

Research Protocol for the STAR_T Couples Intervention Phase: A Multidisciplinary Cluster Randomized Controlled Trial on Stress and Resilience During Relationship Transitions

Celine Schnellbacher

Heidelberg University

Levin Friedemann

Heidelberg University

Felicitas Baumann

Heidelberg University

Andrea Mayer

University of Zurich

Ingmar Rapp

Heidelberg University

Johannes Stauder

Heidelberg University

Martin Bujard

Federal Institute for Population Research

Beate Ditzen

University of Zurich

Katajun Lindenberg

`katajun.lindenberg@psychologie.uni-heidelberg`

Heidelberg University

Study protocol

Keywords:

Posted Date: October 7th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-9760962/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.
[Read Full License](#)

Additional Declarations: No competing interests reported.

1. Title Page

Article Type: Study Protocol

Research Protocol for the STAR_T Couples Intervention Phase: A Multidisciplinary Cluster Randomized Controlled Trial on Stress and Resilience During Relationship Transitions

Celine Schnellbacher¹, Levin Friedemann², Felicitas Baumann³, Andrea Mayer^{3,4}, Ingmar Rapp², Johannes Stauder², Martin Bujard^{3,5}, Beate Ditzen^{3,4,†} & Katajun Lindenberg^{1,*,†}

¹Department of Clinical Psychology of Childhood and Adolescence, Institute for Psychology, Heidelberg University, Heidelberg, Germany

²Max-Weber-Institute of Sociology, Faculty of Economics and Social Sciences, Heidelberg University, Heidelberg, Germany

³Institute of Medical Psychology, Medical Faculty, Heidelberg University, Heidelberg, Germany

⁴Department of Clinical Biopsychology and Psychotherapy, Institute for Psychology, University of Zurich, Zurich, Switzerland

⁵Federal Institute for Population Research (BiB), Wiesbaden, Germany

***Corresponding Author:** Katajun Lindenberg, Department of Clinical Psychology of Childhood and Adolescence, Institute for Psychology, Heidelberg University, Hauptstr. 47-51, 69117 Heidelberg, Germany; Tel: +49 6221 547701; E-Mail: katajun.lindenberg@psychologie.uni-heidelberg.de; ORCID: <https://orcid.org/0000-0001-7415-9856>

[†]Shared senior authorship.

Co-Authors E-Mail Addresses and ORCids:

Celine Schnellbacher, celine.schnellbacher@psychologie.uni-heidelberg.de, ORCID: <https://orcid.org/0000-0002-8310-2445>

Levin Friedemann, levin.friedemann@mwi.uni-heidelberg.de, ORCID: <https://orcid.org/0009-0007-0005-1288>

Felicitas Baumann, felicitas.baumann@med.uni-heidelberg.de, ORCID: <https://orcid.org/0009-0009-9049-8255>

Ingmar Rapp, ingmar.rapp@mwi.uni-heidelberg.de, ORCID: <https://orcid.org/0000-0003-2978-7284>
Johannes Stauder, johannes.stauder@mwi.uni-heidelberg.de, ORCID: <https://orcid.org/0000-0003-1914-9297>

Martin Bujard, martin.bujard@bib.bund.de, ORCID: <https://orcid.org/0000-0002-3603-4160>

Beate Ditzen, b.ditzen@psychologie.uzh.ch, ORCID: <https://orcid.org/0000-0001-5853-4572>

Word Count 7,171

2. Abstract

Background: Relationship stress affects the mental health of couples and their children. Effective behavioral interventions aim to reduce stress within the family system and improve mental health.

This study aims to evaluate the effectiveness of the German PAIRwise online intervention on self-reported mental health outcomes and psychobiological stress indicators in families.

Design, Setting and Participants: STAR_T is a cluster randomized controlled trial conducted in Germany from September 2024 to May 2027. Families with children aged 11-17 experiencing interparental relationship conflict are enrolled and followed up at 2, 6, and 12 months. A target of 180 individuals (60 family triads) are cluster randomized to either a self-guided or eCoach supported version of the *PAIRwise* training.

Interventions: The couple therapy-based online training *PAIRwise* comprises seven core modules and seven optional modules, completed over 11 weeks in sessions lasting approximately 30 to 40 minutes. Two versions of the program are delivered to parents. In the self-guided condition, participants complete the modules fully self-directed. In the eCoach supported condition, participants receive individualized feedback on module-based reflection tasks, provided by trained and supervised eCoaches.

Main Outcomes and Measures: The primary outcome is the reduction of mental health burden over 6 months, assessed using the Depression Anxiety Stress Scales for parents and the Strengths and Difficulties Questionnaire for children. Secondary outcomes include changes in psychobiological stress indicators (salivary cortisol), couple satisfaction, quality of life, parental conflict frequency, and couple communication. In addition, spillover effects between parents and children are examined using psychobiological ecological momentary assessment. Stability of intervention effects over 12 months are assessed.

Expected outcomes: The findings are expected to (a) determine whether *PAIRwise* reduces stress and mental health burden in couples and increases relationship satisfaction, as assessed using self-report and cortisol measures; (b) examine whether the intervention has spillover effects on children's stress and mental health; and (c) evaluate the incremental effects of eCoach support on intervention adherence and effectiveness.

3. Data sharing statement and Open Science

Trial registration. This study was registered in the German Clinical Trials Register (<https://drks.de/search/en/trial/DRKS00036615>), trial registry number DRKS00036615, on April 17, 2025.

Data sharing. Anonymous data and statistical analysis code will be made available upon reasonable request after publication of the main results. Requests for data will be reviewed by the study investigators and shared under a formal data use agreement. Data can be requested by contacting the corresponding author. Interested participants will be added to a mailing list and notified of the published results once the study's main analysis is completed. Access to the *PAIRwise* intervention materials (e.g., module content) can be granted to researchers and practitioners upon reasonable request. The current version of the PAIRwise intervention will be available until the end of 2026. Since the materials are being refined and prepared for broader dissemination, future access will depend on approval by the researchers as well as the availability of the final versions.

Funding. The trial was funded by an internal grant of the Heidelberg University, Field of Focus 4, Self-Regulation and Regulation (ExU 4.19). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript. All authors declare no conflicts of interest.

Roles and responsibilities. Steering committee: Johannes Stauder, Martin Bujard, Beate Ditzen and Katajun Lindenberg. Project coordination: Celine Schnellbacher, Levin Friedemann, Ingmar Rapp and Felicitas Baumann. Intervention delivery: Andrea Mayer and Felicitas Baumann.

4. Text

Background and Rationale

Stress and mental health problems are highly prevalent across the lifespan and constitute a major public health burden. Although stress is a universal response to environmental demands, chronic or poorly regulated stress is a well-established risk factor for depression, anxiety, sleep disturbances, cardiovascular disease, and impaired daily functioning (Lupien et al., 2009). Importantly, stress is not only a correlate but also a key mechanism underlying the development and maintenance of many mental health conditions. Across 131 countries, 30% of individuals report experiencing daily stress (Smith & Wesselbaum, 2025). Mental health conditions are similarly widespread: more than one billion people worldwide are currently living with a mental disorder, accounting for approximately one in six years lived with disability (WHO, 2025). Among children, adolescents, and young adults, an estimated 293 million individuals aged five to 24 years were affected by at least one diagnosable mental disorder in 2019 (Kieling et al., 2024). Beyond individual suffering, these conditions are associated with substantial societal costs, including poorer educational and occupational outcomes, increased health-care utilization, disability, and economic losses. In many OECD and EU countries, these costs exceed 4% of gross domestic product (OECD, 2021; WHO, 2022).

Intimate Relationships as Buffers of Stress and Mental Health Conditions

Given the substantial burden that mental health conditions place on individuals and society, identifying protective factors is essential. Stable attachment bonds and high-quality relationships represent a key resource for maintaining well-being and mental health across the lifespan (Dagan et al., 2018; Mikulincer & Shaver, 2007; Zhang et al., 2022). Higher relationship satisfaction is associated with better mental and physical health, including improved recovery from disease and increased longevity (Robles et al., 2014), with effects operating both at individual and dyadic levels (Stauder et al., 2019).

At the psychological level, close relationships promote emotion regulation, perceived support, and a sense of safety, thereby buffering stress and reducing vulnerability to mental health conditions (Eisenberger et al., 2003; Gross, 1998; Reis et al., 2004; Taylor, 2006). Perceived partner responsiveness and emotional security are central mechanisms linking relationship quality to well-

being (Reis et al., 2004). These effects operate through reduced stress appraisal and enhanced regulatory capacity, ultimately lowering the risk for internalizing symptoms (Hostinar et al., 2014; Slatcher & Selcuk, 2017).

At the neurobiological level, supportive relationships are associated with attenuated stress responses and improved immune functioning (Ditzen & Heinrichs, 2014). The perception of safety within close relationships promotes adaptive neuroendocrine and immune profiles beyond the effects of received social support (Ditzen et al., 2023; Eckstein et al., 2019). Neuroimaging further suggests that positive partner interactions activate neural systems involved in salience processing and emotional reward, highlighting the biological basis of relationship-related safety (Eckstein et al., 2023). Conversely, relationship conflict can trigger stress-related physiological responses, including alterations in metabolic, endocrine, and immune functioning, thereby increasing long-term disease risk (Kiecolt-Glaser & Wilson, 2017). Collectively, this evidence highlights close relationships as a key protective factor for psychological and physical health. However, these benefits critically depend on relationship quality.

Intimate Relationships as Amplifiers of Stress and Mental Health Conditions

Relationship discord and instability are associated with reduced well-being and impaired mental health, reflected in elevated stress, psychological maladjustment, mood disorders, and anxiety (Landolt et al., 2023; Salinger et al., 2021; Sbarra, 2006; Whisman, 2013). Periods of conflict and uncertainty are typically characterized by diminished perceived safety, a core component of psychological functioning in close relationships (Mikulincer & Shaver, 2007). From an attachment perspective, relationship instability can activate threat-related processes, leading to heightened vigilance, emotional dysregulation, and increased distress (Kouri et al., 2024; Mosannenzadeh et al., 2024; Peters et al., 2019; Şenkal Ertürk et al., 2025). In more severe cases, individuals may experience fear within their own relationships, particularly when conflict is chronic, escalatory, or perceived as uncontrollable, thereby further exacerbating stress and undermining mental health.

Spillover Effects of Interparental Relationship Problems on Children's Mental Health

Moreover, these adverse effects extend to the broader family context. The interdependence of family relationships is captured by family systems theory (Bowen, 1978), which conceptualizes the

family as an interconnected system of interrelated subsystems. Within this framework, difficulties in the interparental relationship can spill over into the parent–child dyad, thereby shaping children’s mental health and development (Erel & Burman, 1995). Accordingly, conflict, hostility, and stress in the interparental relationship may undermine emotional availability and impair parenting, particularly in the absence of effective coping or recovery processes.

Interparental conflict and reduced emotional security have been linked to heightened stress, impaired well-being, long-term internalizing and externalizing problems, and dysregulated physiological responses in children, including alterations in cortisol activity (Davies et al., 2007; Harold & Sellers, 2018; Neff & Karney, 2007; Randall & Bodenmann, 2017). In addition, impaired relationship satisfaction is associated with an increased risk of separation (Debrot et al., 2018; Guven et al., 2010; Linville et al., 2010), which may place additional strain on children. In summary, supportive and responsive partnerships foster resilience, whereas conflictual or unstable relationships amplify stress and contribute to psychological distress within the whole family system.

Pathogenic Processes of Interparental Conflict and Opportunities for Intervention

In the context of chronic conflict and discord, many couples struggle to evaluate the resources and vulnerabilities of their relationship. Ineffective communication increases the risk of further escalation, placing a considerable burden on both partners and potentially on children. A growing body of research demonstrates that behavioral, web-based couple interventions can effectively improve communication, interaction patterns, and relationship quality. For example, randomized controlled trials of the online *OurRelationship* program have shown significant improvements in relationship satisfaction, communication, and individual well-being (Doss et al., 2016; Le et al., 2023). Similar effects have been reported for other self-guided online interventions, such as *PaarBalance*, which also yielded substantial gains in relationship satisfaction (Keller et al., 2021). Consistent with the outlined findings, interventions have been shown to improve couple communication skills while reducing stress levels (Ditzen et al., 2011).

A recent systematic review indicates that online programs can enhance communication, emotional interaction and relationship satisfaction with medium effect sizes (Kernová et al., 2025). These improvements may extend to the broader family system beyond interparental outcomes. For

instance, an online relationship intervention for distressed couples has been shown to reduce coparenting conflict and improve child adjustment, supporting spillover mechanisms from the interparental relationship to child outcomes (Doss et al., 2020).

The present paper outlines the research protocol of the STAR_T project, which builds on these considerations by evaluating the effects of the *PAIRwise* online training on family health and well-being.

The STAR_T Project

STAR_T is an interdisciplinary family research project at the intersection of psychology and sociology. The psychological subproject focuses on the effectiveness of the *PAIRwise* intervention. Specifically, it examines whether and how participation reduces stress, alleviates mental health burden, and improves relationship satisfaction in couples; to what extent eCoach support enhances intervention effects relative to its costs; and whether the intervention has spillover effects on children's mental health, well-being, and stress.

The sociological subproject investigates how couples with conflicts who actively seek support and participate in the STAR_T intervention study differ from couples in the general population, both with and without adjusting for relationship quality, and how the partners' relationship satisfaction and well-being develop over time in both groups, controlling for selection into the intervention. To address these questions, the project combines data from the STAR_T intervention study with data from the representative German Family Demography Panel Study (Schneider et al., 2021).

This paper specifically describes the methodology of the psychological subproject, focusing on the evaluation of the *PAIRwise* intervention.

Objectives

The STAR_T intervention study was designed to evaluate the effectiveness of the couple therapy-based *PAIRwise* program in reducing stress and mental health burden and in improving relationship satisfaction in (1) participating couples and (2) children living in the same household who are exposed to parental conflict. Furthermore, the study aims to (3) assess the incremental effects of eCoach support on primary and secondary outcomes and intervention adherence, and (4) evaluate the associated costs and benefits of the eCoach-enhanced version.

Methods

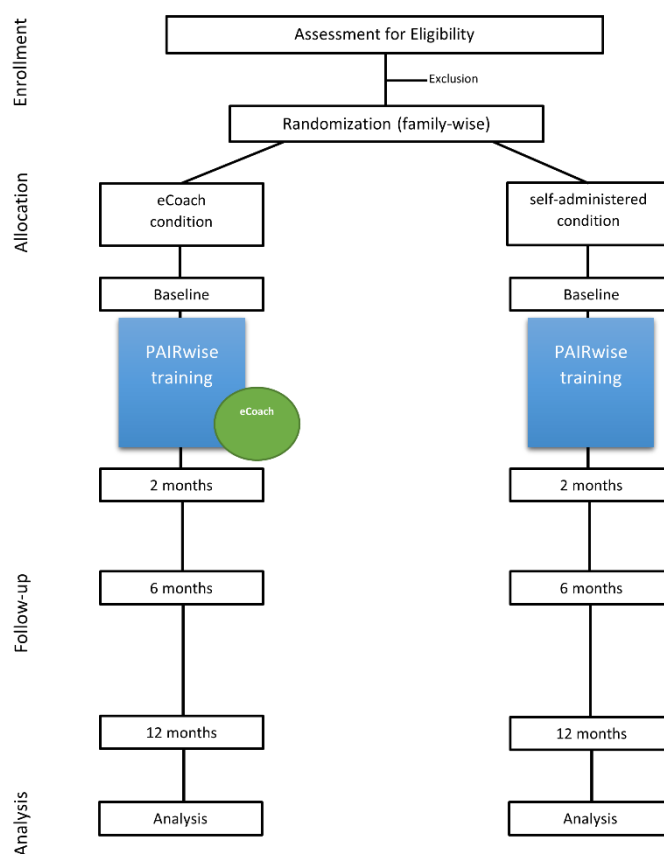
Trial Design

STAR_T is a two-arm randomized superiority trial conducted online with family triads across all federal states of Germany. The trial compares the couple therapy-based *PAIRwise* program in its fully self-directed version (self-guided *PAIRwise*) as compared to its guided version (eCoach supported *PAIRwise*). The study was approved by the Ethics Committee of Heidelberg University on March 16, 2025 (Ref.: Saul 2025 1/1). The trial was conducted in accordance with the Declaration of Helsinki and EU data-protection regulations. Informed consent from parents and adolescents were obtained online prior to participation. The study was registered in the German Clinical Trials Register (DRKS00036615). Important protocol modifications will be documented and communicated to the responsible ethics committee and updated in the trial registry.

The planned trial design can be found in Figure 1.

Figure 1

Study design and process flow chart



Participants and Setting

Participants are couples experiencing relationship conflict and their children aged 11–17 years, recruited via self-referral. Inclusion of parents is not contingent on meeting diagnostic criteria for a mental health disorder according to ICD or DSM. Recruitment took place from April 2025 to April 2026 through couple and family counseling centers, social media, the study website, and psychological practices. Follow-up assessments are planned until May 2027. Participation in the effectiveness study (i.e., data collection) was voluntary and incentivized (€140 for parents and €50 for children).

Inclusion criteria for parents are German language proficiency, age ≥ 18 years, currently in a (conflictual) intimate relationship, having at least one child aged 11–17 years living in the same household, and access to a smartphone with internet connectivity. Inclusion criteria for children are German language proficiency, age 11–17 years, and access to a smartphone with internet connectivity.

The intervention is delivered online via the e-mental-health platform eSano (University of Ulm) and is browser-based. eCoach support is provided within the platform. Self-report assessments (baseline and 2-, 6-, and 12-month follow-ups) are conducted using the smartphone-based application m-Path (m-Path Software B.V.; Leuven, Belgium). The intervention was developed without patient or public involvement. Additional psychobiological ecological momentary assessments (EMA) are conducted at baseline and at the 2- and 6-month follow-ups over one weekend each (12 sampling time points; 6 per day).

Saliva sampling kits are sent to families by mail. Used samples are stored in participants' refrigerators until end of the assessment weekend. Samples are then returned to the laboratory by mail and stored in an ultra-low-temperature freezer until analysis.

Procedure

Parents express interest in the study via an online screening questionnaire administered through LimeSurvey (LimeSurvey GmbH, Hamburg), which also assesses eligibility criteria. Within this form, families indicate whether one or both parents will participate. Accordingly, one or two email addresses are provided, and the study team receives an automated notification.

Family members subsequently receive an enrollment email containing the informed consent form and individual study codes (e.g., 001-1), which are sent separately to each participating parent.

Participants will be informed about the collection and storage of questionnaire and biological data within the present study. Any future ancillary analyses or secondary use of participant data or biological specimens beyond the scope of the current protocol would require additional ethical approval and, where necessary, additional participant consent. Email addresses are stored for allocation purposes, and postal addresses are collected subsequently to enable the mailing of study materials.

After enrollment, participants receive instructions for installing the m-Path application on their smartphone. Once the app is linked to the study, participants are automatically enrolled in the baseline assessment, which takes approximately 30 minutes.

Following baseline, participants schedule a two-day weekend assessment period during which ecological momentary assessment (EMA) and salivary cortisol sampling are conducted. On each day, participants receive six prompts via m-Path: upon awakening, 30 and 45 minutes thereafter, and at 150, 360, and 750 minutes post-awakening (see Table S1 for an exemplary sampling schedule). Each EMA takes approximately 10 minutes. At each prompt, participants provide a saliva sample using pre-supplied collection tubes. All materials are returned to the study team by mail after completion of the weekend.

After the baseline EMA weekend, parents begin the *PAIRwise* intervention. Login credentials are provided via email. The program consists of seven core modules completed sequentially (completion of one module per week is recommended). In addition, seven optional modules are available. Two of these can be accessed immediately after completing the first module. The remaining optional modules are unlocked once participants have completed at least the first five core modules, after which they receive a prompt inviting them to select additional modules. Parents then choose four out of the seven optional modules based on their individual preferences. Completion of each module takes approximately 30 to 40 minutes.

Two and six months after baseline, participants complete additional EMA and saliva sampling periods following the same protocol (six prompts per day). Twelve months after baseline, participants complete a final self-report questionnaire via the m-Path app (approximately 20 minutes). Completion of this assessment marks the end of study participation.

Participant retention and completion of follow-up assessments will be promoted through regular reminders, flexible online participation, and low-threshold access to study materials and questionnaires. Participants will receive automated or personal reminders for upcoming assessments and intervention modules throughout the study period. The online format is intended to reduce barriers to participation and facilitate continued study involvement across follow-up assessments. Reasons for discontinuation, if voluntarily provided, will also be documented.

All electronic data will be stored on secure institutional servers in accordance with applicable data protection regulations and institutional policies. Personal identifying information will be stored separately from study data. Only authorized members of the research team will have access to the final dataset. Data will be retained and archived according to institutional and legal requirements.

Data Monitoring

No formal Data Monitoring Committee (DMC) has been established due to the low-risk nature of the behavioral online intervention and the absence of investigational medicinal products. Study oversight, monitoring of trial conduct, data quality, and participant safety will be performed by the steering committee and the coordinating research team throughout the trial. Monitoring activities include regular review of recruitment progress, data completeness, adherence to study procedures, and documentation of adverse events or protocol deviations. Decisions regarding potential modification or termination of the trial will be made by the principal investigators in consultation with the responsible ethics committee if necessary.

Randomization and Masking

Following online informed consent, families are cluster-randomized at the family level in a 1:1 ratio using a computer-generated allocation sequence implemented in R (R Core Team, 2024). The allocation sequence was generated prior to data collection and stored electronically. A randomization list of family identification codes (001-100) was created, with each family code pre-assigned to one of the two study conditions. For each family code, three individual identification codes (e.g., 001-1, 001-2, 001-3) were generated to allow assignment of multiple family members while retaining the same study condition within each family. Due to the organizational structure of the study, designated study personnel responsible for participant allocation will have access to the randomization sequence at the

time of assignment. However, allocation will be based on a predefined computerized randomization procedure to minimize allocation bias.

As families enroll in the study, they are assigned the next available family identification code from the pre-randomized list in sequential order. This procedure ensures allocation according to the predefined randomization sequence while maintaining equal group sizes across conditions. Investigators have no personal contact with families prior to randomization, and allocation is concealed until assignment. Due to the nature of the intervention, participants cannot be blinded to their assigned condition; however, they are not explicitly informed about the alternative intervention condition.

Intervention

The *PAIRwise* intervention is a couple therapy-based, browser-delivered online program designed to support couples experiencing relationship distress and their families. It was developed as part of a larger, recently completed nationwide project funded by the German Federal Ministry of Family Affairs (<https://www.stark-familie.info/de/>).

After a short technical introduction, the intervention consists of seven sequential core modules targeting fundamental relationship skills as well as seven optional modules that can be selected based on individual needs (see Table 1 for details). The modules combine psychoeducation, interactive exercises, videos, and guided reflection tasks. The intervention can be completed individually only, with each partner using a private account. Each module takes about 40 minutes to complete. Users are encouraged to complete one module per week; however, they may adapt the pacing to their individual needs. Texts, video examples, and interactive tasks are used to facilitate self-reflection, to convey communication skills, and to gather strategies for coping with intense emotions and problems. In addition, information about counseling and support services is provided.

eCoaches (clinical psychologists who work under supervision from psychotherapists) interact with users through regular, semi-structured personalized feedback following each module directly within the online platform; Participants in the eCoach condition have the possibility to ask questions and seek help at any time throughout the intervention.

The *PAIRwise* intervention is primarily grounded in cognitive-behavioral couple therapy approaches, including communication and problem-solving training, cognitive-emotional regulation, and dyadic coping. It further integrates elements of dialectical behavior therapy to support emotion regulation in high-conflict situations. Systemic perspectives are incorporated by addressing interdependencies within the family system, including spillover effects on children.

Two versions of the *PAIRwise* program are implemented: a self-guided condition and an eCoach supported condition. In the self-guided condition, participants completed the program autonomously without contact with the study team regarding module contents. Progression to the next module is available immediately after completing a module. In the eCoach supported condition, participants received individualized feedback on their reflections after each module and proceed to the next module only after receiving this feedback. Participants in both conditions receive standardized reminders with biweekly frequency to support adherence, irrespective of their progress.

Table 1

PAIRwise modules and contents

Core Modules	
Module	Content
1. Crisis—what now?	First steps in dealing with a relationship crisis
2. What does my child need?	The child's needs during relationship crisis
3. What do I need, what do we need?	Self-care and relationship care
4. Managing emotions in relationships	Recognizing and regulating emotions
5. Communication in relationships	Effective communication in a relationship
6. Solving problems	Joint problem-solving and constructive conflict management
7. What comes next?	Next steps and additional resources
Optional Modules	
Module	Content
1. Managing conflict escalation ¹	The time-out technique for managing heated arguments
2. Infidelity and affairs	Addressing infidelity and managing extramarital affairs
3. Stay or leave?	Reflecting on ambivalence and deal-breakers
4. Relationship crises in LGBTQIA+ families	Specific issues for LGBTQIA+ families
5. Sexuality and intimate relationships ¹	Sexuality and relationship crises
6. Stress as a relationship challenge	Managing daily stress and dyadic coping
7. Stepfamilies and blended families	Specific issues for step and blended families

Note. ¹ These modules are available after completion of the first core module ("Crisis—what now?")

Primary and Secondary Outcomes

Self-report data. Self-report data are collected at baseline, 2-, 6-, and 12-month follow-up assessments. Primary and secondary outcomes are described below.

Primary outcomes. The primary outcome of the STAR_T psychology phase is change in self-reported mental health burden from baseline to 6-month follow-up. Parental mental health is assessed using the Depression Anxiety Stress Scales. Child mental health is assessed using the Strengths and Difficulties Questionnaire. These measures are administered at baseline, 2-, 6-, and 12-month follow-ups.

Strengths and Difficulties Questionnaire (SDQ). The Strengths and Difficulties Questionnaire (Goodman, 1997; Woerner et al., 2004) comprises five subscales: Emotional Problems (EP), Conduct Problems (VA), Hyperactivity/Attention Problems (HYP), Peers Problems (PG), and Prosocial Behavior (PRO). Each scale consists of 5 items. Response options range from 0 (“not true”) to 2 (“certainly true”). The scores of EP (e.g., “I worry a lot”) and PG (e.g., “I would rather be alone than with people of my age.”) can be used to form an “internalizing scale” (INT); VA (e.g., “I take things that are not mine (from home, school or elsewhere)”) and HYP (e.g., “I am restless. I cannot stay still for long.”) scores can be used to form an “externalization scale” (EXT). The German self-report version of the SDQ has demonstrated good psychometric properties, including satisfactory validity, reliability, and convergence with established measures of child psychopathology in adolescent samples (Becker et al., 2004; Klasen et al., 2000). The SDQ sum score as well as the internalizing and externalizing subscales serve as the primary outcomes of this study. Internal consistency will be evaluated in the present sample.

Depression Anxiety Stress Scale (DASS). The 21-item short-version of the German Depression Anxiety Stress Scales (Nilges & Essau, 2015) assesses symptoms of depression (e.g., “I couldn’t seem to experience any positive feeling at all.”), anxiety (e.g., “I felt I was close to panic.”) and levels of stress (e.g., “I found it difficult to relax.”) each with 7 items. Response options range from 0 (“did not apply to me at all”) to 3 (“applied to me very much or most of the time”). All items are unidirectional, and subscale scores are calculated by summing item responses. Cut-off scores for the three subscales have been proposed (depression = 10, anxiety = 6, stress = 10). For the present study, both the global DASS score and the three subscale scores will be used as indicators of mental health burden in

primary outcome analyses. The German version of the DASS-21 has demonstrated good psychometric properties, including satisfactory validity as well as good internal consistency, with Cronbach's α of .88 for depression, .76 for anxiety, and .86 for stress (Nilges & Essau, 2015).

Secondary outcomes. Secondary outcomes include changes in psychobiological indicators of stress (salivary cortisol), couple satisfaction, quality of life, parental conflict frequency, and spillover effects between parents and children (assessed via psychobiological ecological momentary assessment) from baseline to 2-, 6-, and 12-month follow-ups.

Couple Satisfaction Index (CSI). Relationship satisfaction is assessed using the 8-item version of the Couples Satisfaction Index (CSI; Funk & Rogge, 2007). The CSI-8 measures global relationship satisfaction across multiple domains, including perceived relationship strength (e.g., "Our relationship is strong"), emotional closeness (e.g., "I have a warm and comfortable relationship with my partner"), and overall satisfaction (e.g., "In general, how satisfied are you with your relationship?"). In addition, global evaluative items assess overall happiness in the relationship as well as semantic differentials (e.g., "bad–good", "miserable–enjoyable"). Items are rated on Likert-type scales ranging from 0 to 5 or 0 to 6, depending on the item. Total scores are calculated according to the manual, with higher scores indicating greater relationship satisfaction. Scores can range from 0 to 41, with values below 27.5 suggesting notable relationship dissatisfaction. The CSI-8 has demonstrated high reliability and validity in prior research and provides a precise and efficient assessment of relationship satisfaction (Funk & Rogge, 2007). The total CSI-8 score will be used as secondary outcome.

World Health Organization Well-Being Index (WHO-5). Subjective well-being of the child is assessed using the 5-item World Health Organization Well-Being Index (WHO-5; Topp et al., 2015). The WHO-5 measures positive well-being over the past two weeks, including positive mood (e.g., "I have felt cheerful and in good spirits"), relaxation (e.g., "I have felt calm and relaxed"), vitality (e.g., "I have felt active and vigorous"), restfulness (e.g., "I woke up feeling fresh and rested"), and interest in daily life (e.g., "My daily life has been filled with things that interest me"). Items are rated on a 6-point Likert scale ranging from 0 ("at no time") to 5 ("all of the time"). A total raw score is calculated by summing all items (range: 0–25), with higher scores indicating greater well-being. For interpretation, the raw score can be multiplied by 4 to yield a percentage scale ranging from 0 to 100.

The WHO-5 demonstrated good internal consistency, with a Cronbach's α typically ranging between .80 and .90 (Topp et al., 2015).

Life Satisfaction Scale. Global life satisfaction in parents is assessed using a single-item measure as widely used in large-scale surveys. Participants are asked: "All things considered, how satisfied are you with your life nowadays?". Responses are provided on an 11-point scale ranging from 0 ("not at all satisfied") to 10 ("completely satisfied"). Higher scores indicate greater life satisfaction. Single-item measures of life satisfaction have been shown to demonstrate adequate reliability and validity in previous research (Lucas & Donnellan, 2012).

Relationship frequencies. Relationship dynamics are assessed using six items from the FReDA partnership frequency scale (Schneider et al., 2021), capturing the frequency of specific interaction behaviors within the couple. The items assess both positive (e.g., "How often do you tell your partner what you are thinking?", "How often does your partner show appreciation?", "How often do you share secrets and private feelings with your partner?") and negative interaction patterns (e.g., "How often are you and your partner annoyed or angry with each other?", "How often do you and your partner disagree and quarrel?"), as well as perceived partner recognition (e.g., "How often does your partner express recognition for what you have done?"). Responses are given on a 5-point Likert scale ranging from 1 ("never") to 5 ("very frequently"). Higher scores indicate a higher frequency of the respective behaviors. Depending on the analytic approach, items can be examined individually or aggregated to reflect overall positive and negative interaction patterns within the relationship. For our secondary outcome analyses, we aim to analyze aggregated negative versus positive interaction subscales.

The assessment schedule for the baseline, 2-, 6-, and 12-month follow-up assessments is presented in Table 2.

Table 2

Schedule of procedures and assessments of self-report data

Procedure / Variable	Enrollment	Baseline		2 Months		6 Months		12 Months	
		Parent	Child	Parent	Child	Parent	Child	Parent	Child
Eligibility screening	x								
Informed consent	x								
Enrollment E-Mail	x								

Procedure / Variable	Enrollment	Baseline		2 Months		6 Months		12 Months	
		Parent	Child	Parent	Child	Parent	Child	Parent	Child
Demographics									
Age		x	x						
Sex		x	x						
Employment status		x	x*						
Finances		x							
Migration status		x							
Number of children		x							
Type of school and grade			x						
Average grade			x						
Highest educational degree		x	x*						
Cohabitation		x							
Living conditions		x							
Sexual orientation		x							
Psychological well-being									
Global life satisfaction		x	x	x	x	x	x	x	x
WHO-5 ^a			x		x		x		x
Self-esteem		x	x	x	x	x	x	x	x
Social integration			x						x
Mental health outcomes									
DASS ^b		x		x		x		x	
SDQ ^c			x		x		x		x
Relationship questions									
Relationship duration		x							
Marriage status and duration		x							
Relationship status updates				x		x		x	
CSI-8 ^d		x		x		x		x	
Frequencies of interactions		x		x		x		x	
Conflict behavior of parents		x	x	x	x	x	x	x	x
Areas of conflict		x		x		x		x	
Separation-related thoughts		x		x		x		x	
Parent-child-interaction									
Parenting		x	x	x	x	x	x	x	x
Emotional insecurity [†]			x		x		x		x
NRI ^{e,†}			x		x		x		x
Time spent together [†]			x		x		x		x
Personality									
BIG Five Personality Scale				x					
PID5BF+M ^f					x				

Procedure / Variable	Enrollment	Baseline		2 Months		6 Months		12 Months	
		Parent	Child	Parent	Child	Parent	Child	Parent	Child
Health related questions									
BMI		x							
Contraceptives		x							
Climacteric period		x		x		x		x	
Last menstruation		x		x		x		x	
Pregnancy / breast feeding		x		x		x		x	
CSSI ^g			x		x		x		x
Addictive behaviors			x		x		x		x
Additional questions									
Way of enrollment		x							
Concomitant care								x	
Family-related values		x							
Division of Labor		x							
Internet usage time		x							

Note. *Employment information and highest educational degree was only assessed from children indicating to not attend school (anymore); [†]Children's perspective on these scales were asked separately for each parent; ^aWorld Health Organization Well-Being Index; ^bDepression Anxiety Stress Scales; ^cStrength and Difficulties Questionnaire; ^dCouple Satisfaction Index, ^eNetwork of relationship inventory; ^fPersonality Inventory for DSM-5 and ICD-11 – Modified Short Form (PID5BF+ M); ^gChildren's Somatic Symptoms Inventory.

Ecological momentary assessment (EMA) data. EMA data and salivary cortisol are

collected at baseline, 2-, and 6-month follow-ups. During each assessment weekend, similar outcomes are collected, as described below.

Interparental couple climate. Perceived couple climate is assessed using five items capturing the quality of the relationship since the previous assessment. Participants rate the atmosphere between partners on five bipolar dimensions (relaxed–tense, friendly–hostile, harmonious–conflictual, close–distant, stable–fragile) using visual analog scales (VAS; 0–100). Higher values indicate a more positive couple climate (e.g., more friendly, close). Items can be analyzed individually or aggregated into a composite index.

Family climate. Perceived family climate is assessed using five items capturing the quality of family interactions since the previous assessment. Participants rate family climate on five bipolar dimensions (conflictual–harmonious, reserved–heartfelt, tense–relaxed, distant–close, cold–warm) using VAS (0–100). Higher values indicate a more positive family climate (e.g., more harmonious, warm). Items can be analyzed individually or aggregated into an overall index.

Given the lack of established EMA scales specifically targeting daily family climate in high-conflict contexts, both climate scales were designed within the study team. Thus, psychometric properties (e.g., reliability and factor structure) will be evaluated prior to hypothesis testing.

Parent EMA. In parents, EMA captures momentary affective states, daily stress experiences, interparental communication, and family interactions. Momentary mood is assessed using a global mood rating (−100 to +100) and multiple bipolar items (e.g., exhausted–energetic, stressed–relaxed, unfocused–focused, annoyed–good-humored, unmotivated–motivated, dissatisfied–satisfied, anxious–fearless, nervous–calm, unhappy–happy), rated on VAS (0–100). Daily stress exposure is assessed by recording the occurrence, timing, description, and perceived intensity (0–100) of stressful events. Interaction behaviors (e.g., expressing one’s perspective, communicating needs, active listening, emotion expression), which represent a core target of the intervention, are assessed using VAS (0–100). Participants additionally report time spent with their partner and family members.

Child EMA. In children, EMA assesses momentary mood using a global, smiley-based VAS (0–100) and parallel bipolar items (e.g., stressed–relaxed, unhappy–happy) in line with adult mood ratings. Children further report on family interactions, including perceived family climate, perceived interparental climate, and occurrence of conflicts (observed between parents and involving the child). Time spent with family members and perceived typicality of the day are also recorded.

Salivary cortisol. Salivary cortisol is collected concurrently with each EMA prompt to capture momentary psychobiological stress responses and diurnal patterns. Samples are obtained multiple times per day using standardized collection procedures aligned with the EMA protocol.

Behavioral and sleep questions. To account for variability in salivary cortisol levels, participants report relevant behaviors since the last assessment (e.g., food and beverage intake, smoking, physical activity). In addition, sleep-related variables are assessed, including sleep duration, sleep quality, and time since awakening.

The psychobiological EMA assessment schedule at baseline, 2- and 6-month follow-ups is presented in Table 3.

474 **Table 3**475 *Schedule of procedures and assessments of EMA data*

Construct / Variable	Baseline						2 Months						6 Months					
	Parent			Child			Parent			Child			Parent			Child		
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Cortisol-relevant questions																		
Behavior questions (e.g., brushed teeth, drank, ate, caffeine, alcohol, pills, nicotine, THC, sport/activity)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Last menstruation	x						x						x					x
Sleep-related questions (e.g., time since awakening, sleeping duration, sleeping quality, discomfort, troubles sleeping)	x						x						x					x
Typical day (stressful event)						x					x						x	
Mood																		
Overall mood	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Mood word pairs	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Partnership questions																		
Climate within the parent couple	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Overall happiness with partnership (CSI-8 ^a adapted)						x							x					x
Time with partner						x							x					x
Couple interaction						x							x					x
Family questions																		
Climate within the family	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Well-being																		
Global life satisfaction						x						x						x
WHO-5 ^b (EMA adapted)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Conflict-related questions																		
Witnessed conflict											x						x	
Experienced conflict											x						x	

476 *Note.* Sampling protocol and used items are identical within both weekend days. ^aCouple Satisfaction Index; ^bWorld Health Organization Well-Being Index.

Harms and concomitant care

Potential harms are defined as unintended negative changes in the primary outcome, operationalized using the Reliable Change Index (RCI). Reliable deterioration is defined as an $RCI \leq -1.96$ from baseline to the 6-month follow-up. In addition, harms (e.g., escalation of conflict, emotional distress), unintended events (e.g., relationship dissolution), and any concomitant care received during the trial are assessed and will be reported.

Criteria for discontinuing or modifying the intervention were not a priori specified. Potential harms occurring during the trial will be discussed in the steering committee meetings. Given the low-risk nature of the present behavioral online intervention, no specific ancillary or post-trial care is planned. Participants may discontinue participation at any time without disadvantage. In cases of severe psychological distress or indication of acute risk, participants will be advised to seek appropriate professional support services.

Sample Size

A priori sample size calculations were conducted assuming a medium between-group effect size ($d = 0.50$), a two-sided significance level of $\alpha = .05$, and 80% statistical power. Given the clustered data structure (family triads), with an average cluster size of 3 and an intraclass correlation coefficient (ICC) of 0.30, the required sample size was adjusted using a design effect. Based on these assumptions, a total sample of 204 individuals (approximately 68 families; 34 families per condition) would be required for a two-arm comparison. Given the planned sample size of 60 families (30 per condition), constrained by available funding, the minimum detectable effect size increases slightly to approximately $d = 0.53$.

Statistical Analysis Plan

Primary and secondary outcomes will be analyzed according to the intention-to-treat principle using multilevel (mixed-effects) models to account for the nested data structure, with repeated measurements nested within individuals and individuals nested within families. Missing data will be handled using multiple imputation under the assumption of missing at random. Sensitivity analyses for the primary outcome will include completer and per-protocol analyses.

Previous research has demonstrated that broad dimensions of psychopathology can be modeled as higher-order latent factors across different instruments. Accordingly, to enable a unified assessment of mental health across parents and children, a latent mental health factor will be specified using confirmatory factor analysis, provided that model fit is adequate. Indicators will include standardized scores from the DASS (parents) and the SDQ internalizing and externalizing scales (children), allowing the extraction of a common underlying dimension of psychological distress. If model fit is insufficient, DASS and SDQ scores will be z-standardized and analyzed separately to ensure comparability across instruments.

Analyses will include reporting of participant flow, baseline characteristics, and intervention adherence; primary outcome analyses (intention-to-treat); sensitivity analyses (including completer and per-protocol analyses); secondary outcomes; responder analyses; harms and concomitant care; as well as implementation fidelity and participant satisfaction.

Cortisol data will be analyzed using multilevel models to account for the nested structure of repeated measurements within individuals and individuals within families. At the momentary level, within-person fluctuations in cortisol will be examined in relation to concurrent EMA measures (e.g., affect, stress, and interactions), including time since waking as a covariate (Stoffel et al., 2021). At the day level, aggregate indicators (e.g., mean cortisol levels and area under the curve with respect to ground, AUCg) will be computed to capture overall daily cortisol output. Analyses will be conducted at both the individual level (separately for parents and children) and at the family level to examine interdependencies and spillover effects. Random intercepts for families will be included to account for clustering due to the study design. Both within-person (intraindividual variation over time) and between-person (stable individual differences) effects will be modeled. Longitudinal intervention effects will be estimated using group $\times$ time interaction terms.

Discussion

The present study evaluates the effectiveness of a couple therapy-based online intervention targeting relationship distress and its consequences for mental health within the family system.

Specifically, the trial will investigate the extent to which the *PAIRwise* intervention reduces stress and mental health burden and improves well-being in participating parents, their partners, and their children. By integrating self-report measures with psychobiological indicators of stress, the study seeks to provide a comprehensive understanding of intervention effects across multiple levels of functioning.

Effects of the Intervention on Parental Mental Health

Main objective of the study is to determine the magnitude of intervention effects on parental mental health. We expect that participation in the *PAIRwise* program will lead to reductions in psychological distress, including symptoms of stress, anxiety, and depression; improvement of relationship satisfaction, well-being and improvements in relationship functioning (e.g., communication) and conflict resolution. Importantly, the study will examine whether these effects are observable not only in self-reported outcomes but also in biological markers of stress, specifically, cortisol levels, assessed over 3 weekends at baseline, 2-months follow-up and 6-months follow-up. Demonstrating convergence between subjective and physiological indicators would provide strong evidence for the intervention's effectiveness and its impact on stress regulation processes.

Spillover Effects on Children

Beyond individual and dyadic effects, the study explicitly addresses spillover effects of parental relationship interventions on children's mental health. Interparental conflict has been consistently linked to increased psychological distress in children, including both internalizing and externalizing symptoms, as well as reduced well-being (van Eldik et al., 2020). This study will examine whether improvements in parental functioning translate into measurable benefits for children, including reductions in general psychopathology, improved quality of life, and changes in both self-reported and biological indicators of stress. Evidence for such spillover effects would underscore the importance of targeting parental relationships as a pathway to improving child mental health.

Specificity of Intervention Effects

The study aims to examine for whom and under which conditions the intervention is most effective. Moderator analyses will investigate the role of sociodemographic factors, intervention

adherence, and dosage, as well as biological markers of stress, in predicting treatment outcomes. Identifying differential effects across subgroups may inform the development of more tailored and efficient intervention strategies and improve the targeting of resources.

Balancing Benefits and Harms

In addition to beneficial outcomes, the study will assess potential adverse effects of the intervention. Relationship-focused interventions may, in some cases, lead to increased conflict awareness or even relationship dissolution. The present study will therefore examine the frequency of negative outcomes, such as escalation of conflict, separation, or divorce, and evaluate these in relation to observed benefits. This balanced perspective is essential for a comprehensive evaluation of intervention effectiveness and safety.

Strengths and Limitations

This study has several notable strengths. First, it examines not only individual and dyadic outcomes but also spillover effects on children, thereby capturing the family as an interconnected system as proposed in family system theory (Bowen, 1978). Second, it combines subjective self-report measures on mental health with psychobiological indicators of stress, including cortisol assessments and ecological momentary data, which allows for a more comprehensive and multimethod evaluation of intervention effects. Such integrative approaches remain rare in the field of couple and family interventions. Importantly, there is currently a lack of accessible and evidence-based German-language online interventions for couples experiencing relationship distress. Thus, if effective, *PAIRwise* may help address an important gap in preventive mental health care by providing a scalable and low-threshold support option for families.

However, several limitations should be considered. First, although families have been recruited throughout all federal states of Germany, the sample is not expected to be representative and requires self-enrolment. However, the sociological subproject will analyze the characteristics of the population enrolled in our program and to develop measures to better reach the underrepresented groups in the future. Second, the sample size, although adequate for detecting moderate effects, may be insufficient to reliably detect small effects or more complex interaction patterns. Given that families—especially those experiencing conflict and ambivalence—are exposed to substantial

everyday stressors, potential dropouts might reduce sample sizes further. Third, the intervention is primarily designed for individual or parallel participation, and direct interaction between partners within the program is limited. Finally, no intervention components are directly targeted at children, which may constrain the magnitude of spillover effects. The integration of different measurement instruments across age groups may introduce challenges in interpretation, despite efforts to harmonize outcomes.

Implications and Future Directions

The present study improves the understanding of how relationship stress affects mental health within the family system and which mechanisms contribute to the transmission of distress between parents and children. By integrating self-report measures with psychobiological stress indicators, the study aims to provide a more comprehensive understanding of both subjective and physiological pathways linking relationship distress to impaired well-being in family members. At the same time, the trial evaluates a scalable and low-threshold online intervention that may offer an accessible support option for families who face barriers to traditional face-to-face services. This is particularly relevant given the limited availability of evidence-based German-language online interventions for couples experiencing relationship distress.

Beyond evaluating intervention effectiveness, the findings may help to identify mechanisms that are especially relevant for promoting resilience and reducing stress within families, thereby informing the further development of family-based preventive interventions. Future research should investigate how intervention effects can be strengthened, for example through increased partner interaction, a stronger focus on parent–child processes, or the inclusion of child-focused intervention components. In addition, larger and more diverse trials are needed to confirm the findings, evaluate long-term outcomes and cost-effectiveness, and examine the applicability of such interventions across different family constellations and sociocultural contexts.

Trial Status: Protocol version 1: May 19, 2026. Start of recruitment: May 21, 2025 – approximately May 31, 2026, with follow-ups lasting up until end of May 2027. Submission of the protocol was delayed because study implementation procedures, preparation of the full study documentation, and preparation of the manuscript were conducted concurrently during the early phase of the trial.

CRedit authorship contribution statement: **Celine Schnellbacher:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Data curation, Visualization. **Levin Friedemann:** Writing – review & editing, Project administration, Methodology, Data curation, Visualization. **Felicitas Baumann:** Writing – review & editing, Intervention delivery, Methodology, Data curation. **Andrea Mayer:** Writing – review & editing, Intervention supervision. **Ingmar Rapp:** Writing – review & editing, Project administration, Methodology, Data curation. **Johannes Stauder:** Writing – review & editing, Supervision, Project administration, Methodology, Conceptualization, Resources. **Martin Bujard:** Writing – review & editing, Supervision, Project administration, Methodology, Conceptualization, Resources. **Beate Ditzen:** Writing – review & editing, Supervision, Project administration, Methodology, Conceptualization, Resources. **Katajun Lindenberg:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Conceptualization, Resources.

References

- Becker, A., Woerner, W [Wolfgang], Hasselhorn, M., Banaschewski, T., & Rothenberger, A [Aribert] (2004). Validation of the parent and teacher SDQ in a clinical sample. *European Child & Adolescent Psychiatry*, 13 Suppl 2, II11-6. <https://doi.org/10.1007/s00787-004-2003-5>
- Bowen, M. (1978). *Family therapy in clinical practice*. Jason Aronson.
- Dagan, O., Facompré, C. R., & Bernard, K. (2018). Adult attachment representations and depressive symptoms: A meta-analysis. *Journal of Affective Disorders*, 236, 274–290. <https://doi.org/10.1016/j.jad.2018.04.091>
- Davies, P. T., Sturge-Apple, M. L., Cicchetti, D., & Cummings, E. M. (2007). The role of child adrenocortical functioning in pathways between interparental conflict and child maladjustment. *Developmental Psychology*, 43(4), 918–930. <https://doi.org/10.1037/0012-1649.43.4.918>
- Ditzen, B., Aguilar-Raab, C., Winter, F., Hernández, C., Schneider, E., Bodenmann, G., Heinrichs, M., Ehler, U., & Läubli, S. (2023). Effects of intranasal oxytocin and positive couple interaction on immune factors in skin wounds. *Brain, Behavior, and Immunity*, 107, 90–97. <https://doi.org/10.1016/j.bbi.2022.08.011>
- Ditzen, B., Hahlweg, K., Fehm-Wolfsdorf, G., & Baucom, D. (2011). Assisting couples to develop healthy relationships: Effects of couples relationship education on cortisol. *Psychoneuroendocrinology*, 36(5), 597–607. <https://doi.org/10.1016/j.psyneuen.2010.07.019>
- Ditzen, B., & Heinrichs, M. (2014). Psychobiology of social support: The social dimension of stress buffering. *Restorative Neurology and Neuroscience*, 32(1), 149–162. <https://doi.org/10.3233/RNN-139008>
- Doss, B. D., Cicila, L. N., Georgia, E. J., Roddy, M. K., Nowlan, K. M., Benson, L. A., & Christensen, A. (2016). A randomized controlled trial of the web-based OurRelationship program: Effects on relationship and individual functioning. *Journal of Consulting and Clinical Psychology*, 84(4), 285–296. <https://doi.org/10.1037/ccp0000063>
- Doss, B. D., Roddy, M. K., Llabre, M. M., Georgia Salivar, E., & Jensen-Doss, A. (2020). Improvements in coparenting conflict and child adjustment following an online program for

- relationship distress. *Journal of Family Psychology : JFP : Journal of the Division of Family Psychology of the American Psychological Association (Division 43)*, 34(1), 68–78.
<https://doi.org/10.1037/fam0000582>
- Eckstein, M., Almeida de Minas, A. C., Scheele, D., Kreuder, A.-K., Hurlemann, R., Grinevich, V., & Ditzen, B. (2019). Oxytocin for learning calm and safety. *International Journal of Psychophysiology : Official Journal of the International Organization of Psychophysiology*, 136, 5–14. <https://doi.org/10.1016/j.ijpsycho.2018.06.004>
- Eckstein, M., Stößel, G., Gerchen, M. F., Bilek, E., Kirsch, P., & Ditzen, B. (2023). Neural responses to instructed positive couple interaction: An fMRI study on compliment sharing. *Social Cognitive and Affective Neuroscience*, 18(1). <https://doi.org/10.1093/scan/nsad005>
- Eisenberger, N. I., Lieberman, M. D., & Williams, K. D. (2003). Does rejection hurt? An FMRI study of social exclusion. *Science (New York, N.Y.)*, 302(5643), 290–292.
<https://doi.org/10.1126/science.1089134>
- Erel, O., & Burman, B. (1995). Interrelatedness of Marital Relations and Parent-Child Relations: A Meta-Analytic Review. *Psychological Bulletin*, 118(1).
- Funk, J. L., & Rogge, R. D. (2007). Testing the ruler with item response theory: Increasing precision of measurement for relationship satisfaction with the Couples Satisfaction Index. *Journal of Family Psychology : JFP : Journal of the Division of Family Psychology of the American Psychological Association (Division 43)*, 21(4), 572–583. <https://doi.org/10.1037/0893-3200.21.4.572>
- Goodman, R [Robert] (1997). The Strengths and Difficulties Questionnaire: A Research Note. *J. Child Psychol. Psychiat.*, 38(5), 581–586.
- Gross, J. J. (1998). The Emerging Field of Emotion Regulation: An Integrative Review. *Review of General Psychology*, 2(3), 271–299.
- Harold, G. T., & Sellers, R. (2018). Annual Research Review: Interparental conflict and youth psychopathology: An evidence review and practice focused update. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, 59(4), 374–402.
<https://doi.org/10.1111/jcpp.12893>

- 687 Hoberg, N. G., Mayer, A. J., Kubb, C., van Eickels, R. L., Zemp, M., Foran, H., Ditzen, B.,
 688 Fischer, M. S., & Milek, A. Reliably Assessing Relationship Quality in German-Speaking
 689 Samples: A Tri-National Online Study Validating the German Versions of the Perceived
 690 Relationship Quality Component Questionnaire (German PRQC) and the Couples Satisfaction
 691 Index (German CSI) [Unpublishes Manuscript]. Advance online publication.
 692 <https://doi.org/10.17605/OSF.IO/RZ3BT>
- 693 Hostinar, C. E., Sullivan, R. M., & Gunnar, M. R. (2014). Psychobiological mechanisms underlying
 694 the social buffering of the hypothalamic-pituitary-adrenocortical axis: A review of animal
 695 models and human studies across development. *Psychological Bulletin*, 140(1), 256–282.
 696 <https://doi.org/10.1037/a0032671>
- 697 Keller, A., Babl, A., Berger, T., & Schindler, L. (2021). Efficacy of the web-based PaarBalance
 698 program on relationship satisfaction, depression and anxiety - A randomized controlled trial.
 699 *Internet Interventions*, 23, 100360. <https://doi.org/10.1016/j.invent.2020.100360>
- 700 Kernová, L., Halamová, J., & Deriglazov, D. (2025). Effectiveness of digital interventions on
 701 relationship satisfaction among couples: A systematic review and meta-analysis. *BMC*
 702 *Psychology*, 13(1), 1069. <https://doi.org/10.1186/s40359-025-03444-y>
- 703 Kiecolt-Glaser, J. K., & Wilson, S. J. (2017). Lovesick: How Couples' Relationships Influence Health.
 704 *Annual Review of Clinical Psychology*, 13, 421–443. [https://doi.org/10.1146/annurev-clinpsy-](https://doi.org/10.1146/annurev-clinpsy-032816-045111)
 705 [032816-045111](https://doi.org/10.1146/annurev-clinpsy-032816-045111)
- 706 Kieling, C., Buchweitz, C., Caye, A., Silvani, J., Ameis, S. H., Brunoni, A. R., Cost, K. T.,
 707 Courtney, D. B., Georgiades, K., Merikangas, K. R., Henderson, J. L., Polanczyk, G. V.,
 708 Rohde, L. A., Salum, G. A., & Szatmari, P. (2024). Worldwide Prevalence and Disability
 709 From Mental Disorders Across Childhood and Adolescence: Evidence From the Global
 710 Burden of Disease Study. *JAMA Psychiatry*, 81(4), 347–356.
 711 <https://doi.org/10.1001/jamapsychiatry.2023.5051>
- 712 Klasen, H., Woerner, W [W.], Wolke, D., Meyer, R., Overmeyer, S., Kaschnitz, W., Rothenberger, A
 713 [A.], & Goodman, R [R.] (2000). Comparing the German Versions of the Strengths and

- Difficulties Questionnaire (SDQ-Deu) and the Child Behavior Checklist. *European Child & Adolescent Psychiatry*(9), 271–276.
- Kouri, G., Meuwly, N., Richter, M., & Schoebi, D. (2024). Attachment insecurities, emotion dynamics and stress in intimate relationships during the transition to parenthood. *BMC Psychology*, 12(1), 200. <https://doi.org/10.1186/s40359-024-01686-w>
- Landolt, S. A., Weitkamp, K., Roth, M., Sisson, N. M., & Bodenmann, G. (2023). Dyadic coping and mental health in couples: A systematic review. *Clinical Psychology Review*, 106, 102344. <https://doi.org/10.1016/j.cpr.2023.102344>
- Le, Y., Roddy, M. K., Rothman, K., Salivar, E. G., Guttman, S., & Doss, B. D. (2023). A randomized controlled trial of the online OurRelationship program with varying levels of coach support. *Internet Interventions*, 34, 100661. <https://doi.org/10.1016/j.invent.2023.100661>
- Lucas, R. E., & Donnellan, M. B. (2012). Estimating the Reliability of Single-Item Life Satisfaction Measures: Results from Four National Panel Studies. *Social Indicators Research*, 105(3), 323–331. <https://doi.org/10.1007/s11205-011-9783-z>
- Lupien, S. J., McEwen, B. S., Gunnar, M. R., & Heim, C. (2009). Effects of stress throughout the lifespan on the brain, behaviour and cognition. *Nature Reviews. Neuroscience*, 10(6), 434–445. <https://doi.org/10.1038/nrn2639>
- Mikulincer, M., & Shaver, P. R. (2007). *Attachment in adulthood: Structure, dynamics, and change*. Guilford Press.
- Mosannenzadeh, F., Luijten, M., MacIejewski, D. F., Wiewel, G. V., & Karremans, J. C. (2024). Adult Attachment and Emotion Regulation Flexibility in Romantic Relationships. *Behavioral Sciences (Basel, Switzerland)*, 14(9). <https://doi.org/10.3390/bs14090758>
- Neff, L. A., & Karney, B. R. (2007). Stress Crossover in Newlywed Marriage: A Longitudinal and Dyadic Perspective. *Journal of Marriage and Family*, 69(3).
- Nilges, P., & Essau, C. (2015). Die Depressions-Angst-Stress-Skalen: Der DASS--ein Screeningverfahren nicht nur für Schmerzpatienten [Depression, anxiety and stress scales: DASS--A screening procedure not only for pain patients]. *Schmerz (Berlin, Germany)*, 29(6), 649–657. <https://doi.org/10.1007/s00482-015-0019-z>

- OECD. (2021). *A New Benchmark for Mental Health Systems*. OECD Publishing.
<https://doi.org/10.1787/4ed890f6-en>
- Peters, B. J., Overall, N. C., Girmé, Y. U., & Jamieson, J. P. (2019). Partners' attachment insecurity predicts greater physiological threat in anticipation of attachment-relevant interactions. *Journal of Social and Personal Relationships*, 36(2), 469–489.
<https://doi.org/10.1177/0265407517734655>
- Randall, A. K., & Bodenmann, G. (2017). Stress and its associations with relationship satisfaction. *Current Opinion in Psychology*, 13, 96–106. <https://doi.org/10.1016/j.copsyc.2016.05.010>
- Reis, H. T., Clark, M. S., & Holmes, J. G. (2004). Perceived Partner Responsiveness as an Organizing Construct in the Study of Intimacy and Closeness. In D. J. Mashek & A. P. Aron (Eds.), *Handbook of closeness and intimacy* (pp. 201–225). Lawrence Erlbaum Associates Publishers.
- Robles, T. F., Slatcher, R. B., Trombello, J. M., & McGinn, M. M. (2014). Marital quality and health: A meta-analytic review. *Psychological Bulletin*, 140(1), 140–187.
<https://doi.org/10.1037/a0031859>
- Salinger, J. M., Whisman, M. A., Randall, A. K., & Hilpert, P. (2021). Associations Between Marital Discord and Depressive Symptoms: A Cross-Cultural Analysis. *Family Process*, 60(2), 493–506. <https://doi.org/10.1111/famp.12563>
- Sbarra, D. A. (2006). Predicting the onset of emotional recovery following nonmarital relationship dissolution: Survival analyses of sadness and anger. *Personality & Social Psychology Bulletin*, 32(3), 298–312. <https://doi.org/10.1177/0146167205280913>
- Schneider, N. F., Bujard, M., Wolf, C., Gummer, T., Hank, K., & Neyer, F. J. (2021). Family Research and Demographic Analysis (FReDA): Evolution, Framework, Objectives, and Design of “The German Family-Demographic Panel Study”. *Comparative Population Studies*, 46. <https://doi.org/10.12765/CPoS-2021-06>
- Şenkal Ertürk, İ., Akyüz, A. N., & Büyüksahin Sunal, A. (2025). Attachment Insecurities and Commitment: The Mediator Role of Relationship Uncertainty. *Psychological Reports*, 332941251351244. <https://doi.org/10.1177/00332941251351244>

- Slatcher, R. B., & Selcuk, E. (2017). A Social Psychological Perspective on the Links between Close Relationships and Health. *Current Directions in Psychological Science*, 26(1), 16–21.
<https://doi.org/10.1177/0963721416667444>
- Smith, M. D., & Wesselbaum, D. (2025). Global evidence on the prevalence of and risk factors associated with stress. *Journal of Affective Disorders*, 374, 179–183.
<https://doi.org/10.1016/j.jad.2025.01.053>
- Stauder, J., Rapp, I., & Klein, T. (2019). Couple relationships and health: The role of the individual's and the partner's education. *Journal of Family Research*, 31(2), 138–154.
<https://doi.org/10.3224/zff.v31i2.02>
- Stoffel, M., Neubauer, A. B., & Ditzen, B. (2021). How to assess and interpret everyday life salivary cortisol measures: A tutorial on practical and statistical considerations. *Psychoneuroendocrinology*, 133, 105391. <https://doi.org/10.1016/j.psyneuen.2021.105391>
- Taylor, S. E. (2006). Tend and Befriend: Biobehavioral Bases of Affiliation Under Stress. *Current Directions in Psychological Science*, 15(6), 273–277.
- Topp, C. W., Østergaard, S. D., Søndergaard, S., & Bech, P. (2015). The WHO-5 Well-Being Index: A Systematic Review of the Literature. *Psychotherapy and Psychosomatics*, 84(3), 167–176.
<https://doi.org/10.1159/000376585>
- van Eldik, W. M., Haan, A. D. de, Parry, L. Q., Davies, P. T., Luijk, M. P. C. M., Arends, L. R., & Prinzie, P. (2020). The interparental relationship: Meta-analytic associations with children's maladjustment and responses to interparental conflict. *Psychological Bulletin*, 146(7), 553–594. <https://doi.org/10.1037/bul0000233>
- Whisman, M. A. (2013). Relationship discord and the prevalence, incidence, and treatment of psychopathology. *Journal of Social and Personal Relationships*, 30(2), 163–170.
<https://doi.org/10.1177/0265407512455269>
- WHO. (2022). *World Mental Health Report: Transforming Mental Health for All* (1st ed.). World Health Organization.
<https://ebookcentral.proquest.com/lib/kxp/detail.action?docID=30480025>

- 797 WHO. (2025). *Over a billion people living with mental health conditions: services require urgent*
 798 *scale-up*. [https://www.who.int/news/item/02-09-2025-over-a-billion-people-living-with-](https://www.who.int/news/item/02-09-2025-over-a-billion-people-living-with-mental-health-conditions-services-require-urgent-scale-up?)
 799 [mental-health-conditions-services-require-urgent-scale-up?](https://www.who.int/news/item/02-09-2025-over-a-billion-people-living-with-mental-health-conditions-services-require-urgent-scale-up?)
- 800 Woerner, W [Wolfgang], Becker, A., & Rothenberger, A [Aribert] (2004). Normative data and scale
 801 properties of the German parent SDQ. *European Child & Adolescent Psychiatry*, 13 Suppl 2,
 802 II3-10. <https://doi.org/10.1007/s00787-004-2002-6>
- 803 Zhang, X., Li, J., Xie, F., Chen, X., Xu, W., & Hudson, N. W. (2022). The relationship between adult
 804 attachment and mental health: A meta-analysis. *Journal of Personality and Social*
 805 *Psychology*, 123(5), 1089–1137. <https://doi.org/10.1037/pspp0000437>
- 806

Supplementary

Table S1

Exemplary psychobiological EMA sampling schedule according to time of awakening

T1	T2	T3	T4	T5	T6
awakening	after 30 min	after 45 min	after 150 min	after 360 min	after 750 min
06:00	06:30	06:45	08:30	12:00	18:30
06:30	07:00	07:15	09:00	12:30	19:00
07:00	07:30	07:45	09:30	13:00	19:30
07:30	08:00	08:15	10:00	13:30	20:00
08:00	08:30	08:45	10:30	14:00	20:30
08:30	09:00	09:15	11:00	14:30	21:00
09:00	09:30	09:45	11:30	15:00	21:30
09:30	10:00	10:15	12:00	15:30	22:00
10:00	10:30	10:45	12:30	16:00	22:30
10:30	11:00	11:15	13:00	16:30	23:00
11:00	11:30	11:45	13:30	17:00	23:30
11:30	12:00	12:15	14:00	17:30	00:00
12:00	12:30	12:45	14:30	18:00	00:30
12:30	13:00	13:15	15:00	18:30	01:00