PE and the video in this study. The low physical activity level coupled with the high BMI of our sample might also be contributory. In a meta-analysis from Ekkekakis and colleagues (2011), inactive obese individuals were more likely to feel negative affect at low PE intensity than active individuals during a single bout of PE. Therefore, future research should investigate this effect in physically active individuals with BPD or with a BMI under 30.

Our findings resemble a previous investigation examining the effects of acute PE on core affect in adults with psychiatric illness (depressive disorder, bipolar disorder and anxiety disorder) using the FS and the FAS (Stanton et al., 2016). This study found a significant increase of valence only among participants with bipolar disorder or depressive disorder but not anxiety disorder. Furthermore, the PE session did not decrease the self-reported arousal level. Therefore, we can conclude that PE's impact on affect likely differs depending on the specific psychiatric disorder. Emotion dysregulation is a component of all three of the disorders included in the Stanton et al. study, as well as BPD, with the latter associated with more severe emotion dysregulation than the other disorders (Gratz et al., 2016). Therefore, we can believe that PE might influence affect in BPD as well. Table 2 presents a set of potential solutions to overtake the main limitations encountered in our study to improve future studies.

Table 2

Study Limitations and Potential Improvements

Limitations	Suggestion
Heterogenous emotion induction (i.e., positive emotion following negative induction)	Three steps negative emotion induction (Kuo et al., 2014): 1. Listening to emotionally charged music while watching emotionally charged photographs; 2. Reading emotionally charged sentences; 3. Vividly imagine personal negative emotion triggered by verbal script previously prepared.
Meditative effect of control condition	Use of placebo exercise (ex., light stretching, articular warm-up, Oberste et al., 2017)
Group discrepancy regarding household income and difficulties in emotion regulation	Recruit a larger sample to decrease group difference risk Or combined with a stratified randomization technique
Possible missed affect change after the ending of the measurement	Continue affect measurement for a period after the intervention (i.e., +5, +10, + 15 minutes)

Limitations	Suggestion
Participants' comorbid disorders were not reported	Accessing participants' medical file to report comorbid disorders
Possible missed adverse effects	Adverse effects and safety should have been systematically assessed in the days following the investigation by calling participants directly
Possible invalid acceptability measure	Acceptability should have been measured using a validated questionnaire or a numerical scale to answer a single question to provide more information (Rabin et al., 2009).
Sample size	Based on a simulation analysis, a future well-powered study should include a total of 70 participants to reach a power of > 80% (Kumle et al., 2021)

On the other hand, this research has many strengths. The main strength is that it is the first study to include individuals with BPD to study the effect of PE. Also, the low to moderate PE intensity as self-selected by the participants optimizes PE benefits on affect (Ekkekakis et al., 2011). Moreover, we used core affect to assess physical activity effect on emotional feeling since it is known to be an effective way to characterize subjective feeling (Ekkekakis, 2013).

Future studies should use better suited negative emotion induction for adults with BPD (e.g., Velten validated battery). Other control strategies should also be used, such as light stretching or articular warm-up (LeBouthillier & Asmundson, 2015) considered as placebo PE. Watching a pleasant video at the end of the protocol could be used to improve participants' affective valence before they complete the study, improving the safety of the protocol (Bernstein & McNally, 2017a, 2017b, 2018). Further work may study the impact of PE on affect in adults with BPD with ecological momentary assessments, which has been shown to be an efficient way to evaluate rapidly evolving phenomena in BPD (Santangelo et al., 2014). For example, the study of affect over a day after a PE session could elucidate the emotion regulation dynamics following PE. Other types, durations, and intensities of PE should also be tested, as these are all possible factors that might influence the affective response to PE (Ekkekakis et al., 2011). Finally, future exercise studies might evaluate the blood level of brain-derived neurotropic factor to measure the potential mediating role of this biomarker on affect in this population.

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Competing Interests: The authors have declared that no competing interests exist.

Twitter Accounts: @SStAmour23, @PaquitoBernard

Data Availability: For this article, a data set is freely available (St-Amour et al., 2021).

Supplementary Materials

Data and analysis coding are available in open access in the Open Science Framework account of the first author (for access see Index of Supplementary Materials below).

Index of Supplementary Materials

St-Amour, S., Cailhol, L., Ruocco, A. C., & Bernard, P. (2021). *Supplementary materials to "Acute effect of physical exercise on negative affect in borderline personality disorder: A pilot study"* [Research data and analysis code]. OSF. https://osf.io/ncd6r/

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Premature Dropout From Psychotherapy: Prevalence, Perceived Reasons and Consequences as Rated by Clinicians

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Abstract

Background: Why clients discontinue their psychotherapies has attracted more attention recently as it is a major problem for many healthcare services. Studies suggest that dropout rates may be affected by the mode of therapy, low-quality therapeutic alliance, low SES, and by conditions such personality disorders or substance abuse. The aims of the study were to investigate what happens in therapies which end in a dropout, and to estimate how common dropout is as reported by practicing clinicians.

Method: An online questionnaire was developed and completed by 116 therapists working in clinical settings. They were recruited via social media (Facebook and different online psychotherapy groups) in Sweden and worked with Cognitive Behavioural Therapy (CBT), Psychodynamic Therapy (PDT), Interpersonal Psychotherapy (IPT) and Integrative Psychotherapy (IP).

Results: Psychotherapists rated the frequency of premature dropout in psychotherapy to be on average 8.89% (MD = 5, SD = 8.34, Range = 0-50%). The most common reasons for a dropout, as stated by the therapists, were that clients were not satisfied with the type of intervention offered, or that clients did not benefit from the treatment as they had expected. The most common feeling following a dropout was self-doubt.

Conclusion: In conclusion, premature dropout is common in clinical practice and has negative emotional consequences for therapists. Premature dropout may lead to feelings of self-doubt and powerlessness among therapists. The therapeutic alliance was mostly rated as good in dropout

therapies. Further research is needed to validate the findings with data on the prevalence and subjective reasons behind a dropout from point of view of clients.

Keywords

premature dropout, psychotherapy dropout, psychotherapy, therapeutic alliance

Highlights

- The dropout rate was estimated to 8.89% by the therapists in this study.
- The psychotherapists believe that reasons as to dropout was that clients were not satisfied with interventions in therapy.
- The most common feeling following a dropout was self-doubt.
- The therapeutic alliance was generally rated as good in therapies resulting in dropout.

Dropout from psychotherapy has been defined as "termination of the treatment without fulfilment of the therapeutic goals, without attainment of the full therapeutic benefit that would have been possible with normal termination of the therapy or without completion of the full scope of the therapy" (Swift & Greenberg, 2012). There is a significant amount of variation on how to operationalize dropout, for example when it is meaningful to use dropout as a description of what happened in a therapy (Garfield, 1994; Hatchett & Park, 2003; Swift et al., 2009; Swift & Greenberg, 2012). One way to operationalize dropout is to consider anyone who do not attend a special number of sessions as a dropout. The idea is that clients need to attend a minimal number of sessions in order to improve (Lambert, 2007). Another operationalization is failure to complete a specific treatment protocol. In this definition anyone who fails to complete a full treatment protocol is considered a dropout. A third operationalization is based on missed sessions. This approach suggests that anyone who misses or fails to reschedule sessions is considered a dropout. Another fourth approach is to let the therapist decide if the client has prematurely dropped out or not. A final approach is to define a dropout when a client terminates prior to a reliable improvement has occurred and prior to obtaining an outcome score within the normal range (Hatchett & Park, 2003). There are both positive and negative aspects of all these operationalizations. While number of sessions, missed sessions and failure to follow a treatment protocol are relatively easy to assess they do not say anything about actual change or improvement. It is problematic to classify a client as a dropout when attending few sessions and showing major improvement when a client who attends all scheduled sessions but do not engage in the therapy and show no improvement will not be defined as a dropout.

When using therapists' judgement there is a considerable risk that the judgment is biased or even flawed (Garb, 2005; Grove et al., 2000). Despite numerous studies there is *no consensus* regarding the definition of dropout. For example, as mentioned it is possible to drop out from a therapy while still reaching the treatment goals. The term

premature suggests that the therapy is terminated *before* the goals of the treatment are obtained. While there are premature terminations of therapy that are agreed upon, not turning up and ending therapy *without explanation* or any notice can be a major problem. For example, clients may not get the treatment they need, and therapists and services are disrupted (for example when trying to locate the client). In a meta-analysis of 125 psychotherapy studies, Wierzbicki and Pekarik (1993) estimated that about 47% of the therapies resulted in a unilateral dropout. However, Swift and Greenberg (2012) reported dropout rates across methods and disorders at approximately 19.7%, and unilateral dropouts ranged between 0 to 74% (M = 19.7%) (Swift & Greenberg, 2012, 2014). Most studies included in these reviews were clinical trials on adult clients who were participants in studies in which both clients and methods had been carefully selected. Thus, there may be differences in reasons behind dropout in therapies conducted in clinical practice and in clinical trials depending on the definition of dropout or the context (for example interviews, questionnaires, videorecording, compliance to a specific method or manual) often present in clinical trials. Psychotherapy in clinical practice more often includes patients that would not be included in clinical trials depending on multiple psychiatric diagnosis, psychosocial problems or other problems that excludes them from clinical trials.

Effects of Premature Dropouts

Premature dropout has been associated with a range of negative effects for both clients and therapists. In clinical trials, dropouts tend to report more dissatisfaction (Björk et al., 2009; Knox et al., 2011; Kokotovic & Tracey, 1987) and poorer treatment outcomes (Cahill et al., 2003; Klein et al., 2003; Lampropoulos, 2010; Pekarik, 1983, 1992; Swift et al., 2009), compared with therapy completers. Therapists are likely to experience loss of revenue (i.e., in private practice), and a sense of failure or demoralization when clients prematurely drop out (Barrett et al., 2008; Ogrodniczuk et al., 2005; Piselli et al., 2011).

Factors Related to Premature Dropout

The therapeutic alliance has consistently been associated with outcome in psychotherapy (Horvath et al., 2011; Lambert & Barley, 2002; Safran et al., 2014). Research commonly shows that a strong alliance is related to better outcomes (Bickman et al., 2012; Flückiger et al., 2018; Spinhoven et al., 2007; Zuroff & Blatt, 2006), and that a weak alliance is related to dropout (Barrett et al., 2008; Sharf et al., 2010). Some meta-analyses show significant correlations between repairing ruptures in the therapeutic alliance and therapy outcome measured either as therapy completion, premature dropout or as change on symptoms measures (Eubanks et al., 2018; Safran et al., 2011; Safran et al., 2014). Moreover, the ability to manage behavioural, cognitive, somatic, and affective reactions during psychotherapy (related to the therapist's own unresolved emotional stressful events or

themes during therapy) may also influence psychotherapy process and outcome. The ability to manage and potentially use own reactions to "what happens during psychotherapy" – for example if the therapist has dealt with his/her own negative experiences and are aware of them - may increase the ability to effectively help the client (Hayes et al., 2011; Hayes et al., 2018).

Overall, the proportion of dropout reported in different studies is related to the definition of dropout, and since there is no consensus on the definition comparisons on rates is difficult. However, the literature suggests that dropout is common, has negative effects on clients and their therapists, and that a poor therapeutic alliance may increase the risk of a premature dropout.

The aim of this study was to investigate how common premature dropout is in clinical practice, to analyse perceived reasons behind a dropout, the role of therapeutic alliance and feelings associated with dropouts. Psychotherapists working with different orientations, target groups, and in different settings completed an online survey with the aim to reach a broad sample.

Method

Procedure

The study was conducted online using an anonymous questionnaire during 2 months in the spring of 2020. The study was announced via social media (Facebook), email to employees at two outpatient psychiatric clinics and networks for psychotherapists. In Sweden, where the study was conducted, almost all practicing clinicians have regular internet access. In total 594 persons accessed the website, and, of those, 116 persons (19.5%) completed the whole questionnaire.

Data Analysis

The data from the survey were prepared with SPSS statistics version 26. Means (*M*), Medians (*Mdn*), Standard deviations (*SD*) and Ranges were calculated. ANOVAs were calculated to investigate differences between means. Nominal data were compiled and descriptive measures such as percentages were calculated.

Participants

Participants were psychotherapists from different professional backgrounds. They had at least basic psychotherapy training (which in Sweden is 3 years) and used psychotherapeutic methods in their work. Participation was anonymous and no data was collected that could be used to identify the participant. Of the 116 psychotherapists who participated, 83 were female (70.9%). They had worked as psychotherapists for an average of 10.51 years (*SD* = 7.91). The professional background of the participants was: clinical

psychologists (n = 67; 57.8%), social workers (n = 28; 24.1%), nurses (n = 4; 3.4%), medical doctors (n = 1; 0.9%) and other (n = 16; 13.8%). Regarding the therapists' main methodological orientation, the following distribution was obtained (multiple answers were possible): cognitive behavioural therapy (CBT) (n = 99; 84.6%), Psychodynamic psychotherapy (PDT) (n = 47; 40.2%), Interpersonal psychotherapy (IPT) (n = 19; 16.2%), Family therapy (FT) (n = 11; 9.4%), Humanistic/Existential psychotherapy (n = 7; 6%) and 20 (n = 20; 17.1%). See Table 1 for further description of the participants.

Table 1

Background Data of the Participating Psychotherapists (N = 117)

Variables	*n* (%)
Gender (female)	83 (70.9%)
Age in profession	*M* = 10.51 years
Profession	
Psychologists	67 (57.8)
Social workers	28 (24.1)
Nurses	4 (3.4)
Medical Doctors	1 (0.9)
Others	16 (13.8)
Workplace	
Public sector (primary care)	46 (39.6)
Public sector (psychiatry)	43 (37.1)
Private sector (psychiatry)	11 (9.4)
Private sector (primary care)	13 (11.2)
Private practice	31 (26.7)
Other	6 (5.2)
Age group	
Children (0-13 years)	14 (12.1)
Youths (14-18 years)	21 (18.1)
Young adults (18-25 years)	35 (30.2)
Adults (18-65 years)	97 (83.6)
Older adults (65 years-)	14 (12.1)
Psychotherapeutic orientation	
Cognitive behaviour therapy (CBT)	99 (84.6)
Psychodynamic therapy (PDT)	47 (40.2)
Interpersonal psychotherapy (IPT)	19 (16.2)
Other	21 (17.9)

Measures

A brief questionnaire was developed for use in the present study. The questionnaire was developed in discussion with clinicians, by consulting the literature on dropout and the therapeutic relationship in psychotherapy. To increase the content validity, the questionnaire was piloted with 6 colleagues, all licensed clinical psychologists, and researchers in clinical psychology. They filled out the questionnaire individually which was followed by a discussion which resulted in some adjustments and clarifications. The final questionnaire started with this definition:

> The aim of this study is to explore psychotherapists' clinically based opinion of the frequency of dropouts in psychotherapy and, also their feelings prior to and after a dropout. Our definition of dropout is "when a client stops coming to an agreed and started psychotherapy without notice."

The initial part of the questionnaire consisted of 6 items on generic information regarding gender, years of working with psychotherapy, primary age group in the work, type of organization, professional background and use of psychotherapeutic methods. The scales were made as nominal variables where the most common professional backgrounds, organizations and most used psychotherapeutic methods were specified as single response options. There was also an open-ended alternative to capture alternatives that were not specified. The participants were asked to estimate the dropout rate in their therapies, based on our definition of a premature dropout, as a percentage of their total number of psychotherapies. In the next section participants were asked why they believed a typical dropout had occurred, their own feelings during the therapy and after the dropout. Further, feelings before and after the dropout were derived from a feeling checklist used in psychotherapy process research (Lindqvist et al., 2017). There were 20 different feelings which were rated on a five-point Likert-scale ranging from 1 ('not very important for me') to 5 ('very important to me'). In the next part, the therapeutic alliance was rated with three items (task, goal, and emotional bond). These items were rated on a three-point Likert-scale from 1 ('bad') to 3 ('very good'). Further the participants rated if they had suspected that the clients would drop out. The rating was made on a five-point Likert-scale ranging from 1 ('not very important for me') to 5 ('very important to me'). Finally, questions regarding discussing the suspicion of a potential dropout with someone (yes/no/don't know) and in that case with whom (e.g. supervisor, colleague, friend, partner), and lastly if they had received the support they needed in psychotherapy supervision. The time for filling out the form was approximately 15 minutes.

Results

The average estimated dropout-rate, defined as the percentage of the total number of psychotherapies during the last two years was 8.89% (*Mdn* = 5, *SD* = 8.34, Range = 0–50%). We conducted an ANOVA-analysis to test if there were any differences regarding the estimated dropout rate between CBT, PDT, IPT and Eclectic therapy and no differences were found, all *p*-values were above $p > .11$. Ratings in the survey done with questions on Likert-scales generally generated responses in the middle of the scales, as measured by median. Few therapists rated in the top end of the scales (4 or 5). The views among the therapists were primarily that dropout depended on the clients, by for example not wanting to do specific interventions or not responding to certain interventions.

Reasons for Dropout

Table 2 shows the therapist's ratings of reasons for dropout (in the order of highest rating first).

Table 2

Therapists' Ratings of Reasons for Dropout

Variables	*M*	*Mdn*	*SD*
The client did not want to do specific interventions related to the method.	3.08	3	1.10
The client did not "respond" to the intervention.	2.99	3	1.25
It seemed like the client did not believe that the method would help.	2.92	3	0.10
The client was in a difficult psychosocial situation.	2.79	3	1.21
The client had difficulties in the attachment with me (the therapist).	2.61	3	1.04
We had a weak emotional bond.	2.55	2	1.05
The client was discontent with me (the therapist).	2.47	2	0.90
The client had too complex psychological problems.	2.43	2	1.15
The therapy had low effect.	2.41	2	0.92
It was the wrong method for the problem.	2.38	2	0.92
We disagreed about the goals with the therapy.	2.31	2	0.97
I think we had too few sessions for our disposal.	2.28	2	1.32
I thought that the client was too difficult.	2.20	2	0.11
I (the therapist) had difficult to attach to the client.	2.08	2	0.92
It was the client's age.	1.69	1	0.94
The client used drugs.	1.65	1	1.06
The client started another psychotherapy.	1.39	1	0.87

Note. $N = 107$. Instruction: *Think of a typical dropout, what do you think it was related to? (Mark one or several alternatives (1 not important and 5 very important).*

When using mean as measure the most common reason for a dropout was that the client did not want to perform the intervention, respond to it, or did not believe in it. The lowest ratings were reasons for dropout related to clients age, clients using drugs or had started another therapy.

Emotions Related to Dropout

The therapists were asked to rate their feelings *during* the therapy and *after* the dropout. Table 3 shows the rating of feelings *during* therapy as indicated by the therapists.

Table 3

Rating of Feelings During Therapy as Indicated by the Therapists

Variables	*M*	*Mdn*	*SD*
Interested	2.94	3	0.67
Calm	2.52	3	0.72
Energetic	2.31	2	0.76
Insecure	2.28	2	0.81
Sceptical	2.13	2	0.84
Powerless	2.07	2	0.82
Content	2.01	2	0.68
Irritated	2.01	2	0.78
Worried	1.97	2	0.77
Tired	1.96	2	0.85
Neutral	1.94	1	0.86
Disappointed	1.93	2	0.73
Tense	1.90	2	0.84
Surprised	1.84	2	0.79
Shame	1.70	2	0.78
Overwhelmed	1.62	1	0.81
Relieved	1.58	1	0.67
Bored	1.54	1	0.72
Angry	1.54	2	0.69

Note. $N = 107$. Instruction: *If you think of the same therapy, which of the following emotions did you experience* ***during*** *therapy, as you remember it? For example "I felt....." (1 not important and 4 very important). Mark one or several feelings.*

Feelings with the highest mean reported by the therapists during therapy were interested, calm, and energetic. Feelings with the lowest mean were relieved, bored, and angry.

In Table 4, the therapists' feelings following a dropout are presented.

The feelings with highest mean after dropout was self-doubt, being touched and powerless. Feelings with lowest mean were satisfied, overwhelmed, and bored.

Table 4

Therapists' Feelings Following a Dropout

Variables	*M*	*Mdn*	*SD*
Self-doubt	2.79	3	1.04
Touched	2.66	3	1.01
Powerless	2.61	2	1.13
Disappointed	2.52	2	0.96
Calm	2.38	2	1.12
Surprised	2.22	2	1.08
Annoyance at the client	2.13	2	0.87
Doubt regarding my method	2.12	2	1.06
Annoyance at myself	2.10	2	1.03
Guilt	2.10	2	1.06
Relieved	1.96	2	0.94
Worried	1.93	2	1.00
Shame	1.92	2	0.96
Neutral	1.73	1	0.98
Indifference	1.39	1	0.72
Satisfied	1.39	1	0.66
Overwhelmed	1.37	1	0.78
Bored	1.28	1	0.69

Note. $N = 107$. Instruction: *What did you feel after the dropout? I felt.... Mark one or several options. (1 not important and 5 very important).*

Therapeutic Alliance and Dropout

The therapeutic alliance with the client who dropped out in mind was rated by the therapists using an ordinal scale with three response options (bad, good, very good). Ratings of alliance in association with a dropout therapy are presented in Table 5.

Table 5

Ratings of Alliance in Association With a Dropout Therapy

Items	Low	Good	Very good	*M*	*Mdn*	*SD*
The task of the therapy	32%	55%	13%	1.81	2	0.65
The goal in the therapy	26%	64%	10%	1.84	2	0.58
Emotional bond in the therapy	33%	55%	12%	1.79	2	0.64

Note. $N = 107$. Instruction: *Afterwards, how would you rate the therapeutic alliance between you and the client who dropped out? (Rate between 1-3 were 1 is low and 3 is very good).*

All three dimensions (task, goal, and bond) of the alliance were generally rated as good, with few (10-13%) stating that it was very good. One third rated the alliance in all three dimensions as low. There was no significant difference between the different aspects of the therapeutic alliance, $F(2, 105) = .24$, n.s.).

Support From Others Regarding Suspicions About Dropout

Regarding the question if the therapists had suspected the dropout during therapy, 24% did not suspect dropout while 76% had suspected dropout. About one fourth (23%) of the therapists had talked with their clients about their suspicions, 37% of the therapists did not talk to the client and 40% did not remember. About 59% of the therapists had talked to a supervisor or a colleague when they suspected that their client would drop out. Only one third (30%) felt that they had received support.

Discussion

One aim of this study was to explore the extent of premature dropout in clinical practice as rated by therapists. The estimated dropout for the last two years was 8.89%. The results indicate that in clinical practice the dropout-rate, as defined in this study, is lower than in earlier studies in which the estimated dropout-rate has been 20% or higher (Swift & Greenberg, 2014). As mentioned in the introduction, Wierzbicki and Pekarik (1993) estimated the dropout-rate to be 47% based on 125 studies, whereas Swift and Greenberg (2012) reported a dropout rate of 19.7% in their meta-analytic study of 669 research studies. It is important to note that these discrepancies most likely depend on the difference in definition of dropout used in studies and reviews. Regarding studies on differences between psychotherapy orientations a significant difference has been reported in depression studies in which CBT was found to result in more dropouts than other therapies (Cuijpers et al., 2008). Swift and Greenberg (2014) reported that that there may be differences between psychotherapies related to diagnosis and that depression, eating disorders and PTSD may be associated with differential dropout rates. These differences were *not* investigated in our study, but we cannot exclude that the sample we obtained and the groups of clients and/or psychotherapy method the therapists worked with influenced the estimated dropout rate.

Information about the proportion of dropout in regular clinical practice seems to be scarce. Cinkaya (2016), in a study on outpatients in Germany, reported that patients with personality disorder were most likely to drop out whereas patients with depression, somatoform, and anxiety disorder were less likely to drop out. Although the estimation done by the therapists in this study could be biased and uncertain, our findings is relevant for the understanding of how common dropout is in clinical practice.

Overall, some prior studies have reported substantially higher dropout rates than we found in this study. There are some possible explanations. First, we used a definition that leaves out agreed upon terminations that would have been regarded as dropouts in research studies. Another possibility, again referring to the difference between research studies and clinical settings, it that the length of a therapy and the demands on the client may be more flexible in clinical settings than in research studies in which for example the number of therapy sessions tend to be tied to treatment manuals. However, this does not mean that the figure we found is low. If almost one out of ten client dropout without any discussion or agreement it is still a problem in clinical settings both for the client and the service provider.

Our study explored reasons and feelings related to a typical premature dropout and the perception of the therapeutic alliance in such therapies. Based on means, the three most common emotions *during* therapy were *interested*, *calm*, and *insecure*. *After* the dropout the three most common emotion were *self-doubt*, *touched* and *powerlessness*. Our results indicate that premature dropouts affect the therapists negatively. After premature dropout therapists tend to feel self-doubt and experience emotions like *powerlessness*. On the other hand, the most common reasons for dropout stated by the therapists were that the client did not want to perform the intervention, respond to it, or did not believe in it. It appears as if the therapists blame themselves emotionally but rationally blame the client. Another explanation might be that therapists do not manage to convince their client of about the ways in which they are supposed to work in therapy and therefore feel powerless in relation to what they are supposed to do in therapy, agreement about goals in therapy, or own conviction about what is best for the client.

Overall, the therapists rated the therapeutic alliance as good. Approximately 30% rated the alliance as low regarding agreement on tasks and the emotional bond, and 26% rated the alliance as regarding goal. The result is a bit puzzling because it would be expected that maybe a higher percentage would rate the alliance as low or weak. As mentioned in the introduction, research has consistently showed that a strong alliance is related to good outcomes (Bickman et al., 2012; Spinhoven et al., 2007; Zuroff & Blatt, 2006), and that a weak alliance is related to dropout (Barrett et al., 2008; Sharf et al., 2010). Some meta-analysis showed a significant correlation between repairing the alliance and therapy outcome (Safran et al., 2011; Safran et al., 2014), which we did not study but could be important to investigate in relation to dropout in future research. Another possibility would be to investigate ruptures in the alliance, which also have been associated with treatment outcome (Larsson et al., 2018). In a micro-analysis of sessions before a dropout more withdrawal alliance ruptures were observed (Gülüm et al., 2018). Findings also suggested that both therapists and clients decreased the pace of work and engaged in less exploration during the sessions before the dropout (Gülüm et al., 2018). Our findings correspond with these findings as approximately 30% rated the alliance as low and suspected a dropout. The fact that they mostly did not talk to

the client suggests a withdrawal pattern in the therapeutic alliance. Nissen-Lie et al. (2017) found that when therapists actively help clients deal with clinical problems by exercising reflexive control and problem solving, it was associated with positive change while avoiding problems was associated with less change. It seems reasonable to assume that when clients dropout, they do so because they experience that they are not getting the help they hoped for or do not have enough trust in the therapist being able to be helping them sufficiently. The therapists provided the highest ratings for the following reasons: a) the client did not want to engage in or respond to specific interventions, b) the clients did not seem to believe that the method would help them. The discrepancy between what therapists reported as reasons for the dropout and their own feelings during therapy suggests that the client and the therapist have different experiences related to therapy. One example of this would be that the therapist is interested and eager to help but the client do not want to engage in or even resists interventions. It is likely that relational strains, which may be interpreted as a rupture in the therapeutic alliance, affects therapy negatively. If the rupture is not articulated there may be a silent withdrawal rupture in the therapeutic alliance, It may also be that psychological mechanisms (for example countertransference or avoidant coping) may be involved without the therapist necessarily being aware of it and still communicating these sentiments in the therapy. Another possibility in terms of psychological mechanisms is when we suspect that a client will leave therapy and this suspicion triggers anxiety about being inferior, being left in other relationships, not being "good-enough", a failure or other signs of downgrading our competence or even ourselves as persons. Thoughts and emotions like this are hard to verbalize and therapists may hesitate to reveal to the client that that he/she suspect that the client will leave the therapy. Our findings showed that a majority suspected premature drop out but only 23% of the therapists had communicated about their suspicions with the client. It seems like many therapists suspect a dropout, but do not communicate their suspicions.

Limitations and Strengths

The study has several limitations. First, the recruitment of therapists was done on the internet via Facebook, email to psychiatric outpatient clinics and different psychotherapy networks. This narrowed down the sample to persons frequently using the internet (e.g. social media and online networks) and could be reached. Even if the sample was limited by the number of persons who could answer the questionnaire, we still believe we reached a fairly broad sample and that many currently active psychotherapists use the internet and social media. Using a postal survey or telephone interview could possibly lead to different estimates and findings even if we doubt there would be major discrepancies. Further, although we asked the therapists to think of a particular premature dropout it is difficult to know if the answers reflect a single dropout or if they rather mirror general opinions related to non-agreed premature dropouts. It can be hard to remember

specific emotions or what was going on in hindsight, and we cannot exclude memory bias and selective reporting. Cuijpers et al. (2015) also showed that there were differences in how dropout had been defined which makes it difficult to interpret the findings.

Some strengths with our study are that we measured what therapists clinically encounter in association with dropouts. Further, the observation that clients drop out fairly often most likely reflects what occurs in a typical clinical setting and adds information to what is already known regarding research and educational settings for psychotherapy where most studies regarding estimated dropout rates have been conducted. Finally, the respondents were from different organizations, used therapeutic methods and had varied work experience as therapists.

Future Research

This study indicates that there are discrepancies in the number of premature dropouts observed in clinical settings, research studies, and studies made in psychotherapy education settings. However, the number of people in the general population who have an experience of premature dropout from psychotherapy is to our knowledge not known and could be investigated as was done long ago with regards to therapy experiences in the Consumers Report study (Seligman, 1995). It is reasonable to assume that there are different reasons behind premature dropouts. To investigate reasons for premature dropout it will be vital to ask clients about their reasons for terminating therapy. To further investigate therapists' views on the impact of dropout, interviews or focus groups are possible methods to obtain a deeper understanding of processes related to dropout. By analysing video clips of therapy session in which clients subsequently dropout, one could gain a deeper understanding the reasons for and the process of dropout.

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A Mental Imagery Micro-Intervention to Increase Positive Affect in Outpatient CBT Sessions (PACIfIC): Study Protocol of a Randomized Controlled Implementation Trial

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Supplementary Materials: Materials [see Index of Supplementary Materials]

Abstract

Background: Recent findings indicated that mental disorders are associated with both an up-regulation of negative affect and a down-regulation of positive affect (PA) as distinct processes. Established treatment approaches focus on the modification of problems and negative affect only. Experimental paradigms in healthy samples and research on strengths-based approaches showed that fostering PA may improve psychotherapy process and outcome. Specific and easily implementable interventions targeting PA in treatment sessions are scarce. Mental imagery was shown to be a promising strategy for boosting positive emotional experiences.

Method: The PACIfIC-study is planned as a longitudinal randomized-controlled trial in the context of cognitive behavioral therapy, implemented at a German outpatient training and research center. In the process analysis, trajectories of PA over the first twelve treatment sessions will be examined with weekly questionnaires. In the intervention analysis, a six-minute positive mental imagery intervention to enhance PA will be developed and tested. The intervention is implemented with loudspeakers at the beginning of each session for a standardized induction of PA. The

experimental group will be compared to an active control group (neutral mental imagery) and treatment as usual. Procedures in all treatment arms are parallelized. Main outcomes after twelve sessions of psychotherapy will be psychosocial resources, resilience and self-esteem (theory-driven), as well as psychopathology and working alliance (secondary outcome). Multilevel modeling will be conducted to address the nested data structure.

Conclusion: Study results may have implications on the consideration of positive constructs in mental disorders and the implementation of strengths-based interventions in psychotherapy.

Keywords

positive affect, mental imagery, psychotherapy process, cognitive behavioral therapy, randomized controlled trial, multilevel models

Highlights

- This planned study will examine the trajectories of positive and negative affect during early CBT.
- Development and pilot-test of a six-minute positive mental imagery intervention are described.
- Possible effects of the positive mental imagery implementation of treatment outcome are discussed.

Treatments like cognitive behavioral therapy (CBT) have shown effectiveness for various mental disorders (e.g. Hofmann et al., 2012). However, there is a lack of knowledge about basic processes in mental disorders and psychotherapy. Affect dysregulation is recently discussed as a factor for the maintenance of psychopathology. Affect is defined as the subjective experience of an emotional state and is differentiated by its valence (Hofmann, 2016). Positive and negative affect are assumed to be correlated, but separate constructs (Larsen et al., 2017; Watson et al., 1999). Dysfunctional up-regulation of negative affect (NA) is a common feature in mental disorders (Aldao et al., 2010) and is successfully modified by CBT (Boumparis et al., 2016; Sauer-Zavala et al., 2012). In contrast, the impact of positive affect (PA) in psychopathology and psychotherapy is not well established. Regarding this research gap, we designed the Positive AffeCt and mental Imagery In the process of Cognitive behavioral therapy (*PACIfIC)*-study.

PA and Psychological Processes

PA is characterized by various emotions and moods with a subjective pleasant valence. According to the broaden-and-build theory of positive emotions, PA initiates a multi-stage upward spiral process (Fredrickson, 2001; Garland et al., 2010). In particular, research findings from healthy samples showed that PA leads to a broadening of attention as well as thought and action repertoires. Positive mood inductions in experimental paradigms increased visuospatial attention as well as information processing (Phaf, 2015;

Pourtois et al., 2017; Vanlessen et al., 2016). High PA was related to better performance in category building and creativity tasks (Baas et al., 2008; Nadler et al., 2010). Observational and experimental studies showed that such broadening, in turn, was associated with a reciprocal increase of psychosocial resources, resilience and mental health (Garland et al., 2010; Griffith et al., 2021). The broaden-and-build theory, therefore, hypothesized that an increase in PA will lead to higher levels in these specific variables. Hence they may help to evaluate interventions that target an increase of PA. Brief descriptions of these constructs are presented in the following: Psychosocial resources were defined as positive and functional aspects of a person or his/her environment (e.g. optimism, social support; Taylor & Broffman, 2011). Previous findings indicated moderate to high correlations between different constructs and the possibility to assess a generic perception of inherent resources (Goldbach et al., 2020; Taylor & Broffman, 2011; Victor et al., 2019). Psychological resilience was defined as the potential to successfully adapt to adversities and stressors (Davydov et al., 2010). Previous studies found that resilience is a dynamic trait, which is both influenced by internal and external experiences and changeable by purposeful interventions (Connor & Davidson, 2003; Mealer et al., 2014). Self-esteem is an important part of mental health and was defined as the degree, a person positively consider his/her characteristics or abilities (Brown, 2007). Baseline parameters and trajectories of self-esteem and PA were strongly related in observational and intervention studies (Garland et al., 2010; Wood et al., 2003). Most concepts have focused on a global evaluation of self-esteem rather on specific facets (Rosenberg et al., 1995).

PA in Psychopathology and Psychotherapy

Carl et al. (2013) pointed out that the down-regulation or dampening of PA is an independent process in mental disorders. In a prospective paradigm, baseline anxiety and depressive symptoms were related to lower rates of daily positive emotional reactivity and decreased levels of PA in the subsequent 14-day period (Carl et al., 2014). Specific analyses found decreased levels of PA for various mental disorders (Cohen et al., 2017; Eisner et al., 2009; Thompson et al., 2016). These findings support the idea to consider and foster PA by psychotherapeutic interventions. Concurrently, classical CBT treatments had only small effects on PA in patients with major depression, $g = 0.41$, $p = .001$, and anxiety disorders, $g = 0.37$, $p = .001$ (Boumparis et al., 2016; Wilner Tirpak et al., 2019).

An established approach to foster positive constructs in psychological treatments is resource activation. The activation of patients' strengths and resources is regarded as a change mechanism in psychotherapy and was significantly associated with patients' PA and treatment outcome in CBT sessions (Flückiger et al., 2009; Mander et al., 2013). Observer ratings showed that successful CBT sessions were characterized by higher levels of resource activation and PA, particularly at the beginning of treatment sessions (Gassmann & Grawe, 2006; Smith & Grawe, 2003). Moreover, Chui et al. (2016) found that

higher initial PA of patients in psychotherapy sessions lead to both more PA of therapists and better rated post-session collaboration. Although these studies indicate the feasibility to increase PA in psychotherapeutic settings and its promotive influences on symptom improvement and working alliance, economical strategies that directly targeting PA are lacking.

Mental Imagery as a Strategy to Increase PA

Mental imagery is defined as "representations and the accompanying experience of sensory information without a direct external stimulus" (Pearson et al., 2015, p. 590). Compared to other interventions, mental imagery was found to be more effective in evoking emotions (Holmes et al., 2009; Holmes & Matthews, 2010; Schubert et al., 2020). Recent research approaches compared the imagination of positive versus neutral contents to differentiate its affective impact (Grol et al., 2017). In clinical settings, most studies of positive mental imagery were conducted as single interventions to promote PA in patients with major depression: these trainings were associated with reduced depressive symptoms and anhedonia, as well as increased optimism, positive self-referent cognitions and behavioral activation in clinical samples (Blackwell et al., 2015; Dainer-Best et al., 2018; Ji et al., 2017; Renner et al., 2017). Alternatively, positive mental imagery has also been discussed to enhance anxiety (Wallace & Alden, 1997) and trigger dissociation (Brewin et al., 2010). Another analysis by O'Donnell et al. (2017) showed that positive mental imagery training in individuals with high hypomanic experiences led to a dysfunctional amplification of positive mood. Thus, while there is substantial evidence that fostering PA may be a promising intervention strategy also in psychotherapy, we do not know whether the systematic implementation of positive mental imagery has a beneficial impact on psychotherapy process and outcome.

Specific analyses found important factors influencing the promotion of PA in mental imagery: practicing mental imagery repeatedly (Blackwell et al., 2015; O'Donnell et al., 2017), including various sensory modalities (Holmes et al., 2008), imaging personally relevant situations, aspects or perspectives (Quoidbach et al., 2009) and employing a field perspective (Grol et al., 2017).

Current Study

The dysregulation of PA is a prominent and distinct factor in psychopathology and should be focused in CBT. Higher experience of PA may broaden patients' receptivity in treatment sessions and may enable goal-related approaching behaviors. However, there is a massive lack of knowledge about PA in the therapeutic process. To the best of our knowledge, no study has attempted to activate PA via an economical intervention in CBT sessions.

Within the *PACIfIC*-study, both a process and an intervention analysis will be conducted. In the process analysis, we will examine the course of PA and NA in the first twelve sessions of CBT treatments. Therefore, primary outcome in the process analysis will be the slope of PA and NA. Further measures of resource activation, working alliance and psychopathology after each of the twelve sessions will be included in the process analysis to analyze their relation to PA (within and between sessions).

In the intervention analysis, we will examine the effects of a six-minute positive mental imagery intervention during an early phase of psychotherapy. The aim of this micro-intervention is to foster patients' in-session PA, which may lead to increased levels of subjective resources, resilience, and self-esteem (theory-driven outcome) as well as improvements in psychopathology and working alliance (secondary outcome). Changes in the theory-driven outcome variables are expected due to the specific effects of increased PA according to the broaden-and-build theory of positive emotions (Fredrickson, 2001). Changes in the secondary outcome variables are expected due to found effects of resource activation and shared positive emotions in treatment (Chui et al., 2016; Flückiger et al., 2009). Patients will be randomized into one of three parallel treatment arms with a 1:1:1 allocation: CBT + positive mental imagery micro-intervention (PMI), CBT + neutral mental micro-intervention (NMI), or treatment as usual (TAU). Two active mental imagery micro-interventions are planned to differentiate the specific effect of a PA induction within treatment sessions. The study serves the following objectives:

1. To explore the trajectories of PA and NA in an early phase of CBT treatment.
2. To develop and test the feasibility of a brief intervention to promote PA in psychotherapy sessions.
3. To analyze the impact of this intervention on the therapeutic process between and within CBT sessions and intermediate outcomes.

We hypothesize that PA will increase, while NA will decrease during the first 12 sessions of therapy. According to the specific effects postulated by the broaden-and-build theory of positive emotions, we further hypothesize that patients in the PMI will show higher in-session PA and higher levels of subjective resources, resilience, and self-esteem compared to the other conditions.

Method

Design

Figure 1 displays a SPIRIT chart of the planned study design. The study is a randomized controlled implementation trial with three parallel treatment arms using a 1:1:1 allocation ratio. A blocked randomization with blocks of variable length conducted by a random-number generator (random.org) will be performed. Block length will be determined

randomly (9, 12 or 15 units), before conditions will be randomized within all blocks separately. An independent research assistant will develop the block list and conduct the randomization. Patients will be randomized to one of the following arms: CBT + positive mental imagery induction (PMI), CBT + neutral mental imagery induction (NMI) and TAU. All arms include an individual CBT treatment. A cross-therapist design in which any therapist can deliver all three conditions is applied. Randomization will be focused on patients only, so that therapists will not see a fixed number of patients per condition. However, we expect that the block randomization will enable an approximately equal number of patients in all conditions per therapist. All participants are blind to the conditions and specific hypotheses. According to the CONSORT statement concerning the criteria of a pragmatic randomized trial (Zwarenstein et al., 2008) therapists and study coworkers conducting the information meetings are not blind to allocation. Researchers involved in data collection and evaluation will be blind to condition labels. An independent researcher will analyze study data with non-identifying codes of the conditions.
The study includes a longitudinal design with an initial diagnostic phase (four to five sessions) and the following twelve psychotherapy sessions. Outcome for the process analysis will be gathered directly after each treatment sessions. In the intervention analysis, assessments will be made every forth session: at the start of treatment (pre), after fourth (mid-4), after eighth (mid-8) and after twelfth treatment session (post-12). In addition, videotapes of treatment sessions 2, 5 and 8 will be analyzed with an observer rating.

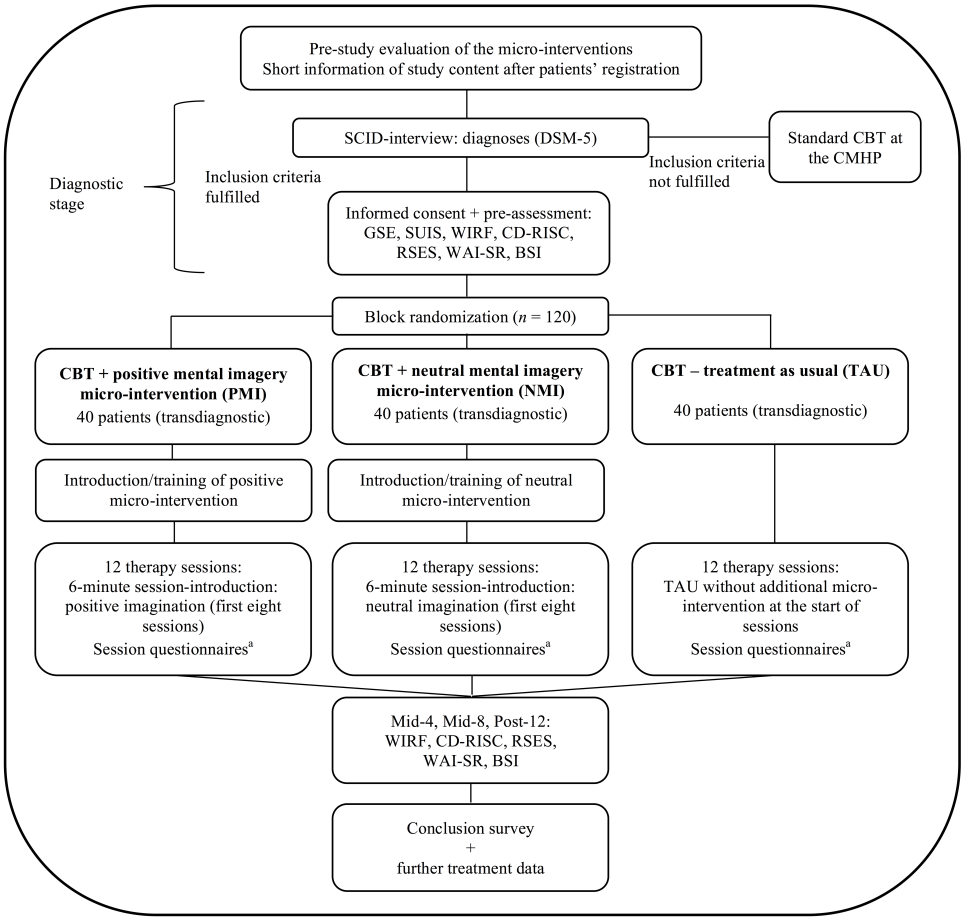
Participants

Patients

A total of 120 patients will be recruited at the Center of Mental Health and Psychotherapy (CMHP), an outpatient training and research center for CBT at Witten/Herdecke University, Germany. General inclusion criteria will be as follows: (1) psychotherapy outpatient, (2) at least one mental disorder according to DSM-5 criteria, (3) at least 18 years of age. General exclusion criteria will be as follows: (1) current diagnosis of a severe episode of major depressive disorder, (2) suffering from a psychotic disorder, (3) suffering from substance use disorder, (4) current episode of (hypo)mania, (5) current suicidal risk, (6) extensive experiences with guided mental imagery interventions (two or more interventions in prior treatment settings), (7) insufficient German language skills, (8) currently receiving another psychological treatment. Prescribed medications for anxiety or depressive disorders do not lead to exclusion from the study. The presence of comorbidities does not result in exclusion from the study.

Figure 1

Flowchart of Study Design



Note. a = session questionnaires: Positive and Negative Affect Schedule (PANAS), Single-item mood scaling, Multiperspective Assessment of Change Mechanisms in Psychotherapy (SACiP-RA), Working Alliance Inventory – Short Revised (WAI-SR), Short version of Derogatis Symptom Checklist (SCL-K-9); BSI = Brief Symptom Inventory; CD-RISC = Connor-Davidson Resilience Scale; CMHP = Center of Mental Health and Psychotherapy; GSE = General Self-Efficacy Scale; RSES = Rosenberg Self-Esteem Scale; SCID = Structured Clinical Interview according to DSM-5 criteria; SUIS = Spontaneous Use of Imagery Scale; WAI-SR = Working Alliance Inventory – Short Revised; WIRF = Witten Strengths and Resource Form.

A power analysis with G*Power (Faul et al., 2007) based on effect sizes from relevant studies (Flückiger et al., 2016; Willutzki et al., 2004) was conducted to determine sample size. The detection of a small to moderate effect (Cohen's $f = 0.15$) for the interaction

between time (pre, mid-4, mid-8, post-12) and treatment condition (PMI vs. NMI vs. TAU) [mixed model analysis of variance (ANOVA), within-between-interaction, $\alpha = .05$, power = .80, number of groups = 3, number of measurements = 4, pre-post correlation = .50, non-sphericity correction = 1] resulted in a sample size of 78 patients. Considering possible dropouts, we will recruit up to 120 patients. Power analysis of a repeated measurement ANOVA is comparable to multilevel models (MLM; Baldwin et al., 2014).

Therapists

20-25 therapists will be recruited at the CMHP. All therapists have at least a master's degree in psychology. Both, licensed CBT therapists and therapists in advanced CBT training will take part in the study. Trainee therapists have at least one year of clinical experience before they start treatments in the CMHP. Parallel to the study, trainee therapists take part in 600 hours of practice-based workshops as a part of CBT training protocols in Germany. Therapists participate in 90-minute supervision in small groups on a weekly basis (general clinical supervision, not study-specific). Every therapist in the CMHP will be informed about study procedures in small group meetings of approx. 30 minutes conducted by JSV.

Standard Procedure at CMHP

Adult patients with various types of mental disorders receive treatment by approximately 20 licensed CBT therapists resp. trainee therapists. The CMHP has eight rooms for providing psychotherapy. All rooms are fully equipped with video and audio recording. Computer-assisted psychometric assessments during therapy are standard procedures at the CMHP and regularly reviewed by staff members. Personal and treatment-specific data is managed with a software called AmbOS. To promote data quality, fixed schedules of assessments for patients and therapists were included. Patients interested in a CBT treatment have a first phone contact and a one-session consultation with a licensed therapist. They are then listed on an internal waiting list (with currently on average six months waiting time). Patients are contacted by a therapist and invited to a standardized diagnostic phase. The diagnostic phase includes four to five sessions with the following order: exploration and treatment consent, Structured Clinical Interview for DSM-5 Disorders (SCID; Beesdo-Baum et al., 2019), biographic work, situation analysis. After the diagnostic phase, a CBT treatment according to the German health system is offered.

Development of the Micro-Interventions

A systematic literature search of interventions to foster PA was conducted, indicating positive mental imagery as a promising strategy. Important aspects to boost emotional experiences in imagery interventions were identified based on relevant studies (e.g. Grol et al., 2017; Holmes et al., 2008). Procedures of positive and neutral interventions used

in these studies are screened in detail. Based on this information, we developed a first version of the PMI in a six-minute format. Next, eleven therapists piloted-tested the intervention with 25 different patients regarding its practical implication. Therapists conducted the intervention within treatment sessions. An anonymous survey was conducted, in which patients and therapists described positive and critical aspects of the intervention independently. We reformulated the intervention script, based on this feasibility information, to its final version. The NMI script was parallelized. Scripts for both interventions can be found in the Appendix (see Supplementary Materials). We decided to record the interventions on audiotapes that will be played at the start of each treatment session to increase standardization (inspired by the PrOMET-study by Mander et al., 2019). Both interventions are spoken and recorded by UW. The audiotapes will be played on bluetooth speakers (Anker SoundCore Mini). Two loudspeakers (grey: PMI; black: NMI) are installed in every therapy room.

Conditions and Experimental Session

All three conditions will be parallelized and include a CBT treatment based on an individual case conception. Every session will start with an initial greeting of patients and the start of video recording.

Experimental sessions will be conducted from session one to eight in the active conditions. In each experimental session of the PMI condition, a grey loudspeaker will be placed on a table in front of patient and therapist with on average one-meter distance. The therapist will carry out the mood scaling by asking the patient to rate his/her mood in the present moment from one (very bad mood) to ten (very good mood). After that, therapists will start the record of the PMI (duration about six minutes). Patients are guided to imagine a positive situation from the last week. Directly after the micro-intervention, the same mood scaling will be conducted again. At the end of the intervention, patients are instructed to communicate the content of their imagination with their therapist for about one minute. After completion, the regular CBT session will begin. After each session patients will complete session questionnaires. Procedures of the experimental sessions in the NMI condition will be parallelized to the description above. At session start, the micro-intervention will be performed with a black speaker with the instruction to imagine a non-emotional situation within the last week. In the control condition, standard CBT will be conducted without additional micro-intervention.

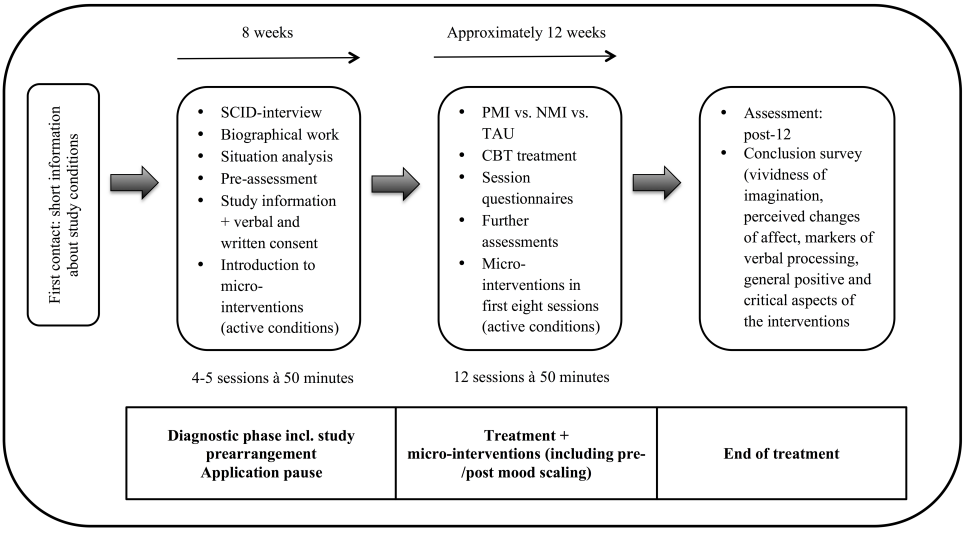
Study Course From Patients' Perspective

Figure 2 shows the study course from patients' perspective. Patients will get a short-information about the studies objectives and procedures within in the first session of the diagnostic phase. If interested, a study coworker will contact them for an additional meeting. Patients will receive written and verbal study information in this meeting and

will sign informed consent. It will be emphasized that study participation is voluntary with the option to revoke study participation at any time without reasons and/or disadvantages. Patients in both active conditions will receive an introduction to the respective mental imagery intervention, including cooperative exploration of specific contents (situation imagery as detailed as possible, sensory modalities, field perspective), examples of positive/neutral situation in the their life, and a practice of the respective intervention. Furthermore, possible difficulties with the interventions will be discussed. The study coworkers will educate patients how to handle it if they fall out of their imagination during the intervention. After the diagnostic phase, all patients will run through twelve CBT sessions. Patients will receive session questionnaires directly after each session. Additional measurements after every forth session will be included in the study.

Figure 2

Study Course From Patients' Perspective



Measures

Table 1 provides an overview of all measures and their application in the study.

Table 1

Application Plan of Measures

Measures	Pre	Session by Session	Measurement waves Mid-4	Mid-8	Post-12
Session questionnaires					
Mood scaling		1-12			
Positive and Negative Affect Schedule (PANAS)	x	1-12			
Resource activation (SACiP-RA)	x	1-12			
Working-Alliance-Inventory (WAI-SR)	x	1-12			
Short version of Symptom-Checklist (SCL-9-K)	x	1-12			
Clinical assessment					
Witten Strengths and Resource Form (WIRF)	x		x	x	x
Connor-Davidson Resilience Scale (CD-RISC)	x		x	x	x
Rosenberg Self-Esteem Scale (RSES)	x		x	x	x
Brief Symptom Inventory (BSI)	x		x	x	x
General Self-Efficacy Scale (GSE)	x				
Spontaneous Use of Imagery Scale (SUIS)	x				
Observer Rating					
Resource-oriented micro-process analysis (ROMA)		2nd, 5th, 8th session			

Note. pre = baseline scores; mid-4 = assessment after fourth sessions; mid-8 = assessment after eighth session; post-12 = final assessment after twelfth session.

Process Analysis – Primary Outcome

Session Questionnaire I — To assess PA and NA of patients, we will apply the Positive and Negative Affect Schedule (PANAS; Krohne et al., 1996). The PANAS is an internationally used 20 item self-report. As described, affect is defined as the subjective experience of an emotional state and is mostly differentiated by positive versus negative valence (Hofmann, 2016). Participants will be asked to rate the items according to how they feel "in the current moment". Two subscales of global PA (ten items, range: 1-5) and global NA (10 items, range: 1-5) will be used. Item examples are shown in the following: “Indicate the extent you feel this way in the current moment - Proud (global PA); - Nervous (global NA). Both scales have shown good internal consistency (PA: α = .85, NA: α = .86) and are widely validated (Krohne et al., 1996).

Process Analysis – Further Measures

Session Questionnaire II — Mood scaling – a single-item mood scaling (“How do you feel in the present moment?”) will be used as an economical assessment of affect. Pa-

tients will be asked to rate their mood on a scale from one (very bad mood) to ten (very good mood). Various short measures of mood were applied in previous studies: These instruments showed practicability and content validity (high correlation with measures of depressive mood) in clinical samples, especially for visual mood scales (Ahearn, 1997; Luria, 1975). Moreover, Van Rijsbergen et al. (2014) showed the transferability of these results for a verbal single-item mood rating. The mood scaling will be used: (1) as a session questionnaire directly after each of the twelve sessions; (2) as an evaluation instrument of the mental imagery micro-interventions in the active conditions (mood scaling before and after the micro-intervention, see conditions and experimental sessions). We decided to include a further affect measure, additionally to the PANAS, because of the simple use of the single item mood scaling in therapy sessions. It is also included as a session questionnaire to analyze the post-hoc correlation between the mood scaling and the PANAS to check construct validity of the single-item measure.

Session Questionnaire III — To assess levels of resource activation from patients' perspective, we will apply the subscale resource activation of the Scale for the Multiperspective Assessment of Change Mechanisms in Psychotherapy (SACiP-RA; Mander et al., 2013). Resource activation refers to transdiagnostic change processes in therapy where strengths or potentials of the patient become perceptible and are used in treatment sessions (Grawe & Grawe-Gerber, 1999). The instrument was included based on prior findings, indicating the association of PA and in-session resource activation (e.g. Flückiger et al., 2009). The subscale consists of three items (range: 0-4). Items of the SACiP-RA were developed based on the Bern Post Session Questionnaire, an established therapy process measure (Flückiger et al., 2010). Item example: "In today's session, I felt where my strengths lie." The subscale has displayed good internal consistency (α = .71) and significant associations with treatment outcome (Mander et al., 2013).

Session Questionnaire IV — To assess quality of the therapeutic alliance, we will apply the Working Alliance Inventory – Short Revised (WAI-SR; Wilmers et al., 2008). We decided to include the WAI-SR as a process measure to analyze its association with PA within and between sessions. Based on prior studies, we expect that patients report better alliance directly after sessions with high levels of PA (Chui et al., 2016). Furthermore, we want to analyze whether PA and the working alliance will develop parallel in the process of treatment. The WAI-SR is an internationally used 12 items self-report of therapeutic alliance measuring bond, goals and tasks in psychotherapy based on feedback of patients concerning the current therapy session. Items are answered on a likert scale from one to five. Item example: "My therapist and I respect each other." The WAI-SR is considered the gold standard in alliance assessment with excellent psychometric properties and outcome prediction (Horvath et al., 2011).

Session Questionnaire V — To assess general psychopathology, we will apply the short version of Derogatis Symptom Checklist (SCL-K-9; Klaghofer & Brähler, 2001). We decided to include the SCL-K-9 as a process measure to analyze its association with PA within and between sessions (e.g. parallel development of increase of PA and improvement in symptoms). The short version with nine items (range: 0-4) is an internationally used self-report. Item example: "During the last past seven days, how much were you distressed by: finding it difficult to start something." The short version has shown good internal consistency (α = .87) as well as high correlations to the original version (Petrowski et al., 2019).

Intervention Analysis – Primary Outcome

Subjective Resources of Patients — Witten Strengths and Resource Form (WIRF; Victor et al., 2019). As described, psychosocial resources were defined as positive and functional aspects of a person or his/her environment (Taylor & Broffman, 2011). The instrument assesses a generic perception of resources rather than separate positive aspects. Therefore, it measures the internal evaluation of a person's inherent resources. This subjective perception should be differentiated to the therapeutic process of resource activation. The WIRF is a self-report with 37 items (range 0-5). In our study we will use a total score of resources in the context of current problems (12 items). Item example: "I am dealing with my current difficulties and problems by – actively tackling tasks." The scale has displayed good internal consistency (α = .88), evidence for convergent and divergent validity as well as evidence of change sensitivity in the course of psychotherapy (Schürmann-Vengels et al., 2022; Victor et al., 2019).

Resilience of Patients — Connor-Davidson Resilience Scale (CD-RISC; 10 Item version, German adaption by Sarubin et al., 2015). As described, psychological resilience is a dynamic and multidimensional trait that enables a successful adaptation to adversities and stressors (Connor & Davidson, 2003). The CD-RISC is an internationally used self-report (range 1-7) to access general resilience. Item example: "I am able to adapt when some things change". The German adaptation with 10 items has shown good internal consistency (α = .84), good retest-reliability (*rtt* = .81, $p < .001$) and evidence for convergent validity (Sarubin et al., 2015).

General Self-Esteem — Rosenberg Self-Esteem Scale (RSES; von Collani & Herzberg, 2003). As described, self-esteem is defined as the degree, a person positively consider his/her characteristics or abilities (Brown, 2007). The RSES is an internationally used self-report with 10 items (range 0-3) to assess a sum score of general self-esteem. Item example: "I am able to do things as well as most other people." The German version shows good internal consistency (α = .83-.88) as well as evidence of criterion and construct validity (von Collani & Herzberg, 2003).

Intervention Analysis – Secondary Outcome

General Psychopathology — Brief Symptom Inventory (BSI; Franke, 2000). The BSI is an internationally used self-report with 53 items (range 0-4). The BSI was chosen as an outcome measure of the intervention analysis to analyze the effects between conditions on symptom improvement. We decided to include this version in addition to the economical process measure of psychopathology (SCL-K-9), because its subscales delivers specific information on the improvement of different mental disorders and it is more comparable to outcome measures in other intervention studies. Item example: "During the last past seven days, how much were you distressed by: feeling lonely." The German version has shown excellent psychometric properties in clinical samples and is one of the most used instruments in psychotherapy research (Geisheim et al., 2002).

Working Alliance — WAI-SR (Wilmers et al., 2008). Description of the instrument, see process analysis – further measures. We further included the WAI-SR as a secondary outcome to analyze whether the conditions have specific influence on general alliance.

Further Measures

Self-Efficacy — General Self-Efficacy Scale (GES; Schwarzer & Jerusalem, 1999). Self-efficacy refers to the subjective belief that a person is confident that his/her actions lead to successful/targeted outcomes (Bandura, 1977). Several studies have suggested the beneficial effects of self-efficacy on mental health (e.g. Schönfeld et al., 2016). The GES was, therefore, included as a possible predictor of the slope of PA and NA in the process analysis. The GES is an internationally used self-report with ten items (range 0-3). Item example: "I can always manage to solve difficult problems if I try hard enough." The instrument has shown excellent internal consistency (α = .80-.90) as well as good predictive quality in psychotherapeutic contexts (Schwarzer & Jerusalem, 1999).

General Mental Imagery Ability — Spontaneous Use of Imagery Scale (SUIS; German adaptation by Görgen et al., 2016). The SUIS is an internationally used self-report. The German adaptation consists of 17 items (range 1-5) and showed good internal consistency (α = .85), evidence for convergent validity as well as high correlations to the original scale (Görgen et al., 2016). Item example: "When I think about visiting a relative, I almost always have a clear mental picture of him/her."

Observer Rating

To assess relevant aspects on a minute-by-minute basis within treatment sessions, the Resource-oriented Microprocess Analysis will be applied (ROMA; Flückiger & Grosse Holtforth, 2008). The instrument is a coding system of different aspects of resource activation (personal resources, motivational resources, reframing of problems, global resource activation) and PA from video recordings of treatment sessions. The coding

system has shown good to excellent interrater reliability for patients and therapists (K = .82 - .99).

Independent research assistants will analyze the videotapes. The specific application of the observer rating will be applied in a prior workshop conducted by CF.

Statistical Analysis

For the main hypotheses, measures will display a nested data structure (sessions at level 1 are nested with patients at level 2, nested with therapists at level 3). Therefore, we will use MLM as recommended by Baldwin et al. (2014). Separate MLM analyses will be conducted for session questionnaires of the process analysis with twelve measurements, and change questionnaires of the intervention analysis with four measurements. Time will be a within-subject factor and treatment condition a between-subject factor in both procedures. Main effects and time*condition interactions will be analyzed. We hypothesize that the slope in the PMI will increase significantly stronger compared to the NMI and TAU conditions. Possible level-2-predictors, especially for the slope of PA, will be considered. Both per-protocol and intention-to-treat analyses will be conducted.

Discussion

The effects of PA on broadening attention and flexibility, as well as building resources and mental health, are well researched. Various findings showed a down-regulation of PA in persons with mental disorders. Despite its relevance for psychotherapy patients, there is a dearth of knowledge about the course and systematic implementation of PA in CBT. No study so far has attempted to activate PA at the start of CBT sessions to explore possible effects on process and outcome. To fill this research gap, we developed the *PACIfIC*-study.

Innovations

The present study includes various innovative aspects: first, in line with other studies (e.g., Mander et al., 2019; Flückiger et al., 2018) a new perspective of standardized strategies to introduce psychotherapy sessions is taken up. Second, our study will have an explicit focus on PA and its impact on CBT. Third, to the best of our knowledge, this study is the first one implementing an economical in-session intervention to enhance PA in psychotherapeutic treatment. Forth, this implementation trial uses a cross-therapist design to systematize on therapist effects (e.g., Flückiger et al., 2018; Schiefele et al., 2017).

Bias Minimization

An independent research assistant will randomize patients to treatment arms. Patients, therapists and researchers involved in the data collection and evaluation will be blind to the randomization. In addition, patients will be blind to the specific hypotheses. Patient characteristics will be compared between conditions to check for possible confounding variables. A cross-therapist design is applied to minimize therapist effects. The application of standardized audiotape records will additionally reduce possible therapists effects. The MLM will decrease an overestimation of effects emerging from the nested data structure and is robust in handling possible missing data.

Adherence Strategies

All study coworkers will use standardized materials to enhance adherence. Patients in both active conditions will be trained in the respective mental imagery intervention during the diagnostic phase. Patients will get email address and phone number of the study coworker who conducted the training to be reachable if any problems or questions occur. Each therapist involved in the study will be informed about study procedures and technical handling. Further, a list with the most important study aspects will be handed out to therapists before enrollment. This list will also be placed in every therapist-office. A study coworker will regularly contact each therapist in person to enhance study compliance. Furthermore, data collection will regularly be checked to discuss irregularities.

Identification of Risks

Previous studies indicated that potential risks of the mental imagery interventions are low (Blackwell et al., 2015; Dainer-Best et al., 2018; Ji et al., 2017; Renner et al., 2017). However, possible risks of the interventions lie in the intensification of specific symptoms (psychopathology) or emotional states. Affect and psychopathology measures in the process analysis will be used for a post-hoc check of unwanted effects/trajectories of involved patients. Furthermore, possible negative effects will be documented from patients' (conclusion survey) and therapists' perspective (regularly exchange with study coworkers).

Conclusion

Our study will examine patients' PA in an early phase of CBT treatment. It will further test a brief mental imagery intervention to foster PA in an outpatient sample. Our results may identify PA as a complementary factor in psychopathology and how it is affected by psychotherapy. Our results could furthermore implement the idea for strengths-based interventions as a transdiagnostic strategy to improve treatment outcome.

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Competing Interests: The authors declare that they have no competing interests.

Author Contributions: JSV, PPV, PO, CF, TT, and UW contributed to the study design. JSV and UW discussed and developed both mental imagery interventions. JSV, PPV, PO, and UW implemented the study at the CMHP. JSV wrote the initial draft of the manuscript. All authors read and approved the final version of the manuscript.

Ethics Statement: Ethics approval for the study was provided by the ethics committee of the Universität Witten/Herdecke (Germany) in October 2018, approval no. 128/2018. All participants provided a written informed consent.

Trial registration: Trial registered at ClinicalTrials.gov, Identifier: NCT03767101 (registered December 6, 2018), https://clinicaltrials.gov/ct2/show/NCT03767101

Supplementary Materials

The Supplementary Materials contain standardized scripts of the positive mental imagery induction (PMI) and neutral mental imagery induction (NMI):

- Appendix A – Positive mental imagery induction (PMI)
- Appendix B – Neutral mental imagery induction (NMI)

For access see Index of Supplementary Materials below.

Index of Supplementary Materials

Schürmann-Vengels, J., Victor, P. P., Odyniec, P., Flückiger, C., Teismann, T., & Willutzki, U. (2022). *Supplementary materials to "A mental imagery micro-intervention to increase positive affect in outpatient CBT sessions (PACIfIC): Study protocol of a randomized controlled implementation trial"* [Additional information]. PsychOpen GOLD. https://doi.org/10.23668/psycharchives.6977

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Clinical Psychology in Europe

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Scientific Update and Overview

Developmental Coordination Disorder (DCD): Relevance for Clinical Psychologists in Europe

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Abstract

Background: Developmental Coordination Disorder (DCD) is a common neurodevelopmental disorder primarily characterized by fine and gross motor coordination difficulties. Yet, many aspects remain unclear regarding the clinical presentation of secondary symptoms and their implications for Clinical Psychology. Therefore, the purpose of this review is to provide an update about the current understanding of DCD for clinical psychologists and psychotherapists across Europe, particularly based on new insights stemming from the last decade of research.

Method: We provide a narrative review of articles published in the last decade on the topic of DCD, and relevant aspects to clinical psychologist, including lesser known aspects of DCD (e.g., executive functions, psychological consequences, and adult DCD).

Results: DCD is a highly prevalent, disruptive, and complex disorder, which should be investigated further in many areas (e.g., co-occurrence to ADHD). Existing evidence points toward a key role of executive functioning difficulties at all ages. Most patients report secondary psychological problems, but little headway has been made in examining the effectiveness of psychotherapy for DCD.

Conclusions: Insights and remaining research gaps are discussed. It is critical for psychologists and clinical researchers to raise awareness for DCD, take note of the growing literature, and foster continued interdisciplinary approaches to research and treatment of DCD.

Keywords

dyspraxia, neurodevelopmental disorders, motor coordination, clinical practice, psychotherapy

Highlights

- Awareness about Developmental Coordination Disorder (DCD) is low among some European Psychologists.
- Growing knowledge about DCD should be disseminated among psychotherapists.

Tanja[1] *is a 20-year-old female from Germany who studies part time at university and has a part-time job as a store manager. She has noticed she takes much longer than her peers to type her papers, and she often struggles to pay attention to long lectures. When she was younger, she had trouble learning how to ride a bike, and struggled to grip her pencils correctly, however, she improved both skills during childhood. She has found that her struggles to pay attention and difficulties with typing are becoming problems at work, but her classmates and colleagues do not seem to notice she is struggling. As the demands of her job and studies increased, her difficulties have become extremely burdensome. Therefore, Tanja is seeking psychotherapy to manage her stress.*

At first glance, some clinicians may suspect the patient has Attention-Deficit/Hyperactivity Disorder (ADHD) based on the characteristic problems with sustained attention. However, she also exemplifies several hallmark symptoms of Developmental Coordination Disorder (DCD). A correct diagnosis in Tanja's case could be critical because treatment for ADHD may require different strategies (i.e., medication). Considering the common misconceptions and lack of knowledge surrounding DCD, it is important clinicians treating complex cases like these are aware of the current clinical picture of DCD.

Key Aspects of Developmental Coordination Disorder

DCD is a neurodevelopmental disorder with primary deficits in fine and gross motor coordination (American Psychiatric Association, 2013). The DSM-5 criteria for a DCD diagnosis include: (1) the acquisition and execution of motor skills and related coordination are below what is expected based on age, (2) the deficits of motor skill and coordination significantly interfere with daily life in the domains of self-care, scholastics, work, leisure, and play, (3) the symptoms began in childhood, and (4) the deficits cannot be better explained by any other condition (e.g., cerebral palsy or neurodegenerative disorder; American Psychiatric Association, 2013; see Table 1). DCD has a profound impact on the lives of individuals suffering from the disorder.

1) This case is based on collective experiences of individuals with DCD, and is not based on any one real person.

Table 1

Diagnostic Criteria and Examples of Symptoms of DCD

Diagnostic Manual / Criteria	Practical Example	Recommendations
DSM 5: Developmental Coordination Disorder		
(A) the acquisition and execution of motor skills and related coordination are below what is expected based on age	The individual might have taken longer to learn to crawl, walk, ride a bike, write, kick a football, climb or descend stairs, etc. They might have also learned motor skills but struggle to execute them in a coordinated fashion.	In children, the MABC-2 (Henderson et al., 2007) can be used to objectively assess motor functions in comparison to same-aged peers (in a percentile score based on age-band). In adults, MABC-2 can be used loosely, a self-report by the patient of novel motor experiences in adulthood might be considered, e.g., a new skill in the workplace or school: typing, driving.
(B) the deficits of motor skill and coordination significantly interfere with daily life in the domains of self-care, scholastics, work, leisure, and play	The individual might avoid socialization, or team sports, in fear of embarrassment for lack of coordination.	Screen for impact of motor skills on daily life, and other psychosocial factor (e.g., co-occurring anxiety, depression).
(C) the symptoms began in childhood	–	If patient is an adult at the time of assessment, the Adult DCD Checklist (ADC; Kirby et al., 2010) section 1 can be used as a proxy for symptoms in childhood.
(D) the deficits cannot be better explained by any other condition	Patient should not have Cerebral Palsy, Huntington's Disease, acquired brain injury, difficulties related to surgery, etc.	Complete diagnostic history, including physical, mental, and genetic conditions, should be considered.
ICD-10: Specific Developmental Disorder of Motor Function (F82)		
(1) A disorder with primary deficits of motor coordination	As listed in DSM 5 criterion (A) above.	As listed in DSM 5 criterion (A) above.
(2) Impairments in fine and gross motor coordination	General difficulties might involve fine motor tasks such as trouble gripping objects, poor handwriting, challenges typing on a keyboard. Difficulties might also involve gross motor functions, such as, trouble walking in a coordinated manner, frequently tripping over or bumping into objects, difficulties kicking or catching a ball.	As listed in DSM 5 criterion (A) above.
(3) Not better explained by an intellectual disability or acquired neurological disorder	Patient should not have Disorder of Intellectual Development, Cerebral Palsy, Huntington's Disease, acquired brain injury, difficulties related to surgery, etc.	As listed in DSM criterion (D) above. Potential rationale for IQ testing.

Note. The ICD-11 "Developmental Motor Coordination Disorder" lists symptoms entirely in line with the DSM 5, adding that symptoms must begin in childhood. Notably, the different name contradicts nomenclature standards set out by DCD experts (see Blank et al., 2019) and the patient preferred name "Dyspraxia." Diagnostic criteria are summarized from the latest guidelines of each diagnostic manual (DSM-5-TR; American Psychiatric

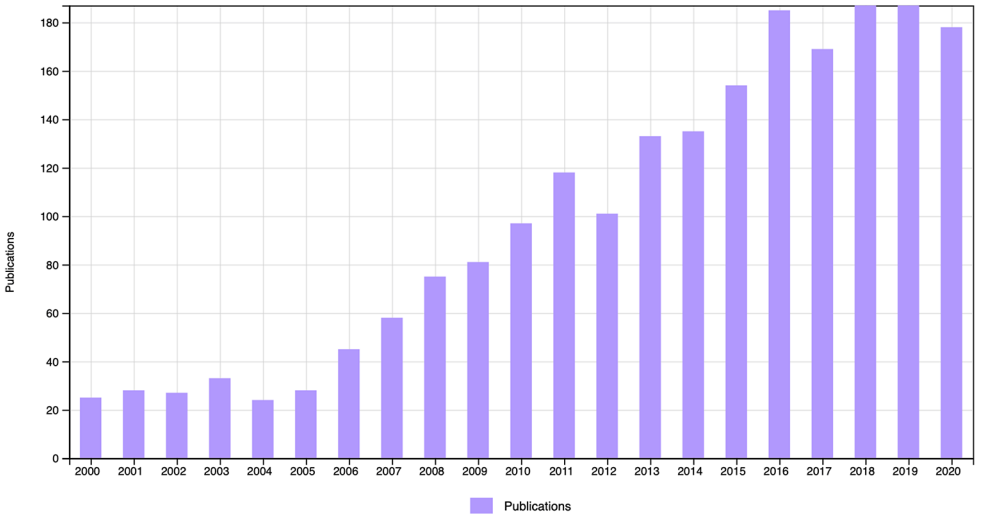
Association, 2022; ICD-11; World Health Organization, 2020). In the new DSM-5-TR, DCD is listed under a further subcategory entitled "motor disorders.

Accumulating research highlights the psychological effects of DCD symptoms still remain unclear (e.g., Kirby et al., 2013; Tal Saban & Kirby, 2018; Zwicker et al., 2018) and executive functioning differences may be present (e.g., Bernardi et al., 2018; Sartori et al., 2020). Furthermore, there is a lack of established gold standard diagnostic procedure for adults with DCD despite increasing evidence that motor symptoms and psychosocial consequences continue into adulthood in most cases (Purcell et al., 2015; Tal Saban & Kirby, 2018).

DCD is a common neurodevelopmental disorder, with a prevalence frequently cited as 5% (Blank et al., 2019). Despite this, DCD has received minimal attention in research, especially compared to other neurodevelopmental disorders (see Figure 1; Bishop, 2010). Even child and adolescent psychiatrists have been reported to profess poor general knowledge of DCD (Wilson et al., 2013). This alludes to a history of potentially overlooking individuals with DCD.

Figure 1

Publications With the Term "Developmental Coordination Disorder" in the Title, Abstract, or Key Words From 2000-2020



Note. A) a total of k = 2,068 articles were retrieved from the search in Web of Science in June 2021. While many search topics have increased in research volume over the years, as a closer comparison, the search term "Attention Deficit Hyperactivity Disorder" returned k = 28,533 articles from the same time period with at least k = 1,000 per year from 2009 on, and k = 2,480 in 2020 alone; exceeding the number in one year for all DCD articles across 20 years.

While the number of publications and citations for papers about DCD is still far behind comparable conditions (e.g., ADHD), there has been a promising increase in publications over the last decade (see Figure 1). In addition, international guidelines for most aspects of DCD were recently released for health care professionals of all fields (Blank et al., 2019). The guidelines solidify that DCD is a unique condition to be recognized by psychologists and offer important insights. Therefore, in this narrative review, we (1) extend upon these guidelines to include an overview on the current state of lesser understood features of DCD (e.g., executive functions, co-occuring ADHD, adult DCD), and (2) highlight available resources specifically for European psychologists (e.g., tools available in various European languages). We include recent insights with research primarily published in the last decade to provide an up-to-date overview of DCD.

Method

The present review is narrative in nature and included evidence from several systematic searches on the PsycINFO and Web of Science databases in November 2020. Search terms included "Developmental Coordination Disorder," "Dyspraxia," and "DCD" in all sections, and some subsections required separate extensive searches. For example, screening tools for DCD were searched by name (i.e., MABC-2; BOT-2; DCD-Q; Adult Developmental Coordination Disorders/Dyspraxia Checklist; AAC-Q). In order to find a comprehensive list of these tools in all European languages, additional searches were conducted on Google Scholar with the name of the language as an additional search term for each of the screening tools (see Table 2). Eligible records were those published between 2009-2020, which were reviews, expert consensus papers, empirical papers, and meta-analyses regarding DCD and relevant aspects to clinical psychology (e.g., psychosocial consequences; executive functions; DCD in adults).

Table 2

Published and Validated Screening Tools for Developmental Coordination Disorder in European Languages

	Motor Screening Tests		Questionnaires for Children		Questionnaires for Adults	
Language	**MABC-2** *(ages 3 to 16)*	**BOT-2** *(ages 4-21)*	**DCD-Q** *(ages 5-15)*	**Little DCD-Q** *(ages 3-4)*	**ADC** *(ages 17 - 42)*	**AAC-Q** *(ages 16-35)*
Language Relevant to Europe						
Czech	Psotta et al., 2012	N/A	N/A	N/A	N/A	N/A
Danish	Reported available by Blank et al., 2019	N/A	Milidou et al., 2015	N/A	N/A	N/A

	Motor Screening Tests		Questionnaires for Children		Questionnaires for Adults	
Language	**MABC-2** *(ages 3 to 16)*	**BOT-2** *(ages 4-21)*	**DCD-Q** *(ages 5-15)*	**Little DCD-Q** *(ages 3-4)*	**ADC** *(ages 17 - 42)*	**AAC-Q** *(ages 16-35)*
Dutch	Schoemaker et al., 2012	N/A	DCDQ-NL; Schoemaker et al., 2006	LDCDQ-NL; Cantell et al., 2019	N/A	N/A
English	UK, Henderson et al., 2007[a]	USA, Bruininks & Bruininks, 2005[a]	Wilson et al., 2009[a]	Canadian, Wilson et al., 2015	UK, Kirby et al., 2010[a]	Tal Saban et al., 2012[a]
Flemish	N/A	N/A	N/A	Reported available by Rihtman et al., 2015 L-DCD-Q-VL Moret et al., 2019	N/A	N/A
French	Marquet-Doléac et al., 2016	N/A	DCDQ-FE: Ray-Kaeser et al., 2019	Reported available by Rihtman et al., 2015	N/A	N/A
German	Petermann, 2008	Blank et al., 2014	DCDQ-G; Kennedy-Behr et al., 2013	Reported available by Rihtman et al., 2015	Meachon et al., 2022	N/A
Greek	Ellinoudis et al., 2011	N/A	N/A[b]	N/A	N/A	N/A
Italian	Zoia et al., 2019	N/A	Caravale et al., 2015	N/A	N/A	N/A
Maltese	N/A	N/A	Camilleri et al., 2020	N/A	N/A	N/A
Norwegian	Holm et al., 2013	N/A	N/A	N/A	N/A	N/A
Polish	N/A	N/A	DCDQ'07-PL; Nowak, 2016	N/A	N/A	N/A
Slovenian	Reported available by Blank et al., 2019	N/A	Tercon et al., 2015	Reported available by Rihtman et al., 2015	N/A	N/A
Spanish	age band 1: Niño-Cruz et al., 2019	for 4-7 years old children: Serrano-Gómez & Correa-Bautista, 2015	Salamanca et al., 2012	Reported available by Rihtman et al., 2015	N/A	Delgado-Lobete et al., 2021
Swedish	Reported available by Blank et al., 2019	N/A	Iwar, 2015	N/A	N/A	N/A

	Motor Screening Tests		Questionnaires for Children		Questionnaires for Adults	
Language	MABC-2 *(ages 3 to 16)*	BOT-2 *(ages 4-21)*	DCD-Q *(ages 5-15)*	Little DCD-Q *(ages 3-4)*	ADC *(ages 17 - 42)*	AAC-Q *(ages 16-35)*
Other Relevant Languages						
Hebrew	N/A	N/A	Version 1: Bar-Ilan Traub et al., 2005	LDCD-Q; Rihtman et al., 2011[a]	Kirby et al., 2010[a]	N/A
Portuguese (Brazil)	Valentini et al., 2014; Capistrano et al., 2015	Okuda et al., 2019	Prado et al., 2009	Reported available by Rihtman et al., 2015	N/A	N/A
Turkish	N/A	N/A	Yildirim et al., 2019	N/A	N/A	N/A

Note. MABC-2: Movement Assessment Battery for Children 2nd edition; BOT-2: Bruininks-Osteretsky Test of Motor Proficiency; DCD-Q: Developmental Coordination Disorder Questionnaire; ADC: Adult Developmental Coordination Disorders/Dyspraxia Checklist; AAC-Q: Adolescents and Adults Coordination Questionnaire; N/A indicates tool is not yet available in the listed language.
[a]Denotes original version. [b]Listed in DCDQ administration manual, but not elsewhere.

Clinical Presentation and Secondary Psychosocial Consequences

DCD has a lifetime prognosis with major symptoms including difficulties with planning and execution of fine motor (e.g., sketching) and gross motor coordination (e.g., riding a bicycle). As described in the DSM 5, individuals with DCD can appear to be generally clumsy, and often have delays in reaching motor milestones compared to their peers (American Psychiatric Association, 2013). Examples of this can be very evident, such as having to spend longer than other children in learning how to hold a pencil, or subtler, such as having more trouble learning to play a musical instrument in school than other children. Notably, research in the last decade has provided increasing evidence that symptoms of DCD extend beyond motor coordination. More specifically, impaired executive functions (i.e., inhibition, cognitive control, working memory, and related processes such as attention) can be recognized as a prominent feature of DCD (Bernardi et al., 2018; Leonard & Hill, 2015; Sartori et al., 2020). However, neither the DSM-5 nor the ICD-11 consider these as potential symptoms of DCD (Purcell et al., 2015; see Table 1). Furthermore, the specific symptom profiles and the extent to which executive function impairments in DCD can be attributed to co-occurring conditions (e.g., attention and inhibition difficulties typical to ADHD) remains unclear (Blank et al., 2019).

A combination of executive functioning and motor coordination difficulties may result in a plethora of consequences and challenges for individuals with DCD in all stages of life. Recent research has suggested core symptoms of DCD likely entail secondary psychological problems, such as decreased quality of life, lower self-esteem, impaired social relationships compared to typically developing peers (e.g., Tal Saban & Kirby,

2018; Zwicker et al., 2018). Internalizing symptoms in the form of secondary anxiety and depression may often occur as a consequence of DCD (Draghi et al., 2020; Kirby et al., 2013; Mancini et al., 2019; Omer et al., 2019; Rigoli & Piek, 2016), which should be of concern in psychotherapy. More research is needed to understand the specificity of these features as they are known in similar conditions (e.g., ADHD). Consequences of DCD also include a risk for obesity, cardiovascular problems, reduced fitness ability, and worse self-reported general health compared to typically developing peers (Cairney et al., 2017; Joshi et al., 2015; Kirby et al., 2013).

Existing Evidence of DCD Prevalence and Etiology

Despite the often stated DCD prevalence rate of 5% (Blank et al., 2012; Blank et al., 2019), prevalence in some in many countries is not clear. Among existing estimates is that 1-19% of school-aged children in the UK suffer from DCD (Zwicker et al., 2012), but more recent estimates are around 10% in samples from the US and 24% from Brazil based on a study children in these regions (Valentini et al., 2017). While the prevalence rate in adults is not known, DCD is estimated to persist into adulthood in 30-70% of cases (Tal Saban & Kirby, 2018). In addition, a recent cross-sectional analysis of children in Spain estimates the prevalence of high risk for DCD is about 12% (Delgado-Lobete et al., 2019). Differences in prevalence estimates still vary greatly between existing studies, possibly due to a variance in identification of DCD.

Previous research has estimated that DCD occurs three to seven times more often in males than females (Zwicker et al., 2012), with recent evidence of a more equal gender ratio in a Brazilian sample (Valentini et al., 2017). However, these gender differences are not necessarily universal, as some recent research has found a more equal ratio between gender in Brazil (Valentini et al., 2017). These gender differences may also be a consequence of bias in detection of symptoms or referral bias, as has occurred for similar neurodevelopmental disorders such as ADHD (Young et al., 2020). Beyond gender differences, recent research found that left-handedness is nearly twice as prevalent among those with DCD as it is for typically developing controls (Darvik et al., 2018). Further research has yet to explore the underlying mechanisms in this phenomenon.

Relatively little is known about the causes of DCD. Compelling evidence for a 70% heritability estimate for DCD was calculated with a population of Swedish twin pairs (Lichtenstein et al., 2010). Low birth weight and premature birth are also predictors of DCD, particularly among males (Spittle et al., 2021; Zwicker et al., 2012). While little is known about risk factors for DCD aside from being male and preterm (van Hoorn et al., 2021), some research on neurodevelopmental disorders in general suggests there may be additional links to family income in addition to low birthweight and premature birth (e.g., Carlsson et al., 2021).

DCD With Co-Occurring ADHD or Autism Spectrum Disorder

Among the various challenges in the diagnosis and detection of DCD are its co-occurring conditions (Cleaton & Kirby, 2018). For instance, DCD and Attention-Deficit/Hyperactivity Disorder (ADHD) have a particularly high co-occurrence of about 50% (Blank et al., 2019). Given the symptomatic overlaps, including motor impairments in ADHD (Kaiser et al., 2015), and attention, inhibition, and hyperactivity sometimes observed in DCD (Harrowell et al., 2018; Wilson et al., 2020), some have speculated whether DCD might be a subtype of ADHD. While concrete evidence for this assumption remains limited to date, more research speaks for a unique pathology in DCD (e.g., in the genetic profile, Pearsall-Jones et al., 2009; physiological responding, Goulardins et al., 2015; neural mechanisms, Meachon et al., 2021). This has also been supported by findings for unique functional pathways in co-occurring DCD and ADHD as opposed to just one disorder (McLeod et al., 2014). It is important that this co-occurrence receives more scientific attention in the future to identify not only the extent to which the clinical symptoms but also their endophenotypes overlap (e.g., Conzelmann et al., 2009). This may help to prevent misdiagnosis, given the many similarities between DCD and ADHD. One simple step researchers and clinicians can take to work toward this goal is to screen for DCD when working with patients who have ADHD (Lange, 2018), and vice versa.

Another common co-occurrence is Autism Spectrum Disorder (ASD; Caçola et al., 2017). ASD can be diagnosed as a co-occurring disorder of DCD since the DSM-5, and researchers are just beginning to explore the co-occurring diagnosis. Unlike ADHD, existing literature clearly supports that the difficulties sourcing from DCD or ASD are unique (Paquet et al., 2019). For example, a systematic review of DCD and ASD behavioral outcomes primarily found clear differences between DCD and ASD (Caçola et al., 2017). Thus, it can be assumed that co-occurring cases of DCD and ASD present a much more complex symptom profile than DCD or ASD alone

Available Screening Tools for DCD in European Languages

In the screening and diagnostic process for DCD, the current best practice is to ensure all four major DSM-5 criteria for diagnosis are met. There are various tests and screening tools which European clinicians can use to identify if a diagnosis of DCD should be considered. The most common tools relevant to European psychologists will be highlighted in this section.

Motor skill assessment is crucial to establish meeting the first criterion for a DCD diagnosis in the DSM-5: that motor skills are below the expected development compared to same-age peers. While there are many tools which can be used to assess motor skills (see Cancer et al., 2020 for an overview of other motor screening tools for children), two of the most common screening tools used to assess risk for DCD are the *Movement Assessment Battery for Children* (MABC-2; Henderson et al., 2007) and the *Bruininks-Oser-*

etsky Test of motor proficiency (BOT-2; Bruininks & Bruininks, 2005). The MABC-2 was developed in English to identify probable DCD in children aged 3 to 16, and is available in Dutch (Schoemaker et al., 2012), German (Petermann, 2008), Italian (Zoia et al., 2019), Greek (Ellinoudis et al., 2011), Norwegian (Holm et al., 2013), and Spanish (age band 1 validated by Niño-Cruz et al., 2019; see Table 2). In addition, some researchers have reported using the MABC-2 but do not reference a validated translation or test of the psychometric properties of the reported language used (e.g., Danish, Slovenian, Swedish; Blank et al., 2019).

The BOT-2 was designed in English as a motor competency test for broader populations among children from 4 to young adults of 21 years old, and available in German (Blank et al., 2014), and Spanish (validated for 4-7 years old children by Serrano-Gómez and Correa-Bautista, 2015). The BOT-2 can reportedly be used to diagnose individuals of any language group, because it uses motor-skill games independent of language (Baharudin et al., 2020), however, its norms should be extended beyond what is now exclusively based on US norms. For example, recent research on the ecological validity of the German BOT-2 showed it strongly relates to other relevant fine motor skills and some gross motor skills, however subtests for bilateral coordination and balance do not have clear ecological validity (e.g., to sports and bike riding) among German children (Vinçon et al., 2017). Notably, the concerns of translation (i.e., for the MABC-2 checklist) and norms is also prevalent with MABC-2, which was developed with UK samples. Some slight differences were observed between British norms and those of other nationalities tested on the MABC-2, suggesting the consideration norms for motor tests be adapted to specific countries, even within Europe (Barnett, 2014; Zoia et al., 2019). Given the age cutoffs, caution should be taken in the interpretation of scores for adolescents and adults, and should not outweigh assessment of the other diagnostic criteria for DCD.

There are several questionnaires which can be used to assess the second and third DSM-5 criterion regarding persistent interruptions of symptoms and presence of symptoms in childhood. For children, the *Developmental Coordination Disorder Questionnaire* is a popular parent-report measure of DCD symptoms developed in English (Wilson et al., 2009). The DCD-Q has been translated and validated into many languages spoken in Europe (see Table 2, including German, (DCDQ-G; Kennedy-Behr et al., 2013), Dutch (DCDQ-NL; Schoemaker et al., 2006), Italian (Caravale et al., 2015), Spanish (Salamanca et al., 2012), Danish (Milidou et al., 2015), and French-European (DCDQ-FE: Ray-Kaeser et al., 2019). In addition, a version to indicate DCD in young children (ages 3-4) exists, known as the *Little Developmental Coordination Disorder Questionnaire* developed in Hebrew (LDCD-Q; Rihtman et al., 2011) and translated into English (LDCDQ-CA; Wilson et al., 2015) and Dutch (LDCDQ-NL; Cantell et al., 2019). The LDCDQ was also translated into many European languages (Rihtman et al., 2015; see Table 1), however validation studies to confirm these translations have not yet been published. Notably, in adolescent populations, parents were less accurate in identifying motor competencies than their

adolescent children's self-reports (Timler et al., 2018), but to our knowledge, there is no evidence if this is the same in children versus parent-reports. Therefore, parent-reports should be used with caution in older children, and should be accompanied by in-depth assessment of the adolescents themselves.

To gain better insight into the daily life interruptions in adulthood, the self-report *Adult Developmental Co-ordination Disorders/Dyspraxia Checklist* (ADC) was developed and validated in English and Hebrew to detect probable cases of DCD in individuals 16 years and older (Kirby et al., 2010). The ADC was also recently translated into German (Meachon et al., 2022) and reevaluated for potential to screen for motor and executive functioning parameters of DCD (Meachon et al., 2022). In addition to the ADC, Tal Saban et al. (2012) developed the Adolescents and Adults Coordination Questionnaire (AAC-Q) as a shorter-form self-report tool to screen for DCD compared to the ADC. The AAC-Q was developed in English (Tal Saban et al., 2012) and recently translated into Spanish (Delgado-Lobete et al., 2021). While retrospective diagnosis of DCD in adulthood is certainly possible, it must be on the premise that symptom experiences began in childhood. There is currently no gold standard motor assessment tool for screening in adults.

In accordance with the final criterion of the DSM-5 for DCD, causes of clumsiness or differences in gait from other medical conditions or brain injury must be ruled out. Contrary to the exclusion criteria of intellectual disorders listed in the DSM-5 and ICD-10 (DSM-5; American Psychiatric Association, 2013; ICD-10; World Health Organization, 2016), children with DCD may score lower than average on some or all domains of IQ tests due to interruptions in motor processing and perception (Jaščenoka & Petermann, 2018). Recent consensus established that IQ score cutoffs should not prevent the diagnosis of DCD (Blank et al., 2019). More research is needed to conclude if this is consistent across the development and into adulthood.

DCD in Adolescents and Adults

Most of the existing research on DCD examines populations of affected children rather than adolescents and adults, even though a majority of adults with DCD continue to experience symptom-related difficulties in their daily lives (Tal Saban & Kirby, 2018). This mirrors a pattern observed in ADHD research, which primarily focuses on child and adolescent populations (Targum & Adler, 2014). The history of overlooking adult populations could be for strictly following diagnostic criteria for DCD (i.e., it must begin in childhood; American Psychiatric Association, 2013). Other possibilities might include (1) the lack of assessment tools for adults, (2) the complex phenotype in adulthood (e.g., co-occurring conditions, symptom progression), and (3) the heterogeneous compensatory strategies adults develop to deal with their motor constraints. Concerning the latter, compensatory strategies may mask symptoms for simple motor tasks (e.g., hand rotation

task; Wilmut, 2017). This should be carefully considered in the diagnostic process for DCD, especially for adults with DCD who were not diagnosed in childhood.

Adults with DCD often struggle with difficulties in psychosocial domains, executive functioning, physical fitness, time management, and organization (e.g., Kirby et al., 2013; Kirby et al., 2011; Tal Saban & Kirby, 2018). In general, underlying mechanisms of DCD are not likely change across the lifespan, however the context, experience of the individual, and compensation may change. For example, motor challenges and difficulty with distance estimation may manifest in adulthood as problems in learning to drive or even crossing the road compared to typical adults (Kirby et al., 2010; Wilmut & Purcell, 2020). While the most relevant DCD symptoms for adults may vary interindividually, symptoms that are less easily detected or treated could become more problematic in adulthood. For example, executive functioning challenges were among the most commonly reported daily concerns for adults with suspected DCD (Purcell et al., 2015), a concern that might not be addressed in traditional physical training to treat symptoms of DCD.

There are also relationships between DCD and increased cognitive difficulties, fatigue, and somatic symptoms compared to a control group, albeit findings are based on cross-sectional data (Thomas & Christopher, 2018). Because of the considerable overlaps between DCD and ADHD that can also be present in adulthood, future research should work toward identifying the specific symptom profiles of DCD and ADHD.

Despite considerable research gaps on adult populations with DCD, some recent research has investigated DCD in emerging adults between the ages of 16 to 25 (e.g., Kirby et al., 2011). This group may still be dependent on their parents but are working toward independence and identity exploration (Tal Saban & Kirby, 2018). Due to the major life changes this age group commonly faces, it may be at risk for experiencing heightened difficulty in coping with DCD symptoms, and should be examined more in future research.

Multidisciplinary Interventions for DCD

There are several training programs frequently utilized for treating specific motor features of DCD used by occupational and physical therapists such as Cognitive Orientation to Daily Occupational Performance (CO-OP) and Neuromotor Task Training (Smits-Engelsman, 2013; Smits-Engelsman et al., 2018). CO-OP and NTT are activity or task-oriented approaches which specifically target physical fitness and motor task-performance (Montgomery et al., 2018) and are historically effective for treating children with DCD (Polatajko & Mandich, 2004). These trainings, along with any other existing treatment, are not intended to cure DCD, and can substantially help the patient improve specific motor skills. However, the increasing evidence that DCD is more than just a disorder of motor functions qualifies that more psychological interventions should be comprehensively investigated (Tamplain & Miller, 2021). It is possible that psychological

support may be equally important as physical treatment for some patients with DCD. This is especially relevant to reduce any risk for potential secondary psychosocial consequences such as depression or anxiety (Kirby et al., 2013).

Presently, an interdisciplinary approach along with occupational therapists and physiotherapists (e.g., typical treatment: CO-OP; NTT for training specific motor skills) is recommended for effective intervention with DCD (Blank et al., 2019; Montgomery et al., 2018). It is also important that specific difficulties to the individual and the goals of the patient are considered in treatment, as this has led to reduced anxiety compared to preset large-group interventions in children (Caçola et al., 2016). For example, one individual might find it most pertinent to practice typing on a keyboard for work or school, while another might want to reduce their anxiety participating in group sports. The role of motor concerns may be direct or indirect in treatment, but regardless, the patient's preferences should determine the approach and prioritization of goals in their treatment plan. A recent review and meta-analysis of motor-based interventions for DCD also suggests that effective interventions are personalized for the patient and their specific goals, contexts, active involvement, functionality and support from peers (Smits-Engelsman et al., 2018). In sum, tailor-made treatments have potential to improve both motor and psychological outcomes, and psychological interventions for secondary problems and psychological consequences of DCD should be examined in great detail future research.

Discussion

Returning to the case of Tanja, it is now clear the patient should be assessed for DCD, with consideration of potential co-occurring ADHD. It is important in her case, to identify if her attentional difficulties are linked to motor activity, in which case she may just have DCD. In psychotherapy, screening for secondary anxiety and depression and working on stress-management would be important for immediate action. A psychotherapist should also consider referrals to a physical or occupational therapist to work on specific motor skills training relevant to her work and school activities (e.g., practicing typing). With a collaborative and patient-focused approach, there is hope for Tanja to feel substantially less burdened by her motor and attentional difficulties.

Taken together, the recent research on DCD highlights several key areas of consideration for clinical psychologists in Europe. First, DCD is a complex disorder with motor-based symptoms, several probable secondary symptoms and psychological consequences (e.g., executive functions; anxiety; depression). These secondary impairments of DCD should continue to be examined systematically in all age groups, and with the consideration of co-occurring disorders. More specifically, the prevalence of DCD should be examined more thoroughly across Europe in adults and children to identify a more accurate prevalence rate that may exceed the presumed international rate of 5% (e.g.,

Delgado-Lobete et al., 2019). This research may function in parallel with the necessary validation of DCD screening tools in additional languages. Future research should also aim to identify if prevalence differs across genders, as well as the consistency of other links such as left-handedness (Darvik et al., 2018) and links to motor integration.

Second, more attention should be devoted to the co-occurrences with DCD, especially between DCD and ADHD. While some research has identified important differences between the two disorders (e.g., Goulardins et al., 2015), there is still ambiguity in the extent to which symptoms overlap and how this might impact co-occurrence rates. It has been suggested that one way to increase detection of DCD could be to screen for it in all potential ADHD cases, considering their high co-occurrence rate (Lange, 2018). Moreover, screening for DCD when at least one other neurodevelopmental condition is clearly present, especially ADHD, should be consistently practiced. Future research should also identify unique symptomatic profiles of DCD and ADHD, and researchers examining DCD or ADHD should consistently screen for the other disorder.

Third, additional attention should be given to the emerging adult and adult populations with DCD in research and practice. While it is possible to diagnose DCD in adults, there are few tools that can be used for the diagnostic process. Furthermore, while there is evidence of psychosocial problems in adulthood (Kirby et al., 2013) there is no research to explore the effects of psychotherapy among adults. While it is thought that the same core motor symptoms generally cross into adulthood (e.g., Kirby et al., 2010; Kirby et al., 2011), along with potential secondary psychological concerns (e.g., depression, anxiety; Kirby et al., 2013), there is a paucity of evidence on the manifestation of these difficulties in new contexts (e.g., transitioning to news schools or jobs). Future research should continue to build the evidence for symptom profiles and screening tools for adults, and more specifically, psychological interventions should be examined for effectiveness in all age groups.

Finally, evidence-based treatments for the primary symptoms and secondary problems are crucial to foster the improvement in quality of life for DCD patients. There is increasing evidence that the psychosocial sequelae of DCD can be addressed with elements of psychotherapy adjunct to motor therapies. Thus, treatment should be collaboratively tailored toward the individual needs of each patient (e.g., Smits-Engelsman et al., 2018). It may also be worth considering if other therapies may be relevant to the treatment of DCD, such as a familial approach in treatment that is often used for ADHD (Weyers et al., 2019). Future research should include a broader examination of the family and social system in the impact and treatment of DCD.

Conclusion

Overall, there are existing research gaps in the understanding of DCD, however, a recent increase in international attention to the condition is promising. We deem it relevant that more European psychological researchers and practitioners take note of this upsurge

and integrate motor skill screenings into their work where possible. Such inclusion is pertinent for more accurate symptom profiles, prevalence estimates, improved differential diagnosis, and effective treatment of the symptoms of DCD across all age groups.

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Systematic Reviews and Meta-analyses

Selected Trends in Psychotherapy Research: An Index Analysis of RCTs

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Supplementary Materials: Materials [see Index of Supplementary Materials]

Abstract

Background: We wanted to analyze trends in psychotherapy research during the last decade. We used published randomized clinical trials (RCTs) that are cited in Web of Science (WoS) as an index for these activities.

Method: We searched for RCTs published between the years 2010 and 2019. Search criteria included cognitive-behavioral treatments (CBT), e-mental health, Acceptance and Commitment Therapy (ACT), psychodynamic treatments, interpersonal therapy (IPT), schema therapy, systemic therapy, mindfulness treatments, and emotion-focused therapy (EFT). The numbers of publications for each treatment approach were accumulated for 5-year blocks (2010 to 2014; 2015 to 2019).

Results: The search revealed 4,523 hits for the selected treatment options, of which 1,605 were finally included in the analysis. There was a continuous increase in published RCTs, with 68% more trials during the second five-year block. CBT (68%) and eHealth interventions (18%) show an increase in the number of studies, but there were no significant changes in its percentage in relation to all published RCTs. The next frequent treatments were ACT (4%), psychodynamic treatments (2%), IPT (2%), and mindfulness interventions (2%). We found a significant increase of the percentage of mindfulness ($p = .008$) and a significant decrease of the percentage of psychodynamic treatments ($p = .02$). Systemic (1.1%), emotion-focused (0.7%) and schema therapy (0.6%) represented smaller parts of published RCTs.

Conclusion: A continuous increase of published RCTs underlines an active field of research on psychological interventions. Third wave treatments such as mindfulness increased their representation in research, while the part of psychodynamic treatments decreased.

Keywords

psychotherapy research, randomized clinical trials RCT, CBT, psychodynamic treatments, ACT, eHealth, mindfulness, schema therapy, systemic therapy, mental health care

Highlights

- Over the period from 2010 to 2019, the number of randomized clinical trials (RCTs) of psychological treatments continuously increased, with CBT representing the majority of published RCTs.
- The number of trials on eHealth-interventions increased over time, but their percentage in relation to all clinical trials did not increase significantly.
- Third wave interventions either already represented a significant proportion of RCTs (e.g., ACT), or showed significantly increasing numbers (mindfulness interventions).
- More traditional approaches represented very small percentages of RCTs (e.g., systemic treatments), or even showed a significant decreased percentage of all RCT-based research (i.e., psychodynamic therapy).

Evidence based psychotherapy is a dynamic field of research. In particular, the last 30 years were characterized by innovations in the field of psychological treatments. Advances have been made both in terms of newly developed interventions (e.g. "third wave"-therapies like ACT or mindfulness-based interventions (Haller, Breilmann, Schroter, Dobos, & Cramer, 2021; Hayes, Luoma, Bond, Masuda, & Lillis, 2006; Hofmann & Asmundson, 2008; Teasdale et al., 2000); mentalization based therapy (Bateman & Fonagy, 2010; Taubner & Volkert, 2019), and new formats to provide psychological treatment (e.g. using electronic media such as the internet and mobile phones; Andersson et al., 2019; Miloff, Lindner, & Carlbring, 2020). However, clear data proving these trends in terms of research activities (i.e. clinical trials) are lacking. How do the flagships of psychotherapy such as psychodynamic treatments, CBT, and others progress in this continuously changing field? Do they lose terrain to new concepts, or are they able to maintain their positions?

More knowledge about current research trends in psychotherapy is helpful to estimate and predict future developments. It can be postulated that those approaches that are currently under investigation will likely influence the future delivery of psychotherapy in health care systems that are based on empirical evidence (AWMF, 2021; Berry & Haddock, 2008; Clark, 2011, 2018; NHS, 2019). To date, several countries aim to link the provision of psychotherapy to its evidence base; however, there is still a wide range. While some countries provide mental healthcare that is more linked to traditional orientations (e.g. China; Ng et al., 2017), other countries offer (and permit) nearly all

orientations of psychotherapy without making a link to their differing evidence base (e.g. Austria; Laireiter & Weise, 2019). A pioneer in this context is England, which tries to implement a fully evidence-based system for psychological therapies, the "Improving Access to Psychological Therapies"-program (IAPT; NHS, 2019). If countries want to move forward with their health care systems in the direction of evidence-based psychological treatments, they need to know current trends and developments in psychotherapy research.

In the German healthcare system we find an example for the interaction between evidence-base and health care regulations. The federal government established a scientific advisory board on psychotherapy ("Wissenschaftlicher Beirat Psychotherapie" [WBP]), that evaluates whether psychotherapeutic approaches are considered as evidence-based for a broad variety of mental disorders. A final positive vote opens the door for the respective treatment to enter a publicly financed health care system. Such a positive statement was given for psychodynamic treatments, systemic treatments and CBT. A recent application for approval of humanistic treatments (including Rogerian psychotherapy) was rejected on the grounds that the quantity of submitted studies were considered insufficient, and the quality criteria of studies did not meet current standards (WBP, 2018). A clear decline of research activities in this field in the 90ies was evident. Humanistic and Rogerian psychotherapy is therefore not a stand-alone treatment of the German public health care system.

The current manuscript reports on a databased analysis of research trends in psychological treatments. While we did not aim to detect all published trials, we focus on the use of a plausible index of publication activities (index approach). We limit our analysis to one of the major global citation databases (i.e. Web of Science, WoS), in which indexed journals have to go through a thorough editorial selection process ensuring sufficient quality of the included journal (e.g. journal must contain primarily original scholarly material). Furthermore, we limit our research to randomized clinical trials (RCT). These results are used as an index of current trends in psychotherapy research. We are aware that these results only indicate trends, and are not a comprehensive summary of all potentially relevant research activities. Our approach is limited to the used search terms, and treatments of interest. We decided to focus on the three traditional and approved treatment for which evidence has been sufficiently proven and which were commonly used in mental health care (psychodynamic, systemic, CBT), to compare them to newer developments such as ACT, mindfulness, IPT, schema therapy, emotion-focused treatments, or eHealth applications. Mentalization-based interventions were grouped with psychodynamic treatments. A specific problem is evident for CBT treatments, although it partly applies to other treatments as well: labels and approaches for one treatment approach can be very diverse, thus preventing them to be covered by search terms (e.g., some textbooks on CBT report up to 100 different techniques). Therefore again, our

analysis is only able to reveal indices, but not a complete picture for general trends in psychotherapy research.

Method

Search Procedure

We chose the citation database "Web of Science" to search for research activities during the last decade for the following reasons: (1) We wanted to ensure a certain quality of trials. WoS requires indexed journals to provide a minimum of quality criteria (e.g. peer review, content relevance, appropriate citations). (2) WoS is less focused on medical research, and includes more psychological and social science studies than PubMed. It includes all publications of the Science Citation Index and the Social Science Citation Index (Falagas, Pitsouni, Malietzis, & Pappas, 2008). (3) WoS has a strong focus on peer-reviewed journal publications of research studies, while other databases also include conference abstracts or monographies (e.g. Scopus). In a recent analysis exploring the optimal combination of databases needed for a systematic review, WoS had an overall recall rate of 68% (Bramer, Rethlefsen, Kleijnen, & Franco, 2017). Yet, it must be considered that recall rates are topic-sensitive and that we did not aim to conduct a systematic review.

Since exploratory searches revealed publications of the non-clinical field (e.g. systemic approaches to strengthen the impact of a business, or to improve performance in a school-based setting), we selected specific WoS-categories for our search (e.g., "psychology, clinical" or "neurosciences"). The complete list of selected categories as well as the specific search terms are available in the Supplementary Materials).

Language restrictions were not applied to the searches. The search was conducted in November 2020 and was updated in August 2021.

Eligibility Criteria

Studies were included if they met the following criteria:

a. The study reported results of a randomized clinical trial.
b. The RCT investigated one or more of the following psychological treatment approaches: cognitive behavior therapy (CBT), psychodynamic treatments, internet-based psychological treatments and other digital approaches using new technologies (eHealth, mHealth, uHealth), mindfulness-based intervention (mindfulness-based stress reduction (MBSR), mindfulness-based cognitive therapy (MBCT)), acceptance and commitment therapy (ACT), interpersonal therapy (IPT), systemic psychological therapy, schema therapy and emotion-focused therapy (EFT).
c. The study was published between 2010 and 2019. This criterion was chosen as we were interested in the most recent trends in psychotherapy research.

We included studies on all age groups (e.g. adults, children, adolescents), all clinical indications for psychotherapy and all countries of origin.

Study Selection

Only articles reporting the major results of the trials were included (i.e. corrections, conference abstracts, comments etc. were excluded to avoid double-counting). In the case of multiple publications of one trial (e.g., post-treatment findings, follow-up data, other secondary analyses), we selected the publication reporting the primary outcomes at post-treatment. eHealth interventions were only counted under this category, but not further according to the conceptual background. The search was conducted stepwise for all treatment approaches, reviewed by two co-authors (MK, RA); weekly consensus meetings took place. In case of uncertainty, the main supervisor (WR) gave advice.

If a study investigated two or more of the above-mentioned treatment approaches in the investigated treatment arms (e.g. CBT versus ACT), the study was counted for both treatments.

Due to their own theoretical background, we did not consider "third wave interventions" as variants of CBT, but counted ACT, mindfulness, schema therapy, IPT etc. as separate groups, without considering them as CBT variants.

Analyses

Publications were first grouped according to treatment approach, publication year, and national origin of the principal investigators, to enable an examination of potential regional differences. For the first analysis of publication trends and to avoid too small cell numbers, publications were additionally grouped into five-year periods (2010 to 2014, and 2015 to 2019). For each treatment group, we compared the number of publications between these two time blocks using the chi^2 test. In case of more than an average of ten annual publications per treatment approach, we report both, analyses of five-year blocks and annual number of RCTs. Additionally, the percentage of publications per treatment approach of all publication hits is computed for the five-year blocks. We also computed the determination coefficient R^2 according to Holt (Holt, 2004) and investigated linear trends in the relationship between publication year and number of publications. This analysis did not only focus on observed data, but also provides an estimation of future developments according to times series modeling. All analyses were conducted using IBM SPSS (Version 26.0) (IBM Corp., 2019).

Results

Table 1 shows the number of hits of the original searches, and the number of finally included trials after checking the inclusion criteria. From the first to the second five-year

block of the last decade (i.e. from 2010-2014 to 2015-2019), we found an overall increase in published RCTs in psychotherapy from 598 to 1,007 (increase of 68%). From 2010 to 2019, the annual number of published RCTs (subsumed over all treatments) increased from 67 to 230 (343%).

Table 1

Comparison of Search Hits and Finally Included Trials

Treatment	Hits	Finally included
CBT	3081	1094
eHealth	931	294
Psychodynamic treatments	96	53
ACT	140	61
Systemic therapy	86	21
IPT	87	42
Mindfulness-based interventions	72	21
Schema therapy	18	10
EFT	12	9
Total	4523	1605

Most Frequently Investigated Psychological Treatments

CBT continues to represent a major part of psychotherapy research with a slight, but non-significant increase from 66% to 68% of all publications comparing the first and the second time block (Table 2). This proportional increase is founded in a more substantial increase in the number of annually published treatment arms using CBT from year to year (see Figure 1a). Considering absolute annual numbers, CBT arms in randomized clinical trials have more than doubled from 2010 to 2019. Holt's R^2 of .95 indicates that this trend of increasing publications on CBT is highly robust.

The second most frequently investigated psychological treatment approach is eHealth interventions. However, considering the overall increase of published clinical trials, the proportion of eHealth interventions remained constant from the first to the second five-year period. The increase was based on a continuous increase in published trials on eHealth interventions per year (see Figure 1b) and parallels the growing numbers for psychotherapy trials in general.

Table 2

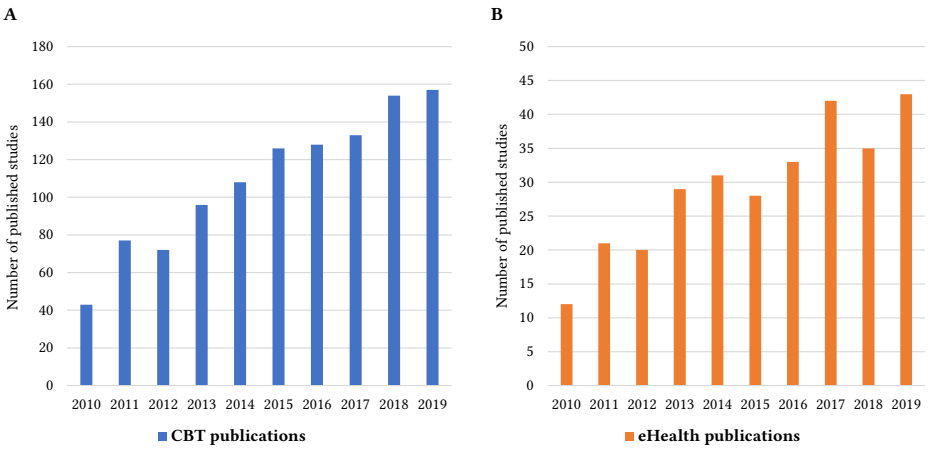
Treatment Arms in RCTs From 2010 to 2019 (Five-Year Blocks)

Treatment Approach	2010–2014	2015–2019	p (χ^2)	R^2 (Holt; prediction per year)
CBT	396 (66.2%)	698 (68.2%)	0.20 (1.52)	.94
eHealth	113 (18.9%)	181 (17.7%)	0.64 (0.21)	.85
ACT	22 (3.7%)	39 (3.8%)	0.84 (0.04)	.62
Psychodynamic treatments	28 (4.7%)	25 (2.4%)	0.02 (5.69)*	-.15
IPT	21 (3.5%)	21 (2.1%)	0.08 (3.00)	-.12
Schema therapy	4 (0.7%)	6 (0.6%)	0.86 (0.03)	-.06
Systemic therapy	10 (1.7%)	11 (1.1%)	0.32 (0.08)	-.17
Mindfulness-based interventions	2 (0.3%)	19 (1.9%)	0.008 (7.02)**	.83
EFT	2 (0.3%)	7 (0.7%)	0.35 (0.88)	.53
Total	598	1007		

Note. CBT: cognitive behavior therapy; eHealth: internet-based psychological treatments and other digital approaches using new technologies; ACT: acceptance and commitment therapy; IPT: interpersonal therapy; EFT: emotion-focused treatments. Please note: because of its linear model, Holt's R^2 can be negative even if five-year block comparisons indicate a significant increase in published treatment arms (e.g., for Schema therapy).

Figure 1

Frequency of Published Studies Including Treatment Arms Testing CBT Interventions (Figure 1A) and eHealth/mHealth Interventions (Figure 1B) Per Year From 2010 to 2019



For all other types of psychological treatments, the numbers of published trials were not large enough (each less than 5% of all trials) to allow for robust predictions of developments based on annual changes. The specific numbers are listed in Table 1 in the Supplementary Materials.

Changes From the First to the Second Five-Year Block

After CBT and eHealth interventions, the next most commonly studied treatments are ACT (2015-2019: 4%), psychodynamic treatments (2%), IPT (2%), and mindfulness interventions (2%). We found a significant increase in the percentage of mindfulness interventions (p = .008) and a significant decrease in the percentage of psychodynamic treatments (p = .02). Systemic therapy (1.1%), emotion-focused treatments (0.7%) and schema therapy (0.6%) represent smaller parts of published RCTs.

Together with systemic therapies, psychodynamic treatments have the highest negative R^2. However, the scores are still very close to zero, indicating that future development is hard to predict.

Although only on a trend level, the situation for IPT seems similar. The number of published treatment arms using this intervention remains stable, but in light of the increasing overall numbers, the proportion of IPT trials is decreasing. Finally, the low number of EFT treatment arms does not allow for any predictions about developments.

Countries of Origin

Interestingly, the countries of origin of the principal investigator differed depending on the treatment approach. Studies on CBT are dominant in the Anglo-American field (US: 295 treatment arms, UK: 126 treatment arms, Australia: 112 treatment arms). eHealth studies mainly originate from Sweden (67 trials), but also from Australia (48) and Germany (45). Studies on ACT show a strong dominance in the US (20) and Sweden (15). Mindfulness trials originate from many different countries (e.g., US: 4, the Netherlands: 3, and 2 trials each from China, Germany and Iran).

Studies with treatment arms using psychodynamic interventions mainly originate from Germany (21), while rarely coming from other countries (UK: 6; Sweden and Denmark: 5). Finally, IPT trials have a strong dominance in the US (19), with some further activities in China (5) and Germany (4).

Discussion

With our study, we wanted to investigate indices for research trends. To ensure some basic methodological quality, we limited our search to studies quoted in "Web of Science", and included only RCTs. Using these specifications, we found a substantial and continuous increase in published research trials on psychotherapy from 2010 to 2019, which

more than doubled in this period. Considering the five-year blocks, the increase was 71% in 2015-2019 as compared to 2010-2014. CBT continues to be the most frequently investigated treatment condition, currently representing 68% of treatment arms in RCTs. The increase in CBT studies is quite robust, and statistical predictions indicate that it will continue this way in coming years. eHealth interventions are considered an emerging field in psychotherapy research. Indeed, the total number of published trials continuously increased from 2010 to 2019. The proportion of eHealth interventions in psychotherapy research remained stable. Research activities on third-wave interventions are also very dynamic and characterized by a continuous increase in published trials. Only for mindfulness interventions and schema therapy did we find a significant increase in the proportion of trials in relation to other published RCTs.

The role of the more traditional treatment approaches such as psychodynamic interventions and systemic therapies seems to have continuously decreased. We found significantly smaller proportions of studies that characterized by psychodynamic treatment arms, and a slight (but not significant) decrease in the proportion of systemic treatment arms. In the 2015-2019 period, psychodynamic approaches accounted for only 2.4% of all psychotherapy treatment trials.

Interestingly, the various treatment approaches are differently represented across countries. For example, a large proportion of studies on eHealth interventions originate from Sweden and Australia, whereas CBT treatment arms are dominant in studies from the US. The reasons for these differences can be manifold: regulations of the national health care systems, financial issues imposed by health care providers and pressure for the provision of short-term interventions, the need for cultural adaptation, or regional conditions such as the distance to available health care providers are just a few of the variety of reasons that can contribute to these national differences (Andersson et al., 2019).

Obviously, the reasons for the trends shown can be manifold. While some people might argue that CBT is over-investigated, others might favor a position that CBT reveals robust results, and is thus the best anchor for comparisons with other/new interventions. Not surprisingly, CBT has been frequently used as comparison group in non-inferiority trials (Rief & Hofmann, 2018). The decreasing influence of the more traditional approaches, which have also been surpassed by third-wave interventions (e.g. ACT) also poses several questions. Is this just the regular up and down in dynamic research fields that should be accepted and called “progress”? Especially psychotherapy is a vivid field that can reflect the cultural and attitude changes in societies.

Moreover, the success of psychotherapy as a first line treatment for most mental disorders also changed psychotherapy itself. It should no longer be a luxurious and costly treatment option for a few rich people of societies – given the strong evidence base of several psychological treatments, a responsible health care system has the highly important task to develop strategies on how affordable psychological treatment can

be made available to all patients who need it (Corscadden, Callander, & Topp, 2018). This need for better availability of evidence-based treatments increases the pressure to develop economic, fast-acting and easily accessible treatments. Accordingly, attempts on how to provide psychological treatments sufficiently on a community and society level are highly laudable, like the IAPT program in England (Clark, 2018).

Is more research needed in psychotherapy? First, there are still clinical fields where too few studies on psychological treatments are available, e.g. anorexia and dissociative disorders (Zhu et al., 2020). Moreover, it is the continuous competition of approaches that helps to better specify and increase the efficacy of interventions. Trends in psychotherapy research cannot only indicate what is more effective, but also what is more suitable for the current needs in society. For example, the rising availability and use of modern technologies (i.e. the internet and smartphones) has laid the groundwork for the development of eHealth interventions. Bringing these treatments to regular health care increases the number of people who can access and benefit from psychological interventions, and enables the treatment for people who would otherwise not have been able to participate in face-to-face treatments (e.g. because of long distances to the closest therapist, Andersson & Titov, 2014).

Continuous psychotherapy research is also the basis for continuing the journey of psychotherapy to become an evidence-based part of most national health care systems. First, there are several clinical conditions for which only very few psychological treatments can be considered as evidence-based (such as in schizophrenia, obsessive-compulsive disorder, insomnia). It was a huge success for the field of psychotherapy to show that specific psychological treatments are effective in psychosis (Lincoln et al., 2012; Lincoln & Pedersen, 2019), even if no concurrent medication is used (Morrison et al., 2018). Others found better effects for depression-specific interventions compared to plausible, but disorder-unspecific treatments (Schramm et al., 2017). These are just a few examples confirming the potential of current psychotherapy research. Further, the more treatment studies we have for one condition, the better we can predict expected treatment outcome. This allows us to compare new study results with these anchors of expected effects. And even if many comparison studies have not revealed significant differences between distinct interventions, some studies did (Poulsen & Lunn, 2014; Schramm et al., 2017; Simon et al., 2021). All these studies on psychological treatments provide important information for scientists, clinicians and stakeholders of health care systems alike.

Some people argue that psychotherapy research is just a reflection of the feasibility of some interventions being used in clinical trials, which does not mirror the necessity of these interventions in clinical practice (Bohart, 2000). This can be considered right and wrong. However, before implementing insufficiently evaluated interventions in a national health care system, studies using controlled designs and valid outcome measures are necessary to prove their efficacy and thus justify their implementation.

Our analysis has some specific limitations, such as the focus on one database (WoS) and on randomized clinical trials. We did not aim for a complete representation of all trials investigating all specific treatments, but rather aimed to find indices of current treatment trends. Whatever approach is selected to find these indices, it always has its specific characteristic and limitations, therefore, we consider our limitations also as a characteristic of this analysis. Others might follow with similar analyses, but using other data sets and other inclusion criteria. For instance, a more hierarchical approach could also be suitable to reveal insights in research developments, starting with a major category (e.g., CBT), and continuing with more detailed analyses (e.g., eHealth interventions using CBT). Of special note is our limitation to RCTs. We are aware that much more clinically relevant studies exist, such as process-oriented trials, qualitative research, effectiveness trials with mere pre-post-comparisons etc. It was our specific aim to focus on RCTs, as this is the study design with the most influence on treatment guidelines (e.g., guidelines of National Institute for Health and Care Excellence NICE; Arbeitsgemeinschaft wissenschaftlich-medizinischer Fachgesellschaften AWMF). However, we agree that the development of psychotherapy research from more traditional approaches investigating one treatment package for one clinical condition, to more process-based treatments and competence-based training of psychotherapists will have consequences for adequate trial designs and thus future trends in psychotherapy research (Hofmann & Hayes, 2019; Rief, 2021).

A further unique part that defines the limitations of our approach is the selection of psychological treatments, and the selection of search terms. We focused on comparing three major treatment approaches with a long history (psychodynamic, systemic and CBT) with more recently developed and outlined approaches, such as ACT, schema therapy, mindfulness, emotion-focused therapy and IPT. Furthermore, we wanted to know what role eHealth developments play in relation to these interventions that are typically provided face-to-face. Of course, this method left many developments unconsidered, such as Unified Protocol approaches, EMDR, or CBASP, to name a few. However, using a comprehensive list of search terms and specific techniques would have been nearly impossible, particularly for CBT techniques. Therefore, we decided to limit this search to major techniques, hereby neglecting further trials that focus on CBT techniques such as stimulus control, habit reversal, or DBT. Further, especially considering this large field of CBT trials, we do not expect substantial differences in percentages if a more inclusive approach would be selected.

Finally, such a database invites to do more detailed analyses on further variables, such as sample sizes, diagnostic unities, study quality, comorbidity, to name just a few. For this first article, this was beyond the scope of the paper.

To conclude, our study confirms the dynamic character of the field of psychotherapy research, with continuously increasing numbers of published trials. It further strengthens the note that the field is not constant, but in continuous change. While new interven-

tions conquer more and more parts of the field, others are losing their representation. Unless we have evidence for negative effects due to these developments, they are primarily to be interpreted as dynamic changes in a developing field. With these changes, challenges for health care systems become evident: How can new developments be considered and eventually included in notoriously conservative health care systems? Our active field of psychotherapy research has shown that it provides specific, evidence-based treatments for most mental disorders, and accordingly, the most powerful and evidence-based treatments should be made available to all patients who need it.

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Competing Interests: Winfried Rief is head of a psychotherapy outpatient clinic, with a focus on CBT and new developments (e.g., expectation-focused psychological interventions), and that will be extended with family therapy in 2022. He receives royalties for book publications on psychotherapy, and as an editor of a book series on progress in psychotherapy. He is also member of several boards of scientific journals, and editor in chief of "Clinical Psychology in Europe". However, he did not play an editorial role for this manuscript, and he did not intervene in any form in the peer review process. Cornelia Weise is one of the Editors-in-Chief of Clinical Psychology in Europe but played no editorial role in this particular article or intervened in any form in the peer review process.

Supplementary Materials

Further details about the search process and origin of studies are presented in the Supplementary Materials (for access see Index of Supplementary Materials below).

Index of Supplementary Materials

Rief, W., Kopp, M., Awarzamani, R., & Weise, C. (2022). *Supplementary materials to "Selected trends in psychotherapy research: An index analysis of RCTs"* [Additional information]. PsychOpen GOLD. https://doi.org/10.23668/psycharchives.6892

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