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Mental health and behavioural problems in children and adolescents in Germany

A public health perspective based on evidence from large epidemiological studies

Dissertation

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“There is no health without mental health.”

David Satcher (1999)

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I Included publications

The following seven publications are included in the cumulative thesis. They represent four topics related to mental health and behavioural problems in children and adolescents and are listed below in the order of their inclusion in the thesis.

Mental health and mental health problems in children and adolescents

1. **Kaman, A.**, Ottová-Jordan, V., Bilz, L., Sudeck, G., Moor, I., & Ravens-Sieberer, U. (2020). Subjektive Gesundheit und Wohlbefinden von Kindern und Jugendlichen in Deutschland – Querschnittergebnisse der HBSC-Studie 2017/18. *Journal of Health Monitoring,* 5(3), 7-21. doi: 10.25646/6891

2. Otto, C., Reiss, F., Voss, C., **Wüstner, A.**, Meyrose, A.-K., Hölling, H., & Ravens-Sieberer, U. (2020). Mental health and well-being from childhood to adulthood: Design, methods and results of the 11-year follow-up of the BELLA study. *European Child & Adolescent Psychiatry.* doi: 10.1007/s00787-020-01630-4

Assessment of behavioural problems in children and adolescents

3. **Kaman, A.**, Otto, C., Devine, J., Döpfner, M., Banaschewski, T., Görtz-Dorten, A., ... Ravens-Sieberer, U. (under review). Assessing anger and irritability in children: Translation, psychometric evaluation and normative data for the German version of the PROMIS® Parent Proxy Anger Scale. *Quality of Life Research*

4. Otto, C.*, **Kaman, A.***, Barkmann, C., Döpfner, M., Görtz-Dorten, A., Ginsberg, C., ... Ravens-Sieberer, U. (under review). The DADYS-Screen – Development and evaluation of a screening tool for affective dysregulation in children. *Assessment*. *shared first authorship

Risk and resource factors for behavioural problems in children and adolescents

5. **Wüstner, A.**, Otto, C., Schlack, R., Hölling, H., Klasen, F., & Ravens-Sieberer, U. (2019). Risk and protective factors for the development of ADHD symptoms in children and adolescents: Results of the longitudinal BELLA study. *PLoS One,* 14(3), e0214412. doi: 10.1371/journal.pone.0214412

6. Ravens-Sieberer, U.*, **Kaman, A.***, Erhart, M., Devine, J., Schlack, R., & Otto, C. (2021). Impact of the COVID-19 pandemic on quality of life and mental health in children and adolescents in Germany. *European Child & Adolescent Psychiatry.* doi: 10.1007/s00787-021-01726-5 *shared first authorship

7. Ravens-Sieberer, U.*, **Kaman, A.***, Otto, C., Adedeji, A., Napp, A.-K., Becker, M., ... Hurrelmann, K. (in press). Seelische Gesundheit und psychische Belastungen von Kindern und Jugendlichen in der ersten Welle der COVID-19-Pandemie – Ergebnisse der COPSY-Studie. *Bundesgesundheitsblatt – Gesundheitsforschung – Gesundheitsschutz.* doi: 10.1007/s00103-021-03291-3 *shared first authorship

II Synopsis

The present thesis is the result of my research on child and adolescent mental health that I have conducted in the research section *Child Public Health* at the University Medical Center Hamburg-Eppendorf over the past three years. Mental health problems in children and adolescents are the leading cause of health-related disabilities worldwide. The promotion of mental health and the prevention, treatment and care of mental disorders in children and adolescents represent a public health priority – especially in times of crisis such as the COVID-19 pandemic. It is of particular concern for me to discover how children and adolescents with mental health problems can be identified and supported at an early stage. Therefore, this thesis focuses on the epidemiology of child and adolescent mental health and mental health problems. Based on evidence from four large epidemiological studies, recommendations for health promotion, prevention and clinical practice are presented.

The thesis has the following structure: **Chapter 1** introduces the topic of child and adolescent mental health and its relevance in order to derive the objectives of this thesis. **Chapter 2** presents the theoretical and scientific background of this thesis. The concepts of mental health and mental health problems are outlined, and findings from previous research on the assessment of mental health problems and associated risk and resource factors are presented, with a focus on behavioural problems. The chapter concludes by highlighting the public health relevance of mental health and behavioural problems. **Chapter 3** states the aims and research questions of the thesis, and **Chapter 4** describes the applied methods used to investigate the research questions. **Chapter 5** summarises the findings of the seven publications included in this thesis. Publications 1 and 2 focus on mental health and mental health problems in children and adolescents. Following this, publications 3 and 4 address the assessment of behavioural problems in children and adolescents. Subsequently, publication 5 explores risk and resource factors for behavioural problems. Finally, publications 6 and 7 examine the challenge of the COVID-19 pandemic for mental health and behavioural problems in children and adolescents. The results are discussed in light of the theoretical and scientific background in **Chapter 6**. In addition, the methodological strengths and limitations are highlighted, and implications for prevention, clinical practice, policy and further research are presented.

1. Introduction

The promotion of mental health and the prevention of mental health problems have been identified as main objectives by the World Health Organization (WHO) (2013) in the Comprehensive Mental Health Action Plan 2013-2020 and by the United Nations (UN) (2015) in the 2030 Agenda for Sustainable Development. To advance mental health policies and to ensure universal mental health coverage, the WHO also implemented the Special Initiative for Mental Health 2019-2023, following the vision that “all people achieve the highest standard of mental health and well-being” (World Health Organization, 2019c, p. 1).

The foundation for a healthy development and good mental health in adulthood is laid in childhood and adolescence. Childhood and adolescence are critical phases of life, as they are characterised by a series of physical, cognitive, social and emotional developmental challenges. These include biological changes, identity development, social role transitions, the formation of peer relationships and the attainment of independence from parents (Arnett, 2016; Sawyer et al., 2012). Coping with these challenges can be difficult for children and adolescents and can thus negatively affect their mental health and well-being.

Mental health problems often have their first onset in childhood and adolescence, are highly recurrent and frequently persist into adulthood (Belfer, 2008; Kessler et al., 2011; Kessler et al., 2005; Patton et al., 2014). The high prevalence of child and adolescent mental health problems is regarded as one of the global health challenges of the 21st century (Patel et al., 2018; World Health Organization, 2018). Behavioural problems such as hyperactivity and affective dysregulation are amongst the most common and challenging symptoms in child and adolescent psychiatry. They cause significant impairments in overall functioning and create a high burden for individuals and their families (Booster et al., 2012; Caci et al., 2014). Moreover, behavioural problems are a common cause of health services utilisation and are associated with high direct and indirect economic costs (Belfer, 2008; Patel et al., 2007).

The relevance of mental health for public health has also become evident in the context of the current coronavirus disease 2019 (COVID-19) pandemic, which has been identified as public health research priority (Holmes et al., 2020). Against this background, the assessment and early identification of children and adolescents with mental health problems and the identification of associated risk and resource factors constitute important research aims, as they form the basis for effective prevention and intervention programmes (Catalano et al., 2012). Although great progress has been made in mental health research in recent years, there is still a lack of longitudinal studies on mental health and associated factors as well as on the assessment of behavioural problems in children and adolescents.

Thus, the present thesis aims to expand knowledge on the epidemiology of mental health and mental health problems in children and adolescents from a public health perspective. Based on cross-sectional and longitudinal data from large epidemiological studies, implications for health promotion, early prevention and clinical practice are derived. First, age- and gender-specific prevalences of mental health and well-being in children and adolescents are examined **(publication 1)**. Based on longitudinal data, trajectories of mental health and well-being from childhood to adulthood and long-term outcomes of mental health problems in childhood and adolescence are investigated **(publication 2)**. Following this, it is examined how behavioural problems in children can be reliably and validly assessed **(publications 3 and 4)** and how risk and resource factors are associated with behavioural problems in children and adolescents over time **(publication 5)**. Finally, the impact of the COVID-19 pandemic on mental health and behavioural problems in children and adolescents is explored **(publications 6 and 7)**.

2. Theoretical background

The following chapter presents the theoretical and scientific background of the thesis. It introduces the concepts and epidemiology of mental health and mental health problems in children and adolescents, followed by an introduction to the assessment of behavioural problems and the theoretical approach to risk and resource factors. The current state of research is presented, and the public health relevance of child and adolescent mental health and behavioural problems is highlighted.

2.1 Mental health and mental health problems in children and adolescents

Mental health is defined as a “state of well-being whereby individuals recognize their abilities, are able to cope with the normal stresses of life, work productively and fruitfully, and make a contribution to their communities” (World Health Organization, 2003, p. 7). The importance of well-being for health has already been emphasised in the WHO’s definition of health (World Health Organization, 1948). This holistic understanding is based on a paradigm shift in medicine, according to which the success of a treatment is no longer solely evaluated on the basis of somatic and medical indicators but also according to subjective indicators of health (Sullivan, 2003). The assessment of subjective well-being has become increasingly important in medicine and health care in recent decades. In this context, the construct of health-related quality of life (HRQoL) is increasingly recognised as a relevant topic and an important outcome of medical treatments, health care services, clinical and health economic studies, epidemiological research and public health (e.g., Baumgarten et al., 2019; Cooper et al., 2020; Crane et al., 2018; Dey et al., 2012; Ravens-Sieberer et al., 2012). HRQoL is defined as a subjective and multidimensional construct that comprises physiological, psychological and social aspects of well-being and functioning (Bullinger, 2002; Ravens-Sieberer, Erhart, et al., 2006; Ravens-Sieberer et al., 2014).

Findings of epidemiological studies showed that most children and adolescents have high levels of well-being and good mental health (Baumgarten et al., 2019; Cosma et al., 2020; Ravens-Sieberer et al., 2012; UNICEF Innocenti, 2020). Impairments in mental health, often characterised by a combination of troubled thoughts, feelings and behaviours, can lead to mental disorders (World Health Organization, 2019b). Mental disorders often have their first onset in childhood and adolescence. More than 50 % of all lifetime mental disorders begin before the age of 14 and approximately 75 % before the age of 24 (Kessler et al., 2005). Longitudinal studies have highlighted the fact that mental health problems in childhood and adolescence are highly recurrent and frequently persist into adulthood (Belfer, 2008; Kessler et al., 2011; Patton et al., 2014; Ravens-Sieberer et al., 2015). According to a meta-analysis of the global prevalence of mental disorders, 13.4 % of children and adolescents worldwide are affected by a mental disorder (Polanczyk et al., 2015). Amongst German children and adolescents, the results from a meta-analysis of 33 studies indicated that the overall prevalence of emotional and behavioural disorders is 17.6 % (Barkmann et al., 2012).

Mental health problems are usually divided into internalising and externalising disorders (Angold et al., 1999). Internalising disorders are characterised by internally focused symptoms and include depressive and anxiety disorders. In contrast, externalising disorders are characterised by externally focused behaviours and include attention-deficit/hyperactivity disorder (ADHD) and conduct disorders (Achenbach et al., 2016). Based on representative population-based data from the German BELLA study, clinically relevant symptoms of depression were found in 11.2 %, anxiety in 10.6 %, ADHD in 5.7 % and conduct disorders in 12.2 % of children and adolescents aged 7 to 19 years (Klasen et al., 2016). There is also evidence of comorbidities between internalising and externalising disorders (Cosgrove et al., 2011), which indicates that there are transdiagnostic symptoms that account for these associations (Fusar-Poli et al., 2019; Krueger et al., 2015). For example, affective dysregulation (AD), characterised by persistent irritability and severe temper outbursts, is associated with several internalising (e.g., depression) and externalising disorders (e.g., ADHD) in children and adolescents. Thus, AD can be conceptualised as transdiagnostic dimension that cuts across multiple diagnoses (Copeland et al., 2013; Waltereit et al., 2019).

The present thesis focuses on behavioural problems in children and adolescents, including externalising mental health problems and transdiagnostic symptoms such as disruptive behaviours and irritability, as they are amongst the most prevalent, burdensome and challenging symptoms in child and adolescent psychiatry.

2.2 Assessment of behavioural problems in children and adolescents

The early identification of behavioural problems in children and adolescents is critical, as behavioural problems are highly prevalent, cause significant impairments in overall functioning and are related to several adverse consequences and poor health outcomes in later adulthood. The valid and reliable assessment and early detection of affected children and children who are at risk of developing behavioural problems form the basis of effective early prevention and intervention strategies.

In recent years, great advances have been made in the assessment of mental health and behavioural problems in children and adolescents. In epidemiological studies, behavioural problems are usually assessed using screening instruments or rating scales. These scales often allow for a dimensional assessment that results in metric symptom scores. Widely used screening instruments include the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997), the Conners Rating Scale (Conners, 2008) and the Child Behavior Checklist (CBCL; Achenbach, 1991). These instruments include both empirically and rationally derived behavioural descriptions and demonstrate good reliability and validity. Moreover, the Patient-Reported Outcomes Measurement Information System (PROMIS®) by the National Institute of Health (NIH) has developed a broad range of patient-reported outcome (PRO) measures using recent advances in psychometrics and information technology (Cella et al., 2010; Cella et al., 2007). Item banks on emotional distress, such as anger and irritability, enable the assessment of PROs via tailored short forms and computer adaptive tests (CATs) by applying item response theory models (Irwin et al., 2012; Pilkonis et al., 2011).

Overall, screening instruments assess symptoms and impairments due to behavioural problems, but they do not examine clinical diagnoses. This would require clinical evaluations such as diagnostic interviews, which take time and resources and are therefore often not feasible in research studies. Established structured and semi-structured diagnostic interviews include the Child and Adolescent Psychiatric Assessment (Angold et al., 1995), the Diagnostic Interview for Mental Disorders (Schneider et al., 2009) and the Diagnostic System for Mental Disorders in Childhood and Adolescence (Döpfner et al., 2017). These clinical interviews are based on the diagnostic criteria of the International Classification of Diseases (ICD-11, World Health Organization, 2019a) and the Diagnostic and Statistical Manual of Mental Disorders (DSM-5, American Psychiatric Association, 2013).

In contrast to the categorical understanding of mental disorders, the NIH introduced the Research Domain Criteria (RDoC) initiative, a novel transdiagnostic approach for understanding and classifying mental disorders through the integration of various scientific disciplines (e.g., neurobiology, genetics and psychology; Insel et al., 2010).

Since research has shown that evaluating symptoms and dimensions may better reflect the complexity and nature of the underlying mental disorder, the RDoC framework focuses on symptoms rather than categorical diagnoses (Carcone et al., 2017; Insel, 2014). Transdiagnostic symptoms such as AD fit well within the RDoC framework (Meyers et al., 2017). In recent years, there has been a controversial debate concerning the diagnostic classification of children who exhibit AD in the form of persistent irritability and severe temper outbursts (Grimmer et al., 2010; Parens et al., 2010). Knowledge regarding the appropriate assessment of transdiagnostic symptoms such as AD remains limited, and validated assessment instruments are rare. Thus, the development of instruments for the transdiagnostic assessment of behavioural problems to guide diagnosis and treatment should be the focus of future research.

2.3 Risk and resource factors for behavioural problems

In addition to the early identification of behavioural problems in children and adolescents, it is crucial to consider potential risk and resource factors for behavioural problems, particularly with regard to the planning and implementation of prevention and intervention programmes. The development and course of behavioural problems in children and adolescents are influenced by various factors, circumstances and contexts, and it is essential to understand the role of these influencing factors.

In mental health research, the concept of risk and resource factors has received increased attention over recent years (e.g., Bayer et al., 2011; Fazel et al., 2012; Hayward et al., 2013; Hölling et al., 2008). The importance of research on risk and resource factors for mental health problems has also been emphasised in the WHO Mental Health Action Plan as the basis for developing and implementing mental health promotion and prevention strategies (World Health Organization, 2013). Risk factors – also referred to as ‘stressors’ or ‘impairment’ – can increase the likelihood of adverse mental health outcomes (Kazdin et al., 1997). Risk factors usually do not occur in isolation but tend to co-exist and interact. This so-called ‘risk accumulation’ leads to an increased risk of a subsequent mental disorder (Schmidt et al., 2007; Schultze-Lutter et al., 2016).

Whilst the investigation of risk factors has a long tradition in epidemiological and clinical research, there is a growing consensus that resources are also extremely relevant to mental health. Resource factors – also referred to as ‘assets’ or ‘promotive factors’ –

support a positive development and increase the likelihood of a positive mental health outcome (Masten et al., 2009). Furthermore, factors that strengthen children's mental health and support them to stay healthy when they are confronted with risks are defined as protective or resilience factors (Fergus et al., 2005; Wille et al., 2010). The salutogenic approach and resilience research form the theoretical framework for this consideration. The *concept of salutogenesis* describes a resource-oriented and preventive approach that focuses on factors that maintain and improve health rather than on pathogenic factors (Antonovsky, 1997). The *concept of resilience* focuses on protective factors in the face of adversity. Resilience is defined as positive functional adaptation to significant adversity or risk, resulting in positive development and long-term health outcomes (Masten et al., 1990; Rutter, 1987).

Risk and resource factors are commonly divided into personal, familial and social factors (Masten et al., 2009; Wille et al., 2008). Research has indicated that risk and resource factors can interact in various ways (Kraemer, 2001). Garmezy et al. (1984) differentiated between three models of interaction: the *challenge model*, the *compensatory model* and the *protective model*. In line with the concepts of salutogenesis and resilience, the protective model assumes that a resource factor acts as moderator and mitigates the adverse effects of a risk factor on an outcome (see Figure 1). Thus, depending on the availability of resources, exposure to a risk factor can lead to either mental health problems or resilience (Noeker et al., 2008).

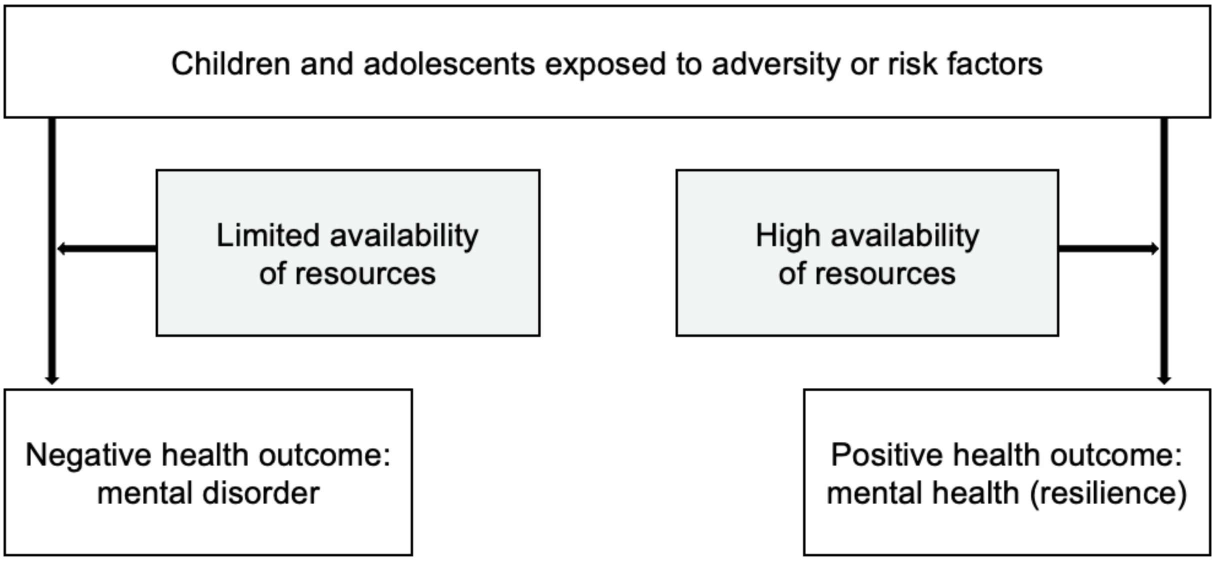

Figure 1. Interaction between risk and resource factors in the context of mental health (own illustration based on Noeker et al., 2008)

Evidence suggests that the development of behavioural problems in children and adolescents is influenced by various demographic, individual, familial and social risk and resource factors. In the following, the current state of research on these factors is presented. The present thesis focuses on psychosocial factors, as these can be influenced by health promotion, prevention and intervention programmes (Ungar, 2015). Nevertheless, the aetiology of behavioural problems is a multifactorial process that also involves genetic and biological vulnerabilities (Azeredo et al., 2018; Biederman et al., 2005; Hohmann et al., 2015; Mana et al., 2010).

In terms of risk factors, several studies have identified parental psychopathology as a well-established risk factor for behavioural problems such as ADHD symptoms (Freitag et al., 2012; Galera et al., 2011; Wolford et al., 2017) and conduct disorders (Farrington, 2005; Monahan et al., 2014). Other studies have suggested that family conflicts (Cotter et al., 2017; Deault, 2010; Monahan et al., 2014), unhealthy family functioning (Piotrowska et al., 2019) and adverse parenting conditions characterised by inconsistent discipline, poor supervision or a lack of warmth towards the child (Freitag et al., 2012; Houltberg et al., 2016) may be associated with behavioural problems in children and adolescents. Moreover, some studies have demonstrated that low socioeconomic status (SES) can predispose children and adolescents to behavioural problems (Arroyo-Borrell et al., 2017; Piotrowska et al., 2019; Russell et al., 2015; Sagiv et al., 2013; Teymoori et al., 2018).

Regarding resource factors, research has revealed positive effects of personal resources such as self-efficacy (Singer et al., 2016) and a high sense of coherence (Edbom et al., 2010) on symptoms of ADHD in children and adolescents. Furthermore, familial resources such as a positive family climate (Duh-Leong et al., 2020; Hölling et al., 2008; Schei et al., 2015), parental warmth (Beckmann et al., 2017) and positive parenting behaviours characterised by support and involvement (Dvorsky et al., 2016; Houltberg et al., 2016; Perra et al., 2020) have a positive impact on children's behaviour. With respect to social resources, studies have identified positive effects of social support (Duh-Leong et al., 2020; Hölling et al., 2008; Schei et al., 2015), teacher support (Cotter et al., 2017) and social skills (Monahan et al., 2014) on behavioural problems such as ADHD symptoms, aggression or conduct problems.

Overall, previous studies have mainly investigated the direct effects of risk and resource factors on behavioural problems based on cross-sectional data. There is still a lack of longitudinal population-based studies on psychosocial risk and resource factors for the development of behavioural problems in children and adolescents over time. Furthermore, studies investigating possible interaction effects between risk and resource factors are needed. Such research is important for the development of evidence-based health promotion, prevention and early intervention strategies.

2.4 Public health relevance

The high prevalence of mental and behavioural disorders in children and adolescents is increasingly recognised as a worldwide public health concern (Patel et al., 2018; World Health Organization, 2018). Data from the Global Burden of Disease Study 2010 indicate that mental disorders are the leading cause of health-related disabilities in children and adolescents aged 0 to 24 worldwide, being responsible for a quarter of all years lived with disability (YLDs). Furthermore, mental disorders are the sixth leading cause of disability-adjusted life years (DALYs) in children and adolescents and are responsible for 5.7 % of the total disease burden worldwide (Erskine et al., 2015). Moreover, childhood behavioural disorders (including ADHD and conduct disorders) significantly contribute to the overall global burden (Erskine et al., 2014).

Mental and behavioural disorders cause significant impairments in various life domains and are related to adverse consequences and health outcomes in young adulthood (Patel et al., 2007). Externalising behaviour problems such as ADHD are amongst the most common and challenging symptoms in child and adolescent psychiatry and have a negative impact on social functioning and peer relationships (Booster et al., 2012; McQuade et al., 2008), family life (Caci et al., 2014) and overall quality of life (Mulraney et al., 2017). Moreover, behavioural problems predict later psychiatric problems such as persistent hyperactivity and attention problems (Turgay et al., 2012), substance abuse (Moore et al., 2017), depression (Stringaris et al., 2009) and suicidal ideation (Benarous et al., 2019). Children and adolescents with behavioural problems also experience notable impairments in their academic and educational achievements, resulting in decreased educational attainment and work performance (Daley et al., 2010; Zendarski et al., 2017) and high rates of unemployment in adulthood (Colman et al., 2009; Knapp et al., 2011).

Mental and behavioural disorders are not only a significant burden for affected individuals and their families, but they also impose a high economic burden. The loss of economic productivity and the frequent utilisation of health services result in high direct and indirect economic costs (Belfer, 2008). In 2010, the total cost of mental disorders in Europe was € 798 billion, of which € 21 billion was attributable to child and adolescent mental disorders (Olesen et al., 2012). The annual cost of child and adolescent ADHD in Europe was approximately € 1 billion to € 1.5 billion, with healthcare costs accounting for only a small proportion of the total cost. The majority of total ADHD-related costs was attributable to education-related expenses, followed by healthcare costs and productivity losses to family members (Le et al., 2014). This finding underlines the multi-faceted impairments of behavioural problems.

The enormous relevance of mental health to public health has also been highlighted in the context of the recent COVID-19 pandemic. The COVID-19 pandemic has led to unprecedented changes in the daily lives of children and adolescents, who must cope with social distancing rules, home confinement and school closures. Paediatric experts around the world have warned that the challenges associated with COVID-19 will have an enormous impact on the mental health of children and adolescents (e.g., Fegert et al., 2020; Fore, 2020; Golberstein et al., 2020; Liu et al., 2020). In fact, there is growing empirical evidence of increased mental health problems and psychological distress in children and adolescents during the COVID-19 pandemic (Jiao et al., 2020; Patrick et al., 2020; Xie et al., 2020; Yeasmin et al., 2020). Determining the acute and long-term mental health consequences of the pandemic and identifying vulnerable groups have been defined as public health research priorities (Holmes et al., 2020; Hotopf et al., 2020).

Overall, mental and behavioural health problems in childhood and adolescence impose an enormous burden on individuals, their families and society, which highlights their high relevance for public health. Thus, the promotion of mental health and the prevention, treatment and care of mental health problems in children and adolescents represent a public health priority – especially in crises such as the COVID-19 pandemic. In this context, the WHO has emphasised the importance of strengthening information, research and evidence for mental health (World Health Organization, 2013).

3. Aims and research questions

The literature review showed that mental health problems in children and adolescents are highly prevalent and burdensome, highlighting their critical relevance for public health. The current state of research indicates that there is a lack of longitudinal population-based studies on mental health and associated factors, as well as validated instruments for assessing behavioural problems and transdiagnostic symptoms in children and adolescents. The aim of the present thesis is to advance knowledge on the epidemiology of mental health and mental health problems in children and adolescents in Germany in order to derive implications for health promotion, prevention and clinical practice.

Based on data from four large epidemiological studies, the present thesis examines prevalences and trajectories of mental health, long-term outcomes of mental health problems, the assessment of behavioural problems in children and adolescents, risk and resource factors associated with behavioural problems and the mental health impact of the COVID-19 pandemic.

The thesis aims to address the following main research questions:

1. What are the age- and gender-specific prevalences and trajectories of mental health and well-being from childhood via adolescence to young adulthood?
2. What are the long-term effects of mental health problems in childhood and adolescence on health- and mental health-related outcomes in young adulthood?
3. How can behavioural problems in children and adolescents be reliably and validly assessed?
4. Which risk and resource factors are associated with behavioural problems in children and adolescents over time?
5. How has the COVID-19 pandemic affected mental health and behavioural problems in children and adolescents?

The specific research questions of the seven publications included in this thesis are detailed in Chapter 5.

4. Methods

The current chapter describes the methods used to examine the research questions. It presents the studies and their samples, followed by a description of the measured constructs and instruments used. Subsequently, the statistical data analyses conducted in the included publications are described.

4.1 Studies and samples

The present thesis is based on four large epidemiological studies that investigated mental health and mental health problems in children and adolescents in Germany. First, the international **HBSC study** is presented, which gives a general overview of mental health and well-being in children and adolescents (publication 1). Second, the **BELLA study** is described, which provides longitudinal data on mental health and mental health problems from childhood to young adulthood (publications 2 and 5). The third study presented is the interdisciplinary **ADOPT study**, which focuses on the assessment of behavioural problems in children (publications 3 and 4). Lastly, the **COPSY study** is described, which examines the impact of the COVID-19 pandemic on child and adolescent mental health (publications 6 and 7).

HBSC study

Health **B**ehaviour in **S**chool-aged **C**hildren (HBSC) is a collaborative cross-national study carried out in collaboration with the WHO in 51 countries across Europe and North America. The international HBSC study aims to collect comprehensive data on the health and health behaviour of children and adolescents and on the social contexts for growing up healthy. As the largest international study on child and adolescent health, HBSC is a fundamental source for international health monitoring. Data have been collected every four years since 1982, and findings have been used to inform policy and practice (Inchley et al., 2020; Inchley et al., 2016). Germany has participated in the HBSC study since 1993. In the most recent survey cycle 2017/18, a total of n = 4,347 children and adolescents aged 11, 13 and 15 were interviewed. Data were collected in the fifth, seventh and ninth grades at a total of 146 schools in Germany. A weighting factor was used to correct for deviations from the population structure within the sample with regard to age, gender and school type. Self-reported data were collected in class using an internationally standardised core questionnaire. Written informed consent was provided by adolescents and their parents. The HBSC study was approved by the ethics committee of the General Medical Council Hamburg and the data protection officer at the Martin Luther University Halle-Wittenberg. The author of this thesis was significantly involved in all phases of the study, including data collection, analysis and publication. A detailed description of the design and methods of the HBSC study can be found elsewhere (Moor et al., 2020).

BELLA study

The longitudinal **Be**haviour and We**l**lbeing of Chi**l**dren and **A**dolescents (BELLA) study is the module on mental health within the German National Health Interview and Examination Survey for Children and Adolescents (KiGGS) of the Robert Koch Institute (Kurth et al., 2008; Lange et al., 2018). The BELLA study collects data on mental health, HRQoL, mental health problems and risk and resource factors amongst German children, adolescents and young adults. Both KiGGS and BELLA have been conducted since 2003 and collect representative cross-sectional and longitudinal data. The KiGGS baseline sample comprised *n* = 17,641 children and adolescents aged 0 to 17. A randomly drawn subsample from KiGGS was included in the BELLA baseline assessment (*n* = 2,863 children and adolescents aged 7 to 17). The BELLA sample was followed up at four measurement points: the one-year (2004 to 2007), two-year (2005 to 2008), six-year (2009 to 2012) and eleven-year (2014 to 2017) follow-ups. In the present thesis, self- and parent-reported data from the first three measurement points of the BELLA study (baseline, one-year and two-year follow-ups), which cover a period of two years, were analysed. Telephone interviews and questionnaires were used to collect data. Parents and adolescents who were at least 14 years old provided written informed consent at each measurement point. The BELLA study has received approval from the Federal Commissioner for Data Protection in Germany and the ethics committee of the University Hospital Charité in Berlin. The author of this thesis was involved in data analysis and interpretation and has contributed to several publications as first author or co-author (Kaman et al., 2021; Meyrose et al., 2019; Otto et al., 2020; Wüstner et al., 2019). Detailed information on the design and methods of the BELLA study has been published (Klasen et al., 2017; Ravens-Sieberer et al., 2015).

ADOPT study

The interdisciplinary research consortium **A**ffective **D**ysregulation in Childhood – **O**ptimizing **P**revention and **T**reatment (ADOPT) aims to investigate the epidemiology of AD in children, develop and evaluate assessment tools for AD and evaluate treatment approaches for children with AD and their parents. The ADOPT study includes five complementary sub-projects. For the present thesis, data from the sub-project ADOPT Epidemiology were used. In this sub-project, a screening instrument for AD was developed and evaluated based on data from a large population-based sample. Data were collected in four German cities (Cologne, Dresden, Mannheim and Ulm) from February 2018 to August 2019. Families with 8- to 12-year-old children (*n* = 79,015) were randomly selected from the official registers of residential registration offices. Participants were informed of the study and provided written informed consent. As an alternative to the paper-and-pencil questionnaire, parents had the option to answer the screening questionnaire online or over the phone. Overall, *n* = 9,759 parents participated in the study. The study ADOPT Epidemiology was approved by the ethics committee of the General Medical Council Hamburg and the commissioner for data protection from the University Hospital Cologne. The author of this thesis worked as a research associate in this study since 2017 and is responsible for coordination, project management, data collection and analysis. For more information about the design and methods of the research consortium ADOPT, see Döpfner et al. (2019).

COPSY study

The nationwide, population-based Impact of **CO**VID-19 on **Psy**chological Health (COPSY) study aims to investigate mental health, HRQoL and mental health problems amongst children and adolescents in Germany during the COVID-19 pandemic. In addition, the study aims to identify risk groups of children and adolescents who are particularly impaired by the COVID-19 pandemic and resource factors that promote the mental health of children and adolescents during the crisis. The study was conducted between May and June 2020. In total, *n* = 1,586 parents of 7- to 17-year-old children and adolescents and *n* = 1,040 children and adolescents aged 11 to 17 participated in the study and completed the online survey. The COPSY study is based on the design and methodology of the longitudinal BELLA study, which enables a comparison of child and adolescent mental health with pre-pandemic data. The COPSY study was approved by the Local Psychological Ethics Committee of the Center for Psychosocial Medicine of the University Medical Center Hamburg-Eppendorf and the commissioner for data protection of the University of Hamburg. The author of this thesis was significantly involved in all phases of the study, including planning and conception, data collection, analysis and publication. A detailed description of the design and methods of the COPSY study can be found elsewhere (Ravens-Sieberer et al., 2021; Ravens-Sieberer et al., 2020).

4.2 Measures

Standardised and established instruments were used in the four studies to assess child and adolescent mental health, mental health problems and psychosocial risk and resource factors. Measures from the seven publications included in this thesis are described in the following section.

Mental health and well-being

S*elf-rated health* (SRH) was assessed in the HBSC study using the single item ‘Would you say your health is…?’. The children and adolescents answered this question on a four-point scale ranging from 1 (‘excellent’) to 4 (‘poor’). The variable was dichotomised into ‘excellent/good health’ (reflecting the answers ‘excellent’ and ‘good’) and ‘rather poor health’ (reflecting the answers ‘fair’ and ‘poor’). The SRH item captures an overall conception of health and is a well-established measure that has been proven to work well in epidemiological studies (Cavallo et al., 2015; Inchley et al., 2016). Furthermore, *life satisfaction* was measured in the HBSC study using the Cantril Ladder (Cantril, 1965). The children and adolescents were provided with an eleven-point visual analogue scale ranging from 0 (‘worst possible life’) to 10 (‘best possible life’) to indicate their current life satisfaction. Participants were categorised according to ‘low life satisfaction’ (0 to 5) and ‘medium to high life satisfaction’ (6 to 10). The item showed good reliability and convergent validity (Levin et al., 2014). In addition, *psychosomatic health complaints* were assessed based on the HBSC Symptom Checklist (HBSC-SCL; Haugland, Wold, et al., 2001). The children and adolescents were asked how often they suffered from headaches, stomach aches, backaches, irritability, feeling low, nervousness, dizziness and sleeping difficulties over the past six months. Items were presented using a five-point response scale (1 = ‘about every day’ to 5 = ‘rarely or never’). ‘Multiple psychosomatic health complaints’ were considered to be present if two or more of these symptoms occurred at least once per week. The HBSC-SCL has been described as a valid and reliable measure (Haugland & Wold, 2001). The three indicators of *self-rated health*, *life satisfaction* and *psychosomatic health complaints* were combined to form an overall index of *subjective well-being*. Subjective well-being was classified as ‘very good/good’ if the children and adolescents rated their health as excellent or good, reported medium to high life satisfaction and suffered from fewer than two psychosomatic health complaints per week.

In the BELLA study, self- and parent-reported *general health* was assessed with the General Health Item (GHI). The item (‘In general, how would you rate your/your child’s health?’) was rated on a five-point scale ranging from 1 (‘excellent’) to 5 (‘poor’). The well-established GHI is recommended by the WHO for its use in epidemiological research (de Bruin et al., 1996).

The SF-36 Health Survey was administered to measure self-reported *HRQoL* (Morfeld et al., 2011; Ware et al., 1992). The instrument covers different dimensions of HRQoL and enables the construction of two summary scales for mental and physical health. The items are presented with different response scales. The scale scores were standardised to a mean of 50, with scores above the mean representing better than average health. The SF-36 has been described as a reliable and valid instrument (Bullinger et al., 1995). The internal consistency for the sum scores was excellent in the analysed samples from the BELLA study (Cronbach’s α ranged from .90 to .94).

Moreover, the well-established and validated KIDSCREEN-10 Index was used to measure self- and parent-reported *HRQoL* in the BELLA and COPSY studies (Ravens-Sieberer & the European KIDSCREEN Group, 2006). The KIDSCREEN-10 Index covers physical, mental and social dimensions of HRQoL and provides a global HRQoL score. The 10 items (e.g., ‘Have you felt full of energy?’) were answered on five-point scales (0 = ‘not at all’ to 4 = ‘extremely’ or 0 = ‘never’ to 4 = ‘always’). T-values (*M* = 50, *SD* = 10) were calculated based on Rasch Person parameters for the European norm sample, with higher T-values reflecting better HRQoL. The internal consistency of the KIDSCREEN-10 Index was acceptable to good in the BELLA study (Cronbach’s α ranged from .78 to .82 for self-reported data and from .74 to .79 for parent-reported data) and good in the COPSY study (Cronbach’s α was .82 for self-reported data).

Mental and behavioural health problems

Mental health problems in children and adolescents were measured in the BELLA and COPSY studies by means of the internationally established Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). The 20 items of the SDQ assess four problem scales on emotional symptoms, hyperactivity, peer problems and conduct problems over the previous six months (e.g., ‘I worry a lot’). Responses were provided by children and adolescents as well as their parents according to a three-point response scale (0 = ‘not true’ to 2 = ‘certainly true’). The Total Difficulties Score of the SDQ was calculated based on all 20 items, with higher scores reflecting stronger mental health problems. According to published cut-offs, the sum scores were categorised into three groups. Eighty percent of the participants were classified as ‘normal’, 10 % as ‘borderline’ and 10 % as ‘noticeable/abnormal’ (Becker et al., 2018; Woerner et al., 2004). The SDQ is regarded as a well-established, reliable and valid screening instrument for assessing mental health problems (Goodman, 2001). The internal consistency of the SDQ was acceptable in the BELLA study (Cronbach’s α ranged from .73 to .75 for self-reported data and from .78 to .79 for parent-reported data) and good in the COPSY study (α = .84 for parent-reported data).

Symptoms of anger and irritability were assessed in the ADOPT study with the PROMIS Parent Proxy Anger Scale (Pilkonis et al., 2011). The scale comprises five parent-reported items on angry and irritable mood of the children and adolescents over the past seven days (e.g., ‘My child was so angry he/she felt like yelling at somebody’). Items were offered with a five-point scale (0 = ‘never’ to 4 = ‘almost always’) and higher scores reflected more severe anger symptoms. The sum score was calculated and translated into a standardised T-score (*M* = 50, *SD* = 10). The internal consistency of the PROMIS Anger Scale in the examined sample from the ADOPT study was good, with Cronbach’s α = .88.

Symptoms of ADHD in children and adolescents were examined in the BELLA study using the German version of the parent-reported Conners Global Index (C-GI; Conners, 2008; Lidzba et al., 2013; Otto et al., 2018). The subscale restless-impulsivity was used in the present analysis; it consists of seven items that focus on ADHD symptoms such as hyperactivity (‘restless or overactive’), inattention (‘inattentive, easily distracted’) and impulsivity (‘excitable, impulsive’). Items were rated on a four-point response scale ranging from 0 (‘not true at all’) to 3 (‘very much true’). A higher mean across the seven items indicates more severe ADHD symptoms. The internal consistency for the C-GI subscale restless-impulsivity in the investigated sample from the BELLA study was good (Cronbach’s α ranged from .77 to .82).

Aggressive and dissocial behaviours in children and adolescents were assessed in the BELLA study with the German version of the Child Behavior Checklist (CBCL;

Achenbach, 1991; Doepfner et al., 2011). The CBCL includes a 20-item subscale on aggressive behaviour (e.g., ‘Behavior of your child: Attacks others’) and a 13-item subscale on dissocial behaviour (e.g., ‘Behavior of your child: Steals at home’). Parents answered the items on a three-point scale ranging from 0 (‘not true’) to 2 (‘very true or often true’). The mean was calculated for the items in each subscale, with a higher mean indicating more pronounced aggressive and dissocial behaviour. The internal consistency of the CBCL subscales was acceptable to excellent in the BELLA study (Cronbach’s α ranged from .88 to .90 for the subscale on aggressive behaviour and from .69 to .75 for the subscale on dissocial behaviour).

Depressive symptoms in children and adolescents were examined by means of the German version of the Center for Epidemiologic Studies Depression Scale (CES-DC; Barkmann et al., 2008). The CES-DC comprises 20 self-reported items that assess emotional, behavioural and cognitive dimensions of depression (e.g., ‘I felt sad’). Items were offered with a four-point scale ranging from 0 (‘not at all’) to 3 (‘a lot’). A higher mean across the 20 items indicates more severe symptoms of depression. Good internal consistency was found for the CES-DC in the examined sample from the BELLA study (Cronbach’s α ranged from .83 to .88). In the COPSY study, seven items of the CES-DC were administered, and the internal consistency was also found to be good (Cronbach’s α = .84).

Symptoms of generalised anxiety were measured in the BELLA and COPSY studies with the German version of the Screen for Child Anxiety Related Disorders (SCARED; Birmaher et al., 1997; Mittenzwei, 2013). The subscale on generalised anxiety includes nine items (e.g., ‘I worry about what is going to happen in the future’). These were answered by the children and adolescents on a three-point scale (0 = ‘not true or hardly ever true’ to 2 = ‘very true or often true’). The mean across the SCARED items was calculated, with a higher mean indicating more pronounced symptoms of generalised anxiety. The internal consistency of the subscale was good in both the BELLA study (Cronbach’s α ranged from .81 to .85) and the COPSY study (α = .89).

Risk and resource factors

Parental mental health problems were assessed with the Symptom Checklist 9-item short version (SCL-S-9; Klaghofer et al., 2000). The SCL-S-9 is an abbreviated version of the Symptom Checklist-90-R (SCL-90-R; Derogatis, 1977). The SCL-S-9 examines the symptom severity of mental health problems over the past week, including depression, somatisation, interpersonal sensitivity, anxiety, phobic anxiety, hostility, obsessive-compulsive disorder, psychoticism and paranoid ideation. Parents answered the items on a five-point scale ranging from 0 (‘none at all’) to 4 (‘very severe’). A global severity index was calculated based on the mean score across all items, with higher values reflecting stronger mental health problems. The SCL-S-9 is considered to be an objective, reliable and valid instrument for assessing parental psychopathology (Klaghofer et al., 2000). Good internal consistency was found for the SCL-S-9 in the examined sample from the BELLA study (Cronbach’s α ranged from .81 to .84).

Self-efficacy in children and adolescents was measured through the self-report version of the General Self-Efficacy Scale (GSE; Schwarzer et al., 1995; Schwarzer et al., 1999). The scale includes ten items (e.g., ‘I can usually handle whatever comes my way’) presented with a four-point response scale ranging from 0 (‘not true’) to 3 (‘exactly true’). A higher mean across all items indicates higher self-efficacy. The GSE has been described as an objective, reliable and valid instrument (Schwarzer et al., 1995; Schwarzer et al., 1999). The internal consistency was found to be good in the BELLA study (Cronbach’s α ranged from .78 to .83).

Family climate was assessed using eight self-reported items from the Family Climate Scale (FCS; Schneewind et al., 1985), which is the adapted German version of the Family Environment Scale (FES; Moos et al., 2009). The FCS items focus on recreational activities and family cohesion (e.g., ‘In our family everybody cares about each other’s worries’) and are presented with a four-point response scale ranging from 0 (‘not true’) to 3 (‘exactly true’). Higher overall scores reflect a better family climate. The internal consistency of the FCS was found to be good in the examined sample from the BELLA study (Cronbach’s α ranged from .78 to .83).

Social support was assessed with the Social Support Survey (SSS; Donald et al., 1984). Eight self-reported items from the German translation of the SSS, which are appropriate for children and adolescents, were administered. The included items assess how often specific types of support are available (e.g., ‘How often is the following type of support available for you if you need it? Someone to give you information to help you understand a situation’). The items were answered on a five-point scale (0 = ‘none of the time’ to 4 = ‘all of the time’). The mean across the eight items was calculated, with a higher mean indicating better social support. The internal consistency was good to excellent in the BELLA study (Cronbach’s α ranged from .88 to .91).

Sociodemographic variables

Age and *gender* were assessed in all studies using single items. In addition, other sociodemographic variables such as *SES*, *family affluence*, *parental education* and *migration background* were considered. *SES* was assessed using the Winkler Index, which collects information on parental education, occupational status and household income (Winkler et al., 1999). The index offers a sum score that ranges from 3 to 21. *Family affluence* was measured by means of the Family Affluence Scale (FAS; Hartley et al., 2016). The FAS consists of six items that assess family wealth (number of cars, computers, bathrooms, dishwashers, holidays and own bedroom). A cumulative index was calculated based on the six items, and participants were divided into the three groups of low (< 20 %), medium (20 % to 80 %) and high (> 80 %) family affluence. *Parental education* was measured using two items that ask about the highest academic and vocational qualifications of both parents. Based on the Comparative Analysis of Social Mobility in Industrial Nations (CASMIN) classification, a categorisation into low, medium and high parental education was performed (Brauns et al., 2003). *Migration background* was assessed through items that ask for the country of birth of the children and adolescents and that of their parents.

4.3 Statistical analyses

Recommended and advanced statistical approaches were applied to analyse the cross-sectional and longitudinal data collected in the HBSC, BELLA, ADOPT and COPSY studies.

Descriptive analyses involved the calculation of absolute and relative frequencies, means and standard deviations for the examined variables. Chi-square tests, *t*-tests and correlations were used for bivariate comparisons. To investigate multivariate associations, multiple linear and logistic regression analyses were performed. To analyse longitudinal data from the BELLA study, individual growth modeling (publication 2) and latent growth modeling (publication 5) were used. The individual growth modeling approach allows data collected at different measurement points to be analysed simultaneously. Linear mixed models can be calculated to examine changes in an outcome of interest over time at both the individual and population levels. Both fixed and random effects can be estimated. Fixed effects represent average effects across the total sample, whilst random effects represent inter-individual differences (DeLucia et al., 2006; Heck et al., 2014). The latent growth modeling approach allows the estimation of two latent factors. These include the intercept (which reflects the initial status of a variable at baseline) and the slope (which represents the change in the variable over time). In a two-step process, latent growth models (LGMs) were first calculated for each longitudinally measured construct. Then, intercepts and slopes derived from the LGMs were used in linear regression models. More information on these approaches can be found in the respective publications 2 and 5.

Psychometric analyses in publications 3 and 4 were based on methods from classical test theory (CTT) and item response theory (IRT). CTT analyses included the investigation of item difficulties, inter-item correlations, factor loadings, corrected item-total-correlations and Cronbach's α. IRT analyses involved the examination of item and threshold parameters, item fit, item information functions, residual correlations and differential item functioning (DIF). The instrument development process in publication 4 followed a mixed methods approach and additionally included qualitative evaluations of clinical experts and parents based on a Delphi rating and focus groups.

To examine differences in mental health outcomes before and during the COVID-19 pandemic (publications 6 and 7), data from the COPSY study (index group) and the BELLA study (control group) were pooled, and multivariate linear regression analyses were conducted. Different subsamples from the BELLA study were used (depending on data availability).

Prevalences were calculated using a weighting factor that corrected for deviations from the structure of the German population within the sample in terms of school type, age and gender (publication 1) or school type, age, gender, region, federal state, household size, parental education and marital status (publications 6 and 7).

The strengths of detected effects were evaluated according to partial eta square ($\eta^2 = 0.01$ represents a small, $\eta^2 = 0.06$ reflects a medium and $\eta^2 = 0.14$ indicates a large effect), Cohen's d (d = 0.2, d = 0.5 and d = 0.8 represent small, medium and large effects, respectively), Cohen's f^2 ($f^2 = 0.02$, $f^2 = 0.15$ and $f^2 = 0.35$ indicate small, medium and large effects, respectively) or according to Cohen's (1988) rule of thumb for standardised regression weights ($\beta = .1$ represents a weak, $\beta = .3$ indicates a medium and $\beta = .5$ reflects a strong effect). The significance level was set to $p < .05$. Statistical analyses were mainly performed using IBM SPSS Statistics (IBM Corp, 2020) and Mplus (Muthén et al., 2017). IRT analyses were conducted using WINMIRA (von Davier, 2001) and Winsteps (Linacre, 2020).

5. Results

In the following, findings from the seven publications included in this thesis are presented. Their specific aims and research questions are stated, followed by a summary of key findings. More detailed information on the studies' background, methods and discussion can be found in the original articles.

5.1 Publication 1: Mental health and well-being in children and adolescents

Kaman, A., Ottová-Jordan, V., Bilz, L., Sudeck, G., Moor, I., & Ravens-Sieberer, U. (2020). Subjektive Gesundheit und Wohlbefinden von Kindern und Jugendlichen in Deutschland – Querschnittergebnisse der HBSC-Studie 2017/18. *Journal of Health Monitoring,* 5(3), 7-21. doi: 10.25646/6891

The first publication addresses the mental health and well-being of children and adolescents and presents current prevalences and associations with sociodemographic and psychosocial factors.

Research questions

1a) What are the age- and gender-specific prevalences of self-rated health, life satisfaction and psychosomatic health complaints among children and adolescents in Germany?

1b) Which sociodemographic and psychosocial factors are associated with subjective well-being in children and adolescents?

Results

A total of 88.9 % of n = 4,347 children and adolescents aged 11 to 15 years rated their health as excellent or good. A significantly higher proportion of boys (90.4 %) than girls (87.3 %) rated their health positively ($\chi^2(1) = 10.47$; $p = .001$). Health ratings were more positive in younger compared to older children. This age-specific difference was more pronounced in girls than boys. Similar patterns were found with respect to life satisfaction. The majority of children and adolescents (88.7 %) reported medium to high life satisfaction; this prevalence was significantly higher amongst boys (91.6 %) than girls (85.9 %) ($\chi^2(1) = 34.65$; $p < .001$). Whilst the proportion of boys who reported medium to high life satisfaction hardly differed between age groups, the proportion of girls who reported medium to high life satisfaction was notably higher in younger compared to older age groups. The overall prevalence of psychosomatic health complaints was 26.9

%. Girls reported psychosomatic health complaints significantly more often (34.2 %) than boys (19.7 %) ($\chi^2(1) = 114.06$; $p < .001$). Whereby the prevalence of psychosomatic health complaints in boys was only slightly higher in older compared to younger age groups, the corresponding difference in girls was more pronounced.

A high level of subjective well-being – defined as excellent or good self-rated health, medium to high life satisfaction and fewer than two psychosomatic health complaints per week – was reported by 66.1 % of children and adolescents. Findings from the multivariate logistic regression analysis indicated that girls and older adolescents reported significantly lower levels of subjective well-being than boys and younger adolescents. Lower family affluence and school pressure were also associated with lower levels of subjective well-being. High family support was associated with higher levels of subjective well-being amongst children and adolescents (see Table 1).

Table 1. Multivariate logistic regression to predict the subjective well-being of children and adolescents

	OR	**95 % CI**	***p-value***
Gender			
Boys (reference)			
Girls	**0.53**	**[0.46 – 0.61]**	**< .001**
Age group			
11 years (reference)			
13 years	0.90	[0.74 – 1.08]	.236
15 years	**0.70**	**[0.59 – 0.83]**	**< .001**
Family affluence			
High (reference)			
Medium	**0.61**	**[0.48 – 0.79]**	**< .001**
Low	**0.79**	**[0.65 – 0.97]**	**.022**
Migration status			
No (reference)			
One-sided	0.93	[0.75 – 1.16]	.522
Two-sided	0.86	[0.72 – 0.97]	.090
School pressure			
Rather low (reference)			
Rather high	**0.65**	**[0.55 – 0.76]**	**< .001**
Family support			
Low (reference)			
High	**3.01**	**[2.54 – 3.56]**	**< .001**
Model fit	$R^2 = 0.12$; $\chi^2(9) = 346.22$; $p < .001$		

Note. OR = odds ratio, CI = confidence interval, in boldface = statistically significant ($p < .05$) in comparison to the reference group (adapted from Kaman et al., 2020)

Although most children and adolescents reported high levels of subjective well-being, impairments were especially evident amongst girls, older adolescents, adolescents with low family affluence and those under school pressure. These results highlight the need for gender-sensitive and target group-specific health promotion and prevention programmes to improve the mental health and well-being of children and adolescents.

5.2 Publication 2: Trajectories of mental health and long-term outcomes of mental health problems in children and adolescents

Otto, C., Reiss, F., Voss, C., Wüstner, A., Meyrose, A.-K., Hölling, H., & Ravens-Sieberer, U. (2020). Mental health and well-being from childhood to adulthood: Design, methods and results of the 11-year follow-up of the BELLA study. *European Child & Adolescent Psychiatry.* doi: 10.1007/s00787-020-01630-4

Building on the first publication, which examined the mental health and well-being of children and adolescents based on cross-sectional data from the HBSC study, the second publication aims to investigate trajectories of mental health from childhood via adolescence to young adulthood and long-term outcomes of mental health problems based on longitudinal data from the BELLA study.

Research questions

2a) What are the age- and gender-specific trajectories of general health and HRQoL from childhood via adolescence to young adulthood?

2b) What are the long-term effects of mental health problems in childhood and adolescence on health- and mental health-related outcomes in young adulthood?

Results

Based on valid data for *n* = 4,987 participants (52 % female), self-reported general health in 10- to 31-year-olds was better for boys than girls and for younger than older participants. The age-specific differences were more noticeable amongst girls (see Figure 2). Comparable patterns were observed for parent-reported general health in 3- to 20-year-olds (*n* = 5,754; 50 % female). Parent-reported general health was also found to be better in younger compared to older participants. In younger participants, general health was better for girls; in older participants, general health was better for boys.

Based on valid data for *n* = 4,293 participants (51 % female), self-reported HRQoL in 10- to 20-year-olds was better for boys compared to girls and for younger than older participants. The decrease in HRQoL with age was more noticeable amongst girls (see Figure 3). The same patterns were identified for parent-reported HRQoL in 6- to 20-year-olds (*n* = 4,345; 50 % female). Higher HRQoL scores were observed for younger compared to older participants. In younger participants, HRQoL was better for girls; in older participants, HRQoL was better for boys.

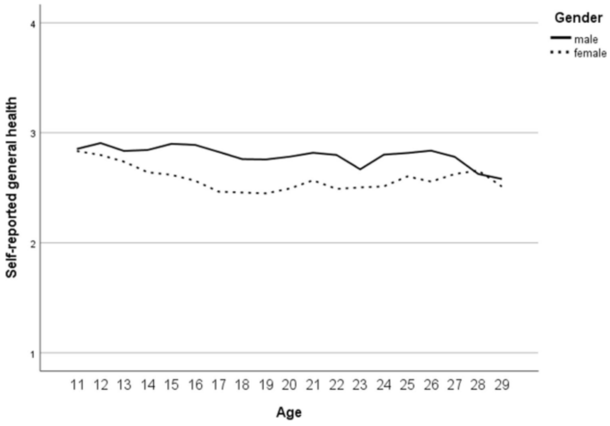

Figure 2. Gender-specific course of self-reported general health from age 11 to age 29 (according to the GHI; 1 = poor/fair, 2 = good, 3 = very good and 4 = excellent; reprinted from Otto et al., 2020)

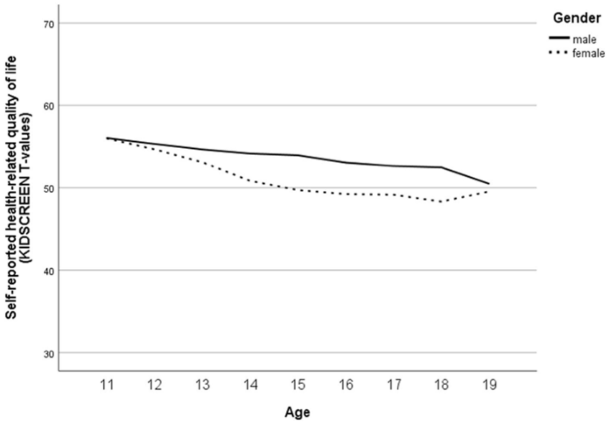

Figure 3. Gender-specific course of self-reported health-related quality of life from age 11 to age 19 (according to the KIDSCREEN-10 Index; reprinted from Otto et al., 2020)

Findings from longitudinal analyses of the impact of mental health problems in childhood and adolescence revealed negative long-term effects on health- and mental health-related outcomes in young adulthood. Based on self-reported data, we found that baseline mental health problems were significantly related to impaired general health (B = -0.3, $p < .05$) and mental health (B = -0.3, $p < .001$) at the six-year follow-up, and with impaired general health (B = -0.6, $p < .01$), mental health (B = -0.3, $p < .01$) and physical health (B = -0.3, $p < .001$) at the eleven-year follow-up. Moreover, a high subjective impact of mental health problems at baseline was significantly associated with impaired general and mental health six and eleven years later. Based on parent-reported data, similar results were found. Parent-reported mental health problems in children and adolescents were significantly negatively associated with self-reported general health (B = -0.6, $p < .01$ / B = -0.6, $p < .001$), mental health (B = -0.3, $p < .001$ / B = -0.2, $p < .05$) and physical health (B = -0.1, $p < .05$ / B = -0.2, $p < .001$) at the six-year and eleven-year follow-ups. However, no effects were found for the impact of child and adolescent mental health problems reported by parents at baseline on health- and mental health-related outcomes at the follow-ups. Detected effects were small according to partial eta square ($\eta^2 = .01$ to $.03$).

Overall, the findings on the trajectories of general health and HRQoL underline the need for effective prevention strategies that take into account age- and gender-specific differences. The results further underline the significance of early intervention programmes for children and adolescents who are at risk of developing mental disorders, as mental health problems in childhood are associated with negative long-term outcomes in young adulthood.

5.3 Publication 3: Assessing anger and irritability in children

<u>Kaman, A.</u>, Otto, C., Devine, J., Döpfner, M., Banaschewski, T., Görtz-Dorten, A., ... Ravens-Sieberer, U. (under review). Assessing anger and irritability in children: Translation, psychometric evaluation and normative data for the German version of the PROMIS® Parent Proxy Anger Scale. *Quality of Life Research*

The previous two publications highlighted the relevance of mental health and mental health problems in children and adolescents. Given the negative long-term health outcomes of mental health problems identified in the second publication, the early identification of mental health problems in children and adolescents is critical, as it is the first step towards prevention. Therefore, the third publication addresses the assessment of anger and irritability in children and adolescents and aims to evaluate the psychometric properties of and provide normative data for the German version of the PROMIS Anger Scale.

Research questions

3) Is the German translation of the PROMIS Parent Proxy Anger Scale a psychometrically sound, reliable and valid instrument for the assessment of anger and irritability in children?

Results

The translation of the PROMIS Anger Scale from American English to German followed international guidelines approved by the PROMIS network. Results from pilot testing and cognitive debriefing indicated ease of comprehension and good acceptability for the items. Parents did not report any serious difficulties responding to the items.

The German translation of the PROMIS Anger Scale was completed by n = 8,746 parents of children aged 8 to 12 years (48.7 % female). Item-level mean scores ranged from M = 0.38 to 1.56. Floor effects were found for four of the five items. Furthermore, descriptive analyses showed very few missing values (0.1 % to 0.4 % per item), indicating good acceptability of the items. Item difficulties were relatively low (p_i = .10 to .39), and corrected item-total correlations ranged from r_{it} = .65 to .81. Medium to strong inter-item correlations were detected between the five items of the PROMIS Anger Scale, with correlation coefficients ranging from r = .47 to .73.

The distribution characteristics of the PROMIS Anger Scale demonstrated that raw sum scores ranged from 0 to 20 (M = 4.37, SD = 3.55). The standardised T-scores ranged from 29 to 85 (*M* = 44.38, *SD* = 10.48). In line with the results of the item analysis, the distribution of the scale was positively skewed. The low kurtosis points to a platykurtic distribution, characterised by a lower peak and shorter tails in comparison to a normal distribution.

A confirmatory factor analysis was conducted to evaluate the unidimensionality of the scale. The descriptive fit indices indicated a good model fit (RMSEA = 0.066, 90 % CI = 0.058-0.074, SRMR = 0.018, CFI = 0.998, TLI = 0.996). Standardised factor loadings ranged from .79 to .93. Thus, the PROMIS Anger Scale can be considered sufficiently unidimensional, confirming its factorial validity.

In terms of reliability, good internal consistency was found for the PROMIS Anger Scale (Cronbach's α = .88). Moreover, a strong positive correlation was found between the PROMIS Anger Scale and a measure of affective dysregulation in children (DADYS-Screen; *r* = .77; *p* < .001), which supports the construct validity of the scale.

Overall, the German translation of the PROMIS Parent Proxy Anger Scale demonstrated good psychometric properties, including satisfactory fit statistics, unidimensionality, good reliability and convergent validity. As a measure of anger and irritability in children, the German version of the PROMIS Anger Scale can thus be recommended for use in clinical practice and future research. The resulting normative data provided are expected to facilitate the interpretation of test scores in future research and practice for German clinicians and researchers.

5.4 Publication 4: Development and evaluation of a screening tool for affective dysregulation in children

Otto, C.*, Kaman, A.*, Barkmann, C., Döpfner, M., Görtz-Dorten, A., Ginsberg, C., ... Ravens-Sieberer, U. (under review). The DADYS-Screen – Development and evaluation of a screening tool for affective dysregulation in children. *Assessment*.
*shared first authorship

Building on the third publication, which concerns the translation and psychometric evaluation of an existing instrument for the assessment of anger and irritability in children, the fourth publication aims to develop and evaluate a new screening instrument for the assessment of AD in children based on a mixed methods approach. Existing instruments include items that measure certain aspects of AD, such as anger, impulsivity or irritability. However, knowledge regarding the appropriate assessment of AD as a transdiagnostic symptom in children remains limited, and validated instruments structured around the phenotype of AD are lacking.

Research questions

4a) Which items from existing measures are psychometrically sound and suitable for creating an item pool to assess AD in children based on evaluations of clinical experts and parents as well as CTT and IRT analyses?

4b) Is the developed DADYS-Screen a psychometrically sound, reliable and valid screening instrument for the assessment of AD in children?

Results

Development of DADYS-Screen

Clinical and research experts selected items related to symptoms and behaviours that are associated with AD (e.g., irritability, emotion dysregulation and impulsivity) from the following well-established instruments: the Affective Reactivity Index (7 items; Stringaris et al., 2012), the PROMIS Anger Scale (5 items; Irwin et al., 2012), the Emotion Regulation Checklist (24 items; Shields et al., 1997), the Dysregulation Profile of the SDQ (10 items; Goodman, 1997), the Conners Global Index (10 items; Conners, 2008), and the Disruptive Mood Dysregulation and Irritability Scale from the Diagnostic System for Mental Disorders in Children and Adolescents (11 items; Döpfner et al., 2017). The initial item pool included 67 parent-reported items. Through a Delphi rating of experts, 17 items were identified as suitable for the screening of children for AD, whilst seven items were classified as unsuitable. In the focus group of clinical experts, seven items were identified as relevant and suitable, whilst eight items were classified as unsuitable for screening children for AD. Furthermore, items that are redundant or too strongly related to other mental health problems were considered for exclusion. According to the focus groups with parents, the proposed items were mostly easy to understand; only a few items were difficult to answer. In addition to the qualitative evaluation of the initial item pool, quantitative investigations of the items were conducted using CTT and IRT methods. Clinical and research experts discussed the exclusion of items with critical values in the statistical parameters (detailed results can be found in publication 4). The final screening tool (DADYS-Screen) included 14 items (e.g., ‘Often loses temper’) offered with a four-point response scale (0 = ‘not at all true’ to 3 = ‘completely true’).

Evaluation of DADYS-Screen

The final screening tool was completed by n = 8,988 parents of children aged 8 to 12 years (48.7 % female). Results based on CTT indicated relatively low item difficulties (p_i = .08 to .36), strong associations between items (r_{ii} = .36 to .78) and good corrected item-total correlations (r_{it} = .62 to .86). The one-factor solution was supported by the scree plot and the Eigenvalue criterion, explaining 60 % of the overall variance amongst the items. High factor loadings were detected in the principal axis analysis (from .65 to .85). Furthermore, results from the one-factorial CFA demonstrated an acceptable model fit according to the RMSEA (0.091, 90 % CI = 0.089-0.093) and a good fit according to the CFI (0.974) and the SRMR (0.45). Factor loadings ranged from .74 to .91, and residual correlations were consistently below the threshold (between -.11 and .15). Results based on IRT revealed that item parameters ranged from -1.24 to 1.69. Threshold parameters ranged from -4.62 to 3.23 and were monotonically increasing for all items. Item fit was good for almost all items. Item information functions were accordingly bell-shaped; only two items showed slight bimodality. Reliability was very good with R = .92. No item bias could be identified by age, gender, parental education or assessment mode. The item-person map indicated that the items were somewhat too difficult for the investigated population-based sample. However, the DADYS-Screen would probably reveal a better fit in clinical samples of children with an elevated symptom level of AD.

Overall, the use of the DADYS-Screen to identify children with AD is psychometrically supported and can facilitate appropriate diagnosis, treatment and clinical practice.

5.5 Publication 5: Risk and resource factors for ADHD symptoms in children and adolescents over time

Wüstner, A., Otto, C., Schlack, R., Hölling, H., Klasen, F., & Ravens-Sieberer, U. (2019). Risk and protective factors for the development of ADHD symptoms in children and adolescents: Results of the longitudinal BELLA study. *PLoS One,* 14(3), e0214412. doi: 10.1371/journal.pone.0214412

In addition to the reliable and valid assessment and early identification of children with behavioural problems (publications 3 and 4), it is crucial to understand the role of risk and resource factors for the development and course of behavioural problems in children. The identification, avoidance and control of risk factors, combined with the strengthening of resources, comprise a fundamental starting point for early prevention and intervention programmes. Thus, the fifth publication aims to advance knowledge on risk and resource factors for ADHD symptoms in children and adolescents based on data from the longitudinal BELLA study.

Research questions

5a) Which risk and resource factors are associated with the development of ADHD symptoms in children and adolescents over time?
5b) How do the identified risk and resource factors interact?

Results

The analysed sample included *n* = 1,384 children and adolescents aged 11 to 17 at baseline (51.0 % female). Analyses based on baseline data revealed that ADHD symptoms were more prevalent in boys than girls and in younger compared to older participants. Moreover, stronger aggressive behaviour was related to stronger ADHD symptoms in children and adolescents. In addition, pronounced parental mental health problems were related to stronger symptoms of ADHD in children. No effects were found for self-efficacy, family climate and social support in the baseline model. The effects found for age, gender and parental mental health problems were small, and the effect of aggressive behaviour on ADHD symptoms was strong.

Based on longitudinal data, girls compared to boys and participants with migration background compared to those without showed a stronger increase in ADHD symptoms over time. In addition, increasing symptoms of generalised anxiety and aggressive behaviour were both related to increasing ADHD symptoms over time. Moreover, an increase in parental mental health problems was associated with increasing ADHD symptoms over time. In terms of resource factors, improving family climate over time was related to decreasing ADHD symptoms in children and adolescents. In line with the baseline model, self-efficacy and social support were not found to have an effect on symptoms of ADHD. Effects detected by means of the longitudinal model were small. The findings from the two regression models based on cross-sectional and longitudinal data are presented in Figure 4.

Further regression models explored potential interaction effects between risk and resource factors. No moderating effects were found based on baseline data. Findings based on longitudinal data revealed a moderating effect of social support. Increasing social support mitigated the adverse effect of increasing parental psychopathology on increasing ADHD symptoms over time. Furthermore, an association between increasing social support and increasing ADHD symptoms over time was only found in children of parents experiencing mild mental health problems. The detected interaction effects were small.

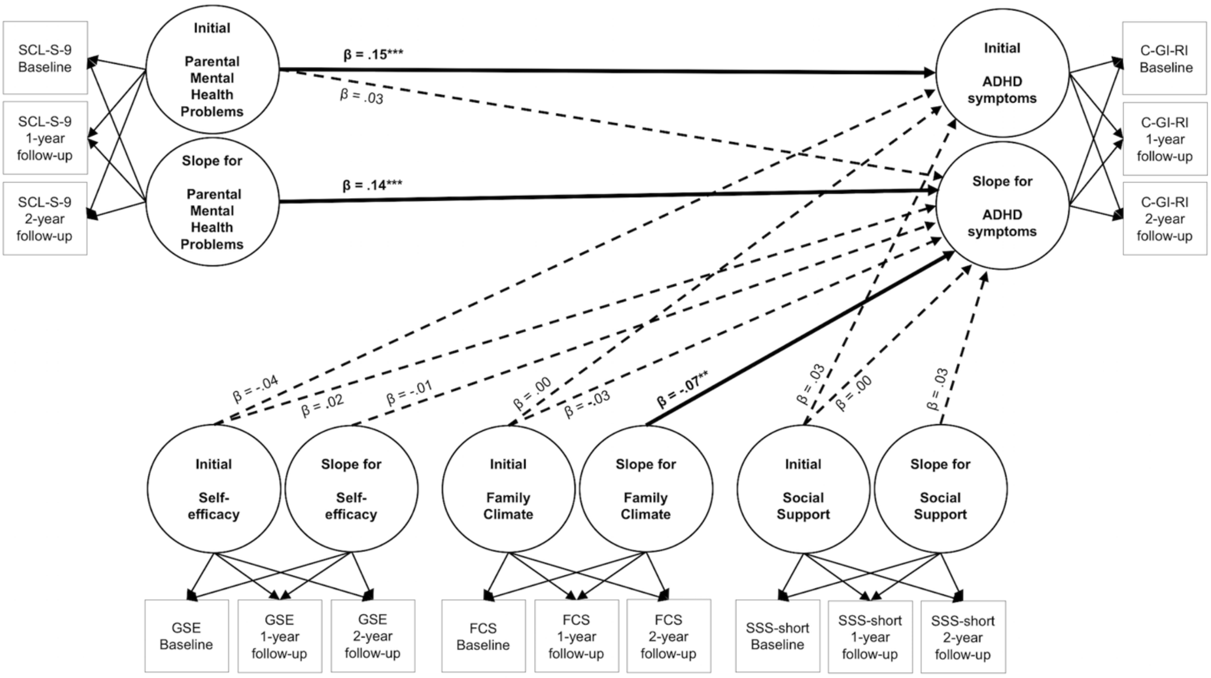

Figure 4. Effects of risk and resource factors on ADHD symptoms in children and adolescents. Continuous lines mark significant effects, interrupted lines indicate non-significant effects. *n* = 1,384. C-GI-RI = subscale restless-impulsivity of the Conners Global Index (Conners, 2008); SCL-S-9 = Symptom-Checklist short version (Klaghofer et al., 2000); GSE = General Self-Efficacy Scale (Schwarzer et al., 1995); FCS = Family Climate Scale (Schneewind et al., 1985); SSS-short = Social Support Survey (Donald et al., 1984); *β* = standardised regression coefficient; ****p* ≤ .001; ***p* ≤ .01 (reprinted from Wüstner et al., 2019)

5.6 Publications 6 and 7: The challenge of the COVID-19 pandemic for mental health and behavioural problems in children and adolescents

Ravens-Sieberer, U.*, Kaman, A.*, Erhart, M., Devine, J., Schlack, R., & Otto, C. (2021). Impact of the COVID-19 pandemic on quality of life and mental health in children and adolescents in Germany. *European Child & Adolescent Psychiatry.* doi: 10.1007/s00787-021-01726-5 *shared first authorship

Ravens-Sieberer, U.*, Kaman, A.*, Otto, C., Adedeji, A., Napp, A.-K., Becker, M., ... Hurrelmann, K. (in press). Seelische Gesundheit und psychische Belastungen von Kindern und Jugendlichen in der ersten Welle der COVID-19-Pandemie – Ergebnisse der COPSY-Studie. *Bundesgesundheitsblatt – Gesundheitsforschung – Gesundheitsschutz.* doi: 10.1007/s00103-021-03291-3 *shared first authorship

In the previous publication, the relevance of risk and resource factors for child and adolescent mental health was highlighted. The findings indicated that a positive family climate characterised by warmth and good communication, and the availability of social support through positive peer relationships, are important resources for children and adolescents. The recent COVID-19 pandemic has caused unprecedented changes in the lives of children and adolescents. Due to social distancing rules, many resources of the children and adolescents have been restricted, and new challenges and risks have emerged. Determining the impact of the COVID-19 pandemic on the mental health of children and adolescents is the aim of the sixth and seventh publications. Based on data from the COPSY study, the mental health and behavioural problems of children and adolescents during the pandemic are examined and compared to pre-pandemic data from the BELLA study. The publications further aim to identify vulnerable groups that are at particular risk of being impaired by the COVID-19 pandemic.

Research questions

6a) What challenges do children and adolescents face during the pandemic?
6b) How does the COVID-19 pandemic affect mental health and behavioural problems in children and adolescents?
6c) Which children and adolescents are at risk of being particularly impaired by the COVID-19 pandemic?
6d) How can parents of children and adolescents be supported?

Results

Perceived challenges of the pandemic

Data from *n* = 1,586 parents of 7- to 17-year-old children and adolescents (50 % female) and *n* = 1,040 children and adolescents aged 11 to 17 (51.1 % female) were analysed. Overall, 71.4 % of the children and adolescents and 75.4 % of the parents felt burdened by the COVID-19 pandemic and the associated changes. Two-thirds of children and adolescents (64.4 %) found home-schooling and learning during the pandemic to be difficult. In addition, most children and adolescents (82.8 %) had fewer social contacts, and 39.3 % reported that relationships with their friends were impaired by social distancing rules. Moreover, one-quarter of the children and adolescents (27.6 %) stated that arguments in their family had increased, and one-third of the parents (32.0 %) reported that disputes had escalated more frequently.

Mental health impact of the pandemic

Children and adolescents experienced significantly lower HRQoL during the COVID-19 pandemic. In the COPSY study, 40.1 % of 11- to 17-year-old children and adolescents reported low HRQoL; by contrast, only 15.3 % had reported low HRQoL in the BELLA study before the pandemic. Analyses stratified by gender and age revealed that girls and younger children were more likely to report low HRQoL than boys and older children, respectively. The prevalence of parent-reported mental health problems in children and adolescents increased from 17.6 % (noticeable: 9.9 %; borderline: 7.7 % according to the SDQ) before the pandemic to 30.4 % (noticeable: 17.8 %; borderline: 12.6 %) during the pandemic. A significantly stronger increase was found in younger children than older ones. Furthermore, increased rates of hyperactivity, emotional problems, peer problems and conduct problems were found during the pandemic (see Table 2).

In addition, children and adolescents reported more pronounced symptoms of generalised anxiety during the pandemic (24.1 %) compared to before the pandemic (14.9 %). However, no significant increase was found in the prevalence of depressive symptoms during the pandemic. Nevertheless, children and adolescents stated that they had trouble concentrating (62.1 %), had little interest or joy in activities (58.4 %) or felt sad (33.7 %). Overall, significant differences were found between the COPSY data (during the pandemic) and BELLA data (before the pandemic) for all mental health outcomes except emotional symptoms and depression. The detected effects were small for mental health problems (Cohen's $f^2 = .04$), hyperactivity ($f^2 = .03$) and peer problems ($f^2 = .05$) and negligible for conduct problems ($f^2 = .01$) and anxiety ($f^2 = .01$).

Table 2. Mental health problems in children and adolescents before vs. during the pandemic

	Mental health problems (total)	**Emotional symptoms**	**Conduct problems**	**Hyper-activity**	**Peer problems**
Before pandemic (*n* = 1,553)					
normal	82.4 %	83.6 %	86.9 %	87.2 %	88.6 %
borderline	7.8 %	6.2 %	6.5 %	5.1 %	3.9 %
noticeable/abnormal	9.9 %	10.2 %	6.6 %	7.7 %	7.5 %
During pandemic (*n* = 1,585)					
normal	69.6 %	79.0 %	80.8 %	76.4 %	78.2 %
borderline	12.5 %	7.7 %	9.1 %	8.9 %	10.2 %
noticeable/abnormal	17.8 %	13.3 %	10.0 %	14.6 %	11.5 %
	$p < .001$	$p = .007$	$p < .001$	$p < .001$	$p < .001$

Note. p-values resulting from χ^2 - tests comparing groups *normal* and *borderline* (gathered into one group) vs. *noticeable/abnormal* according to the SDQ (adapted from Ravens-Sieberer et al., 2021)

Risk factors for mental health problems during the pandemic

Findings from the high-risk analysis indicated that socially disadvantaged children and adolescents were particularly burdened by the COVID-19 pandemic. This applies to children from families with i) a low level of education, ii) a migration background or iii) less than 20 square meters of living space per person, if the family climate was also poor. This high-risk group of children reported a significantly higher burden due to the COVID-19 pandemic, lower HRQoL, more mental health problems, hyperactivity, emotional symptoms, peer problems, conduct problems and symptoms of anxiety and depression compared to their peers.

Need for support during the pandemic

Two-thirds of the parents (63.0 %) wanted support in relation to their child's response to COVID-19. Most often, parents desired support in managing their child's educational demands, emotions and behaviours. When asked how they would like to receive this support, the most common responses were from their child's schools or teachers, friends and family, a professional by telephone and written online materials.

Overall, findings from the COPSY study highlighted the tremendous mental health impact of the COVID-19 pandemic on children and adolescents. Effective prevention and intervention strategies must be implemented to mitigate the burden caused by the pandemic and to maintain the mental health of children and adolescents.

6. Discussion

In the following chapter, the results of the thesis are summarised and discussed with regard to the research questions and the current state of research. The methodological strengths and limitations are explained, and implications for prevention and intervention as well as directions for future research are highlighted.

6.1 Summary and discussion of results

The presented findings of the thesis expand available knowledge on child and adolescent mental health and associated factors and the assessment of behavioural problems and transdiagnostic symptoms. Recent population-based data from large epidemiological studies on the mental health of German children and adolescents were presented.

The **first research question** of the thesis focused on the age- and gender-specific prevalences and trajectories of mental health. Cross-sectional findings from the HBSC study indicated that most children and adolescents had good mental health. They rated their health positively and were satisfied with their lives. Boys rated their health more positively and were more satisfied with their lives compared to girls. These gender-specific differences were observed in all age groups and increased with age (Kaman et al., 2020). Current data from the KiGGS study also demonstrated that most children and adolescents were in good health (Poethko-Müller et al., 2018). Furthermore, the findings on the age- and gender-specific prevalences aligned with previous results from the international HBSC study (Cavallo et al., 2015; Inchley et al., 2016) and other cross-sectional, population-based studies on child and adolescent mental health (Casas et al., 2019; Kaye-Tzadok et al., 2017; Meade et al., 2015).

Longitudinal results from the BELLA study on mental health trajectories from childhood to young adulthood pointed in the same direction. Self-reported general health (in 10- to 31-year-olds) and HRQoL (in 10- to 20-year-olds) were better in boys compared to girls and in younger than older participants. The decrease in general health and HRQoL with age was more noticeable in girls (Otto et al., 2020). These age- and gender-specific trajectories were also observed in a five-year longitudinal study of Spanish adolescents, which confirmed that well-being decreases during adolescence and that the decrease is more pronounced in girls (González-Carrasco et al., 2020). The findings further coincided with those of numerous national and international studies, which have reported that mental health problems often have their first onset in childhood and increase during adolescence (Kessler et al., 2005; Klasen et al., 2016).

The identified age and gender-specific differences could be attributed to various factors. Since adolescence is a critical phase of life associated with a series of developmental challenges, the decrease in mental health can be considered a developmental phenomenon (Goldbeck et al., 2007). Girls and boys must cope with different developmental challenges during puberty, including physical changes and identity formation (Patton et al., 2007). At the same time, research has indicated that girls and boys experience and cope with stress differently. Whereas girls often adopt problem-focused coping mechanisms, boys tend to rely on avoidance-focused coping strategies (Eschenbeck et al., 2007). Furthermore, girls tend to have a more negative self-concept, are more likely to ruminate and are more sensitive to interpersonal stress (Johnson et al., 2013; Meiser et al., 2019), which could account for the gender difference observed in the prevalences of mental health. However, further research is needed to fully understand this gender gap. Future studies should take into account age- and gender-specific differences in mental health. In addition, the results highlight the need for gender-sensitive approaches in developing health promotion and prevention programmes.

With regard to the **second research question**, longitudinal findings from the BELLA study revealed that mental health problems in childhood and adolescence are associated with negative long-term outcomes in young adulthood. More precisely, mental health problems during childhood predicted impaired general health, mental health and physical health six to eleven years later (Otto et al., 2020). The results are in line with those of a longitudinal study by Copeland et al. (2015), who found that individuals with childhood mental health problems were six times more likely to experience at least one negative outcome (e.g., physical and mental health problems, educational failure, suicidality and social isolation) in adulthood compared to individuals with no mental disorder in childhood. Even individuals with subthreshold mental health problems in childhood had a three times higher likelihood of having an adverse adult outcome. To prevent these negative long-term outcomes, the reduction of childhood psychiatric disorders should be a focus in public health efforts. In this context, early prevention and intervention services for children and adolescents are promising (see Chapter 6.3). The results further underline the importance of identifying children and adolescents who are at risk of developing mental health problems at an early stage, as it is the first step towards prevention.

This leads to the **third research question** of this thesis, which concerns how behavioural problems in children and adolescents can be reliably and validly assessed. The German translation of the PROMIS Anger Scale proved to be a psychometrically sound, reliable and valid measure of anger and irritability in children and can be recommended for application in clinical practice and research (Kaman et al., submitted). Following the novel transdiagnostic approach of the RDoC initiative (Insel et al., 2010), we further developed a new screening instrument for the assessment of AD in children (i.e., DADYS-Screen). As a transdiagnostic symptom, AD has been associated with a wide range of mental disorders, including ADHD, conduct disorder, depression and anxiety (Axelson et al., 2012; Copeland et al., 2013; Roy et al., 2013), resulting in poor diagnostic specificity (Holtmann et al., 2017). In the past, children with AD have often been misdiagnosed with bipolar disorder or ADHD, leading to a controversial debate about the diagnostic classification of children with AD (Grimmer et al., 2010; Parens et al., 2010). The DADYS-Screen is the first screening instrument for the transdiagnostic assessment of AD in children. Since AD in childhood is associated with significant impairments and predicts adverse adult outcomes such as depression, suicidality and anxiety (Benarous et al., 2019; Stringaris et al., 2009), the early identification and treatment of children with AD is crucial. In general, the evaluation of the DADYS-Screen demonstrated good psychometric properties (Otto et al., submitted). Thus, the use of the DADYS-Screen enables researchers and clinicians to more easily identify children with AD and is promising for appropriate diagnosis and treatment.

In addition to the early identification of children with behavioural problems, the **fourth research question** examined the role of risk and resource factors for the development and course of behavioural problems in children and adolescents. Cross-sectional and longitudinal findings from the BELLA study demonstrated that parental mental health problems are a risk factor for ADHD symptoms in children and adolescents, both initially and over the course of two years (Wüstner et al., 2019). This finding is consistent with existing research on parental mental health and child psychopathology (e.g., Kaman et al., 2021; Plass-Christl et al., 2017; Weijers et al., 2018) and studies that have indicated a strong association between parental ADHD problems and child ADHD (Agha et al., 2013). There is evidence that both genetic and environmental mechanisms account for the association between parental and child mental health problems

(Bornovalova et al., 2010; Natsuaki et al., 2014; Paananen et al., 2020). Consequently, considering parental mental health in targeted prevention and intervention programmes for children and adolescents is of high importance. Longitudinal findings from the BELLA study further indicate that family climate is a resource factor for the development of ADHD symptoms in children and adolescents (Wüstner et al., 2019). This is in line with previous studies (Hölling et al., 2008; Schei et al., 2015) and supports the approach of family-based interventions that aim to increase family support and communication. Family-based interventions have proven to be effective in treating children and adolescents with ADHD (Fowler et al., 2014; Webster-Stratton et al., 2013). In line with the concept of resilience and the protective model (see Figure 1), longitudinal analyses from the BELLA study additionally revealed that social support acts as moderator and mitigates the adverse effect of parental psychopathology on ADHD symptoms in children and adolescents (Wüstner et al., 2019). To help children and adolescents cope with a parent's mental disorder, prevention and intervention programmes should focus on strengthening resources in children and adolescents, including the availability of social support. Cognitive behavioural therapies that focus on enhancing social skills and peer inclusion interventions that aim to improve social functioning have proven to be effective in this regard (Cordier et al., 2018; Park et al., 2015).

This leads to the **fifth research question** of the present thesis, which examined how the COVID-19 pandemic has affected mental health and behavioural problems in children and adolescents. Findings from the COPSY study indicated that many resources of children and adolescents are restricted during the pandemic, including the availability of a positive family climate and social support. Children and adolescents reported that relationships with their friends were impaired and that home-schooling and learning were challenging during the pandemic. Moreover, family conflicts increased and escalated more frequently (Ravens-Sieberer et al., 2021). Previous studies have shown that the risk of domestic violence and child abuse increase during times of crisis (Schneider et al., 2017), and experts have called for action to prevent violence against children and adolescents during the COVID-19 pandemic (Fegert et al., 2020; Fore, 2020; Thomas et al., 2020). Findings from the COPSY study further highlighted the pandemic's significant mental health impact. Children and adolescents experienced significantly lower HRQoL and more mental and behavioural health problems than before the pandemic. In particular, hyperactivity and peer problems have strongly increased (Ravens-Sieberer et al., 2021; Ravens-Sieberer et al., in press). These results are in line with a growing body of research that has indicated increased mental health problems during the first months of the pandemic (Ezpeleta et al., 2020; Gassman-Pines et al., 2020; Jiao et al., 2020; Patrick et al., 2020; Xie et al., 2020; Yeasmin et al., 2020). Whether this psychological distress is only an acute reaction to the unprecedented COVID-19 pandemic or will become chronic and lead to the emergence of manifest mental disorders over time remains unknown and will require longitudinal studies to determine. Therefore, a follow-up survey of the COPSY study is currently being conducted; the author of this thesis contributed to the successful acquisition of funding. To support children and adolescents who are experiencing psychological distress during the pandemic and to prevent acute mental health problems from developing into manifest disorders, prevention and intervention strategies are needed, and resources must be allocated. Policymakers need to carefully balance social distancing and lockdown measures against mental health risks.

Given that the COPSY study has identified socially disadvantaged children and adolescents who are at particular risk of being impaired by the COVID-19 pandemic (Ravens-Sieberer et al., 2021), targeted and low-threshold preventive programmes that meet their needs must be initiated. These programmes should focus on strengthening resources that help to maintain and improve child and adolescent mental health. Another publication based on data of the COPSY study, in which the author of this thesis was involved, has indicated that children and adolescents with high levels of familial resources (i.e., spending quality time with family) and personal resources (i.e., optimism and confidence) experience higher HRQoL during the COVID-19 pandemic (Ravens-Sieberer et al., 2020). Following the concept of resilience by Masten et al. (1990), the longitudinal COPSY study will examine protective factors that support positive functional adaptation to the pandemic, which would result in positive mental health outcomes and positive development.

6.2 Methodological strengths and limitations

Findings from the present thesis need to be discussed in the context of methodological strengths and limitations. The first strength relates to the fact that the findings are based on data from four large epidemiological studies on child and adolescent mental health. These include the WHO's collaborative cross-national HBSC study; the BELLA study, which is one of the most important longitudinal studies on mental health in children and adolescents in Germany; the interdisciplinary ADOPT study; and the COPSY study, which is the first representative study on the impact of the COVID-19 pandemic on the mental health of children and adolescents in Germany. The strengths of these studies include, amongst other factors, the use of large population-based samples and the wide age range of the participants (7 to 31 years old). Prevalences were calculated with weighting factors that allowed representative statements to be made for the general German population. In addition to representative cross-sectional analyses, longitudinal analyses on mental health from childhood to young adulthood and on risk and resource factors were conducted. Mental health, mental health problems and risk and resource factors were measured using standardised instruments that have been widely used in previous epidemiological studies and proven to be objective, reliable and valid instruments for measuring the relevant constructs (e.g., KIDSCREEN, SDQ, CES-DC and SCL-S-9). The reliability of these measures was tested using Cronbach's α, which resulted in good internal consistency for most scales. State-of-the-art, recommended and advanced methodological approaches were applied to analyse the cross-sectional and longitudinal data (e.g., multiple linear regression analyses, latent growth modeling, CTT and IRT analyses). The instrument development process followed a mixed methods approach and additionally included qualitative analyses (i.e., Delphi rating and focus groups). A multi-perspective approach was used to assess mental health, including self-reports from children and adolescents and proxy-reports from parents. Overall, various aspects of child and adolescent mental health and mental health problems were examined from a public health perspective, including the investigation of prevalences, developmental trajectories, long-term outcomes, the assessment of mental health, risk and resources factors for behavioural problems and mental health in times of crisis.

Despite these strengths, some limitations need to be considered. The presented findings were based on observational studies that only identified associations and no causal relationships. When considering risk and resource factors for mental health problems (publication 5), reciprocal influences are conceivable. Furthermore, differences in mental health problems before and during COVID-19 were attributed to the pandemic (publications 6 and 7), although other factors may account for these differences. In order to establish causality, randomised controlled trials (RCTs) are regarded as the gold standard. However, RCTs in the context of child and adolescent mental health raise a number of ethical concerns. In addition, data were only collected in German; thus, children and adolescents with a migration background were underrepresented in the examined studies. The application of a weighting factor corrected for deviations from the structure of the German population in the samples. A further limitation of longitudinal cohort studies is the loss to follow-up (publications 2 and 5). Drop-out analyses from the BELLA study indicated that participants with lower SES and those with a migration background were lost significantly more often. However, drop-out was not associated with health- or mental health-related outcomes (Otto et al., 2020; Ravens-Sieberer et al., 2015). Furthermore, mental health problems were assessed with screening instruments; thus, no clinical diagnoses were examined. It is possible that the symptoms of mental health problems identified in the examined studies simply marked normal developmental transitions. However, even without fulfilling the diagnostic criteria for a mental disorder, children and adolescents with subthreshold mental health problems may be impaired and in serious need of treatment. Thus, analysing metric scale scores resulting from screening instruments provides important information for planning prevention and early intervention programmes. Lastly, the explained variances in the investigated models were rather low, and detected effects were mostly small. These findings may be due to the fact that there are other predictors that were not considered in the models and that population-based samples with consistently and relatively low levels of mental health problems were examined.

6.3 Implications and directions for future research

The findings from this thesis enhance our understanding of the epidemiology of child and adolescent mental health and have important implications for health promotion, prevention and clinical practice. Child and adolescent mental health problems are highly prevalent, create a serious burden for individuals and society and are associated with impaired long-term health outcomes. Given their public health significance, the WHO has emphasised the importance of strengthening evidence and research related to mental health to address the increasing global burden of mental health problems.

Childhood and adolescence represent vulnerable phases of life characterised by various developmental challenges that can affect mental health. Research has shown that mental health tends to decrease during adolescence (Otto et al., 2020). The majority of all mental disorders have their onset during adolescence, many of which are undiagnosed and untreated (Kessler et al., 2005). Thus, it is important to identify children and adolescents who are at risk of developing mental health problems at an early stage, as this is the first step towards prevention. The identification of transdiagnostic symptoms is particularly challenging, as they can be related to various mental disorders. The presented screening instruments (i.e., the PROMIS Anger Scale and the DADYS-Screen) are promising to guide diagnosis and treatment of children with irritability and AD. General practitioners and primary health care professionals must be educated to better recognise (subthreshold) mental health problems and to provide access to mental health services (Patel et al., 2007). Moreover, the school environment plays a crucial role. Teachers see their students almost daily and are thus able to identify changes in behaviour. Therefore, teachers must be trained to recognise warning signs of mental health problems and to refer affected children and adolescents for mental health services (Gibson et al., 2014). In the face of the COVID-19 pandemic, experts warn that school closures are causing many mental health problems to remain undetected and that access to mental health support is restricted (Lee, 2020). A universal screening using teacher- and student-reported questionnaires could provide a valuable opportunity to identify students with behavioural or emotional problems who might benefit from prevention or early intervention services (Dowdy et al., 2015).

In line with the WHO Mental Health Action Plan (World Health Organization, 2013), identifying risk and resource factors for mental health problems is the second fundamental step in planning effective prevention and intervention programmes. Future research should focus on longitudinal studies that investigate risk and resource factors for mental health problems over the life course. Such studies should also address mediating factors that help to explain the mechanisms underlying the association between risk factors and mental health problems. It is the responsibility of longitudinal cohort studies such as the BELLA study (Otto et al., 2020), the Dunedin Multidisciplinary Health and Development Study in New Zealand (Poulton et al., 2015), the British cohort studies (Joshi et al., 2016), the Longitudinal Study of Australian Children (Edwards, 2012) and the National Longitudinal Study of Adolescent to Adult Health in the United States (Harris et al., 2019) to provide such information.

Following the concepts of salutogenesis and resilience (Antonovsky, 1997; Masten et al., 1990), resource-oriented preventive approaches are needed to maintain and improve mental health. Particularly in times of crisis such as the COVID-19 pandemic, strengthening resources for children and adolescents is important, as experts have increasingly raised concerns about a subsequent mental health crisis. The present thesis indicates that a positive family climate and social support are important resources for children and adolescents. Previous studies have additionally identified self-efficacy, a positive self-concept, family cohesion and peer competence as resources for mental health and HRQoL (Kaman et al., 2021; Miller-Lewis et al., 2013; Otto et al., 2017). Therefore, fostering personal, familial and social resources for children and adolescents through health promotion and prevention strategies offers an opportunity to maintain and enhance their mental health. According to the *Ottawa Charta for Health Promotion* by the WHO (1986), health promotion and prevention programmes should adopt a settings approach that takes into account the environment and social contexts of children and adolescents. Two of the most important settings for children's physical, emotional and social development are schools and day-care centres, as children spend considerable time there.

Examples of effective health promotion and prevention programmes in Germany include the projects *Schatzsuche* and *JolinchenKids*. Findings from the longitudinal BELLA study on risk and resource factors for mental health served as scientific basis for the development of these programmes. *Schatzsuche* is a parent education programme for day-care centres and schools that follows a resource-oriented approach and aims to promote the mental health of children. It has been successfully implemented in 620 facilities in eleven German federal states. *JolinchenKids* is a day-care programme developed by the health insurance AOK that aims to promote the health of pre-schoolers. The programme has been implemented in 5,000 day-care facilities throughout Germany and includes a module on mental well-being that focuses on enhancing resilience factors such as positive self-concept, self-efficacy and the ability to deal with conflicts. The nationwide implementation and scientific evaluation of these prevention programmes would be desirable. At the international level, the *WHO Health Promoting School framework* is a promising approach to developing effective mental health promotion and prevention strategies in a school setting. However, more research is needed to evaluate the effectiveness of this approach (Langford et al., 2014). Given the COVID-19 pandemic and its significant impact on mental health, the WHO (2020) has prioritised the need for more high-quality evaluation studies to improve available knowledge on the implementation and long-term effectiveness of mental health promotion and prevention programmes.

Since research has shown that socially disadvantaged children and children of mentally ill parents have a higher risk to develop mental health problems, target group-specific and low-threshold prevention efforts are needed. Furthermore, the development of strategies that aim to reduce social inequalities in health should have a high priority in health policy and public health. Unfortunately, research and practice have established that individuals who are highly in need of prevention efforts are often difficult to reach, even though they particularly stand to benefit from these offers. This observation is known as *inequality paradox* (Frohlich et al., 2008; Hurrelmann et al., 2014). Therefore, prevention strategies should address the needs and concerns of vulnerable children and their families and follow intersectoral, community-based and participatory approaches.

For children who are at risk of experiencing mental health problems or those who already exhibit symptoms of a mental disorder, early intervention services may be helpful. A pioneer in providing early intervention services is the Australian National Youth Mental Health Foundation's *headspace*. Headspace aims to support adolescents with mental health problems to access mental health services (McGorry et al., 2007) and has been successfully evaluated, indicating significant improvements in psychosocial functioning and mental health (Rickwood et al., 2015). Similar early intervention services can be found in Germany. For example, Hamburg recently implemented the pilot project *RECOVER*, which is a cross-sectional coordinated, severity level and evidence-based care model for adolescents and adults with mental health problems. Such early intervention services should be further expanded, as research has indicated that affected adolescents benefit enormously from their support.

Beyond early intervention services, the findings from the present thesis indicate that interventions that focus on increasing family support, enhancing social skills and improving social functioning may be particularly effective for treating children and adolescents with mental health problems such as ADHD. The effectiveness of family-based interventions and cognitive behavioural therapies for child psychopathology in general and for ADHD in particular has been scientifically proven (Cordier et al., 2018; Fowler et al., 2014; Hofmann et al., 2012; Kaslow et al., 2012). Furthermore, Forbes et al. (2019) proposed a transdiagnostic approach to intervention that focuses on common shared risk factors across different mental health problems (e.g., self-regulation and negative parenting). This approach is in line with the dimensional perspective of the RDoC framework and could be promising for the treatment of transdiagnostic symptoms such as AD. More research is needed to better understand the emerging field of transdiagnostic risk factors and intervention approaches. However, from a public health perspective, interventions that can be applied during childhood to prevent the full spectrum of lifetime mental health problems appear to be a promising approach.

In addition to behavioural prevention and intervention for children and adolescents, structural prevention is also important, as the mental health of children and adolescents is also related to socioeconomic, environmental and structural factors. Thus, it is the responsibility of the federal government, health policy, health insurance funds as well as public health and social institutions to address the mental health of children and adolescents and to create conditions that support their healthy development. Findings of the present thesis can be used to raise public awareness about the importance of child and adolescent mental health and to identify prevention and intervention needs. Thus, the results are an important scientific basis for political decision-making processes, supporting the provision of targeted prevention strategies and health care services. Previous findings of the BELLA study have been used to give recommendations for policy to the German Ministry of Health. The development of a national preventive health care strategy was strengthened by the *Prevention Act* introduced by the German Federal Ministry of Health in 2015. Furthermore, the German Federal Ministry of Health and Social Security declared growing up healthy to be one of the *National Health Targets* in 2000. The National Health Targets prioritise fields of action for targeted and coordinated health policies. At the international level, the *Health in All Policies* approach aims to strengthen collaboration amongst policy makers across sectors to improve population health and health care. Evidence from the international HBSC study on child and adolescent mental health and its association with social context factors is used by the WHO to inform international policy and practice.

Taking a public health perspective and based on data from large epidemiological studies, the thesis demonstrated that mental and behavioural health problems are highly prevalent, are associated with adverse long-term outcomes, need to be identified early and are related to psychosocial risks and resources that can be addressed by health promotion and prevention programmes. Given the significant public health relevance, the development, implementation and evaluation of national strategies for mental health promotion and prevention should be further advanced and treated as a high priority. Integrating findings from epidemiological studies into evidence-informed policymaking is an important step in taking the mental health agenda forward. Mental health in childhood is a fundamental prerequisite for adult health. The promotion of mental health and the prevention and care of mental disorders in children and adolescents provide opportunities to improve the health of the next generation and to address the global burden of disease caused by mental health problems.

III Abkürzungsverzeichnis

AD	Affective dysregulation
ADHD	Attention-deficit/hyperactivity disorder
ADOPT	Affective Dysregulation – Optimizing Prevention and Treatment
β	Standardised regression coefficient
B	Unstandardised regression coefficient
BELLA	Behaviour and Wellbeing of Children and Adolescents in Germany
CASMIN	Comparative Analysis of Social Mobility in Industrial Nations
CAT	Computer adaptive test
CBCL	Child Behavior Checklist
CES-DC	Center for Epidemiologic Studies Depression Scale
CFA	Confirmatory factor analysis
CFI	Comparative Fit Index
CI	Confidence interval
COPSY	Impact of COVID-19 on Psychological Health
COVID-19	Coronavirus disease 2019
CTT	Classical test theory
C-GI	Conners Global Index
DALYs	Disability-adjusted life years
DIF	Differential item functioning
DSM	Diagnostic and Statistical Manual of Mental Disorders
f^2	Measure of effect size
FAS	Family Affluence Scale
FCS	Family Climate Scale
FES	Family Environment Scale
GHI	General Health Item
GSE	General Self-Efficacy Scale
HBSC	Health Behaviour in School-aged Children
HBSC-SCL	HBSC Symptom Checklist
HRQoL	Health-related quality of life
ICD	International Classification of Diseases
IRT	Item response theory

KiGGS	German National Health Interview and Examination Survey for Children and Adolescents
LGM	Latent growth model
M	Mean
n	Number of participants in a subsample
η^2	Partial eta square
NIH	National Institute of Health
OR	Odds ratio
p	p-value
p_i	Item difficulty
PRO	Patient-reported outcome
PROMIS	Patient-Reported Outcome Measurement Information System
r	Correlation coefficient
R	Reliability coefficient
RDoC	Research Domain Criteria
RMSEA	Root Mean Square Error of Approximation
SCARED	Screen for Child Anxiety Related Disorders
SCL-S-9	Symptom-Checklist 9-item short version
SCL-90-R	Symptom Checklist-90-R
SD	Standard deviation
SDQ	Strengths and Difficulties Questionnaire
SES	Socioeconomic status
SRH	Self-rated health
SRMR	Standardised Root Mean Square Residual
SSS	Social Support Survey
t	Value of the t-test statistic
TLI	Tucker-Lewis Index
UKE	University Medical Center Hamburg-Eppendorf
UN	United Nations
WHO	World Health Organization
χ^2	Value of the chi-square test statistic
YLDs	Years lived with disability

IV Literaturverzeichnis

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Subjektive Gesundheit und Wohlbefinden von Kindern und Jugendlichen in Deutschland – Querschnittergebnisse der HBSC-Studie 2017/18

Abstract

Subjektive Gesundheit wird als multidimensionales Konstrukt verstanden, welches körperliche, seelische und soziale Dimensionen des Wohlbefindens einer Person umfasst. Die Förderung der subjektiven Gesundheit und des Wohlbefindens von Kindern und Jugendlichen ist von hoher Public-Health-Relevanz, da gesundheitliche Beeinträchtigungen oftmals mit langfristigen Gesundheitsproblemen im späteren Erwachsenenalter einhergehen. Informationen über mögliche Risikofaktoren und Ressourcen sind daher von zentraler Bedeutung. In diesem Beitrag werden aktuelle Prävalenzen zum subjektiven Gesundheitszustand, zur Lebenszufriedenheit und zu psychosomatischen Beschwerden von 11-, 13- und 15-jährigen Kindern und Jugendlichen in Deutschland aus der „Health Behaviour in School-Aged Children (HBSC)“-Studie 2017/18 berichtet (N=4.347, 53,0% Mädchen). Zudem werden soziodemografische und psychosoziale Einflussfaktoren des subjektiven Wohlbefindens untersucht. Die meisten Kinder und Jugendlichen schätzten ihre Gesundheit und Lebenszufriedenheit positiv ein. Dennoch litt etwa ein Drittel der Mädchen und ein Fünftel der Jungen unter mehreren (multiplen) psychosomatischen Beschwerden. Beeinträchtigungen im subjektiven Wohlbefinden zeigten sich vor allem bei Mädchen, älteren Jugendlichen, Jugendlichen mit niedrigerem familiären Wohlstand sowie bei hoher schulischer Belastung. Eine hohe familiäre Unterstützung war hingegen mit einem besseren subjektiven Wohlbefinden assoziiert. Die Ergebnisse verdeutlichen die Notwendigkeit zielgruppenspezifischer Angebote der Prävention und Gesundheitsförderung, um die subjektive Gesundheit und das Wohlbefinden von Kindern und Jugendlichen zu fördern.

SUBJEKTIVE GESUNDHEIT · WOHLBEFINDEN · KINDER UND JUGENDLICHE · HBSC-STUDIE

1. Einleitung

Die subjektive Gesundheit und das Wohlbefinden sind wichtige Ressourcen im Kindes- und Jugendalter und werden als Zielkriterien in vielfältigen Maßnahmen zur Prävention und Gesundheitsförderung festgelegt. So definiert die Weltgesundheitsorganisation (WHO) in ihrem Rahmenkonzept „Gesundheit 2020“ die frühe und gezielte Förderung des Wohlbefindens als eine der zentralen Strategien, um zu einer gesunden Entwicklung von Kindern und zukünftigen Generationen beizutragen [1]. Die regelmäßige Erfassung der subjektiven Gesundheit und des Wohlbefindens im Rahmen von bevölkerungsbasierten Surveys ist eine wichtige Voraussetzung für ein kontinuierliches Gesundheitsmonitoring und darauf basierend für die Planung von gezielten Maßnahmen der Prävention und Gesundheitsförderung [2, 3]. Mit den Gesundheitsstudien HBSC (Health Behaviour in School-aged Children) und KiGGS (Studie zur Gesundheit von Kindern und Jugendlichen in Deutschland) liegen geeignete Monitoring-Instrumente vor, die wichtige Informationen zur subjektiven Gesundheit und zum Wohlbefinden von Kindern und Jugendlichen in Deutschland bereitstellen. Nach der Definition der WHO [4] ist die Gesundheit ein Zustand des vollständigen körperlichen, seelischen und sozialen Wohlbefindens. Gesundheit und Wohlbefinden bedingen sich dabei gegenseitig und unterliegen gemeinsamen Determinanten (oftmals werden diese Begriffe synonym verwendet) [5]. Die Definition der WHO unterstreicht weiterhin den subjektiven Charakter des Wohlbefindens und weist auf dessen Multidimensionalität hin. Das subjektive Wohlbefinden ist mit den individuellen Lebensbedingungen und -erfahrungen von Menschen verknüpft [6]. Als zentrale Indikatoren des subjektiven Wohlbefindens werden in der Forschung oftmals die subjektive Einschätzung der eigenen Gesundheit, die Lebenszufriedenheit, also die Bewertung des eigenen Lebens, sowie psychosomatische und körperliche Gesundheitsbeschwerden berücksichtigt [7, 8].

Studien haben gezeigt, dass die Gesundheit und das Wohlbefinden wichtige Ressourcen im Kindes- und Jugendalter sind, deren Beeinträchtigungen zu langfristigen Gesundheitsproblemen im Erwachsenenalter führen können [9, 10]. So weisen die Ergebnisse zahlreicher Studien darauf hin, dass die subjektive Gesundheit ein zuverlässiger Prädiktor für das spätere Auftreten von körperlichen und psychischen Erkrankungen, die zukünftige Inanspruchnahme von Gesundheitsleistungen sowie Mortalität ist [11-13]. Die subjektive Gesundheit und das Wohlbefinden werden dabei von zahlreichen psychosozialen Faktoren beeinflusst. Eine besondere Bedeutung wird schulbezogenen Einflussfaktoren zugeschrieben, da Jugendliche einen Großteil ihrer Zeit in der Schule verbringen und häufig einem hohen Leistungsdruck ausgesetzt sind [9, 14]. So zeigen die Ergebnisse der internationalen HBSC-Studie beispielsweise, dass schulische Belastungen und (Cyber-)Mobbing zu den wesentlichen Risikofaktoren zählen, die sich negativ auf die subjektive Gesundheitseinschätzung [15, 16], die Lebenszufriedenheit [17] sowie psychosomatische Beschwerden [18, 19] von Schülerinnen und Schülern auswirken. Darüber hinaus sind Risikoverhaltensweisen wie Rauchen [20] und exzessiver Medienkonsum [21] mit einer höheren subjektiven Beschwerdelast assoziiert. Psychosoziale Ressourcen in der Schule (z. B. ein gutes Klassenklima) und in der Familie (z. B. familiäre Unterstützung) wirken sich hingegen positiv auf die allgemeine Lebenszufriedenheit von Kindern und Jugendlichen aus [22, 23].

Neben diesen psychosozialen Risikofaktoren und Ressourcen ist das subjektive Wohlbefinden eng mit soziodemografischen Faktoren wie Geschlecht, Alter und dem sozioökonomischen Status (SES) assoziiert. Im Allgemeinen zeigen Mädchen im Vergleich zu Jungen sowie ältere Jugendliche im Vergleich zu Jüngeren häufiger Beeinträchtigungen in ihrem subjektiven Wohlbefinden [24, 25]. Zudem ist ein niedriger SES oftmals mit einer schlechteren Gesundheit von Heranwachsenden assoziiert [25]. Internationale Ergebnisse der HBSC-Studie deuten auf bedeutende soziale Ungleichheiten in verschiedenen Bereichen der subjektiven Gesundheit von Kindern und Jugendlichen hin, die in nahezu ganz Europa bestehen und über die letzten Jahre überwiegend konstant geblieben sind [26-30]. Darüber hinaus liegen Hinweise vor, dass sich Jugendliche mit Migrationshintergrund in ihrer Gesundheit und ihrem Gesundheitsverhalten von Heranwachsenden ohne Migrationshintergrund unterscheiden. Der Migrationshintergrund kann dabei sowohl positiv als auch negativ mit verschiedenen Gesundheitsindikatoren assoziiert sein [31].

Vor diesem Hintergrund sollen in dem vorliegenden Beitrag aktuelle Prävalenzen der HBSC-Studie zur subjektiven Gesundheitseinschätzung, zur Lebenszufriedenheit und zu psychosomatischen Gesundheitsbeschwerden von 11-, 13- und 15-jährigen Kindern und Jugendlichen in Deutschland berichtet werden. Darüber hinaus sollen Zusammenhänge zwischen einem Gesamtindex, der das subjektive Wohlbefinden als multidimensionales Konstrukt abbildet, und i) den soziodemografischen Faktoren Geschlecht, Alter, familiärer Wohlstand und Migrationshintergrund sowie ii) den psychosozialen Faktoren schulische Belastung und familiäre Unterstützung untersucht werden.

2. Methode

2.1 Stichprobendesign und Studiendurchführung

Datengrundlage für die Analysen des vorliegenden Beitrags bilden die im Jahr 2018 in Deutschland erhobenen Daten der HBSC-Studie. Die internationale HBSC-Studie zielt darauf ab, umfassende Daten zur Gesundheit und zu gesundheitsrelevanten Verhaltensweisen von Heranwachsenden zu erheben. Um eine standardisierte Durchführung der Studie sicherzustellen, wurde ein international verbindliches Forschungsprotokoll eingesetzt. So erfolgte die Stichprobenziehung über eine Zufallsauswahl aus der Grundgesamtheit der Klassen aller allgemeinbildenden Schulen der fünften, siebten und neunten Jahrgangsstufe entsprechend der prozentualen Verteilung der bundeslandspezifischen Schulformen. Zur Datenerhebung wurde ein international standardisierter Kernfragebogen eingesetzt, welcher von den Schülerinnen und Schülern im Rahmen einer Unterrichtsstunde ausgefüllt wurde. Voraussetzung für die Teilnahme war das Vorliegen der schriftlichen Einwilligungserklärung der Schülerinnen und Schüler sowie der Eltern am Tag der Befragung. Die Teilnahme an der Studie war freiwillig. Die Datenschutzbeauftragte der Martin-Luther-Universität Halle-Wittenberg und die Ethikkommission der Ärztekammer Hamburg haben die Studie fachrechtlich beraten und ihr zugestimmt. Weiterhin wurde die Durchführung der Studie vorab von allen Bundesländern durch die zuständigen Kultus- beziehungsweise Bildungsministerien genehmigt. Eine ausführliche Darstellung der Methodik der HBSC-Studie findet sich in dem Beitrag von Moor et al. in dieser Ausgabe des Journal of Health Monitoring.

2.2 Instrumente

Indikatoren der subjektiven Gesundheit und des Wohlbefindens

Die Erfassung der subjektiven Gesundheitseinschätzung der Schülerinnen und Schüler erfolgte über die Frage: „Wie würdest du deinen Gesundheitszustand beschreiben?“ mit den Antwortmöglichkeiten: „ausgezeichnet“, „gut“, „einigermaßen“ und „schlecht“. Die Kategorien „ausgezeichnet“ und „gut“ wurden im Anschluss zu einer „ausgezeichneten/guten“

Gesundheit und die Kategorien „einigermaßen“ und „schlecht“ zu einer „eher schlechten“ Gesundheit zusammengefasst. Die Lebenszufriedenheit wurde mithilfe der „Cantril Ladder“ [32] erfasst. Die Jugendlichen wurden gebeten, auf einer elfstufigen visuellen Analogskala in Form einer Leiter anzugeben, auf welcher Stufe sie ihr derzeitiges Leben verorten. Das obere Ende der Leiter steht dabei für das „beste denkbare Leben“ (zehn Punkte) und das untere Ende für das „schlechteste denkbare Leben“ (null Punkte). Die Antworten wurden im Anschluss dichotomisiert in „niedrige Lebenszufriedenheit“ (null bis fünf Punkte) und „mittlere bis hohe Lebenszufriedenheit“ (sechs bis zehn Punkte). Die psychosomatischen Gesundheitsbeschwerden wurden über die HBSC-Symptom Checklist (HBSC-SCL) [33] erfragt. Die Jugendlichen gaben auf einer fünfstufigen Antwortskala von „fast täglich“ bis „selten oder nie“ an, wie häufig sie in den letzten sechs Monaten unter Kopfschmerzen, Bauchschmerzen, Rückenschmerzen, Niedergeschlagenheit, Gereiztheit, Nervosität, Einschlafproblemen und Benommenheit litten. Traten zwei oder mehr dieser Beschwerden mindestens wöchentlich auf, so wird von „multiplen psychosomatischen Beschwerden“ gesprochen. Die drei Indikatoren subjektive Gesundheitseinschätzung, Lebenszufriedenheit und psychosomatische Gesundheitsbeschwerden wurden anschließend zu einem Gesamtindex kombiniert, der in diesem Beitrag als subjektives Wohlbefinden definiert wird (dichotomisiert in „sehr gut/gut“ und „eher schlecht“) [24]. Ein sehr gutes/gutes subjektives Wohlbefinden lag vor, wenn die Jugendlichen ihren Gesundheitszustand als ausgezeichnet oder gut einschätzten, eine mittlere bis hohe Lebenszufriedenheit (sechs oder mehr Punkte) sowie weniger als zwei wöchentlich auftretende psychosomatische Beschwerden angaben.

Soziodemografische Faktoren

Das Geschlecht der Kinder und Jugendlichen wurde über die Frage „Bist du ein Junge oder ein Mädchen?“ erfasst. Das Alter wurde mit zwei Fragen zum Geburtsmonat und zum Geburtsjahr operationalisiert. Die Schülerinnen und Schüler wurden im Anschluss in die drei Altersgruppen 11 Jahre, 13 Jahre und 15 Jahre eingeteilt, wobei die genannten Altersgruppen weitgehend der fünften, siebten und neunten Jahrgangsstufe entsprechen. Zur Erfassung des familiären Wohlstands wurde die Family Affluence Scale (FAS) [34, 35] herangezogen. Mithilfe der FAS wurden die Schülerinnen und Schüler zu bestimmten Wohlstandsgütern im Elternhaus befragt (Computer, Autos, eigenes Zimmer, Urlaube, Badezimmer, Geschirrspülmaschine). Aus diesen sechs Items wurde ein summativer Index gebildet, welcher mithilfe einer RIDIT (Relative to an Identified Distribution Integral Transformation)-Kalkulation umgewandelt und im Anschluss anhand einer Quintilseinteilung in die drei Gruppen niedriger (< 20 %), mittlerer (20 – 80 %) und hoher (> 80 %) familiärer Wohlstand eingeteilt wurde. Der Migrationshintergrund der Kinder und Jugendlichen wurde anhand von Fragen zum eigenen Geburtsland und zum Geburtsland der Eltern operationalisiert. Heranwachsende, von denen ein Elternteil nicht in Deutschland geboren ist, werden als Heranwachsende mit einseitigem Migrationshintergrund bezeichnet. Ein beidseitiger Migrationshintergrund liegt vor, wenn a) die Heranwachsenden selbst nicht in Deutschland geboren wurden und mindestens ein Elternteil nicht in Deutschland geboren wurde oder b) beide Eltern zugewandert sind beziehungsweise nicht in Deutschland geboren wurden.

Psychosoziale Faktoren

Die Erfassung der schulischen Belastung der Schülerinnen und Schüler erfolgte über die Frage: „Wie stark fühlst du dich durch das belastet, was in der Schule von dir verlangt wird?“ mit den Antwortmöglichkeiten: „überhaupt nicht“, „etwas“, „einigermaßen stark“ und „sehr stark“ [9]. Die Kategorien „überhaupt nicht“ und „etwas“ wurden im Anschluss zu einer „eher geringen“ und die Kategorien „einigermaßen stark“ und „sehr stark“ zu einer „eher hohen“ schulischen Belastung zusammengefasst. Die familiäre Unterstützung der Jugendlichen wurde anhand einer Subskala der Multidimensional Scale of Perceived Social Support (MSPSS) [36] erfasst. Diese Subskala umfasst vier Items, die die subjektive emotionale Unterstützung innerhalb der Familie erfragen (z. B. „Ich kann mit meiner Familie über meine Probleme sprechen“). Die Fragen werden auf einer siebenstufigen Antwortskala von „stimmt überhaupt nicht“ bis „stimmt genau“ beantwortet. Gemäß den Empfehlungen der HBSC-Studie [9] wurde der aus den Antworten ermittelte Gesamtscore anschließend anhand eines Cut-offs (≥ 5,5) geteilt und die Jugendlichen einer Gruppe mit „geringer familiärer Unterstützung“ und einer Gruppe mit „hoher familiärer Unterstützung“ zugeordnet.

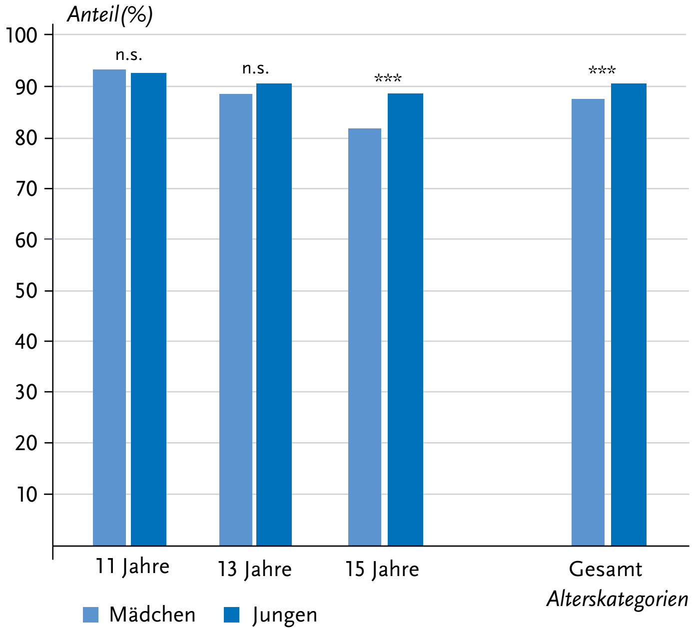
2.3 Statistische Analysen

Zur Beschreibung der Stichprobe wurden absolute und relative Häufigkeiten der analysierten unabhängigen Variablen berechnet. Im Anschluss wurden die Prävalenzen ausgezeichneter oder guter subjektiver Gesundheitseinschätzung, mittlerer bis hoher Lebenszufriedenheit und multipler psychosomatischer Beschwerden stratifiziert nach Alter und Geschlecht ermittelt. Die Berechnungen der Prävalenzen wurden mit einem Gewichtungsfaktor durchgeführt, der Abweichungen der Stichprobe von der Bevölkerungsstruktur hinsichtlich Schultyp, Alter und Geschlecht korrigiert. Mittels multipler logistischer Regressionen wurden anschließend Zusammenhänge zwischen dem Gesamtindex des subjektiven Wohlbefindens und den soziodemografischen Faktoren Geschlecht, Alter, familiärer Wohlstand und Migrationshintergrund sowie den psychosozialen Faktoren schulische Belastung und familiäre Unterstützung untersucht. Signifikante Unterschiede zwischen Gruppen wurden bei einem Signifikanzniveau von $p<0{,}05$ angenommen. Alle Analysen wurden mit IBM SPSS Version 26 durchgeführt.

3. Ergebnisse

Insgesamt nahmen N = 4.347 Schülerinnen und Schüler der fünften, siebten und neunten Klasse im Alter von 11 Jahren, 13 Jahren und 15 Jahren an der Befragung teil (53,0 % Mädchen). Auf Grundlage der Quintilseinteilung konnten knapp zwei Drittel der Jugendlichen Familien mit mittlerem Wohlstand (65,7 %) und jeweils knapp ein Fünftel der Befragten Familien mit niedrigem (18,2 %) beziehungsweise hohem (16,0 %) Wohlstand zugeordnet werden. Etwa zwei Drittel der Jugendlichen hatten keinen Migrationshintergrund (64,7 %). Ein Viertel der Schülerinnen und Schüler (25,1 %) fühlte sich durch die schulischen Anforderungen einigermaßen bis sehr stark belastet. Der Großteil der Jugendlichen (74,0 %) berichtete über eine hohe familiäre Unterstützung. Weitere Charakteristika der Studienpopulation sind in dem Beitrag von Moor et al. in dieser Ausgabe des Journal of Health Monitoring beschrieben.

Abbildung 1
Prävalenz ausgezeichneter oder guter subjektiver Gesundheitseinschätzung nach Geschlecht und Alter (n = 2.160 Mädchen, n = 2.159 Jungen)
Quelle: HBSC-Studie Deutschland 2017/18



***=p<0,001, n.s.=nicht signifikant

Die meisten Kinder und Jugendlichen schätzen ihre Gesundheit als ausgezeichnet oder gut ein und berichten eine mittlere bis hohe Lebenszufriedenheit.

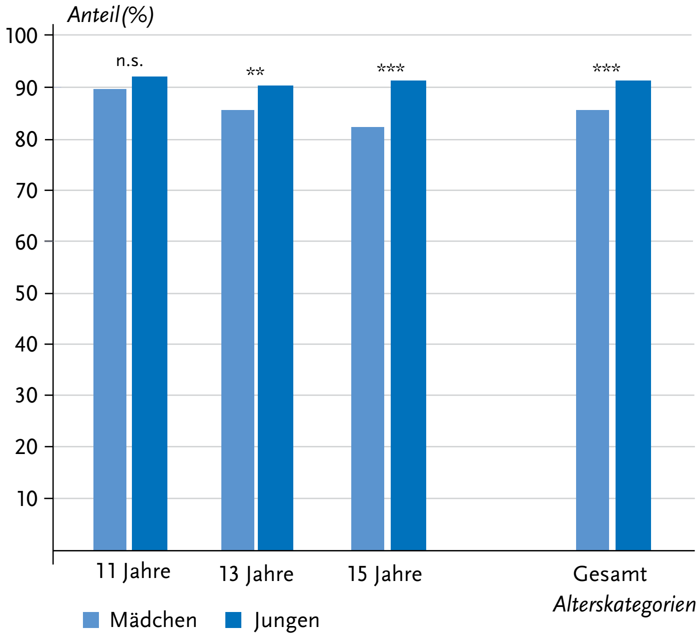
Subjektive Gesundheitseinschätzung

Abbildung 1 zeigt den Anteil der Kinder und Jugendlichen, die ihren Gesundheitszustand als ausgezeichnet oder gut einschätzten, differenziert nach Alter und Geschlecht. Die Mehrheit der Befragten (88,9 %) berichtete eine ausgezeichnete oder gute Gesundheit. Mit 90,4 % schätzten die Jungen ihre Gesundheit dabei signifikant besser ein als die Mädchen (87,3 %). Die positive Gesundheitsbewertung nahm in den höheren Altersgruppen für beide Geschlechter ab, wobei die Abnahme bei den Mädchen (-11,5 Prozentpunkte) deutlich stärker ausgeprägt war als bei den Jungen (-4,0 Prozentpunkte).

Lebenszufriedenheit

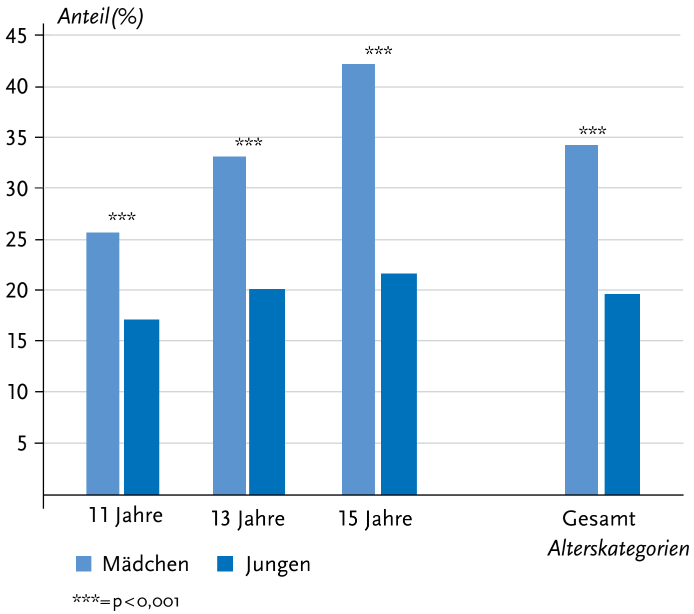
Geschlechtsunterschiede zeigten sich auch in der Bewertung der Lebenszufriedenheit (Abbildung 2). Die Mehrheit der Jugendlichen (88,7 %) gab eine mittlere bis hohe Lebenszufriedenheit an, wobei diese von den Jungen (91,6 %) im Vergleich zu den Mädchen (85,9 %) signifikant positiver bewertet wurde. Während sich der Anteil der Jungen mit einer mittleren bis hohen Lebenszufriedenheit über das Alter hinweg nur wenig veränderte und zwischen dem 13. und 15. Lebensjahr sogar leicht anstieg, nahm der Anteil der Mädchen, die eine mittlere bis hohe Lebenszufriedenheit angeben, in den höheren Altersgruppen deutlich ab (- 7,4 Prozentpunkte).

Abbildung 2
Prävalenz mittlerer bis hoher Lebenszufriedenheit (sechs oder mehr Punkte) nach Geschlecht und Alter (n = 2.153 Mädchen, n = 2.145 Jungen)
Quelle: HBSC-Studie Deutschland 2017/18



***=p<0,001, **=p<0,01, n.s.=nicht signifikant

Abbildung 3
Prävalenz multipler psychosomatischer Beschwerden (mindestens wöchentlich) nach Geschlecht und Alter (n = 2.152 Mädchen, n = 2.147 Jungen)
Quelle: HBSC-Studie Deutschland 2017/18



Etwa ein Drittel der Mädchen und ein Fünftel der Jungen leidet unter multiplen psychosomatischen Gesundheitsbeschwerden.

Psychosomatische Gesundheitsbeschwerden

In Abbildung 3 wird der alters- und geschlechtsspezifische Anteil der Kinder und Jugendlichen dargestellt, die in den letzten sechs Monaten unter mindestens zwei wöchentlich auftretenden psychosomatischen Beschwerden litten. Insgesamt berichteten 26,9 % der Befragten von multiplen psychosomatischen Beschwerden, wobei die Mädchen mit 34,2 % deutlich häufiger unter derartigen Beschwerden litten als die Jungen mit 19,7 %. Dieser signifikante Geschlechtsunterschied war in allen Alterskategorien zu beobachten und nahm in den höheren Altersgruppen zu. So stiegen die Häufigkeiten multipler psychosomatischer Beschwerden bei den Mädchen über das Alter hinweg deutlich an (+ 16,4 Prozentpunkte), während der Anteil bei den Jungen nur leicht zunahm (+ 4,5 Prozentpunkte).

Gesamtindex zum subjektiven Wohlbefinden

Ein mindestens gutes subjektives Wohlbefinden, gekennzeichnet durch eine ausgezeichnete oder gute subjektive Gesundheitseinschätzung, eine mittlere bis hohe Lebenszufriedenheit sowie weniger als zwei wöchentlich auftretende psychosomatische Beschwerden, wurde von 66,1 % der Kinder und Jugendlichen berichtet. Tabelle 1 stellt die Ergebnisse der multivariaten logistischen Regressionsanalyse dar. Die Analyse zeigt, dass Mädchen im Vergleich zu Jungen sowie ältere Jugendliche (15 Jahre) im Vergleich zu

Tabelle 1
Multivariate logistische Regression zur Vorhersage des subjektiven Wohlbefindens von Kindern und Jugendlichen (n = 2.058 Mädchen, n = 1.740 Jungen)
Quelle: HBSC-Studie Deutschland 2017/18

	OR	(95 %-KI)	p-Wert
Geschlecht			
Jungen (Referenz)			
Mädchen	**0,53**	**(0,46 – 0,61)**	**< 0,001**
Alter			
11 Jahre (Referenz)			
13 Jahre	0,90	(0,74 – 1,08)	0,236
15 Jahre	**0,70**	**(0,59 – 0,83)**	**< 0,001**
Familiärer Wohlstand			
Hoch (Referenz)			
Mittel	**0,61**	**(0,48 – 0,79)**	**< 0,001**
Niedrig	**0,79**	**(0,65 – 0,97)**	**0,022**
Migrationshintergrund			
Kein (Referenz)			
Einseitig	0,93	(0,75 – 1,16)	0,522
Beidseitig	0,86	(0,72 – 0,97)	0,090
Schulische Belastung			
Eher gering (Referenz)			
Eher stark	**0,65**	**(0,55 – 0,76)**	**< 0,001**
Familiäre Unterstützung			
Gering (Referenz)			
Hoch	**3,01**	**(2,54 – 3,56)**	**< 0,001**

OR = Odds Ratio, KI = Konfidenzintervall
Fettdruck = statistisch signifikant im Vergleich zur Referenzgruppe (p < 0,05)

Jüngeren (11 Jahre) über ein signifikant schlechteres subjektives Wohlbefinden berichteten. Im Vergleich zu Schülerinnen und Schülern aus Familien mit hohem Wohlstand, gaben jene mit mittlerem beziehungsweise niedrigem familiären Wohlstand ebenfalls ein signifikant schlechteres subjektives Wohlbefinden an. Kein Zusammenhang zeigte sich zwischen dem subjektiven Wohlbefinden und dem Migrationshintergrund. Im Hinblick auf die schulische Belastung berichteten die Schülerinnen und Schüler, die sich durch die schulischen Anforderungen einigermaßen bis sehr stark belastet fühlten, über ein signifikant schlechteres subjektives Wohlbefinden. Eine hohe familiäre Unterstützung der Jugendlichen ging hingegen mit einem signifikant besseren subjektiven Wohlbefinden einher.

Beeinträchtigungen im subjektiven Wohlbefinden liegen vor allem bei Mädchen, älteren Jugendlichen, niedrigerem familiären Wohlstand sowie bei hoher schulischer Belastung vor.

4. Diskussion

Im vorliegenden Beitrag wurden aktuelle Prävalenzen zur subjektiven Gesundheitseinschätzung, Lebenszufriedenheit und psychosomatischen Beschwerden von 11-, 13- und 15-jährigen Kindern und Jugendlichen in Deutschland berichtet sowie Zusammenhänge zwischen dem Gesamtindex des subjektiven Wohlbefindens und soziodemografischen sowie psychosozialen Faktoren untersucht. Zusammenfassend schätzten die meisten Kinder und Jugendlichen ihren Gesundheitszustand als ausgezeichnet oder gut ein und berichteten eine mittlere bis hohe Lebenszufriedenheit, wobei Jungen ihre Gesundheit und Lebenszufriedenheit positiver bewerteten als Mädchen. Etwa ein Drittel der Mädchen und ein Fünftel der Jungen litt unter multiplen psychosomatischen Beschwerden. Im Einklang mit der Literatur hing das subjektive Wohlbefinden als multidimensionales Konstrukt, das sich aus der subjektiven Gesundheitseinschätzung, Lebenszufriedenheit und psychosomatischen Beschwerden zusammensetzt, mit den Einflussfaktoren Geschlecht, Alter, familiärer Wohlstand, schulische Belastung und familiäre Unterstützung zusammen, jedoch nicht mit dem Migrationshintergrund der Jugendlichen.

Die Resultate dieser Studie bestätigen die Ergebnisse früherer Befragungswellen der HBSC-Studie und anderer nationaler, bevölkerungsbasierter Studien. Auch in den aktuellen Daten der Studie zur Gesundheit von Kindern und Jugendlichen in Deutschland (KiGGS Welle 2) zeigte sich, dass die meisten Kinder und Jugendlichen einen guten oder sehr guten allgemeinen Gesundheitszustand aufweisen [25]. Während die Daten der HBSC-Studie jedoch auf Selbstangaben von 11-, 13- und 15-jährigen Schülerinnen und Schülern basieren, stützen sich die Ergebnisse von KiGGS Welle 2 auf Elternangaben von 3- bis 17-jährigen Kindern und Jugendlichen und sind somit nur eingeschränkt vergleichbar. Dennoch konnten in beiden Studien statistisch bedeutsame alters- und geschlechtsspezifische Unterschiede im Hinblick auf die Gesundheit festgestellt werden. So zeigten die Ergebnisse der vorliegenden Studie, dass 11-, 13- und 15-jährige Jungen ihre Gesundheit positiver einschätzten und zufriedener mit ihrem Leben waren als Mädchen. Diese Geschlechtsunterschiede waren in allen Alterskategorien zu beobachten und nahmen in höheren Altersgruppen zu. Während Mädchen mit zunehmendem Alter deutlich seltener eine ausgezeichnete oder gute Gesundheit und eine mittlere bis hohe Lebenszufriedenheit angaben, veränderten sich die Prävalenzen bei den Jungen kaum. Die beschriebenen Ergebnisse decken sich auch mit bisherigen Erkenntnissen der internationalen HBSC-Studie [9, 37] sowie

Eine hohe familiäre Unterstützung ist mit einem besseren subjektiven Wohlbefinden assoziiert und kann als wichtige Ressource im Kindes- und Jugendalter betrachtet werden.

anderer internationaler Surveys zum Wohlbefinden von Kindern und Jugendlichen [38, 39]. Darüber hinaus zeigt sich insgesamt ein positiver Trend im Hinblick auf die subjektive Gesundheitseinschätzung und Lebenszufriedenheit. Verglichen mit den Prävalenzen vorheriger Befragungswellen der HBSC-Studie [24], schätzen zunehmend mehr Kinder und Jugendliche ihre Gesundheit als ausgezeichnet oder gut ein und berichten eine mittlere bis hohe Lebenszufriedenheit. So stieg der Anteil der Jugendlichen mit einem ausgezeichneten oder guten Gesundheitszustand von 86,0% (2006) über 87,1% (2010) und 86,6% (2014) auf 88,9% (2018). Der Anteil der Jugendlichen mit einer mittleren bis hohen Lebenszufriedenheit stieg von 81,9% (2006) über 84,1% (2010) und 82,6% (2014) auf 88,8% (2018).

Den alters- und geschlechtsspezifischen Unterschieden in der subjektiven Gesundheitseinschätzung und Lebenszufriedenheit können verschiedene Faktoren zugrunde liegen. Dazu zählen beispielsweise geschlechtsspezifische Entwicklungsaufgaben verbunden mit der Pubertät, die bei den Mädchen und Jungen mit unterschiedlichen Herausforderungen auf mentaler und körperlicher Ebene verknüpft sind. Diese umfassen beispielsweise körperliche Veränderungen und die Entwicklung der eigenen Identität [40]. Studien weisen zudem darauf hin, dass Mädchen und Jungen in der anforderungsreichen Lebensphase der Adoleszenz Belastungen unterschiedlich wahrnehmen und anders mit Stress umgehen. So nutzen Mädchen häufig aktive, problemorientierte Bewältigungsstrategien, während sich bei Jungen eher problemmeidendes Verhalten beobachten lässt [41, 42]. Gleichzeitig nimmt der schulische Leistungsdruck mit dem Alter zu, was sich auf die allgemeine Lebenszufriedenheit der Jugendlichen auswirken kann [23].

Auch wenn die meisten Kinder und Jugendlichen ihren Gesundheitszustand als ausgezeichnet oder gut einschätzen und zufrieden mit ihrem Leben sind, zeigen die Ergebnisse der HBSC-Studie einen großen Handlungsbedarf, denn rund ein Drittel der Mädchen und ein Fünftel der Jungen gab an, unter multiplen psychosomatischen Beschwerden zu leiden. Am häufigsten litten die Jugendlichen dabei unter Einschlafproblemen, Kopfschmerzen, Rückenschmerzen und Bauchschmerzen (Daten nicht gezeigt). Bei den Mädchen zeigte sich, dass die Beschwerden mit dem Alter deutlich zunehmen, was unter anderem durch das Einsetzen der Menstruation sowie durch die höhere Sensibilität von Mädchen für ihren eigenen Körper erklärt werden kann. Dieser Befund deckt sich mit bisherigen Ergebnissen aus internationalen Studien, in denen deutlich höhere Beschwerdehäufigkeiten bei Mädchen im Vergleich zu Jungen gefunden wurden [43]. Im Abgleich mit den berichteten Prävalenzen früherer Befragungswellen der HBSC-Studie [24] wird deutlich, dass der Anteil an Schülerinnen und Schülern mit multiplen psychosomatischen Beschwerden in den letzten Jahren kontinuierlich angestiegen ist, was die Notwendigkeit von zielgerichteten Präventions- und Interventionsangeboten in diesem Bereich verdeutlicht. Da die Forschung gezeigt hat, dass Mädchen und Jungen aufgrund biologischer, kultureller und psychosozialer Einflüsse unterschiedlich mit psychosomatischen Beschwerden umgehen [44], bedarf es einer geschlechtersensiblen Entwicklung von Angeboten der Prävention und Gesundheitsförderung. Derartige Angebote sollten unter anderem auf das Erlernen von Bewältigungsstrategien für den Umgang mit Stressoren sowie auf die Stärkung von sozio-emotionalen Fähigkeiten der Jugendlichen abzielen. Bei der Umsetzung sollten die Sozialisationsinstanzen Familie und Schule eng zusammenarbeiten [45].

Werden alle drei Aspekte des subjektiven Wohlbefindens gemeinsam betrachtet, weisen die Ergebnisse der multivariaten Regression, neben den Alters- und Geschlechtseffekten, auf Unterschiede im subjektiven Wohlbefinden in Abhängigkeit vom familiären Wohlstand hin. Kinder und Jugendliche aus Familien mit niedrigem beziehungsweise mittlerem familiären Wohlstand gaben im Vergleich zu Jugendlichen mit hohem Wohlstand ein signifikant schlechteres subjektives Wohlbefinden an. Anders als vermutet, war das Risiko für Kinder und Jugendliche mit niedrigem familiären Wohlstand im Vergleich zu jenen mit hohem Wohlstand etwas geringer als das entsprechende Risiko von Jugendlichen mit mittlerem im Vergleich zu hohem Wohlstand. Eine genauere Untersuchung dieser Zusammenhänge in zukünftigen Studien wäre sehr interessant. Soziale Ungleichheit in der Gesundheit wurde bislang in zahlreichen nationalen und internationalen Studien belegt [30, 46, 47]. Die Tatsache, dass sozial benachteiligte Kinder und Jugendliche von Beeinträchtigungen in verschiedenen Bereichen ihrer Gesundheit betroffen sind, verdeutlicht den besonderen Bedarf an zielgruppenspezifischen und niedrigschwelligen Angeboten der Prävention und Gesundheitsförderung. Dies bekräftigt Strategien, die die Verringerung gesundheitlicher Ungleichheit als ein zentrales Ziel der Gesundheitspolitik und Public Health formulieren.

Weiterhin zeigten die Ergebnisse, dass das subjektive Wohlbefinden der Schülerinnen und Schüler nicht mit dem Migrationshintergrund zusammenhängt. Auch in KiGGS Welle 2 konnten keine statistisch bedeutsamen Unterschiede in der Selbsteinschätzung der allgemeinen Gesundheit zwischen Kindern und Jugendlichen mit und ohne Migrationshintergrund festgestellt werden, wenngleich sich migrationsbezogene Unterschiede im Gesundheitsverhalten der 11- bis 17-Jährigen zeigten [31]. Limitierend ist jedoch anzumerken, dass Jugendliche mit Migrationshintergrund eine sehr heterogene Gruppe darstellen, weshalb neben dem Vorliegen eines Migrationshintergrundes auch weitere migrationsbezogene Merkmale (wie z. B. die Aufenthaltsdauer der Eltern in Deutschland und die zu Hause gesprochene Sprache) berücksichtigt werden sollten.

Im Einklang mit früheren Ergebnissen der internationalen HBSC-Studie [15, 18] zeigte sich auch in den aktuellen nationalen Daten, dass Jugendliche ein schlechteres subjektives Wohlbefinden angeben, wenn sie sich durch die schulischen Anforderungen belastet fühlen. Eine hohe schulische Belastung kann demnach als wichtiger Risikofaktor für das subjektive Wohlbefinden von Schülerinnen und Schülern angesehen werden. Um dem entgegenzuwirken, können schulbasierte Interventionen, die auf das Erlernen von Entspannungstechniken und Bewältigungsstrategien für den Umgang mit schulischen Belastungen abzielen, förderlich sein [48]. Weiterhin zeigen vorangegangene Studien, dass sich ein positives Schulklima und die Förderung der Autonomie der Schülerinnen und Schüler positiv auf die Zufriedenheit und das Wohlbefinden in der Schule auswirken [23]. Demzufolge sind insbesondere auch von Interventionen, die neben dem individuellen Verhalten auch an den Prozessen und Strukturen der Schule ansetzen, förderliche Auswirkungen auf die Gesundheit von Schülerinnen und Schülern zu erwarten.

Zuletzt unterstreichen die Ergebnisse der vorliegenden Studie die Bedeutung der familiären Unterstützung für das

Zielgruppenspezifische Angebote der Prävention und Gesundheitsförderung sind notwendig, um die subjektive Gesundheit und das Wohlbefinden von Kindern und Jugendlichen zu fördern.

subjektive Wohlbefinden von Kindern und Jugendlichen, was sich mit bisherigen Forschungsergebnissen deckt [22]. Eine hohe familiäre Unterstützung wirkte sich positiv auf das subjektive Wohlbefinden aus und kann somit als wichtige Ressource im Kindes- und Jugendalter betrachtet werden. Es ist zu vermuten, dass die familiäre Unterstützung auch als Schutzfaktor wirken kann, indem sie den nachteiligen Effekt der schulischen Belastung auf das subjektive Wohlbefinden abmildert. Zukünftige Studien sollten derartige Zusammenhänge mithilfe von Moderationsanalysen näher untersuchen.

Die vorliegende Arbeit weist zahlreiche Stärken auf. Dazu zählen das standardisierte Vorgehen hinsichtlich der Datenerhebung in der HBSC-Studie, der Einsatz validierter und international erprobter Instrumente, der große Stichprobenumfang sowie die Erfassung der untersuchten Indikatoren aus subjektiver Sicht der Kinder und Jugendlichen. Zu den Limitationen der vorliegenden Studie zählt, dass aufgrund des Querschnittsdesigns keine kausalen Zusammenhänge untersucht werden konnten. Weiterhin konnten lediglich 12,0 % der Varianz des subjektiven Wohlbefindens der Kinder und Jugendlichen durch die analysierten soziodemografischen und psychosozialen Faktoren erklärt werden (Daten nicht gezeigt). Es gilt daher weitere Einflussfaktoren des subjektiven Wohlbefindens zu bestimmen, welche in der aktuellen Studie nicht berücksichtigt werden konnten. Dies könnten beispielsweise weitere psychosoziale Faktoren wie Mobbing [17], verhaltensbezogene Faktoren oder auch das Vorliegen von chronischen Erkrankungen [49] sein.

Zusammenfassend ist festzuhalten, dass die meisten Kinder und Jugendlichen ihr subjektives Wohlbefinden als sehr gut oder gut bewerten und Beeinträchtigungen vor allem bei Mädchen, älteren Jugendlichen, Jugendlichen mit niedrigerem familiären Wohlstand sowie bei hoher schulischer Belastung vorliegen. Gleichzeitig hat sich die familiäre Unterstützung als wichtige Ressource für das subjektive Wohlbefinden herausgestellt. Aus den Ergebnissen lassen sich Ansatzpunkte für zielgruppenspezifische Angebote der Prävention und Gesundheitsförderung ableiten. Neben Angeboten auf individueller Ebene, die auf das Erlernen von Bewältigungsstrategien für den Umgang mit Stressoren abzielen, können Interventionen auf Familien- und Schulebene zur Stärkung von Kompetenzen und zur Verbesserung der strukturellen Rahmenbedingungen hilfreich sein, um die subjektive Gesundheit und das Wohlbefinden von Kindern und Jugendlichen zu fördern. Einen breiten Zugang zu allen Kindern und Jugendlichen ungeachtet ihrer soziodemografischen und sozioökonomischen Ausgangslage bietet hierbei insbesondere die schulische Gesundheitsförderung. Zukünftig können die Daten der HBSC-Studie für internationale Vergleiche sowie Trendanalysen für eine Vielzahl an Indikatoren der Gesundheit und des Gesundheitsverhaltens von Kindern und Jugendlichen genutzt werden. Neben KiGGS ist die HBSC-Studie somit ein zentrales Instrument des Gesundheitsmonitorings, welches wichtige Informationen zur Gesundheit von Kindern und Jugendlichen in Deutschland bereitstellt und Grundlagen für die Planung von Maßnahmen der Prävention und Gesundheitsförderung schafft.

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Datenschutz und Ethik

Bei der zugrundeliegenden Befragung wurden die datenschutzrechtlichen Bestimmungen der EU-Datenschutzgrundverordnung (DSGVO) und des Bundesdatenschutzgesetzes (BDSG) eingehalten. Die Ethikkommission der Ärztekammer Hamburg hat die Studie ethisch und fachrechtlich beraten und ihr zugestimmt (Bearbeitungs-Nr. PV5671). Die Teilnahme an der Studie war freiwillig. Die Schülerinnen und Schüler sowie deren Erziehungsberechtigte wurden vollständig über Inhalte und Ziele der Studie sowie über den Datenschutz aufgeklärt und gaben ihre schriftliche Einwilligung zur Teilnahme (active consent).

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Die Autorinnen und Autoren geben an, dass kein Interessenkonflikt besteht.

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Publication 2: Trajectories of mental health and long-term outcomes of mental health problems in children and adolescents

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ORIGINAL CONTRIBUTION

Mental health and well-being from childhood to adulthood: design, methods and results of the 11-year follow-up of the BELLA study

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Abstract

Mental health and well-being are of great interest in health policy and research. Longitudinal surveys are needed to provide solid population-based data. We describe the design and methods of an 11-year follow-up of the German BELLA study in children, adolescents and young adults, and we report on age- and gender-specific courses of general health and well-being, long-term health-related outcomes of mental health problems, and mental health care use. The BELLA study is the module on mental health and well-being within the German Health Interview and Examination Survey for Children and Adolescents (KiGGS). Standardised measures were used at each of the five measurement points of the BELLA study. In the 11-year follow-up, young people aged 7–31 years participated ($n = 3492$). Individual growth modelling, linear regression and descriptive analyses were conducted. Self-reported general health and well-being were both better in younger (vs. older) and in male (vs. female) participants according to the data from all five measurement points. Mental health problems in childhood and adolescence (measured at baseline) predicted impaired health outcomes at 6-year and 11-year follow-ups. Approximately one out of four children with a diagnosed mental disorder was not undergoing mental health treatment. With its 11-year follow-up, the prospective longitudinal BELLA study provides new and solid data on mental health and well-being from childhood to adulthood in Germany, and these data are important for health promotion and prevention practices. These results are consistent with previous findings. Promising future analyses are planned.

Keywords Health-related quality of life · Health care use · Children and adolescents · Young adults · Nation-wide survey · Longitudinal analyses

Introduction

Mental health problems are the leading cause of health-related disability in children and adolescents worldwide [1] and are a global health challenge of the twenty-first century [2]. Likewise, mental health and well-being in childhood and adolescence have been the focus of interest among researchers in recent decades [3–5]. The magnitude of the problem also becomes clear when inspecting the global prevalence rates of mental disorders. Epidemiological studies report that approximately 13–20% of children and adolescents worldwide are affected by mental health problems [3, 6–8]. The results from a meta-analysis of 33 cross-sectional and longitudinal studies ($n = 72{,}978$) demonstrate that the overall prevalence of behavioural and emotional disorders among children and adolescents in Germany is 17.6% [9]. Research results from the representative 4 decade longitudinal birth cohort in New Zealand (Dunedin Study) and other

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Christiane Otto and Franziska Reiss contributed equally to this manuscript (shared first authorship).

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longitudinal studies indicate that experiencing a diagnosable mental disorder at some point during the life course affects the majority of people rather than only a small subgroup [10, 11]. In the Dunedin cohort study, only 17% of the participants had never been diagnosed with a mental disorder between birth and midlife [10].

Mental health problems cause a high burden for both individuals and society and cause significant impairments in various life domains, such as family life, professional life, quality of life and the wider social environment [12–14]. From an economic perspective, mental disorders lead to high direct and indirect costs for society [15].

Mental disorders in children and adolescents are highly recurrent and persistent, and the development of comorbidities as well as chronic impairments during adulthood is frequent [6, 16–19]. With regard to health care utilisation, recent reviews point out that a number of barriers, such as structural issues, a lack of knowledge and understanding as well as negative attitudes towards mental health treatments, hinder affected children and adolescents or their parents from accessing mental health services [20, 21]. Overall, study findings underline the high relevance of mental health as an important factor in strengthening healthy childhood development and ensuring social participation.

Especially with regard to prevention and intervention, subjective well-being and health-related quality of life (HRQoL) are important aspects of modern concepts of health. HRQoL is a subjective and multidimensional construct that has become a major issue in epidemiological and clinical research and paediatric health care. The concept of HRQoL includes physiological, psychological, and functional aspects of health and well-being [22]. Recent research reviews underline that HRQoL and mental health problems are closely linked to each other, whereby children with mental health problems experience a noticeable reduction in various domains of HRQoL [4, 23]. Therefore, HRQoL measures can increase understanding the impact of mental health problems on children's and adolescents' lives and well-being and provide useful information for planning prevention and intervention strategies targeted to this age group [24].

The prospective longitudinal BELLA study focuses on mental health and well-being in children and adolescents in Germany and is conducted in close cooperation with the German Health Interview and Examination Survey for Children and Adolescents (KiGGS) of the Robert Koch Institute (RKI, Federal Public Health Institute of Germany). The BELLA study provides not only representative cross-sectional results on mental health and well-being in children and adolescents aged 7–17 years in Germany including information on mental health care use, but also longitudinal findings on developmental trajectories and on risk and protective factors of mental health and well-being from childhood via adolescence to young adulthood. The BELLA study is thus of high importance for public health and epidemiological research, and for research on resilience, as well as for health policy supporting the provision of targeted health care services, prevention and early intervention measures, and health promotion. The BELLA study has gathered data since 2003 at five measurement points using standardised and established measurement instruments. Data from the most recent 11-year follow-up (2014–2017) of the BELLA study are now ready to be analysed.

The present paper has the following objectives: first, to describe the design and methods of the 11-year follow-up of the longitudinal BELLA study, including non-response and dropout analyses; second, to report on age- and gender-specific courses of self- and parent-reported general health and HRQoL; third, to examine the long-term health-related outcomes of mental health problems during childhood and adolescence; and fourth, to report on mental health care use in children, adolescents and young adults in Germany.

Methods

Study design

The BELLA study is the module on mental health and HRQoL within the German Health Interview and Examination Survey for Children and Adolescents (KiGGS). Both studies have been conducted in close cooperation nationwide since 2003 and provide representative cross-sectional health- and mental health-related data on German children and adolescents as well as longitudinal data following participants into adulthood. The BELLA study uses a subsample of KiGGS. Participants were randomly drawn from the KiGGS sample and assigned to the BELLA study. The BELLA baseline assessment took place between 2003 and 2006 ($n = 2863$ children and adolescents aged 7–17 years) and was followed up at four measurement points, i.e., the 1 year (2004–2007), 2 year (2005–2008), 6 year (2009–2012), and the most recent 11-year follow-ups (2014–2017). New participants were included at the last two follow-ups to re-establish representative cross-sectional samples of children and adolescents and to compensate for loss due to dropout. Detailed information on the design of the BELLA study is presented in Fig. 1 (including a small preschool sample at BELLA baseline). Detailed descriptions of the KiGGS study [25, 26] and on the baseline assessment and first three measurement points of the BELLA study have been published [19, 27].

Only participants of KiGGS Wave 2 who agreed in KiGGS to be contacted for the BELLA study were invited to the 11-year follow-up. A letter was sent out including study information and a form to gather written informed consent. All participants and/or their parents were informed

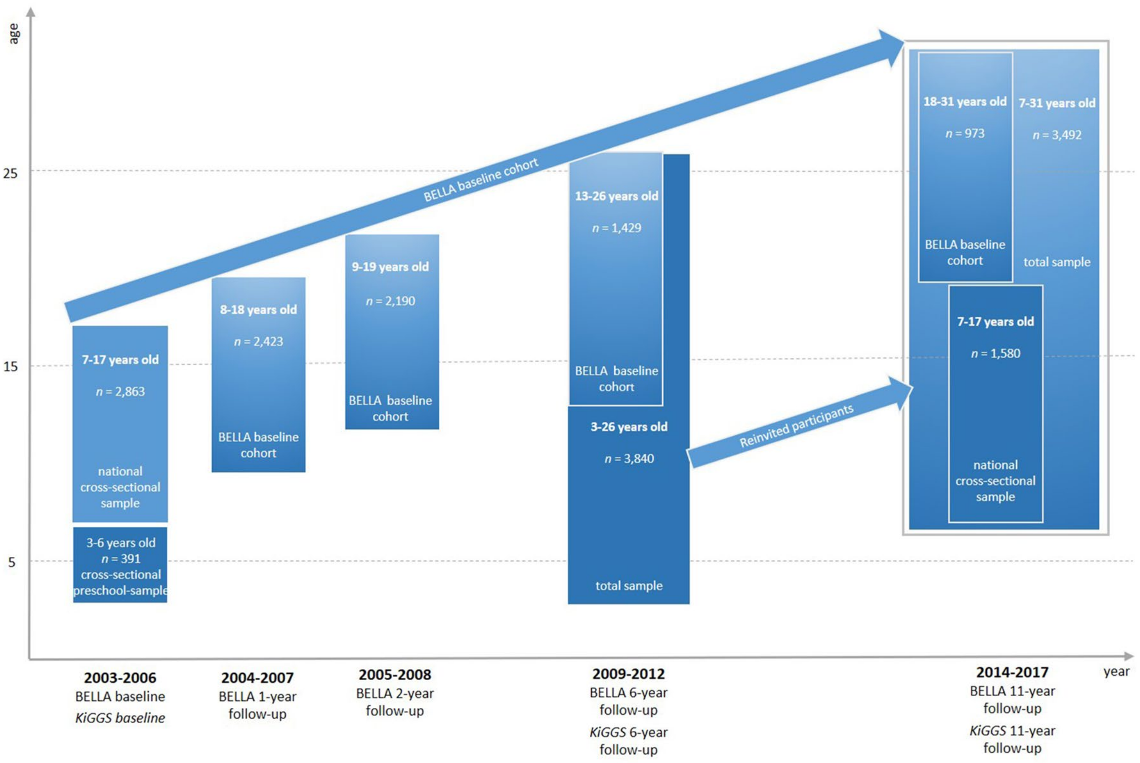

Fig. 1 Measuring points of the BELLA study

about the study procedures, told about means taken to protect their data and informed that participation was voluntary. Informed consent was gathered from the parents of children and adolescents younger than 18 years and from adolescents and young adults aged at least 14 years (adults could give their informed consent online as well). Data assessment was conducted online for the first time in the BELLA study; only if participants had no access to the internet or were not willing to participate online, a paper version of the questionnaire was provided (previous data assessments had been conducted by paper pencil questionnaires and computer-assisted telephone interviews). Parent reports were gathered on children aged 7–13 years, and self-reports were gathered in children, adolescents and young adults aged 11–31 years. The 11-year follow-up of the BELLA study was approved by the Federal Commissioner for Data Protection and received a positive vote from the Ethics Committee of Hamburg's Chamber of Psychotherapists (on 24 September 2014).

Sampling

Participation in the most recent 11-year follow-up of the BELLA study required participation in KiGGS wave 2. The sampling for KiGGS wave 2 was conducted in two steps. First, cross-sectional sampling included randomly selected children and adolescents from 167 cities and municipalities in Germany, which were selected from official residency registries [28]. Second, for the longitudinal sampling in the KiGGS study, only participants who took part in the baseline assessment were followed up at KiGGS wave 2; KiGGS baseline participants could be included in KiGGS wave 2, if they agreed to participate [26]. Participants were excluded from the sample as quality neutral losses when they did not belong to the target population (e.g., invalid address, moved to a foreign country, deceased) or if communication with parents was not possible due to language barriers [28]. The numbers of invited and participating children and adolescents across all measurement points of the BELLA study are presented in Fig. 2. For the 11-year follow-up of the BELLA study, participants of the BELLA baseline assessment were re-invited for the baseline cohort sample of the BELLA study. In addition, new participants were included out of a randomly drawn subsample of the KiGGS wave 2 sample to allow representative cross-sectional analyses for children aged 7–17 years to be included in the cross-sectional sample. Please note, participants who participated for the first time in the BELLA study at the 6-year follow-up were not systematically re-invited for the 11-year follow-up, but the sampling procedure conducted in the KiGGS study resulted in a corresponding subsample in the BELLA study (see Fig. 2 and "Participants"). Out of the KiGGS wave 2 participants with an assignment to the BELLA study

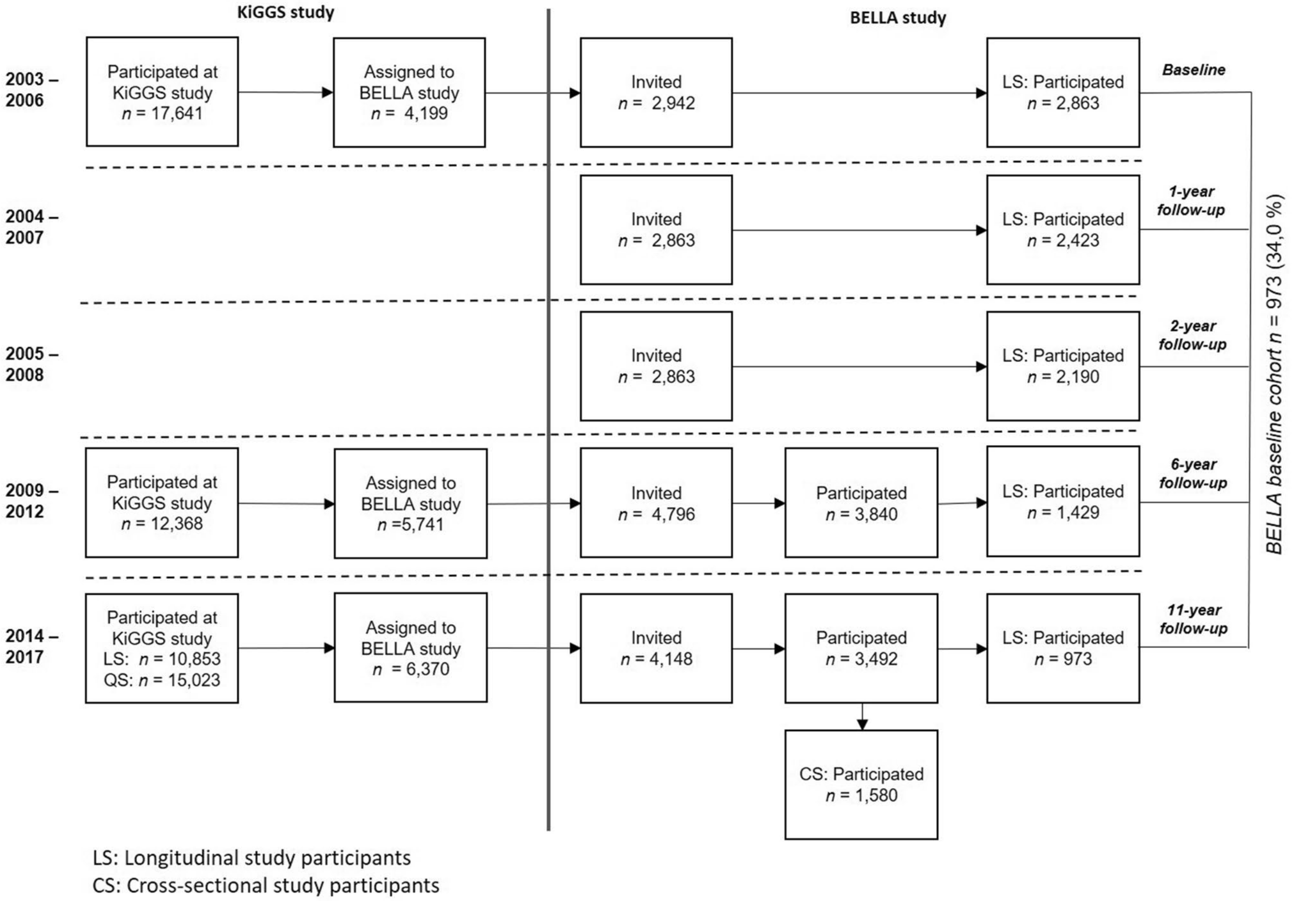

Fig. 2 Numbers of invited and participating children and adolescents in the BELLA study

($n = 6370$), 65.1% ($n = 4148$) agreed to be contacted by the BELLA study (baseline cohort sample: 73.7%; cross-sectional sample: 53.2%). Finally, $n = 3492$ children, adolescents and young adults participated in the 11-year follow-up of the BELLA study.

Response and cooperation rates

Response rates (RRs) and cooperation rates (COORs) were calculated according to the formulas RR2 and COOR 2 provided by the American Association for Public Opinion Research (AAPOR, [29]). Both rates were calculated twice, referring to the KiGGS participants with an assignment to the BELLA study ($n = 6370$) and regarding those KiGGS participants who agreed to be contacted by the BELLA study ($n = 4148$). Focusing on the latter sample, we calculated the response rate as the number of cases with valid survey data ($n = 3492$) divided by all cases we tried to get in contact with (i.e., those who participated, refused to participate, did not react at all to our invitation and we couldn't reach via phone, and those with invalid contact information according to back-coming information); for calculating the corresponding cooperation rate, we divided the number of all cases with valid survey data by the number of cases we got in contact with (i.e., those who participated and those who refused to participate). The rates were calculated accordingly referring to the sample of KiGGS participants with an assignment to the BELLA study (using the corresponding numbers provided to us by the KiGGS study team). Of all KiGGS wave 2 participants assigned to the BELLA study ($n = 6370$), the (minimum) response rate was 56.5% and the cooperation rate was 68.7%. Of the families who had participated in KiGGS wave 2 and agreed to be contacted again by the BELLA study ($n = 4148$), $n = 3492$ finally participated in the 11-year follow-up with a (minimum) response rate of 84.5% and a cooperation rate of 94.5%.

Response analyses for participants and non-participants

Of those who agreed to be contacted by the BELLA study ($n = 4148$), $n = 656$ did not participate (15.8%). The main reasons were unavailability (66.2%, $n = 398$), active refusal

(33.8%, $n = 203$), exclusion due to data quality issues (6.1%, $n = 40$) and quality neutral losses (i.e., letter undeliverable; 2.3%, $n = 15$). Among those young people who actively refused study participation, the main reasons were no interest (36.5%), no time (19.2%), and other reasons, e.g., negative experiences with studies or privacy issues (14.4%); approximately one-quarter of those who actively refused participation stated no reasons for refusal (23.7%), and a few people immediately hung up the phone when called to remind them of the study (7.4%).

Differences between the population of children and adolescents in Germany and KiGGS wave 2 participants are described elsewhere [26, 28]. We compared responders and non-responders of the KiGGS wave 2 participants with an assignment to the BELLA study ($n = 6370$). For this purpose, we predicted participation in the BELLA study by means of logistic regression analyses using sociodemographic (i.e., gender, age, urbanization, region, migration background, and SES) and health- and mental health-related variables (i.e., self- and parent-reported mental health problems, general health, physical health, impairments due to mental and physical health problems, and mental health care use in the last 12 months). To interpret our results, we followed recommendations [30] suggesting that OR = 1.68, 3.47, and 6.71 are equivalent to Cohen's $d = 0.2$ (small), 0.5 (medium), and 0.8 (large), respectively. Only for age did we found a small effect, indicating that participation in the BELLA study was more likely in those aged 18–31 years than in those aged 14–17 years (OR = 1.73, 95% CI 1.51–1.97). For the remaining sociodemographic, health- and mental health-related variables, any effects were negligible.

Weighting

For the cross-sectional sample (at the 11-year follow-up), a weighting procedure was applied to ensure adaptation to the KIGGS wave 2 population. The KIGGS wave 2 cross-sectional sample was itself weighted to be representative of the population in Germany taking the survey design (selection of a particular sample point and selection of participants within the sample point) and population distributions regarding age, gender, federal state (as of 31 December 2015) and foreigner status (German nationality yes/no; as of 31 December 2014) into account [28]. For the BELLA cross-sectional sample, a weighting variable was calculated based on two steps: (1) the inverse participation probability multiplied by the KIGGS wave 2 weight was calculated based on the best participation probability model for participation in the BELLA study considering age, gender, citizenship of the mother, SES, current smoking of the mother, community size, highest education status of the parents, and apartment size; (2) an adaption weight was calculated to ensure comparability with the abovementioned population distributions covering four levels, namely, (i) age x gender, (ii) region (West, Berlin, East) × age group × education status of the parents, (iii) federal state × gender × age group, and (iv) region (West incl. Berlin vs. East) × foreigner status.

Dropout analyses for the 11-year follow-up

Regression analyses were conducted to examine systematic dropout at the 11-year follow-up for participants of the BELLA baseline ($n = 2863$) using sociodemographic and health- and mental health-related variables. Small effects found in the baseline sample indicated that dropout at the 11-year follow-up was more likely among those with a lower SES than a moderate SES (OR = 2.66, 95% CI 1.99–3.56) and with non-German citizenship (OR = 2.35, 95% CI 1.54–3.59). For remaining sociodemographic, health- and mental health-related variables, effects were negligible, if found at all.

Participants

Based on the 11-year follow-up, the BELLA sample can be differentiated into three main samples (see Fig. 2): first, a cross-sectional sample ($n = 1580$) including children aged 7–17 years, who were randomly selected for each age category and represent the German population for this age group; second, the baseline cohort sample of $n = 973$ participants of BELLA baseline (34.0% out of $n = 2863$ baseline participants); third, a total sample of all participants at the 11-year follow-up BELLA study ($n = 3492$) including those who had already participated at the 6-year follow-up, but not at previous measurement points of the BELLA study ($n = 1050$; 43.6% out of $n = 2411$ new 6-year follow-up participants). The sampling procedure conducted by the KiGGS study in combination with the fact that some villages used as sample points in the KiGGS study only had very small numbers of inhabitants, resulted in the following situation for the BELLA study. One individual from the baseline cohort sample and $n = 110$ individuals from the total sample, who had participated already and for the first time at the 6-year follow-up of the BELLA study, were included in the cross-sectional sample as well. The total sample of the 11-year follow-up of the BELLA study thus includes $n = 3492$ individuals (3603 cases summarized over all three samples minus 111).

Details on the sociodemographic characteristics of the BELLA cross-sectional sample (weighted and unweighted data), the BELLA baseline cohort sample (unweighted) and the BELLA total sample (unweighted) at the 11-year follow-up are presented in Table 1. The sociodemographic characteristics, region, migration background, and SES were almost equally distributed across all unweighted samples at the 11-year follow-up (please note, SES was measured in

Table 1 Socio-demographic characteristics of the BELLA sample at the 11-year follow-up

	BELLA cross-sectional sample, weighted ($n = 1580$)[a]			BELLA cross-sectional sample, unweighted ($n = 1580$)			BELLA baseline cohort sample, unweighted ($n = 973$)			BELLA total sample, unweighted ($n = 3492$)		
	n	%	*M* (SD)	*n*	%	*M* (SD)	*n*	%	*M* (SD)	*n*	%	*M* (SD)
Gender												
Male	*816*	*51.6*		754	47.7		389	40.0		1550	44.4	
Female	*764*	*48.4*		826	52.3		584	60.0		1942	55.6	
Age			*12.73 (3.21)*			13.02 (2.94)			23.17 (3.32)			17.33 (5.83)
7–10 years	*545*	*34.5*		442	28.0		–	–		442	12.7	
11–13 years	*409*	*25.9*		514	32.5		–	–		779	22.3	
14–17 years	*626*	*39.6*		624	39.5		3	0.3		881	25.2	
18–31 years	–	–		–	–		970	99.7		1390	39.8	
Region												
Eastern Germany (incl. Berlin)	*267*	*16.9*		544	34.4		335	34.4		1184	33.9	
Western Germany	*1313*	*83.1*		1,036	65.6		638	65.6		2308	66.1	
Community size (inhabitants)												
Rural (< 5000)	*283*	*17.9*		383	24.2		157	16.1		689	19.7	
Small town (5000–< 20,000)	*446*	*28.2*		459	29.1		225	23.1		925	26.5	
Medium-sized town (20,000–< 100,000)	*477*	*30.2*		419	26.5		242	24.9		944	27.0	
Metropolitan (≥ 100,000)	*374*	*23.7*		319	20.2		349	35.9		934	26.7	
Migration background												
No	*1200*	*76.0*		1379	87.3		868	89.2		3048	87.3	
One sided	*160*	*10.1*		113	7.2		42	4.3		221	6.3	
Two sided	*210*	*13.3*		79	5.0		63	6.5		210	6.0	
No information	*10*	*0.6*		9	0.6		–	–		13	0.4	
Living situation (family of origin, own family)												
Living with both biological parents	*1223*	*77.4*		1276	80.8		299	30.7		2160	61.9	
Living with one biological parent[b]	*306*	*19.4*		279	17.7		100	10.3		540	15.5	
Living with a partner	–	–		–	–		268	27.5		350	10.0	
Living alone	–	–		–	–		134	13.8		191	5.5	
Living in a flat-sharing community	–	–		–	–		101	10.4		131	3.8	
Living in another family structure[c]	*30*	*1.9*		17	1.1		18	1.8		45	1.3	
No information	*21*	*1.3*		8	0.5		53	5.4		75	2.1	
Socio-economic status (family of origin)			*12.83 (3.91)*			14.35 (3.84)			–			14.29 (3.87)
Low	*264*	*16.7*		122	7.7		–	–		175	5.0	
Middle	*1013*	*64.1*		960	60.8		–	–		1318	37.7	
High	*274*	*17.4*		488	30.9		–	–		656	18.8	
No information	*28*	*1.8*		10	0.6		–	–		1343	38.5	

Weighted data in *Italics*

M = mean, SD = standard deviation

[a] Data weighted to correct for deviation of the sample from the age, gender, parental education, regional, citizenship, and foreigner status structure of the German population (in 2015); for details see sampling Section

[b] Living with one biological parent includes participants living with a single biological parent with or without a new partner and living in shared care

[c] Living in another family structure includes participants living with grandparents or other relatives, with adoptive or foster parents, and in children's homes or boarding schools**Table 1** Socio-demographic characteristics of the BELLA sample at the 11-year follow-up

children and adolescents younger than 18 years based on information on income, profession and education of the parents). Participants in the BELLA baseline cohort sample were older ($M = 23.17$, SD = 3.32) at the 11-year follow-up compared to those in the BELLA total sample ($M = 17.33$, SD = 5.83) and those in the BELLA cross-sectional sample ($M = 13.02$, SD = 2.94). The age of participants at each measurement point of the BELLA study can be found in the Supplementary Material (File 1, Table S1).

Measurements

For the 11-year follow-up of the BELLA study, data assessment was conducted mainly online; only if participants refused to fill out the online questionnaire or had no access to the internet was a paper version of the questionnaire provided. Self-reported data were collected from children and adolescents aged 11 years and older, and parent-reported data were additionally gathered for children younger than 14 years. The BELLA study used standardised instruments if available (complemented by self-developed measurements) to assess different aspects of health, HRQoL, mental health problems and mental health care utilisation. An overview of the instruments used across all measurement points of the BELLA study is provided in the Supplementary Material (File 1, Table S2). In addition, a large number of variables raised by the KiGGS study as indicators of somatic health (e.g., body mass index, blood pressure, laboratory parameters), health behaviour (e.g., nutrition, sports activities), and sociodemographic determinants (e.g., SES, migration background) are available and can be linked to mental health indicators from the BELLA study [31, 32]. We describe key measures administered at the 11-year follow-up in the following sections. Instruments used for analyses in the present article are mentioned again in the data analysis and results section (including information on their internal consistency in the corresponding samples under analysis).

Health and health-related quality of life

General health was assessed using the general health item (GHI) in self- and parent reports ("In general, how would you rate your/your child's health?") with a five-point response scale (1 = "excellent", 2 = "very good", 3 = "good", 4 = "fair", 5 = "poor"). The GHI is well-established and recommended by the WHO for use in health surveys [33]. To measure self-reported HRQoL, the Kids-CAT was administered for the first time in a large population-based epidemiological sample. The Kids-CAT tool, developed and validated by the authors of this article, measures HRQoL in healthy and ill children and adolescents based on the five item banks on physical well-being, psychological well-being, parent relations, social support and peers, and school well-being [34, 35]. Acceptable to good internal consistency was found for the Kids-CAT dimensions in its validation study (mean standard errors of measurement ranged from 0.38 to 0.49 corresponding to Cronbach's alphas from 0.76 to 0.86, [35]). The IRT-based measurement selects and administers the most informative items for each participant based on his or her location on the underlying latent trait [36]. Therefore, the Kids-CAT provides fewer items and is as precise as traditional paper–pencil questionnaires. It has a child-friendly design and was easily accessible via the BELLA online questionnaire. For the first time, we also integrated a static proxy version of the most powerful Kids-CAT items to survey the parents' perspective at the 11-year follow-up. Moreover, the well-established self- and parent-reported KIDSCREEN-27, including the KIDSCREEN-10 index with a five-point response scale (0 = "not at all" to 4 = "extremely" or 0 = "never" to 4 = "always") [37], the SF-12 questionnaire [38], and the SF-36 questionnaire [39], were administered to measure HRQoL. Furthermore, validated short questionnaires of the item banks developed by the Patient-Reported Outcome Measurement Information System (PROMIS®) initiative [40, 41] were used to assess subjective well-being, family relations, physical activity, relations with peers, and global health. Good to mainly excellent internal consistency was reported for original PROMIS scales [42–49]. Within the scope of the BELLA study, the PROMIS questionnaires were translated into German (see e.g., [50], more publications on translations are to follow).

Mental health problems

At all measurement points, parent- and self-reports on mental health problems were assessed with the Strengths and Difficulties Questionnaire (SDQ) accompanied by the 5-item SDQ Impact supplement asking for difficulties that upset or distress the child and for interference with home life, friendships, classroom learning, and leisure activities with a four-point response scale (0 = "not at all", 1 = "only a little", 2 = "quite a lot", 3 = "a great deal") [51, 52]. For respondents aged 18 years and older, the Composite International Diagnostic-Screener (CID-S) [53] and the Symptom-Check List 9-item Short version (SCL-S-9) [54] were used at the 11-year follow-up. To survey symptoms of depression, the Center for Epidemiological Studies Depression Scale for Children and Adolescents (CES-DC, [55]) and the Patient Health Questionnaire-9 for Young Adults (PHQ [56, 57];) were used. Furthermore, depressive symptoms were assessed using the German translations of PROMIS Depression Short Forms across all age groups [58, 59]. The SCL-S-9, the

CES-DC and the PHQ showed good to excellent internal consistency in former studies (Cronbach's alphas ≥ 0.80 and 0.90, respectively; [54, 60, 61]).

Mental health care utilisation

Mental health service utilisation was assessed by surveying the psychiatric/sociopsychiatric/psychotherapeutic, psychological, or sociopedagogic care that respondents had used and how satisfied they had been with their treatment. Additionally, we assessed possible treatment needs and barriers that prevented people from accessing treatment.

Data analysis

Age- and gender-specific effects on general health and health-related quality of life over time

We investigated age- and gender-specific effects on self- and parent-reports of general health measured with the GHI and on HRQoL assessed with the KIDSCREEN-10 index using all available data across the measurement points of the KiGGS and BELLA studies. For analyses, we recoded response options of the GHI so that higher values indicated better general health. We calculated T values ($M = 50$; SD = 10) for the KIDSCREEN-10 index based on Rasch Person parameters of the European norm sample [37], with higher values indicating better HRQoL. Individual growth modelling was used for data analyses calculating linear mixed models, which allowed for repeated measurements using full-information maximum likelihood (FIML). Each model included age (at baseline), gender, the interaction age by gender, a linear time variable (with information on intervals between baseline and the measurement point in question in years), a squared and a cubic time variable as fixed effects; on the level of random effects, a subject identification variable was considered as random intercept and linear time was used as random slope. For each model, age was centred using the group mean at baseline (across all participants with valid baseline scores; $M_{\text{age,t0 valid}}$); for parent-reported HRQoL, the mean age from the 1-year follow-up was used ($M_{\text{age,t1 valid}}$) since no corresponding baseline data were gathered. We created graphs to illustrate gender-specific trajectories across age based on data from all measurement points using estimated marginal means from corresponding models. In preliminary analyses, we investigated potential cohort effects for each outcome. Random intercept models served to investigate whether the year of birth moderated the relationship between age (at each measurement point) and the outcome in question. Since information criteria and the χ^2 difference test depend on sample size [62], we used McFadden's R^2 [63] to evaluate the strengths of potential cohort effects comparing models with and without the interaction term of interest.

Mental health problems at baseline and related outcomes at 6-year and 11-year follow-ups

To examine the association between self- and parent-reported mental health problems (measured with the SDQ and SDQ Impact) reported at baseline and health-related outcomes at 6-year and 11-year follow-ups, we developed univariate general linear models for each perspective (self- and parent-reports at baseline), outcome (self-reported general health, mental health, physical health) and measurement point (6-year and 11-year follow-ups and). We included only predictors measured at baseline, i.e., mental health problems, impairment due to mental health problems (none, moderate, high), gender, age, SES, and the interaction of gender by age. Regarding health-related outcomes measured at 6-year and/or 11-year follow-up, we used the first item of the SF-36 to assess general health and transformed the item to a scale from 0 to 100, with higher scores indicating better general health; furthermore, the mental and physical health components of the SF-36 were used and standardised to a mean of 50, with a score above 50 representing better than average function and a score below 50 representing poorer than average function. Effect sizes were calculated using partial eta squared ($\eta^2 = 0.01$ indicates a small, $\eta^2 = 0.06$ a medium, and $\eta^2 = 0.14$ a large effect).

Mental health care utilisation

Descriptive analyses were conducted on mental health care use and barriers to mental health care use.

All analyses were conducted with IBM SPSS 26.

Results

Age- and gender-specific effects on general health and health-related quality of life

Across all measurement points, valid data for self-reported general health were available for $n = 4987$ (52% female; overall, 10,213 valid scores were gathered across measurement points in 10- to 31-year-olds). With the parent-reported GHI, valid information was gathered in $n = 5754$ (50% female; overall 11,149 scores for 3- to 20-year-olds). Due to strong ceiling effects for both versions of the GHI (the option "poor" was chosen for less than 1% of the ratings for each version; self-report: $n = 35$; parent-report: $n = 26$), we collapsed response options (gathering "fair" and "poor"). The results from null models indicated that 37% of the total

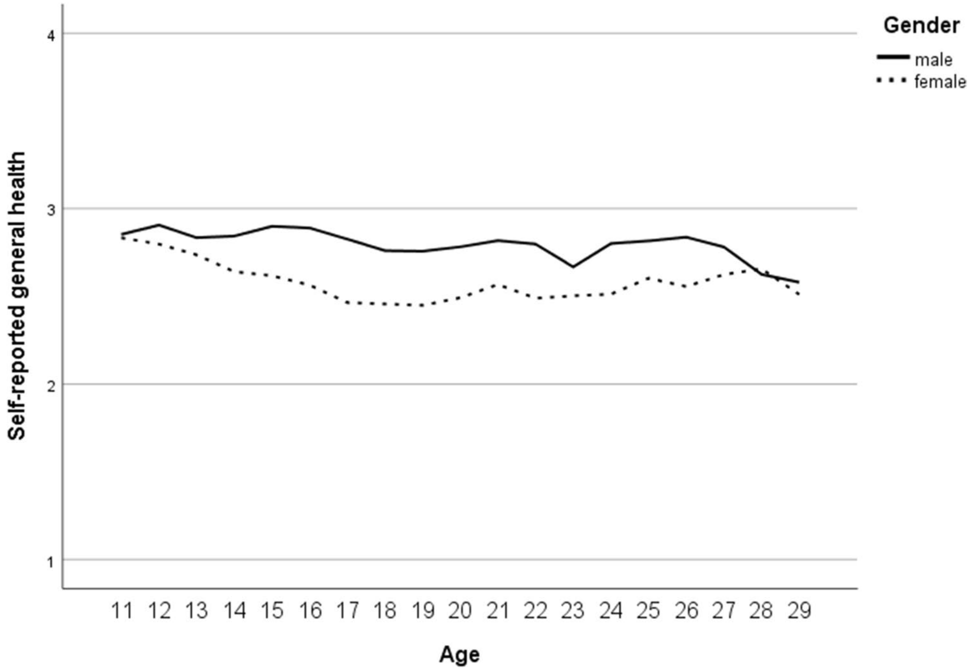

Fig. 3 Gender-specific course of self-reported general health (according to the general health item; GHI) from age 11 to age 29 (1 = 'poor' / 'fair', 2 = 'good', 3 = 'very good' and 4 = 'excellent' general health)

variance in the self-reported and 42% for the parent-reported general health score could be explained by differences between subjects. Fit information on null models and results of final models are depicted in the Supplementary Material (File 2, Tables S3 and S4). For self-reported general health, we found an overall mean of 2.80 after controlling for covariates in the final model (i.e., average score at baseline for boys aged approximately 14 years; $M_{\text{age,t0 valid}} = 13.94$, $SD_{\text{age,t0 valid}} = 2.005$). Effects for time variables indicated a slight increase over time. Better self-reported general health was found in younger than older and in male compared to female participants; the age-specific difference was more pronounced in girls. For parent-reported general health, an overall mean of 2.87 was estimated (at baseline for boys aged approximately 12 years; $M_{\text{age,t0 valid}} = 11.75$, $SD_{\text{age,t0 valid}} = 3.145$), and again, a slight increase over time was found. Parent-reported general health was overall better for younger than older participants, with higher scores for girls in younger participants and higher scores for boys in older participants. Findings from sensitivity analyses using general estimation equation models (GEEs) for categorical outcomes [64] were similar.

For HRQoL, valid self-reports were gathered with the KIDSCREEN-10 index in $n = 4293$ (51% female; overall 7136 scores from 10- to 20-year-olds), and parent-reports were gathered in $n = 4345$ (50% female; overall 6783 scores for 6- to 20-year-olds). Due to the results from the null models, 48% of the total variance in self-reported HRQoL and 49% for parent-reported HRQoL could be explained by differences between the subjects' model fit results (Table S3). The internal consistency of the KIDSCREEN-10 was acceptable to good in the present study (Cronbach's alphas ranged for the self-report from 0.78 to 0.82 and for the parent-report from 0.74 to 0.79 across measurement points in the analysed samples). The results of the final model for self-reported HRQoL (Table S4) showed an overall mean of 53.37 (at baseline for boys aged approximately 14 years; $M_{\text{age,t0 valid}} = 13.94$, $SD_{\text{age,t0 valid}} = 1.984$), a slight increase over time, and higher scores for younger than older and for male compared to female participants; the decrease with ongoing age was more pronounced in girls. For parent-reported HRQoL according to the KIDSCREEN-10 index, an overall mean of 53.55 was estimated (at 1-year follow-up for boys aged 12 to 13 years; $M_{\text{age,t1 valid}} = 12.62$, $SD_{\text{age,t1 valid}} = 3.122$), which increased slightly over time; higher scores were reported for younger than older participants with better HRQoL for girls in younger and for boys in older ones.

In the presented final models (Table S4), random effects indicated significant differences in the variances of intercepts and slopes across participants, and only the variance of the slope for self-reported HRQoL was not significant. Intercepts and slopes covaried negatively and significantly; only for parent-reported HRQoL was a positive significant covariance found. In preliminary analyses, we further found no evidence for a cohort effect in any outcome; McFadden's R^2 was consistently below 1%, if corresponding effects were significant at all. Figures 3, 4, 5 and 6 present graphs on gender-specific courses across age (only for this, we collapsed age categories at margins, if a category was represented by less than $n = 30$), which reflect findings from the models as reported.

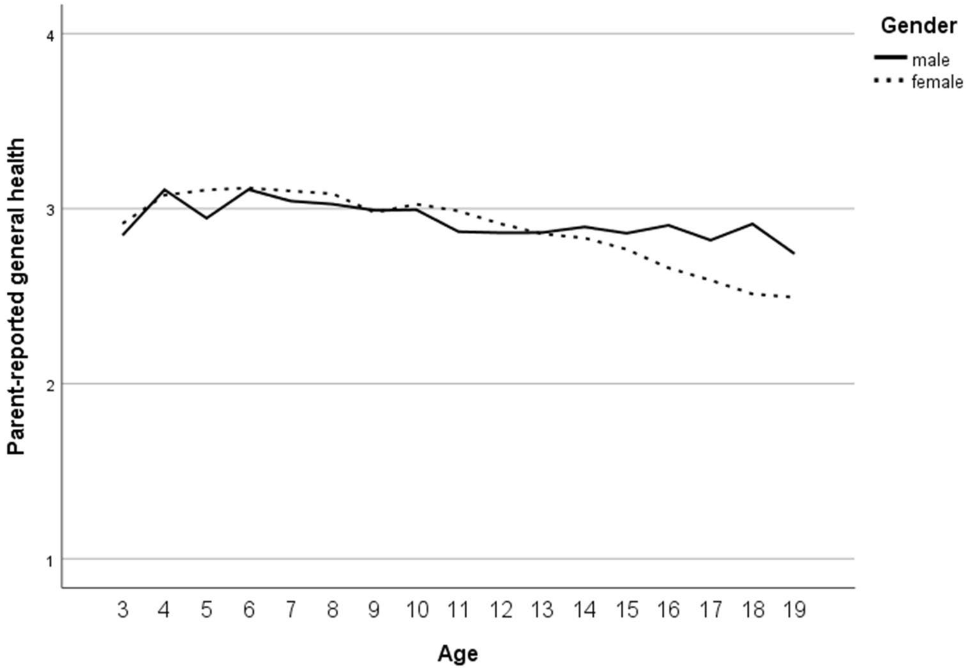

Fig. 4 Gender-specific course of parent-reported general health (according to the general health item; GHI) from age 3 to age 19 (1 = 'poor' / 'fair', 2 = 'good', 3 = 'very good' and 4 = 'excellent' general health)

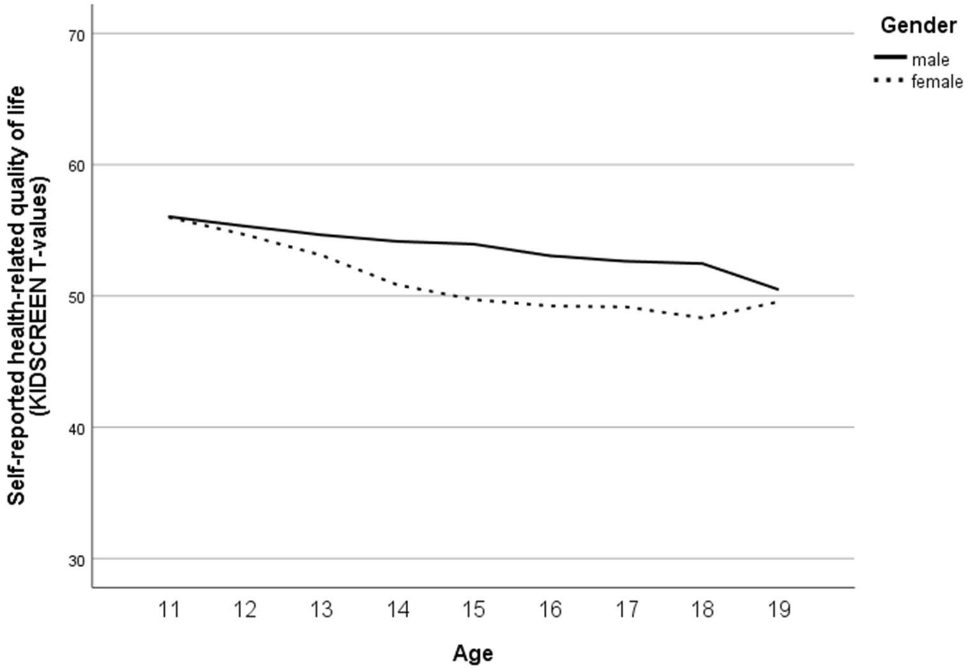

Fig. 5 Gender-specific course of self-reported health-related quality of life (according to the KIDSCREEN-10 index) from age 11 to age 19

Mental health problems at baseline and related outcomes at 6-year and 11-year follow-ups

We investigated associations of self- and parent-reported mental health problems in children and adolescence and their impact measured at baseline (using the SDQ and its impact supplement) with self-reported general, mental and physical health at 6-year and 11-year follow-ups (according to the SF-36). Based on self-reported baseline data, we analysed $n = 566$ with self-reported at the 6-year follow-up (females: $n = 306$; mean age at baseline: $M = 14.11$, SD = 1.86) and $n = 504$ at the 11-year follow-up (females: $n = 315$; mean age at baseline: $M = 13.94$, SD = 2.01). Based on parent-reported baseline data, we examined health outcomes of $n = 597$ at the 6-year follow-up (females: $n = 316$; mean age at baseline: $M = 13.95$, SD = 2.00) and $n = 886$ at the 11-year follow-up (females: $n = 529$; mean age at baseline: $M = 11.69$, SD = 3.17).

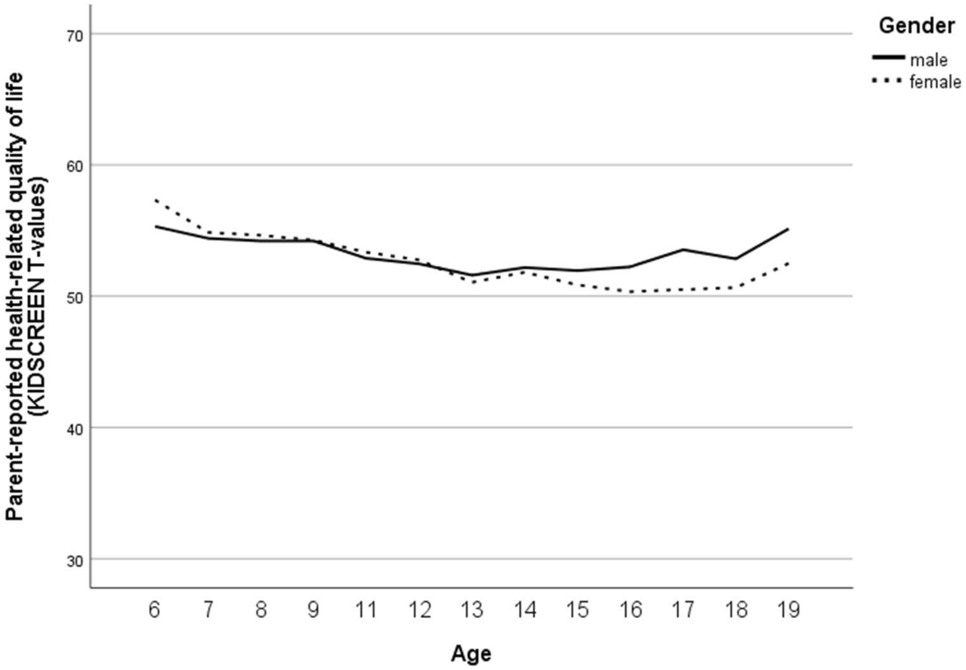

Fig. 6 Gender-specific course of parent-reported health-related quality of life (according to the KIDSCREEN-10 index) from age 6 to age 19

The internal consistency of SDQ scores was consistently acceptable in the analysed samples (for the self-reported total difficulties score Cronbach's alphas were 0.75 and 0.73, and for the self-reported impact supplement.70 and 0.74; for parent reports, alphas for the total score were 0.79 and 0.78, and for the impact supplement 0.76 and 0.75; please note the impact includes a key item and its internal consistency across all items is thus calculated based only on those with an impact of mental health problems). For the investigated SF-36 sum scores, the internal consistency was excellent in the analysed samples (Cronbach's alphas were 0.90 for the 6-year follow-up and 0.94 for the 11-year follow-up).

Results of our models adjusted for gender, age, and the interaction of gender by age at baseline revealed the following results. Pronounced self-reported mental health problems at baseline were significantly associated with impaired self-reported general and mental health 6 years later, and with impaired self-reported general, mental and physical health 11 years later (see Table 2 and Fig. 7). The self-reported impact status due to mental health problems at baseline was significantly negatively associated with general and mental health 6 years later as well as 11 years later; that is, severe self-reported impact due to mental health problems at baseline was associated with reduced general and mental health 6 and 11 years later. We further found that pronounced parent-reported mental health problems at baseline were associated with impaired self-reported general, mental and physical health 6 as well as 11 years later. However, we found no effects for the parent-reported impact of mental health problems at baseline on self-reported health outcomes at follow-ups (see Table 2 and Fig. 8). Our findings additionally showed that a higher SES was associated consistently with better general health, and with better physical health in two out of four models at follow-ups. Reported effects were consistently small ($0.01 \leq \eta^2 < 0.06$; see Table 2 and Figs. 7 and 8; please note, results on SES are not included in the figures).

Mental health care utilisation

Out of the total BELLA sample of the 11-year follow-up, 7.0% ($n = 144$) of participants aged 14 years or older reported a mental disorder, which was recently diagnosed by a physician, psychologist or other professional. A percentage of 61.8% ($n = 89$) of these mentally ill adolescents and young adults were, therefore, in mental health care, and the majority (71.9%, $n = 64$) of these patients were "rather happy" or "very happy" with the treatment. Among participants in mental health care, 37.1% ($n = 33$) rated the treatment as "very effective" and 46.1% ($n = 41$) as "a little bit effective". A percentage of 38.2% ($n = 55$) of the participants currently used no mental health treatment, even though a mental disorder was recently diagnosed. The six most frequently mentioned reasons (multiple answers possible) for no mental health care use were no interest in treatment ($n = 15$), treatment already finished ($n = 14$), participant under medical treatment by physician ($n = 14$), poor communication with professional ($n = 6$), uncertainty about severity of the problem ($n = 6$), and fear of stigma ($n = 5$). Concerning a lifetime mental disorder, a total of 291 (14.2%) participants reported ever being diagnosed with a mental disorder, and

Table 2 Mental health problems and their impact at baseline, and health-related outcomes at 6-year and 11-year follow-ups

	6-year follow-up			11-year follow-up		
	General health (SF-36 scale, 0–100)	Mental health (SF-36 scale, 0–100)	Physical health (SF-36 scale, 0–100)	General health (SF-36 scale, 0–100)	Mental health (SF-36 scale, 0–100)	Physical health (SF-36 scale, 0–100)
	B [95% CI]	B [95% CI]	B [95% CI]	B [95% CI]	B [95% CI]	B [95% CI]
Self-reported mental health problems at baseline (SDQ total difficulties score)	**−0.3* [−0.7, −0.0]**	**−0.3*** [−0.5, −0.2]**	−0.1 [−0.2, 0.0]	**−0.6** [−1.0, −0.2]**	**−0.3** [−0.5, −0.1]**	**−0.3*** [−0.4, −0.1]**
Self-reported impact of mental health problems at baseline (SDQImpact score)						
[Ref. Normal]						
Borderline	**−6.4* [−11.4, −1.3]**	**−3.4** [−5.7, −1.0]**	−0.8 [−2.3, 0.8]	−3.5 [−9.1, 2.2]	−0.5 [−3.6, 2.6]	−1.0 [−3.1, 1.0]
Abnormal	**−10.2*** [−15.6, −4.9]**	**−5.1*** [−7.6, −2.6]**	−1.0 [−2.6, 0.6]	**−6.1* [−12.0, −0.3]**	**−6.2*** [−9.5, −2.9]**	−0.3 [−2.4, 1.8]
Socio-economic status	**0.9*** [0.6, 1.3]**	−0.1 [−0.3, 0.1]	**0.1* [0.0, 0.3]**	**0.8*** [0.4, 1.2]**	0.1 [−0.1, 0.4]	0.1 [−0.1, 0.2]
Model fit (adjusted R^2)	*0.13*	*0.13*	*0.4*	*0.10*	*0.08*	*0.04*
Parent-reported mental health problems at baseline (SDQ total difficulties score)	**−0.6** [−0.9, −0.2]**	**−0.3*** [−0.5, −0.2]**	**−0.1* [−0.2, 0.0]**	**−0.6*** [−0.9, −0.3]**	**−0.2* [−0.4, 0.0]**	**−0.2*** [−0.3, −0.1]**
Parent-reported impact of mental health problems at baseline (SDQ-Impact score)						
[Ref. Normal]						
Borderline	−3.1 [−9.2, 3.0]	−0.9 [−3.8, 2.0]	−0.4 [−2.2, 1.4]	−3.0 [−8.3, 2.3]	0.3 [−2.6, 3.2]	−1.7 [−3.5, 0.2]
Abnormal	−3.5 [−9.1, 2.1]	−2.6 [−5.3, 0.0]	−1.2 [−2.9, 0.5]	−4.0 [−8.5, 0.5]	−2.2 [−4.7, 0.3]	−1.0 [−2.6, 0.6]
Socio-economic status	**0.9*** [0.5, 1.3]**	−0.1 [−0.2, 0.1]	0.1 [0.0, 0.2]	**0.8*** [0.4, 1.1]**	0.1 [0.0, 0.3]	**0.2** [0.0, 0.3]**
Model fit (adjusted R^2)	*0.11*	*0.08*	*0.04*	*0.10*	*0.06*	*0.05*

All analyses were adjusted for gender, age at baseline, and gender by age at baseline.

B unstandardized regression coefficient, CI confidence interval.

*$p \le 0.05$, **$p \le 0.01$, ***$p \le .001$. Small effects according to partial eta square ($0.01 \le \eta^2 < 0.06$) are printed in bold. For measures see "Methods"

80.4% ($n = 234$) of these patients were in psychological, psychiatric or psychotherapeutic treatment.

Parents reported diagnoses of mental health disorders for their children aged 7 to 13 years. In total, 8.3% ($n = 117$) of parents stated that their child was recently diagnosed with a mental disorder by a physician, psychologist or other professional; 65.0% ($n = 76$) of these children were in mental health care, and the majority (77.6%, $n = 59$) of parents were "rather happy" or "very happy" with the child's treatment. A total of 39.5% ($n = 30$) of parents with children in mental health care assessed the treatment as "very effective", and 42.1% ($n = 32$) assessed the treatment as "a little bit effective". A total of 35.0% ($n = 41$) of the parents reported that their child currently used no mental health treatment, even though a mental disorder was recently diagnosed. The most frequently mentioned reasons (multiple answers possible) for no mental health care use were as follows: child is under medical treatment by the physician ($n = 18$), treatment is already finished ($n = 15$), and child is under treatment by Ergo therapist ($n = 11$). Concerning a lifetime mental disorder, a total of 178 (12.7%) parents reported that their children had ever been diagnosed with a mental disorder, and 75.8% ($n = 135$) of these children were in psychological, psychiatric or psychotherapeutic treatment.

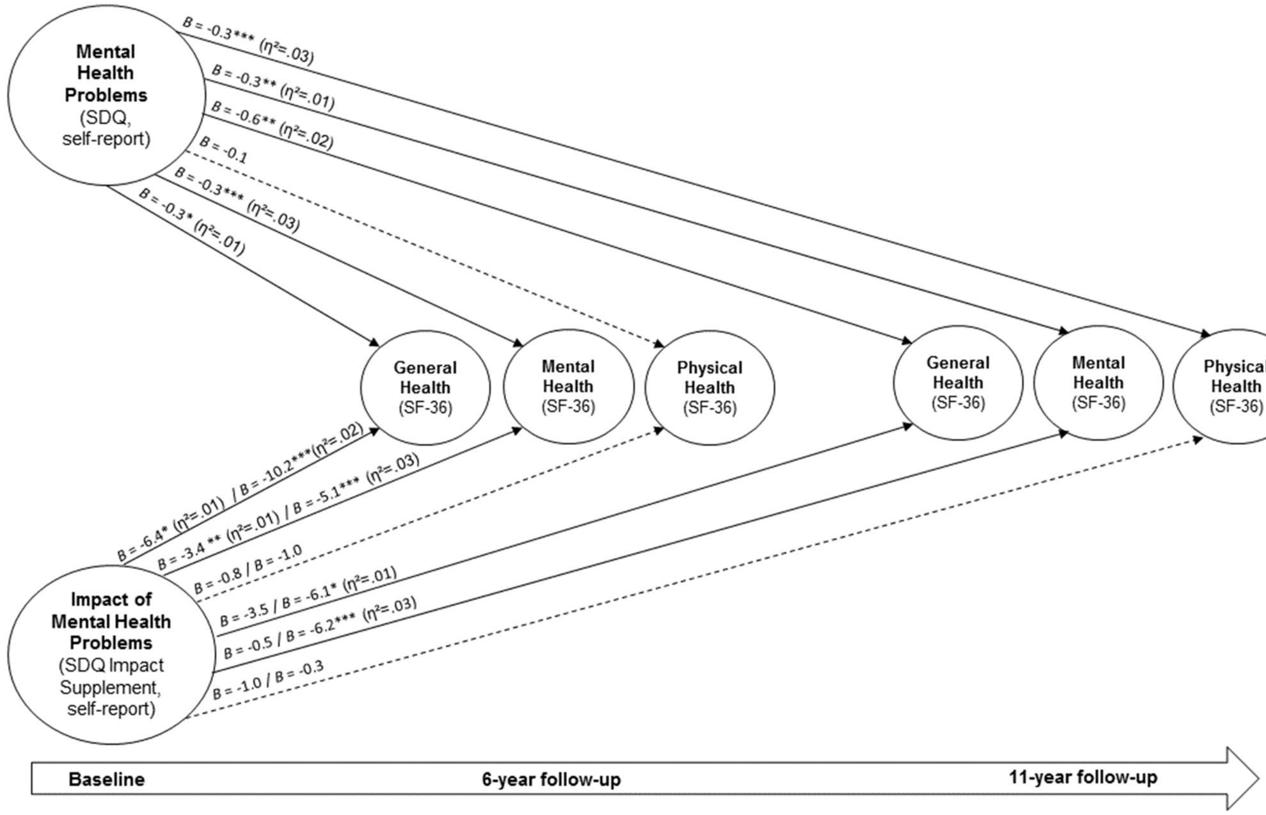

Fig. 7 Long-term effects of self-reported mental health problems and of the impact of mental health problems (according to the Strengths and Difficulties Questionnaire (SDQ) and its impact supplement) at baseline on health-related outcomes (according to the SF-36) at 6-year and 11-year follow-ups. B = unstandardized regression coefficient; $*p < 0.05$, $**p < 0.01$, $***p < 0.001$; dashed lines indicate non-significant effects, continuous arrows indicate significant effects; η^2 indicates effect sizes; for the impact of mental health problems, groups borderline and abnormal were compared each to the group normal

Discussion

The BELLA study is a profound and comprehensive longitudinal study on mental health and HRQoL in children and adolescents in Germany. The BELLA study provides solid data that enable both cross-sectional and longitudinal analyses of child and adolescent mental health, mental health care use and developmental trajectories of mental health from childhood to young adulthood. The aims of the present paper were to describe the design and methods of the 11-year follow-up of the BELLA study, to examine age- and gender-specific courses of general health and HRQoL, to investigate long-term health outcomes of mental health problems and to report on mental health care use in young people in Germany.

For the 11-year follow-up of the BELLA study, we predicted study participation and investigated drop-out. We only found a considerable difference between responders and non-responders in age. Furthermore, a higher likelihood for dropout was detected in young people with a lower SES and in non-German citizens (in line with published findings from the 6-year follow-up [19]). For health- and mental health-related variables, we found only negligible effects if significance was detected at all. To compensate for sociodemographic differences, a weighting variable was generated that allows representative analyses of the cross-sectional sample.

In our longitudinal analyses on the course of general health and HRQoL from childhood via adolescence to young adulthood, we found significant differences by age and gender investigating self- and parent reports. Self-reported general health (in 10- to 31-year-olds) was better in younger than older participants and in boys compared to girls, and the age-specific difference was more pronounced in girls. Similar patterns in relation to age and gender were found for parent-reported general health (in 3- to 20-year-olds), indicating that overall health was better in younger than older participants, with higher scores for girls in younger participants and for boys in older participants. Our findings are in line with the results of a number of cross-national studies reporting that self-reported subjective health complaints increase from childhood to adolescence and are more

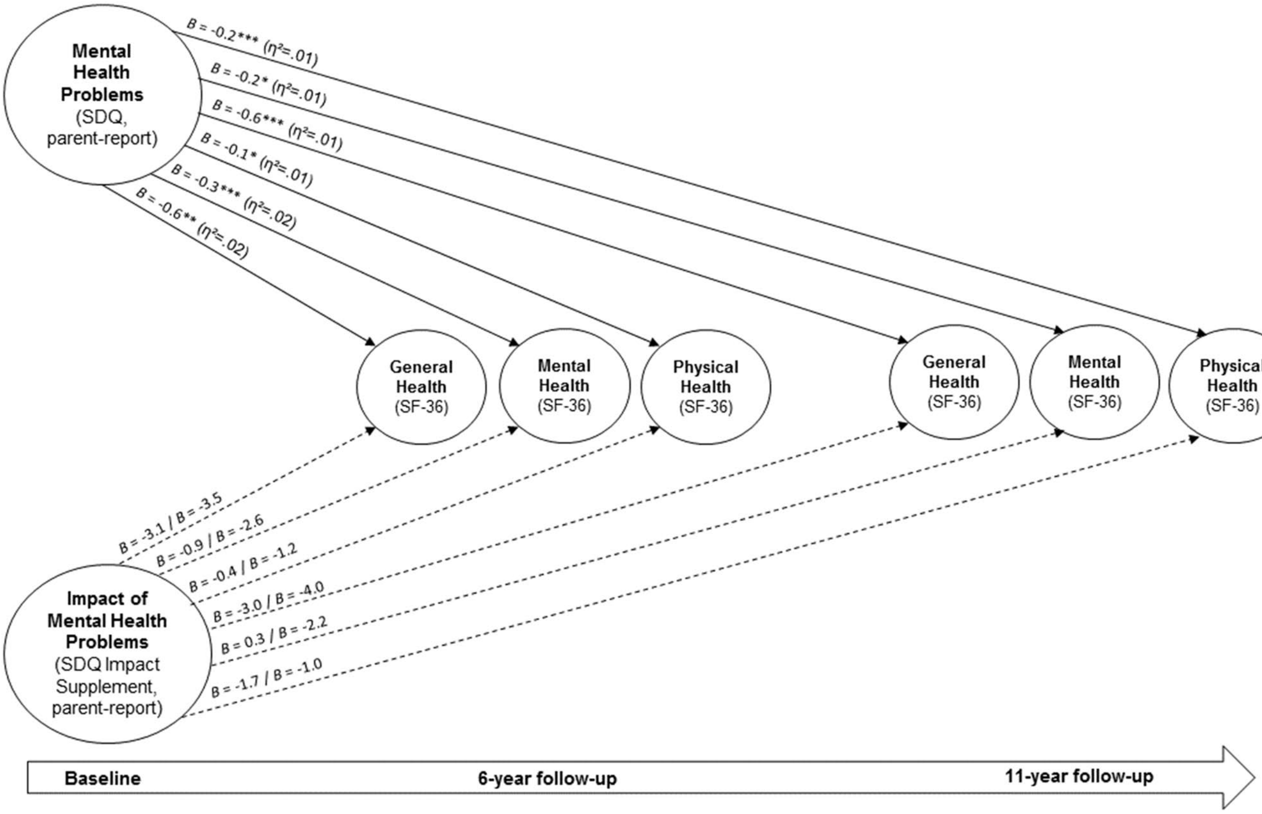

Fig. 8 Long-term effects of parent-reported mental health problems and of the impact of mental health problems (according to the Strengths and Difficulties Questionnaire (SDQ) and its impact supplement) at baseline on health-related outcomes (according to the SF-36) at 6-year and 11-year follow-ups. *B* = unstandardized regression coefficient; $*p < 0.05$, $**p < 0.01$, $***p < 0.001$; dashed lines indicate non-significant effects, continuous arrows indicate significant effects; η^2 indicates effect sizes; for the impact of mental health problems, groups borderline and abnormal were compared each to the group normal

prevalent among girls than boys [65, 66]. Furthermore, a representative epidemiological study with more than 2000 parent–adolescent dyads from Australia reported clinically significant differences in the perceptions of general health comparing child and parent reports [67]. We did not compare self- and parent reports directly, but our graphs point in a similar direction. These results may imply that adolescents are less positive about their health than their parents. In particular, girls reported worse general health, which might partly be due to "gendered" health complaints such as headache and abdominal pains, in which mid-adolescent girls had more than 2.5 higher odds than boys of reporting recurrent patterns [66]. Future epidemiological studies should be aware of the age- and gender-specific differences in general health in self- and parent-reports.

Furthermore, self- and parent-reported HRQoL was better in younger than older participants, covering an age range from 6- to 20-year-olds. This finding is in line with previous international studies that reported that younger age was significantly associated with perceptions of better overall HRQoL [68–70]. Moreover, our study findings indicate that self-reported HRQoL was better in male participants than in female participants, whereas the decrease with ongoing age was more pronounced in girls. The results are in line with the findings of previous studies, indicating that from about age 9 or 10 years on girls had lower HRQoL scores in most of the dimensions of HRQoL [68, 71, 72] and that there was a stronger decline in HRQOL among girls compared to boys with increasing age [70]. Overall, our findings on the trajectories of general health and HRQoL highlight the importance of effective prevention strategies that need to respond sensitively to age- and gender-specific differences.

Regarding the examined impact of mental health problems, we found negative long-term health outcomes of mental health problems during childhood and adolescence, confirming results from previous studies investigating this relationship [73–75]. In particular, symptom severity during childhood and adolescence predicted general health and mental health and, to a lesser extent, physical health 6–11 years later. Further, a high subjective impact of mental health problems in children and adolescents (but not the impact as perceived by their parents) predicted impaired general and mental health 6 and 11 years later. Copeland et al. [76] conducted a longitudinal study using more than 1,200 participants from an US–American population-based sample from childhood (9–16 years) to young adulthood (19–26 years of age), and they found that individuals with a childhood mental disorder had sixfold higher odds of at least one adverse adult outcome (e.g., multiple psychiatric problems) compared to those with no history of mental health problems in childhood. The results were also robust for participants without a diagnosed mental disorder but with subthreshold mental health problems and even stronger for cumulative childhood exposure to mental disorder [76]. To prevent those negative long-term consequences, the early detection of children and adolescents at risk of developing mental health problems is of great importance as it is the first step towards prevention. In this context, early intervention services such as the Australian National Youth Mental Health Foundation's headspace [77] can support young people who experience mental health problems and help them access health services.

Mental health problems during childhood and adolescence predicted young adults' health outcomes in the presented models. We found small effects and explained 4–13% of the variance in the outcomes in our general population sample over 6 and 11 years. It is known that mental health disorders often begin in childhood or adolescence and persist into adulthood [16]. In a former analysis based on data from the BELLA study [19] using further self- and parent-reported measures besides the SDQ, about 31% of the participants with mental health problems at baseline had corresponding problems at the 6-year follow-up (in line with Ihle and Esser [78]). Results from British cohort studies are important to consider as well, though not necessarily directly comparable. Findings from the Millenium Cohort study showed moderate stability of mental health outcomes over a period of three years analysing parent-reports for 11-year-olds and self-reports for 14-year-olds [79]. In another British study, strong stability in mental health scores was found over 3 years based on data from two measurement points (using self-, parent- and teacher-reports of the SDQ [80]). Moreover, studies analyzing trajectories of mental health problems over time usually include further factors (see e.g., this Australian study [81]). Research showed that multiple adverse childhood experiences (e.g., abuse experiences, parental separation, and growing up in a household with mental illness) increase the risk of negative health outcomes in adulthood [82–84]. Factors such as school connectedness and cognitive ability [85], bullying experiences [86], and drug abuse may additionally affect the development of mental health in young peoples' lives. Overall, we assume that our present results reflect that we used a limited selection of predictors (measured all at baseline), health outcomes from only one follow-up measurement in each model and did not combine information from different sources. Further studies based on data of the BELLA study will aim to investigate the course of mental health problems from childhood via adolescence into adulthood in more depth considering potential risk and protective factors, data from more measurement points and different respondents in a model.

With regard to the present results, the SES of the family in childhood was a significant predictor of general health, mental health, and physical health in young adults aged 18–28 years. This finding is in line with research on social inequality and health. Children with a low SES suffer not only from greater health problems in childhood but also from poorer health outcomes in adulthood [87, 88]. To reduce the identified health inequalities, targeted and low-threshold approaches of prevention and intervention are needed, especially for children with a socially deprived background.

In our analysis regarding reported diagnoses for mental disorders and mental health care use, we were able to confirm the results of recent studies. In the total BELLA sample at the 11-year follow-up, 7.0% of self-reports and 8.2% of parent reports indicated a current diagnosis of a mental disorder. Of those with a diagnosed mental disorder, 71.5% of self-reports and 77.8% of parents reports stated that they are currently under mental health treatment or that they finished treatment. Similar results were found in the representative 2016 US-National Survey of Children's Health, according to which up to 80.0% of participants with a mental disorder (prevalence ranged from 3.2 to 7.4%) received treatment in the previous year with differences by specific mental disorders [89]. However, our results do not provide information about access to care, quality of mental health care and treatment success, which are important determinants for health care and should be examined in future research. Since our findings revealed that approximately one out of four children with a diagnosed mental disorder is not under mental health treatment, it is important to better understand which factors inhibit or facilitate access to health care. Another important aspect is the need for an efficient transition from paediatric to adult care to prevent adolescents and young adults from dropping out of care. As the process of transition is often poorly managed, strategies are needed to ensure the successful transition to adult-oriented care [90].

Strengths and limitations

The BELLA study is one of the most important longitudinal studies on mental health and HRQoL in children and adolescents in Germany. Our findings provide new cross-sectional as well as longitudinal data on child and adolescent mental health, HRQoL and mental health service use, which were collected nationwide across Germany. The strengths of the BELLA study include the profound and solid data, the large population-based cohort and the wide age range of the participants from 7 to 31 years. This allowed us to analyse developmental trajectories of mental health and well-being from childhood via adolescence to young adulthood. The BELLA study focuses on mental health, well-being, and young people's resources rather than mental disorders. Thus, the findings of the BELLA study are important for the development of targeted mental health promotion and early prevention strategies. Furthermore, the BELLA study used standardised and established self- and parent-reported instruments to assess mental health, HRQoL and mental health care utilisation. Moreover, we used appropriate statistical approaches (e.g., individual growth modelling) to analyse our longitudinal data.

Despite these strengths, there are some limitations. Data were not collected in different languages; thus, families with migration backgrounds could not be treated as representative of migrant families in Germany. A further limitation and common problem of longitudinal studies is the loss to follow-up over time. However, several approaches were undertaken to compensate for loss to follow-up in the BELLA and KiGGS studies. These include the application of a weighting procedure to correct for deviations from the sociodemographic and socioeconomic structure of the target population as well as an oversampling of families with migration backgrounds. Moreover, the BELLA study is an observational study that only identifies associations and no cause–effect relationships. In our analyses, we used only single items to investigate mental health care use; future research may wish to investigate mental health care use in more depth.

Conclusion

With the most recent 11-year follow-up, the prospective longitudinal BELLA study provides new data on mental health and HRQoL in children, adolescents, and young adults in Germany that are of great relevance for health promotion and prevention practices. The first results on mental health, HRQoL and mental health care use in children, adolescents and young adults were presented in the present paper. Future analyses using cross-sectional and longitudinal data of the BELLA study are planned, including the provision of reference scores for PROMIS instruments, reference scores and investigations on HRQoL using data collected by means of the Kids-CAT, and the development of further CATs. The investigation of mental health and well-being from childhood over adolescence into adulthood is still a challenge. In large surveys and clinical studies, we usually follow the state of the art by measuring mental health and well-being with age-appropriate questionnaires. Future research should review given statistical approaches to overcome this challenge and provide, use, and describe practical procedures that allow age comprehensive comparisons and tracking of mental health and well-being across age groups based on longitudinal data from a large survey.

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Compliance with ethical statement

Conflict of interest None of the authors has a conflict of interest to disclose.

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Supplementary Material

File 1

Mental health and well-being from childhood to adulthood: Design, methods and results of the 11-year follow-up of the BELLA study

Journal: Journal of European Child and Adolescent Psychiatry

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Supplementary Table S1 Age of participants at the measurement points of the BELLA study

	BELLA baseline cohort					**New participants (included at the 6-year follow-up)**		**New participants (11-year follow-up)**
Age of participants	**Baseline (2002-2006)**	**1-year follow-up (2004-2007)**	**2-year follow-up (2005-2008)**	**6-year follow-up (2009-2012)**	**11-year follow-up (2014-2017)**	**6-year follow-up (2009-2012)**	**11-year follow-up (2014-2017)**	**11-year follow-up (2014-2017)**
3 years						47		
4 years						128		
5 years						152		
6 years						202		
7 years	268					256	1	51
8 years	283	234				197	3	112
9 years	287	249	206			187	9	144
10 years	291	250	231			151	9	135
11 years	265	250	240			110	82	165
12 years	252	212	225			110	113	168
13 years	261	219	181	28		91	121	181
14 years	221	227	207	117		91	126	172
15 years	266	183	208	167		88	75	146
16 years	243	220	167	166		67	60	133
17 years	226	191	192	130	3	61	58	144
18 years		188	158	159	65	72	54	27
19 years			175	111	85	66	38	2
20 years				127	100	73	35	
21 years				95	109	68	24	
22 years				105	82	56	29	
23 years				224	91	138	40	
24 years					90		39	
25 years					81		40	
26 years					78		20	
27 years					62		30	
28 years					71		27	
29 years					37		12	
30 years					15		4	
31 years					4		1	
Total	***2,863***	***2,423***	***2,190***	***1,429***	***973***	***2,411***	***1,050***	***1,580***

Supplementary Table S2 Measurements used at the measurement points of the BELLA study

Construct	Standardised measures/specific items	Baseline	1-year follow-up	2-year follow-up	6-year follow-up	11-year follow-up
Socio-demographic Variables						
Gender	single item	✓	✓	✓	✓	✓
Age	single item	✓	✓	✓	✓	✓
Socio-economic status	Winkler-Index[1]	✓	-	-	-	-
	Revised SES Index[2]	-	-	-	✓	✓
Mental Health Problems						
General mental health problems	SDQ	✓	✓	✓	✓	✓
Anxiety	SCARED	✓	✓	✓	✓	-
	PHQ-Screener	-	-	-	✓	✓
	Selected items of the FBB-ANG assessing Anxiety disorders (from the DISYPS-KJ)	-	-	✓	-	-
Depression	CES-DC	✓	✓	✓	✓	✓
	ADS	-	-	-	-	✓
	DIKJ	✓	✓	✓	-	-
	PHQ-8	-	-	-	✓	✓
	Selected items of the FBB-DES assessing Depressive disorders (from the DISYPS-KJ)	-	-	✓	-	-
	PROMIS-Depression (short form)	-	-	-	-	✓
Conduct Disorder	CBCL	✓	✓	✓	✓	-
ADHD	CRS-R	✓	✓	✓	✓	-
	FBB-HKS assessing Hyperkinetic disorders (from the DISYPS-KJ)	✓	✓	✓	-	-
Eating Disorders	Body weight in kilograms and height in meter for calculating the Body Mass Index (BMI)	✓	✓	✓	✓	✓
Mental Disorders						
	SCOFF	✓	✓	✓	✓	✓
	Confirmed diagnosis of mental health problems by physician.	✓	✓	✓	✓	✓
	DIPS for Anxiety Disorders, Affective Disorders, Conduct Disorders, ADHD, Eating Disorders, Substance abuse/addiction.	-	-	-	✓	-
	CID-S	-	-	-	✓	✓
Health-related Quality of Life						
	Kids-CAT	-	-	-	-	✓
	KIDSCREEN	✓	✓	✓	✓	✓
	KINDL-R	✓	✓	✓	✓	-
	SF-12	-	-	-	-	✓
	SF-36	-	-	-	✓	✓
	PROMIS-Subjective well-being	-	-	-	-	✓
	PROMIS-Family well-being	-	-	-	-	✓

	PROMIS-Physical activity	-	-	-	-	✓
	PROMIS-Relations with peers	-	-	-	-	✓
	PROMIS-General health	-	-	-	-	✓
	PROMIS-Profile 29	-	-	-	-	✓
Risk factors						
Parental psychopathology	SCL-S-9	✓	✓	✓	✓	-
Parental quality of life	SF-12	✓	✓	✓	✓	-
Parental strain	Items assessing the burden caused by housekeeping, being a single parent, tending a family member in need of care, job-related problems, or financial problems	✓	-	-	✓	✓
Risk-Index	Items assessing family conflicts, harmony in partnership, unemployment, parental chronic diseases, unwanted pregnancy, parental alcohol consumption	✓	✓	✓	✓	-
Life events	Items assessing serious illness or accident, death of a close person, marriage or new partnership, change of school	-	✓	✓	✓	✓
Protective factors						
Self-efficacy	GSE	✓	✓	✓	✓	✓
Self-concept	SPPC	✓	✓	✓	-	-
	Selected items of the CHIP-AE	✓	-	-	-	-
Coping	ACOPE, ECOPE	-	✓	✓	✓	-
Optimism	BFW, CSOS	✓	✓	✓	✓	✓
Family climate	FCS	✓	✓	✓	✓	✓
Parental support	8 items from the HBSC	✓	✓	✓	✓	-
Social support	8 selected age-appropriate items from the German SSS	✓	✓	✓	✓	✓
Peer competence	5 items from the HBSC	✓	✓	✓	✓	-
School climate	5 items from the HBSC	✓	✓	✓	✓	-
Health care utilisation						
	Items assessing use (and frequency of use) of health care utilisation by professionals, e.g. psychiatrist or psychologist	✓	✓	✓	✓	✓
	Items assessing paths of mental health care utilisation	-	-	-	✓	-
	Items assessing knowledge of mental health care provision	-	-	-	✓	✓
	Items assessing satisfaction with health care services	-	-	-	✓	✓
	Items assessing barriers towards mental health care utilisation	-	-	-	✓	✓

[1] by Winkler & Stolzenberg [1]; [2] by Lampert et al. [2, 3]

Note. Explanations of abbreviations and references are presented at the end of this file.

List of abbreviations

ACOPE	Problem-focused Coping [Problemorientiertes, aktives Coping] [4]
ADHS	Attention deficit hyperactivity disorder
BFW	Berner Questionnaire on Adolescents' Subjective Well-Being [Berner Fragebogen für Wohlbefinden] [5]
CBCL	Child Behavior Checklist [6]; German version by Arbeitsgruppe Deutsche Child Behavior Checklist [7]
CES-DC	Center for Epidemiological Studies Depression Scale for Children [8]; German version by Barkmann et al. [9]
CHIP-AE	Child Health and Illness Profile-Adolescent Edition [10]
CID-S	Composite International Diagnostic Screener [11]
CRS-R	Conners‘ Rating Scales-Revised [12]; German version by Erhart, Döpfner [13]
CSOS	Children's Sense of Coherence Scale [14]; German version by Kern [15]
DIKJ	Depression Inventory for Children and Adolescents [Depressions-Inventar für Kinder und Jugendliche] [16, 17]
DIPS	Diagnostic Interview for Mental Disorders in Children and Adolescents [Diagnostisches Interview bei psychischen Störungen im Kindes- und Jugendalter] [18, 19]
DISYPS-KJ	Diagnostic System for Mental Disorders in Childhood and Adolescence [Diagnostik-System für psychische Störungen im Kindes- und Jugendalter] [20]
ECOPE	Emotion-focused Coping [Emotionsorientiertes, vermeidendes Coping] [21]
FBB-ANG	Proxy-questionnaire for Anxiety disorders [Fremdbeurteilungsbogen für Angststörungen] from the Diagnostic System for Mental Disorders in Childhood and Adolescence [Diagnostik-System für psychische Störungen im Kindes- und Jugendalter] [20]
FBB-DES	Proxy-questionnaire for Depressive disorders [Fremdbeurteilungsbogen für Depressive Störungen]) from the Diagnostic System for Mental Disorders in Childhood and Adolescence [Diagnostik-System für psychische Störungen im Kindes- und Jugendalter] [20]
FBB-HKS	Proxy-questionnaire for Hyperkinetic disorders [Fremdbeurteilungsbogen für hyperkinetische Störungen] from the Diagnostic System for Mental Disorders in Childhood and Adolescence [Diagnostik-System für psychische Störungen im Kindes- und Jugendalter] [20]
FCS	Family Climate Scale [22], which is the German adaptation of the Family Environmental Scale [23, 24]
GSE	General Self-Efficacy Scale [25]; German version by Bäßler and Schwarzer [21]
HBSC	Health Behaviour in School-aged Children survey [26]
KIDS-CAT	Kids-Computer-Adaptive Test [27]
KIDSCREEN	Quality of Life Questionnaire for Children and Adolescents [28]
KINDL-R	Questionnaire to assess Health-related Quality of Life in Children and Adolescents – Revised version [29]
PHQ-8	Patient Health Questionnaire-8 [30]; German version by Löwe, Spitzer [31] and Gräfe, Zipfel [32]
PHQ-Screener	Patient Health Questionnaire-Screener for Panic Syndrom [33]; German version by Löwe, Spitzer [31] and Gräfe, Zipfel [32]
PROMIS	Patient-Reported Outcomes Measurement Information System [34, 35]
SCARED	Screen for Child Anxiety Related Emotional Disorders [36, 37]; German version by Plass, Barkmann [38]
SCL-S-9	Symptom-Checklist Shortversion-9 [39]
SCOFF	SCOFF Questionnaire [40], German version by Hölling and Schlack [41]
SDQ	Strengths and Difficulties Questionnaire [42] & Impact Supplement [43]
SES	socio-economic status (parental education, occupational qualification, occupational position, income)
SF-12	Short Form-12 Health Survey [44]; German version by Bullinger and Kirchberger [45]
SF-36	Short Form-36 Health Survey [46]; German version by Bullinger and Kirchberger [45]
SPPC	Self-Perception Profile for Children [47]; German version by Asendorpf and Aken [48]
SSS	Social Support Scale [49]

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Supplementary Material

File 2

Mental health and well-being from childhood to adulthood: Design, methods and results of the 11-year follow-up of the BELLA study

Journal: Journal of European Child and Adolescent Psychiatry

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Supplementary Table S3 Model fit of null models on self- and parent-reported general health and health-related quality of life

	General health		**Health-related quality of life**	
	Self-report (n = 4,987)	**parent-report** (*n* = 5,754)	**self-report** (*n* = 4,293)	**parent-report** (*n* = 4,345)
Null model fit				
-2 Log Likelihood	22,852.13	25,127.03	52,031.22	49,585.73
df	3	3	3	3
AIC	22,858.13	25,133.03	52,037.22	49,591.73
BIC	22,879.83	25,154.98	52,057.84	49,612.20

Note: analysed longitudinal data was gathered at five measurement points, only for parent-reported health-related quality of life no baseline data was available.
CI = Confidence Interval; df = degrees of freedom; AIC = Akaike's Information Criterion; BIC = Schwarz's Bayesian Information Criterion.

Supplementary Table S4 Age- and gender-specific effects on self- and parent-reported general health and health-related quality of life over time

	General health				**Health-related quality of life**			
	Self-report (n = 4,987)		**parent-report** (*n* = 5,754)		**self-report** (*n* = 4,293)		**parent-report** (*n* = 4,345)	
	b	*95 % CI*	*b*	*95 % CI*	*b*	*95 % CI*	*b*	*95 % CI*
Fixed effects								
Intercept	2.80***	2.75, 2.84	2.87***	2.83, 2.90	53.37***	52.73, 54.02	53.55***	53.01, 54.10
Level 1-predictors								
Time	0.13***	0.10, 0.17	0.09***	0.06, 0.12	2.31***	1.86, 2.77	0.81**	0.23, 1.39
Time x time	-0.03***	-0.04, -0.03	-0.03***	-0.04, -0.02	-0.83***	-0.95, -0.71	-0.54***	-0.72, -0.37
Time x time x time	0.00***	0.00, 0.00	0.00***	0.00, 0.00	0.05***	0.04, 0.06	0.05***	0.03, 0.06
Level 2-predictors								
Age	-0.01**	-0.01, -0.00	-0.03***	-0.03, -0.02	-0.78***	-0.90, -0.66	-0.27***	-0.36, -0.18
Female	-0.26***	-0.31, -0.22	-0.08***	-0.13, -0.04	-3.01***	-3.78, -2.23	-1.01**	-1.67, -0.35
Age by female	-0.01***	-0.02, -0.01	-0.01***	-0.02, -0.01	-0.11*	-0.22, -0.01	-0.16***	-0.26, -0.07
Random effects								
Residual	0.36***	0.34, 0.38	0.35***	0.34, 0.36	48.40***	45.88, 51.05	45.76***	43.13, 48.54
Intercept (subject id)	0.28***	0.25, 0.31	0.32***	0.29, 0.35	62.01***	55.64, 69.10	63.05***	57.49, 69.15
Slope (time)	0.00***	0.00, 0.00	0.00***	0.00, 0.00	0.23	0.08, 0.69	0.86***	0.60, 1.24
Intercept, slope	-0.01***	-0.02, -0.01	-0.02***	-0.02, -0.01	-3.30***	-4.71, -1.90	0.86***	0.60, 1.24
Model fit								
-2 Log Likelihood	22,515.76		24,850.33		51,401.91		49,296.58	
df	11		11		11		11	
AIC	22,537.76		24,872.33		51,423.91		49,318.58	
BIC	22,617.30		24,952.84		51,499.52		49,393.62	

Note: analysed longitudinal data was gathered at five measurement points, only for parent-reported health-related quality of life no baseline data was available.
CI = Confidence Interval; df = degrees of freedom; AIC = Akaike's Information Criterion; BIC = Schwarz's Bayesian Information Criterion.

Publication 3: Assessing anger and irritability in children

Kaman, A., Otto, C., Devine, J., Döpfner, M., Banaschewski, T., Görtz-Dorten, A., ... Ravens-Sieberer, U. (under review). Assessing anger and irritability in children: Translation, psychometric evaluation and normative data for the German version of the PROMIS® Parent Proxy Anger Scale. *Quality of Life Research*

Assessing anger and irritability in children: Translation, psychometric evaluation and normative data for the German version of the PROMIS® Parent Proxy Anger Scale

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Abstract

Purpose: Anger and irritability are common and impairing symptoms in children. The PROMIS Anger scales assess self- and parent-reported irritable and angry mood over the past seven days. The aim of this study was to translate the PROMIS Parent Proxy Anger Scale (Short Form v1.0) into universal German, to evaluate the psychometric properties and to provide normative data.

Methods: According to the PROMIS translation guidelines, the translation process included forward and backward translations of all items and response options as well as pre-testing with cognitive debriefing. To evaluate the psychometric properties, data from the study ADOPT Epidemiology were used. In this study the PROMIS Anger Scale was administered to a population-based sample of *n* = 8,746 parents of children aged 8 to 12 years. Psychometric analyses were carried out including the investigation of distribution characteristics, factor structure, model fit, reliability, and construct validity. Normative data were calculated as percentile ranks and T-scores.

Results: The translated scale demonstrated good psychometric properties, including satisfactory distribution characteristics, unidimensionality, good internal consistency as well as convergent validity. German normative data for the PROMIS Parent Proxy Anger Scale are presented.

Conclusion: The German version of the PROMIS Parent Proxy Anger Scale can be recommended for use in research and practice. The normative data will allow researchers and clinicians an interpretation of the test scores in future applications.

Keywords: anger, irritability, PROMIS, children and adolescents, psychometric evaluation

Background

Anger is a negative emotional state that is elicited by interpersonal provocation or frustration and often manifests itself in verbal and/or physical aggressive behavior [1,2]. Irritability is conceptualized as a low threshold for experiencing negative affects such as anger in response to frustration. Thus, anger, frustration, aggression and irritability are interrelated psychological constructs [3].

Anger and irritability are common and impairing symptoms in children and adolescents and are among the most common reasons for referrals to child and adolescent mental health services [3]. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM), irritability is an associated symptom of numerous mental disorders, including attention-deficit/hyperactivity disorder (ADHD), oppositional defiant disorder (ODD) and disruptive mood dysregulation disorder (DMDD) [4]. Furthermore, irritability in childhood and youth often predicts anxiety and depressive disorders in adulthood [5,6]. Since irritability can have serious psychosocial implications and can predict long-term adversities [7,8], the reliable and valid assessment of anger and irritability is important in order to identify and treat affected children at an early stage.

In the assessment of psychological symptoms, patients' reports on their symptoms, well-being and functioning play a crucial role, as outcomes such as emotions and affects are best known to the patients themselves. In recent years, patient-reported outcomes (PROs) have become an important endpoint in health care, clinical research, and evaluation studies [9,10]. Against this background, the National Institute of Health (NIH) set up an initiative to develop and evaluate a set of accessible, flexible and psychometrically sound item banks to measure a broad range of PROs - the Patient-Reported Outcome Measurement Information System (PROMIS®). Those measures aim to be more reliable, valid, and responsive compared to existing PROs and enable an efficient application in research and clinical settings [11,12]. The PROMIS measures capture physical, mental, and social aspects of health and can be used in the general population as well as in individuals living with chronic conditions. The item banks allow for the assessment of PROs via tailored short forms and Computer

Adaptive Tests (CATs) by using item response theory (IRT) models [13,14].

To assess patient-reported emotional distress, three PROMIS item banks have been developed following the methodology of item development adopted by the PROMIS network. This includes comprehensive literature searches to identify existing items, item classification and selection, qualitative item review and revision, focus groups with patients, cognitive interviews, and final item revision before field testing [15-18]. The calibrated item banks cover three domains of emotional distress – depression, anxiety, and anger. The PROMIS Anger item banks offer a dimensional assessment of irritable and angry mood, frustration as well as aggressive behavior over the past seven days. Besides the comprehensive item banks, the PROMIS Anger instruments are available as tailored short forms and as CATs. Further, PROMIS provides Anger instruments for pediatric self-report (ages 8 to 17), adult self-report (ages 18+), and parent proxy-report (children ages 5 to 17) [15]. Although self-report should be considered the standard in the assessment of PROs, there may be circumstances in which parent proxy-reports are required, e.g. in situations in which the child is cognitively impaired or too young to complete a questionnaire [19,20]. Moreover, research has shown that prevalence estimates for externalizing problems that are based on self-report are generally lower compared to parent proxy-reported symptoms [21,22]. Externalizing behavior problems such as anger and aggression are better observable by parents and less prone to dissimulation tendencies. Thus, parent proxy-reports are considered to be reliable and relevant sources of information.

The PROMIS initiative aims to implement PROMIS measures in clinical research across the world. Many efforts are currently being made to translate selected PROMIS measures into various languages. The PROMIS Anger item banks are already available in different languages; however, no German version exists. The aims of this study were to translate the PROMIS Parent Proxy Anger Scale (Short Form v1.0) into universal German, to evaluate the psychometric properties of the scale in a population-based sample, and to provide normative data that will facilitate interpretation of the test scores in research and practice.

Methods

Translation

The translation of the PROMIS Anger Scale was performed after obtaining permission from the PROMIS Health Organization in 2014. Both the Pediatric Short Form and the Parent Proxy Short Form were translated from American English into universal German according to the established Functional Assessment of Chronic Illness Therapy (FACIT) Translation Methodology [23,24], which has been approved by the PROMIS network as the standard approach for translating PROMIS instruments.

Step 1: Forward translation. First, the items were translated by two independent professional translators from American English into three German language versions (German-German, Austrian-German and Swiss-German). As the items of the Pediatric and Parent Proxy Short Forms are presented with equally wordings, the parent-report items were not translated individually, but were adopted according to the self-report items.

Step 2: Reconciliation of translators and experts. Second, the two forward translations of each item were reviewed by a third independent translator and one reconciled translation for each German language version was selected. Subsequently, experts agreed on one universal German version for each item.

Step 3: Back translation. Third, the items of the reconciled universal forward translation were back-translated into American English by another independent translator without seeing the original English items or item definitions.

Step 4: Expert reviews. Fourth, the back-translated items were compared with the original English items to check the conceptual equivalence and to resolve discrepancies between original items and back-translations. Three reviewers independently examined all previous steps and made recommendations on the most appropriate translation for each item or provided an alternative translation if the previous translations were not acceptable.

Step 5: Finalization and harmonization. Fifth, the final version of the items was determined by the Translation Project Manager after evaluating the reviewers' recommendations. A quality review was performed by the Translation Project Manager and the PROMIS Statistical Center. The finalized and harmonized versions were formatted and proofread by two independent proofreaders.

Step 6: Pilot testing/cognitive debriefing interviews. Finally, the German language versions of the PROMIS Pediatric and Parent Proxy Anger Scales were pretested and linguistically validated using focus group interviews with children, adolescents and their parents in Germany, Austria and Switzerland. Each focus group consisted of three to five participants and each item was debriefed in at least one focus group interview. The participants answered questions regarding item comprehension in order to examine if the meaning of the translated item is equivalent to the English original item. After reviewing the comments and suggestions of the participants, final item revisions were made, and the translations were finalized. Overall, no serious difficulties in understanding the translated items were reported and only one item of the Pediatric Anger Scale and two items of the Parent Proxy Anger Scale required minor modification.

Psychometric evaluation

Study

Psychometric evaluation of the PROMIS Parent Proxy Anger Scale was performed using data from the study ADOPT Epidemiology, which is part of the research consortium ADOPT (**A**ffective **D**ysregulation – **O**ptimizing **P**revention and **T**reatment). The study ADOPT Epidemiology aims to investigate the epidemiology of affective dysregulation and irritability in children. This sub-project is responsible for the development of a reliable screening tool for affective dysregulation, which is administered, together with other relevant measures, in a population-based sample in Germany. Data were collected across four German cities (Cologne, Dresden, Mannheim and Ulm) over the course of 19 months (February 2018 to August 2019). Families with children aged 8 to 12 years were randomly selected from the residents' registration offices of the four cities. Potential participants were informed about the study and asked for their participation. Once their written informed consent was obtained, the parents were asked to complete a paper-pencil questionnaire. Alternatively, the participants had the opportunity to complete the questionnaire online or to answer the questions on the phone. Data collection and management were supported using a secure, web-based application named REDCap [25]. The study ADOPT Epidemiology was approved by the ethics committee of the General Medical Council Hamburg and the commissioner for data protection from the University Hospital Cologne. For further details concerning the design and methods of the research consortium ADOPT and the sub-project ADOPT Epidemiology, see Döpfner et al. [26] and Otto et al. [27].

Participants

Of the *N* = 79,015 potential participants contacted within the population-based screening of the study ADOPT Epidemiology, *n* = 10,288 (13.7 %) parents agreed to participate. Participants were included in the present analyses, if i) their child was between 8 and 12 years of age at the time of participation and ii) they answered at least one of the items of the PROMIS Anger Scale. The final sample under analysis included *n* = 8,746 parents of children aged 8 to 12 years.

Measures

Sociodemographic variables. Age (in years) and gender of the child as well as the education of the parents were assessed. Parental education, an indicator of the socioeconomic status (SES), was assessed by two items asking for the highest academic and vocational qualification of both parents. Children were assigned the highest point score their parents provided. Levels of education were operationalized based on the international 'Comparative Analysis of Social Mobility in Industrial Nations' (CASMIN) classification of education [28]. This classification differentiates nine categorical levels of education based on distinct combinations of academic and vocational qualifications. Based on these combinations, a categorization into parents with low (primary), medium, (secondary) and high (tertiary) education was performed.

PROMIS Anger Scale. Parents completed the German translation of the PROMIS Parent Proxy Anger Scale [15]. The scale consists of five items covering parent-reported irritable and angry mood of the child over the past seven days (e.g., 'My child felt mad'). Items were rated on a 5-point response scale ranging from 0 (never) to 4 (almost always), with higher scores indicating more severe symptoms. The total score of the scale was calculated and translated into a standardized T-score, which allows an interpretation of a person's anger symptoms compared to other individuals in the reference population. A score of 50 represents the mean T-score of the US general population with a standard deviation of 10. Symptom scores of 0.5, 1.0, and 2.0 standard deviations above the mean indicate mild, moderate, and severe symptoms.

Symptoms of affective dysregulation. For the assessment of construct validity, symptoms of affective dysregulation in children were measured using the Screening Tool for Affective Dysregulation in Children (DADYS-Screen) [27]. The parent-reported screening tool includes 14 items focusing on symptoms of persistent irritability and severe temper outbursts in children (e.g., 'Often loses temper' or 'Gets angry frequently'). Items were offered with a 4-point response scale ranging from 0 (not at all true) to 3 (completely true). The raw sum scores ranged from 0 to 42.

Data analysis

The psychometric properties of the PROMIS Parent Proxy Anger Scale were examined following the recommendations and guidelines of the PROMIS network [29]. First, common item characteristics including mean (*M*), standard deviation (*SD*), response frequencies, proportion of missing values, item difficulties, item-total correlations, and inter-item correlations were calculated. At the scale level, distribution characteristics including range, mean, standard deviation, skewness, and kurtosis of the raw sum score as well as US T-scores were examined.

A confirmatory factor analysis (CFA) was conducted to evaluate unidimensionality of the PROMIS Anger Scale using a weighted least squares means and variance adjusted (WLSMV) estimator. To examine model fit, the comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA) with 90 % confidence interval (CI), and the standardized root mean squared residual (SRMR) were taken into account. CFI and TLI values ≥ .95 [30,31], RMSEA values ≤ .06 [30], and SRMR values ≤ .08 [30] indicate a good model fit.

Reliability was examined via Cronbach's α coefficient with values above 0.70 indicating acceptable reliability [32]. Construct validity was assessed by examining the correlation between the PROMIS Anger Scale and the DADYS-Screen. We calculated the Pearson correlation coefficient (*r*), expecting both scales to be strongly positively correlated ($r > .50$).

Finally, normative data for the German version of the PROMIS Parent Proxy Anger Scale were calculated. To assess the need for age- and gender-specific normative data, effects of age and gender were examined using analyses of variance (ANOVA). Following this, a rank-based transformation [33,34] was performed due to the non-normal distribution of the PROMIS Anger test scores. Based on the cumulative frequencies of the raw scores, percentile ranks (PR) were calculated and transformed into normalized z-scores. These z-scores were then transformed into standardized T-scores with a mean of 50 and a standard deviation of 10. Mplus 8 [35] was used for CFA, all other analyses were conducted using IBM SPSS Version 27.

Results

The analyzed sample including n = 8,746 parents of children and adolescents aged 8 to 12 years is described in Table 1. About half of the investigated children and adolescents were female (48.7 %), and the mean age was 10 years (*SD* = 1.38). The questionnaire was answered predominantly by mothers (76.8 %) of the participating children, in 17.3 % of the cases, fathers responded, for 5 % of the children both, mothers and fathers answered the survey together and for 0.9 % of the children other relatives (e.g., step-, foster- or grandparents) provided proxy-reports. Most of the parents were highly educated (69.4 %), 27.3 % had a medium and 3.3 % a low educational level.

PLEASE INSERT TABLE 1 HERE

Descriptive statistics. The item characteristics of the PROMIS Anger Scale are shown in Table 2. Item-level means ranged from 0.38 (‘My child was so angry he/she felt like throwing something’) to 1.56 (‘My child felt upset’). Considering the threshold of 15 % of respondents scoring at the lowest possible category [36], floor effects were observed for all items except item 4 (‘My child felt upset’). The proportion of missing values was very low, ranging from 0.1

% to 0.4 % per item. Item difficulties ranged from p_i = .10 to .39, and corrected item-total correlations ranged from r_{it} = .65 to .81. As displayed in Table 3, medium to strong inter-item correlations were found with correlation coefficients ranging from r = .47 to .73. The distribution characteristics of the PROMIS Anger Scale are shown in Table 4. The raw sum scores ranged from 0 to 20 (M = 4.37, SD = 3.55), and the standardized US T-scores ranged from 29.0 to 85.0 (M = 44.38, SD = 10.48). The scale had a positively skewed distribution, supporting the results of the item analysis. The low kurtosis indicated a platykurtic distribution of the scale, characterized by a lower peak and shorter tails compared to the normal distribution.

PLEASE INSERT TABLES 2 TO 4 HERE

Dimensionality. The descriptive fit indices resulting from the CFA pointed to a good model fit (RMSEA = 0.066, 90 % CI = 0.058-0.074, SRMR = 0.018, CFI = 0.998, TLI = 0.996). The standardized factor loadings ranged from 0.79 to 0.93. Residual correlations among items were very low (between -.03 and .04). Thus, findings indicated that the 5-item PROMIS Anger Scale can be considered sufficiently unidimensional, confirming the factorial validity of the scale.

Reliability and construct validity. The internal consistency of the PROMIS Anger Scale in the present study was good with Cronbach's α = 0.88. Further, in support of convergent validity, a strong positive correlation was found between the PROMIS Anger Scale and the DADYS-Screen (r = .77; p < .001).

Normative data. Percentile ranks and T-scores for the total sample were given as normative data (see Table 5). Although there were significant effects of age (F(4, 8671) = 10.122, p < .001, η^2 = .005) and gender (F(1, 8674) = 38.048, p < .001, η^2 = .006), they did not reach the lower limit of practical relevance of 1 %. Thus, no age- and gender-specific normative data were given.

PLEASE INSERT TABLE 5 HERE

Discussion

The aims of the present study were to translate the PROMIS Parent Proxy Anger Scale into German and to investigate the psychometric properties of the translated items in a population-based sample of parents with children aged 8 to 12 years. Overall, the German translation of the PROMIS Parent Proxy Anger Scale demonstrated good psychometric properties, including unidimensionality, good fit statistics, good reliability, and convergent validity. The normative data will allow German clinicians and researchers an interpretation of the test scores in clinical practice and future studies.

The descriptive analyses showed very few missing values, indicating a good acceptability of the items. Easy item comprehension was also found in cognitive interviews during the translation process: parents did not report any serious problems responding to the items. In line with Pilkonis et al. [15] who examined the distribution characteristics for the original English version of the PROMIS Anger Scale, we detected rather low item difficulties as well as floor effects for most of the items, which could indicate limited content validity and reduced variability in the data. Only very few parents reported that their children exhibited irritable or angry mood *often* or *almost always*. As a consequence, healthy children and children with mild irritability can not be differentiated very well by the PROMIS Anger Scale. The positively skewed distribution of the scale can be attributed to the fact that we conducted a symptom screening in a population-based sample, in which the prevalence of angry mood and aggressive behavior is generally lower compared to prevalences in clinical samples.

The confirmatory factor analysis showed that the hypothesized unidimensional model structure fits the data reasonably well. Model fit indices were well above popular rules of thumb and the standardized factor loadings were high. Thus, the factorial validity of the PROMIS Anger scale was confirmed.

The internal consistency of the scale was good, indicating that the PROMIS Anger Scale is a reliable instrument to measure anger and irritability in children. Further, our results provide support for the construct validity of the PROMIS Anger Scale, which showed convergent validity with a measure on affective dysregulation in children (DADYS-Screen).

Future studies may also test the discriminant validity using, for example, measures of psychological functioning, positive affect or global health. For the original English version of the PROMIS Anger Scale, Pilkonis et al. [15] found evidence of discriminant validity using PROMIS Global Health items as divergent measure (*r* = .40).

Although we found significant effects of age and gender on parent-reported symptoms of anger, these effects did not reach the lower limit of clinical relevance of 1 %. This is in line with results by Humphreys et al. [37], who found no gender differences in levels of irritability in a community sample of children aged 9 to 13 years. However, it could be that practically relevant gender differences first emerge during adolescence and become more pronounced during puberty. Future studies are needed to examine this relationship in more detail.

The mean symptom severity (T-score = 44.36) in our sample was considerably lower compared to the mean in the US reference population (T-score = 50). This finding is in line with a cross-cultural study that found that US parents reported more externalizing problems for their children compared to German parents [38]. Mean scores can differ among countries because of cultural differences or as a result of the translation. The reference values available on the PROMIS website are based on a sample of parents with children aged 5 to 17 years of the US general population that matches the distribution of age, gender, race, and education in the 2000 US Census [39]. As our sample consisted of parents with children aged 8 to 12 years, it is not fully comparable to the US reference sample. Moreover, lower educated parents were underrepresented in our sample. Therefore, the German normative values provided in the present study apply to this reference group only and described findings should not be generalized to children and adolescents outside this age range. For the German normative values provided, a T-score of 50 represents the average score of parent-reported anger symptoms among children aged 8 to 12 years in the German general population. The calculated percentile ranks and T-scores have the advantage that they can be used in the case of a non-normal distribution as they are based not on a linear, but on a rank-based transformation of the raw scores [33,34].

Our study has the following limitations. First, our analyses were based on a population-based sample of parents with children aged 8 to 12 years. Thus, findings should not be generalized to children and adolescents outside this age range. Second, we had no access to sociodemographic or health-related information of the non-participating parents. The fact that participants with a low level of education were underrepresented in our sample may indicate that non-response was associated with parental education. This should be taken into account when interpreting the results, as research has shown that externalising problems are more common among children with a lower SES [40]. Further, it should be noted that our translation and psychometric testing was based on the PROMIS Anger Scale Short Form v1.0. However, this version is highly comparable to the recently developed Short Form v2.0 because the underlying items and response options are identical. The only difference lies in the coding of the response scales ranging from 0 (never) to 4 (almost always) in version 1.0 and 1 (never) to 5 (almost always) in version 2.0, respectively.

This study has several strengths. We developed a universal German language version of the PROMIS Anger Scale following the very thorough and scientifically advanced international translation guidelines approved by the PROMIS network. Psychometric analyses were based on a very large population-based sample and were conducted in accordance with the recommendations for psychometric evaluation after translation of PROMIS instruments. Further, data were collected by means of an online survey, paper-pencil questionnaire or telephone interview, depending on what the participants preferred, in order to minimize barriers and increase willingness to participate. Lastly, the country-specific normative data can help facilitate German researchers and clinicians an interpretation of the test scores in future applications of the PROMIS Anger Scale in research and practice.

Overall, the PROMIS Parent Proxy Anger Scale has been successfully translated into universal German. Our findings provide evidence of the reliability, construct validity, and unidimensionality of the PROMIS Anger Scale as a measure of anger and irritability in children. Future studies may wish to undertake further psychometric analyses, including the investigation of discriminant validity and differential item functioning as well as further investigations in a clinical sample using methods based on IRT. On the basis of our results, the German version of the PROMIS Anger Scale can be recommended for use in future studies and clinical applications.

Declarations

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Conflicts of interest. Anne Kaman, Christiane Otto, Janine Devine, Manfred Döpfner, Anja Görtz-Dorten, Charlotte Hanisch and Ulrike Ravens-Sieberer declare that they have no conflicts of interest. Tobias Banaschewski served in an advisory or consultancy role for ADHS digital, Infectopharm, Lundbeck, Medice, Neurim Pharmaceuticals, Oberberg GmbH, Roche, and Takeda. He received conference support or speaker's fee by Medice and Takeda. He received royalties from Hogrefe, Kohlhammer, CIP Medien, Oxford University Press; the present work is unrelated to these relationships. Michael Kölch received funding by German Ministry of Education and Research for several projects. He received royalties from Springer, Hogrefe and Beltz; the present work is unrelated to these relationships. Veit Roessner has received payment for consulting and writing activities from Lilly, Novartis, and Shire Pharmaceuticals, lecture honoraria from Lilly, Novartis, Shire Pharmaceuticals/Takeda, and Medice Pharma, and support for research from Shire Pharmaceuticals/Takeda and Novartis. He has carried out clinical trials in cooperation with the Novartis, Shire Pharmaceuticals/Takeda, Servier and Otsuka companies; the present work is unrelated to these relationships.

Availability of data and material. The data that support the findings of this study are available from the corresponding author upon reasonable request.

Code availability. Codes for data cleaning and analysis are available from the corresponding author upon reasonable request.

Authors' contributions. Conceptualization: Anne Kaman; Methodology: Anne Kaman, Christiane Otto; Formal analysis and investigation: Anne Kaman, Ulrike Ravens-Sieberer; Writing - original draft preparation: Anne Kaman; Writing - review and editing: Anne Kaman, Christiane Otto, Janine Devine, Manfred Döpfner, Tobias Banaschewski, Anja Görtz-Dorten, Charlotte Hanisch, Michael Kölch, Veit Roessner, Ulrike Ravens-Sieberer; Funding acquisition: Ulrike Ravens-Sieberer, Manfred Döpfner; Resources: Ulrike Ravens-Sieberer, Manfred Döpfner; Supervision: Christiane Otto, Janine Devine, Manfred Döpfner, Tobias Banaschewski, Anja Görtz-Dorten, Charlotte Hanisch, Michael Kölch, Veit Roessner, Ulrike Ravens-Sieberer.

Ethics approval. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study ADOPT Epidemiology was approved by the ethics committee of the General Medical Council Hamburg (PV5677)

Consent to participate. Informed consent was obtained from all individual participants included in the study.

Consent for publication. The participants provided informed consent for publication of the anonymized data.

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Table 1. Description of the analyzed sample

	n = 8,746		
	n	%	*M (SD)*
Gender			
Male	4,489	51.3	
Female	4,257	48.7	
Age			10.00 (1.38)
Respondent			
Mother	6,714	76.8	
Father	1,510	17.3	
Mother and father	440	5.0	
Others	82	0.9	
Parental education[1]			
Low	281	3.3	
Medium	2,316	27.3	
High	5,886	69.4	

[1] Missing values were given for *n* = 263 for parental education

Table 2. Item-level descriptive statistics of the PROMIS Parent Proxy Anger Scale

		Mean (*SD*)	Response frequencies (%)					Missing values (%)	p_i	r_{it}
			never	rarely	some-times	often	almost always			
1	My child felt mad.	1.20 (0.88)	23.0	41.3	28.6	6.6	0.4	0.1	.30	.78
2	My child was so angry he/she felt like yelling at somebody.	0.81 (0.98)	51.0	24.6	18.0	4.9	1.3	0.2	.20	.81
3	My child was so angry he/she felt like throwing something.	0.38 (0.76)	75.5	14.1	7.8	2.0	0.5	0.1	.10	.66
4	My child felt upset.	1.56 (0.94)	13.1	33.4	38.9	12.2	2.0	0.4	.39	.70
5	When my child got mad, he/she stayed mad.	0.42 (0.73)	69.6	20.7	7.6	1.7	0.3	0.2	.11	.65

p_i = item difficulty; r_{it} = corrected item-total correlation

Table 3. Inter-item correlations of the PROMIS Parent Proxy Anger Scale

		1	2	3	4	5
1	My child felt mad.	-				
2	My child was so angry he/she felt like yelling at somebody.	.73***	-			
3	My child was so angry he/she felt like throwing something.	.53***	.60***	-		
4	My child felt upset.	.68***	.63***	.47***	-	
5	When my child got mad, he/she stayed mad.	.54***	.55***	.51***	.51***	-

Inter-item correlations are presented by Spearman rank correlations; *** $p < .001$

Table 4. Scale-level descriptive statistics of the PROMIS Parent Proxy Anger Scale

	Range	*M*	*SD*	S	K
PROMIS Anger Scale raw sum scores	0 - 20	4.37	3.55	1.07	0.85
PROMIS Anger Scale T-scores[1]	29.0 - 85.0	44.38	10.48	0.70	0.09

M = mean; *SD* = standard deviation; S = skewness; K = kurtosis; [1] *based on US reference population*

Table 5. Normative data (percentile ranks and T-scores) for the PROMIS Parent Proxy Anger Scale

Raw score	Percentile rank	T-score
0	9.07	28.4
1	21.54	39.4
2	37.93	44.5
3	51.02	48.3
4	61.56	51.7
5	68.94	54.0
6	75.53	55.9
7	81.21	57.9
8	86.14	59.9
9	90.34	62.0
10	93.20	64.0
11	95.03	65.7
12	96.73	67.5
13	97.82	69.3
14	98.84	71.4
15	99.35	73.7
16	99.61	75.7
17	99.75	77.3
18	99.91	79.0
19	99.94	80.0
20	100.00	80.0

Publication 4: Development and evaluation of a screening tool for affective dysregulation in children

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Otto, C.*, **<u>Kaman, A.*</u>**, Barkmann, C., Döpfner, M., Görtz-Dorten, A., Ginsberg, C., ... Ravens-Sieberer, U. (under review). The DADYS-Screen – Development and evaluation of a screening tool for affective dysregulation in children. *Assessment*. *shared first authorship

The DADYS-Screen – Development and Evaluation of a Screening Tool for Affective Dysregulation in Children

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Abstract

Affective dysregulation (AD) in children is characterized by persistent irritability and severe temper outbursts. This study developed and evaluated a screening questionnaire for AD in children. The development included the generation of an initial item pool from existing instruments, a Delphi rating of experts, focus groups with experts and parents, and psychometric analyses of clinical and population-based samples. Based on data of a large community-based study, the final screening questionnaire was developed (*n* = 771) and evaluated (*n* = 8,966) with methods from classical test theory and item response theory. The developed DADYS-Screen includes 14 items with good psychometric properties and scale characteristics including an acceptable to good fit to a one-factorial model. Results could be confirmed using a second and larger data set. Only few items need further investigation using clinical data. The use of the DADYS-Screen in identifying children with AD is psychometrically supported.

Keywords

affective dysregulation – disruptive mood dysregulation disorder – children – screening – parent-report – item response theory

Affective dysregulation (AD) is characterized by persistent irritable mood and severe outbursts of temper, which are among the most common and challenging symptoms in child and adolescent psychiatry (Baweja, Mayes, Hameed, & Waxmonsky, 2016). Children with AD are excessively angry and aggressive in response to negative emotional stimuli. AD is often characterized as a transdiagnostic dimension (Döpfner et al., 2019) and is associated with a wide range of internalizing and externalizing mental disorders, including depression, anxiety, attention-deficit hyperactivity disorder (ADHD), oppositional defiant disorder (Roy et al.) and conduct disorder (Axelson et al., 2012; Brotman et al., 2006; Copeland, Angold, Costello, & Egger, 2013; Roy et al., 2013), which can result in poor diagnostic specificity (Holtmann, Legenbauer, & Grasmann, 2017). Validated instruments for the assessment of AD in children are rare.

In recent years there has been a controversial scientific debate about the diagnostic classification of children with AD (Grimmer, Hohmann, Banaschewski, & Holtmann, 2010; Parens & Johnston, 2010). As a consequence of this debate, a new diagnosis for children was introduced in the revision of the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5; American Psychiatric Association, 2013), called Disruptive Mood Dysregulation Disorder (DMDD). With an onset usually before the age of 10 years, DMDD has two core symptom criteria: severe, recurrent outbursts of temper and persistent irritable or angry mood. Considering the lack of empirical studies on DMDD, the inclusion of this new diagnosis has been controversially discussed (Birkle, Legenbauer, Grasmann, & Holtmann, 2017). In line with the proposal of Lochman et al. (2015), in the recently published eleventh revision of the International Classification of Diseases (ICD-11), AD was introduced not as an independent diagnosis, but as a specifier for the existing diagnosis of ODD, to differentiate between ODD with and without chronic irritability and anger (World Health Organization, 2019). As the symptomatology of AD cuts across multiple diagnoses, AD fits well within the research framework RDoC (Research Domain Criteria) by the National Institute of Mental Health – a transdiagnostic dimensional approach to understand mental disorders (Insel et al., 2010). The RDoC concept encompasses the construct of frustrative nonreward into which children with AD can be classified (Meyers, DeSerisy, & Roy, 2017; Morris & Cuthbert, 2012).

Despite increasing interest among researchers and clinicians, relatively little empirical research has yet been performed on the assessment, etiology and epidemiology of AD. Depending on the underlying conceptualization of AD, previous epidemiological studies have reported prevalence rates between 0.8 % and 9.2 % (Brotman et al., 2006; Copeland et al., 2013; Grau et al., 2018; Mayes et al., 2015). Affected children are severely impaired in various life domains, such as school and family life (Copeland et al., 2013; Dougherty et al., 2014). Furthermore, AD in childhood predicts later psychiatric problems such as depression, anxiety and suicidal ideation (Benarous et al., 2019; Stringaris, Cohen, Pine, & Leibenluft, 2009; Vidal-Ribas, Brotman, Valdivieso, Leibenluft, & Stringaris, 2016) and is a common cause of health services utilization (Dougherty et al., 2016), pointing out a significant public health impact. Overall, these findings underline the importance to identify and treat children with AD at an early stage.

So far, however, knowledge regarding the appropriate assessment of AD in children is still limited and validated instruments are rare. Some standardized questionnaires and structured clinical interviews include items that measure certain aspects of AD, such as irritability (Affective Reactivity Index; Stringaris et al., 2012), anger (PROMIS Anger Scale; Irwin et al., 2012) or emotion regulation (Emotion Regulation Checklist; Shields & Cicchetti, 1997). Further established rating scales assessing emotion dysregulation include the dysregulation profiles of the Strengths and Difficulties Questionnaire (SDQ-DP; Deutz et al., 2018) and of the Child Behaviour Checklist (CBCL-DP; Geeraerts et al., 2015). However, instruments structured around the phenotype of AD are still missing (McTate & Leffler, 2017; Waltereit, Giller, Ehrlich, & Roessner, 2019). The development of focused screening and assessment tools to guide diagnosis and treatment for AD should be in the focus of future research.

The aim of this study was to develop and evaluate a parent-reported screening questionnaire on AD in 8- to 12-year-old children following a mixed methods approach. We aimed to investigate the following research questions.

i) Which items from existing measures can be used to create a corresponding item pool for measuring AD?

ii) Which items out of this item pool should be used in a preliminary version of a screening tool on AD due to evaluations of clinical experts (Delphi ratings and focus group), ratings of parents (focus groups) and according to clinical and archived population-based data (based on methods of classical test theory (CTT))?

iii) Which items out of the preliminary version of the screening tool are psychometrically sound, valid and reliable to measure AD (based on methods of CTT and item response theory (IRT)) according to prospectively gathered population-based data and should be included in the final screening tool?

iv) How valid and reliable is the final screening tool on AD (based on CTT and IRT) according to a large sample with prospectively gathered population-based data?

Methods

Study & Samples

The research consortium ADOPT (**A**ffective **D**ysregulation – **O**ptimizing **P**revention and **T**reatment) aims at developing valid assessment tools for AD, investigating the epidemiology of AD, and developing and evaluating treatment approaches for affected children and their parents. For more information on the consortium ADOPT including a description of the design, methods and all included sub-projects, see Döpfner et al. (2019). The tasks of the sub-project ADOPT Epidemiology are to develop, evaluate and validate a screening tool on

AD assessing and using data of a large community sample. ADOPT Epidemiology was approved by the ethics committee of the General Medical Council Hamburg and the commissioner for data protection from the University Hospital Cologne.

For developing the preliminary version of the screening questionnaire (i.e., pre-DADYS-Screen), a clinical pilot study was conducted at the outpatient clinic of the School of Child and Adolescent Cognitive Behavior Therapy (AKiP) at the Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy at the University of Cologne, Germany; data was gathered over four months (September to December 2017) from parents of $n = 141$ children aged 8 to 12 years referred for treatment (28 % female; $M_{\text{age}} = 9.90$ years, $SD_{\text{age}} = 1.354$). We further investigated data from the population-based longitudinal BELLA study on mental health and well-being in children and adolescents in Germany (Ravens-Sieberer et al., 2015); parent-reported data from the second measurement point of the BELLA study (conducted 2004 to 2007) on 8- to 12-year-olds was used ($n = 1{,}089$; 46 % female; $M_{\text{age}} = 9.96$ years, $SD_{\text{age}} = 1.38$).

For developing and evaluating the final version of the screening questionnaire (i.e., DADYS-Screen), we prospectively recruited a large community sample in the project ADOPT Epidemiology. Data was collected across four German cities (Cologne, Dresden, Mannheim, and Ulm) over 18 months (February 2018 to August 2019). Families with children aged 8 to 12 years were randomly selected from the official registers of the residents' registration offices. Potential participants were contacted by the ADOPT Epidemiology study team using conventional mail to inform about the study and ask for written informed consent to participate. Additionally, the screening questionnaire was sent out to the parents. Parents were reminded once within the study (after 4 weeks). Alternative to the paper-and-pencil questionnaire, participants had the opportunity to fill in the questionnaire online or to answer the questions on the phone. Data collection and management were supported using a secure, web-based application named REDCap (Harris et al., 2009) hosted at the Clinical Trials Centre Cologne.

Overall, we contacted $n = 79{,}015$ parents of children aged 8 to 12 years in the above-mentioned cities out of which 5 % ($n = 3{,}897$) could not be reached by the given addresses.

Out of the remaining families (*n* = 75,118), *n* = 10,288 parents gave their informed consent and participated in the study (response rate: 14 %), and 1 % families (*n* = 1,060) actively refused participation (main reasons for refusal, if mentioned, were “no interest” and “no time”). We had to exclude participants from the study sample due to i) children who did not fit the relevant age range anymore (*n* = 194), ii) inconsistent information on age and/or gender of the respective child (*n* = 236), and iii) missing responses to all items of the screening tool (*n* = 99). This resulted in a total sample of *n* = 9,759 parents of children aged 8 to 12 years who participated in the study and responded to at least one item of the screening questionnaire. For developing the final version of the screening tool (i.e., DADYS-Screen), valid data of the first *n* = 771 participants gathered until the end of March 2018 with the preliminary version of the screening tool (i.e., pre-DADYS-Screen) was used. For evaluating the final screening tool (i.e., DADYS-Screen), we investigated data of *n* = 8,988 participants who participated from April 2018 until August 2019.

The flowchart on the process of selecting the study participants in the community-based study is presented in Figure 1. Additionally, both subsamples and the total sample from the community-based study are described in Table 1.

Measurement

In the community sample of the project ADOPT Epidemiology, the preliminary version of the screening tool with 24 items (i.e., pre-DADYS-Screen) was administered until March 2018, and the final version with 14 items (i.e., DADYS-Screen) from April 2018 until August 2019. Throughout the data assessment, parents further responded to socio-demographic questions. Parental education was assessed by two items asking for the highest academic and vocational qualification of both parents. According to the international “Comparative Analysis of Social Mobility in Industrial Nations” (CASMIN) classification (Brauns, Scherer, & Steinmann, 2003), a categorization into parents with low, medium and high education was performed. Further, general health of the child was assessed using the item “In general, how would you rate your child’s health?” provided with a five-point scale (1 = *excellent* to 5 = *poor*).

Analyses

Development of DADYS-Screen. The development of the screening tool followed a stepwise process using qualitative and quantitative methods.

Generation of the initial item pool. The initial item pool was created based on existing instruments. Clinical and research experts identified and reviewed well-established, validated and standardized clinical rating scales, and selected items on symptoms and behaviors closely related to AD (such as irritable mood, emotion dysregulation, anger, impulsivity and reactivity).

Qualitative and quantitative investigations of the initial item pool to develop pre-DADYS-Screen. Qualitative investigations included a Delphi rating and focus groups. The Delphi process is a consensus method frequently used in health research with the aim to determine the extent to which experts agree on a given issue (Jones & Hunter, 1995; Landeta, 2006). In this study, a multidisciplinary group of experts, composed of child and adolescent psychologists, psychotherapists, pediatricians and researchers, was asked to participate because of their expertise and clinical experience in the field of child mental health (*n* = 12 experts were invited, *n* = 8 consented to participate). In the first round of the Delphi rating, experts were asked to define the construct of AD. Content analysis was used to categorize responses and to develop a definition of AD as conceptual basis. In the second round, experts were asked to evaluate the joint definition of AD. In the third round, experts were presented with the complete initial item pool and asked for their level of agreement with the inclusion of each item based on a four-point response scale ranging from 0 (*strongly disagree*) to 3 (*strongly agree*). Consensus was reached, if at least 90 % of experts either agreed (*rather agree* and *strongly agree*) or disagreed (*rather disagree* and *strongly disagree*).

Focus groups were conducted with clinical experts (*n* = 9 clinicians, psychotherapists and pediatricians) and with parents of mentally ill children (*n* = 11) by trained moderators at the University Hospital Cologne, Germany. In the first focus group, clinical experts evaluated the relevance and comprehensiveness of all items included in the initial item pool. Clinical experts discussed which items are most important in assessing AD and which items are redundant or rather capture other clinical symptoms. In the second focus group, parents were asked to comment on the comprehensibility of the items. Both focus groups were audio-recorded, transcribed verbatim and content analyzed.

For the quantitative investigation of the initial item pool, data of the clinical pilot study and population-based data from the BELLA study was used. Analyses based on methods from CTT were conducted. We investigated item distributions, item difficulties, item inter-correlations, corrected item-total-correlations, and factor loadings resulting from a principal component analysis (PCA) assuming one general factor.

Based on results of quantitative and qualitative investigations, the initial item pool was reduced using a priori defined criteria. Exclusion of items was considered, if an item i) was regarded as unsuitable for assessing AD by clinical experts (resulting from the Delphi rating and focus group), ii) was difficult to understand by parents (resulting from focus groups), iii) had a low item difficulty (only relevant for the clinical sample; $P_i < .20$), iv) had a low factor loading ($a_{i1} < .30$), and/or v) had low corrected item-total-correlations ($r_{i(t-i)} < .30$). Each item was discussed considering critical values (below or close to a priori defined thresholds) in a group of six clinical and research experts. Items were included or excluded based on a final agreement among all experts. This procedure resulted in the preliminary version of the screening tool, i.e., pre-DADYS-Screen.

Empirical investigation of pre-DADYS-Screen to develop DADYS-Screen. The quantitative investigation of pre-DADYS-Screen was conducted based on first data of the community sample ($n = 771$) using methods of CTT and IRT. Based on CTT, we investigated item difficulties, item inter-correlations, factor loadings from PCA (one general factor), corrected item-total-correlations, and Cronbach's alpha. We further conducted a confirmatory factor analysis (CFA) and determined model fit, factor loadings and residual correlations. Within the IRT, item fit was assessed by means of the so-called infit value based on the standardized mean squared residuals (MNSQ). Additionally, category characteristic curves, item characteristic curves and item information functions were inspected. We investigated whether item threshold parameters were monotonously increasing and residual correlations. Further, a potential item bias was determined by differential item functioning (DIF) analysis on the basis of ordinal logistic regressions with age, sex, parental education, and assessment mode. Uniform DIF means a constant bias across all trait levels, non-uniform DIF means a dependency of the bias on the trait level.

We discussed excluding items from pre-DADYS-Screen, if i) inter-correlations were very low ($r_{ii} < .10$), ii) factor loading from PCA was low ($a_{ij} < .30$), iii) corrected item-total correlation was low ($r_{i(t-i)} < .30$), iv) factor loading from CFA was low ($\lambda_i < .40$ according to Nunnally (1978)), v) residual correlations were too high ($r_{res} > .25$ according to Fliege et al. (2005)), vi) IRT-based item infit was not satisfying (MNSQ > 1.30 according to Embretson and Reise (2000)), vii) threshold parameters were not monotonously increasing, viii) an IRT-based residual correlation was relatively high ($r > .40$), and if ix) DIF was found (difference in Nagelkerke's $R^2 > .035$ according to Zumbo (1999)). Item exclusion was discussed among clinical and research experts, and only realized in agreement. In general, we did not exclude items only due to low item difficulties found in our community sample, since we aimed to develop the screening tool for its use in clinical samples. Once the final screening measure (i.e., DADYS-Screen) was developed, a cutoff was determined to identify children with considerable symptoms of AD using a statistical case definition and the 90th percentile.

Evaluation of DADYS-Screen. Using data of the community sample gathered from April 2018 until August 2019 (n = 8,988), we evaluated the screening tool using methods from CTT and IRT. Based on CTT, we calculated item difficulties and item-inter-correlations, conducted a principal axis analyses (PAA; to evaluate the number of factors based on the Scree plot and Eigen-values, the amount of variance explained by the final solution and factor loadings), calculated corrected item-total correlations and Cronbach's α, and conducted a CFA (to determine model fit, factor loadings and residual correlations). Based on IRT, the same statistics and criteria were applied as in the development phase. To test for model fit, a factor analysis of the residuals was performed. Good model fit is indicated by residual factors with less than 10 % explained variance (Smith, 2002). Besides, the item-person-map and the proportion of persons with not fitting response patterns were calculated.

IBM SPSS Statistics was used for CTT analyses, Mplus for CFAs, and WINMIRA and Winsteps for IRT analyses.

Results

Development of DADYS-Screen

Generation of the initial item pool. Clinical and research experts gathered items on AD from the following measures: the Affective Reactivity Index (ARI; 7 Items; Stringaris et al., 2012), the Emotion Regulation Checklist (ERC; 24 items; Shields & Cicchetti, 1997), the PROMIS Anger Scale (five items; Irwin et al., 2012), the Global Index of the Conners' Rating Scale (10 items; Conners, Pitkanen, & Rzepa, 2011; Otto et al., 2018), the dysregulation profile of the Strengths and Difficulties Questionnaire (SDQ; 10 items; Goodman, 1997), and the Disruptive Mood Dysregulation and Irritability Scale from the Symptom-Checklist for Oppositional Defiant Disorder and Conduct Disorder (SCL-ODD, 11 items), which assesses the symptom criteria of DMDD according to DSM-5 and is part of the German Diagnostic System for Mental Disorders in Children and Adolescents (DISYPS-III; Döpfner & Görtz-Dorten, 2017). The generated initial item pool included 67 items and is presented in the Supplementary Material (Table S1).

Qualitative and quantitative investigations of the initial item pool to develop pre-DADYS-Screen*.* By means of the Delphi rating, consensus among the experts (≥ 90 % agreement) was reached for 24 of the 67 items. Positive consensus was achieved for 17 items (i.e., at least 90 % of the experts agreed that these items should be included in the screening questionnaire). Negative consensus was reached for seven items, indicating that these items are rather unsuitable to screen children for AD. For the remaining 43 items, no consensus was achieved. Detailed information on the results of the Delphi rating is depicted in Table S2.

In the focus group among clinical experts, seven items were identified as relevant and suitable to screen children for AD, whereas eight items were classified as unsuitable. The experts further found that some items were too strongly related to other mental disorders or redundant (e.g., items i10 and i34, see Table S2). According to the focus groups with parents, the presented items were mostly well understood, some items were rather difficult to answer (especially double-barrelled items or those with very long phrasings; e.g., items i7 and i11 in Table S2).

Quantitative investigations were conducted on the complete initial pool of 67 items. A number of 47 items from the initial pool was administered in the clinical pilot study. The remaining 20 items of the initial item pool had been administered in the population-based German BELLA study (Ravens-Sieberer et al., 2015) (i.e., ten items from the Conners' Global Index (Lidzba, Christiansen, & Drechsler, 2013; Otto et al., 2018) and ten items from the SDQ (Goodman, 1997)). Results of the conducted analyses are provided in Table S2. Exclusion of each item with critical values in at least one statistical parameter was discussed in detail. Based on a consensus, some items (items i1, i13, i16 and i30) were kept in the screening measure due to their highly relevant content for assessing AD in children, though one or even two statistical parameters indicated their exclusion. Overall, pre-DADYS-Screen included 24 items.

Empirical investigation of pre-DADYS-Screen to develop DADYS-Screen. We investigated pre-DADYS-Screen using data of the first participants of the community sample (*n* = 771). Results based on CTT and IRT are provided in Table S3; IRT analyses using alternative software (i.e., WINSTEPS and the R package ltm) confirmed the results reported based on WINMIRA. Please note that three items on symptoms of depression were excluded before analyses at this step due to the consensual decision to focus the screening tool on AD. Exclusion of each item with critical values in at least one of the remaining statistical parameters was discussed in detail. Based on a consensus, some items (items i10, i16, i18 and i22) were kept in the screening measure due to their relevant content for assessing AD in children, though one or even two statistical parameters indicated their exclusion. Overall, the final screening tool included 14 items which are presented in Table 2. Analyses were repeated using only the selected 14 items, additionally the corresponding model was evaluated by means of a one-factorial CFA with mean-and variance-adjusted unweighted least squares (ULSMV)-estimation ($\chi2 = 407.04$, *df* = 77, $p < 0.001$) (Xia, 2016). Following Schermelleh-Engel, Moosbrugger, and Müller (2003), the Root Mean Square Error of Approximation indicated mediocre fit (RMSEA = 0.074, Confidence Interval (CI) 90 % = 0.067-0.081), the Comparative Fit Index and the Standardized Root Mean Square Residual pointed out a good fit (CFI = .976; SRMR = 0.49*)*. The screening score was calculated across all items ranging from 0 to 42 with higher scores indicating more severe AD. We determined the cutoff using a statistical case definition, i.e., the 90th percentile. According to this cutoff, children with screening scores ≥ 20 show considerable symptoms of AD. In the analyzed sample, *n* = 10 cases (1 %) had a score of 20, which resulted in a proportion of 11 % (*n* = 84) of children with considerable symptoms of AD according to the cutoff. Figure 2 illustrates the process of developing and evaluating the screening tool.

Evaluation of DADYS-Screen

Results based on classical test theory. Among participants of the investigated subsample who responded to at least one item of the DADYS-Screen (*n* = 8,988), 3 % had one missing value (*n* = 300), 1 % had two missing values (*n* = 42), less than 1 % had three missing values (*n* = 16), and 1 % had four up to 13 missing values (*n* = 22) in the 14 items of the screening tool (per item, missing value rates were consistently below 1 %). For further analyses we replaced missing values using the Expectation-Maximization (EM) algorithm only if up to three missing values in the items of the screening tool were given; this resulted in a sample of *n* = 8,966.

Results are presented in Table 3 and gathered in the following. Item difficulties in our general population sample ranged from .08 to .36 across the 14 items (only presented for descriptive purposes). Correlations indicated moderate to strong associations among items (r_{ii} = .36 to r_{ii} = .78). The scree-plot and the Eigen-value criterion supported the one factor solution, which explained 60 % of the overall variance among the items; high factor loadings were found in the PAA (from .65 to .85). Corrected item-total correlations were good as well (ranging from .62 to .86). The internal consistency of the 14-item screening tool score was excellent (Cronbach's α = .95). Further, model fit was determined based on a one-factorial CFA using ULSMV-estimation (χ^2 = 5756.13, *df* = 77, *p* < 0.001), with results indicating acceptable fit according to the RMSEA (0.091, CI (90 %) = 0.089-0.093) and good fit according to the CFI (0.974) and the SRMR (0.45) following Schermelleh-Engel et al. (2003). Factor loadings from CFA ranged from .74 to .91 across the items and residual correlations were consistently below the threshold (between -.11 and .15). Sensitivity analyses revealed that these results hold for the subsample of those with complete data in all items of the screening tool (*n* = 8,608).

In the analyzed sample (*n* = 8,966), a percentage of 13 % (*n* = 1,159) had considerable symptoms of AD according to the cutoff (≥ 20). In the sample which had been used for developing DADYS-Screen the corresponding frequency was 11 % (*n* = 84 out of *n* = 771). This observed difference was due to sampling and measurement error, the comparison of group frequencies across both samples revealed no significant difference ($X^2(1)$ = 2.63, *p* = 0.105).

Results based on item response theory. Table 4 shows the item statistics according to the probabilistic test theory following the partial credit model. The item parameters (equivalent to item difficulty in the CTT, i.e., location of the items on the latent trait) ranged from -1.24 to 1.69. The threshold parameters (location of category boundaries) were monotonically increasing for all items and ranged from -4.62 to 3.23. The item fit was good for almost all items, only item 5 of the DADYS-Screen ("Demands must be met immediately - easily frustrated") showed a minimal worse fit value (1.32). The item information functions were accordingly bell-shaped with the exception of item 1 ("Is easily annoyed by others") and item 6 ("Responds angrily to limit-setting by adults") with a slight bi-modality. The reliability was very good (i.e., *R* = .92). A factor analysis of the residuals should not yield residual factors with more than 10 % explained variance as desired. In fact, the explained variance of the first contrast was only 6 %. The analysis on DIF using ordinal logistic regression showed no effects in the sense of an item bias by age, sex, parental education or assessment mode (all values < .035). The item-person map in Figure 3 shows the correspondence of persons and items along the latent trait. The person parameters were normally distributed, but truncated to the left, and correlated strongly with the raw score values (*r* = .95). The proportion of participants with response patterns not conform to the model was low (4 %).

Discussion

The present study described the development and evaluation of a screening questionnaire based on parent-reports to assess AD in 8- to 12-year-old children. We used qualitative methods like Delphi rating of experts and focus groups with clinicians and parents, and quantitative methods based on CTT and IRT investigating clinical and population-based data. The resulting 14 items of the DADYS-Screen are appropriate and suitable for assessing AD comprehensively due to ratings of clinical experts, and comprehensible according to the feedback of parents. The evaluation of the DADYS-Screen demonstrated good feasibility and mainly good psychometric properties according to parameters based on CTT and IRT.

We followed the state of the art in our proceeding using a mixed methods approach with recommended methods. Further, we chose the items for the initial item pool from existing well-established and validated instruments, such as the Affective Reactivity Index (Stringaris et al., 2012) and the Emotion Regulation Checklist (Shields & Cicchetti, 1997). Moreover, we followed Boateng et al. (2018) and used a deductive method in developing our screening tool. Our item pool covered a broad and comprehensive construct, which was somewhat broader than the target construct of AD and included almost five times as many items as gathered in the final DADYS-Screen (Boateng et al., 2018; Weiner, Schinka, & Velicer, 2012).

Results on the development of the screening tool were gained considering recommended parameters and established thresholds. We could include 14 items in our screening tool, with good psychometric properties and an acceptable to good fit of the final model to the data.

In our evaluation of the screening measure, we detected overall good psychometric properties according to the CTT. We found good item-inter-correlations, high factor loadings, good internal consistency, low residual correlations and an acceptable to good fit for the model to the data. Low item difficulties were tolerated since our data was gathered in a community sample, but the main target group for the screening tool will be children under risk of AD and clinical samples. The analyses in the probabilistic model on the evaluation of DADYS-Screen confirmed the good measuring characteristics of the scale overall. Although the item difficulties were located rather closely, the category difficulties were sufficiently broadly spread. The not optimal fit of item 5 ("Demands must be met immediately - easily frustrated") corresponded to the somewhat lower loading in the CFA and thus showed that this item also represents, at least partly, contents that are not directly associated with the AD construct. This and the slight bimodality of the information curves of item 1 ("Is easily annoyed by others") and item 6 ("Responds angrily to limit-setting by adults") should therefore be further investigated in future studies. All other characteristics showed a good fit of the Rasch model to the data, also an item bias could not be identified. The item-person map indicates that the items are somewhat too difficult for a community sample. However, since the target group of the instrument is selected subjects with an elevated symptom level of AD, the screening tool will probably show a better fit in corresponding clinical samples; this will be investigated in future studies.

We will validate our screening tool based on clinical data collected in the ADOPT consortium. So far, cases with AD can only be identified based on a statistical case definition using the reported cutoff (≤ 20). Based on future clinical data, we aim to provide a cutoff for our screening measure considering its sensitivity and specificity due to relevant psychiatric diagnoses.

The construct of AD is very closely related to the new diagnosis of DMDD. According to the DSM-5, DMDD is set into the section of mood disorders, but in the ICD-11, AD will be a subcategory of ODD. It thus seems that AD can be seen as a phenomenon which occurs in both internalizing and externalizing disorders. Research has shown that internalizing problems of children are often underestimated by parents (Dolle, Schulte-Körne, von Hofacker, Izat, & Allgaier, 2012), but externalizing problems are more obvious and better observable by parents (Holmbeck, Li, Schurman, Friedman, & Coakley, 2002; Klasen et al., 2016). Our screening tool on AD gathers parent-reports. For further research on AD (including studies comparing parent- and self-reports) and clinical practice, a screening measure for gathering self-reports on AD in children is needed as well. Thus, a self-reported version of our screening-tool will be provided by the ADOPT consortium. Both measures could be useful and easily administered in studies and in clinical practice investigating AD as a potential transdiagnostic dimension.

Our study has some limitations. We did not develop our screening tool for children younger than eight years of age. Future research may wish to investigate the feasibility and validity of our screening tool for use in younger children. Further, the validation of the DADYS-Screen and of its self-reported version are not provided so far, but will add important information for their use especially in samples under risk of AD. Our study has some strengths as well. We included items from well-established measures, followed a mixed methods approach and analyzed a large population-based sample. Further, especially in the development of the screening tool, a strong team of clinical and research experts cooperated very closely considering additionally focus groups results gathered in parents.

Overall, the use of the DADYS-Screen in identifying children with persistent irritability and severe temper outbursts is psychometrically supported by this study. DADYS-Screen seems to allow clinicians and researchers a better identification of children with AD and is thus promising to support appropriate diagnosis, treatment and clinical practice.

Methodological Disclosure

We described how we recruited our population-based sample, all data exclusions and all measures in the study.

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Figure 1. Selection of study participants in the community sample

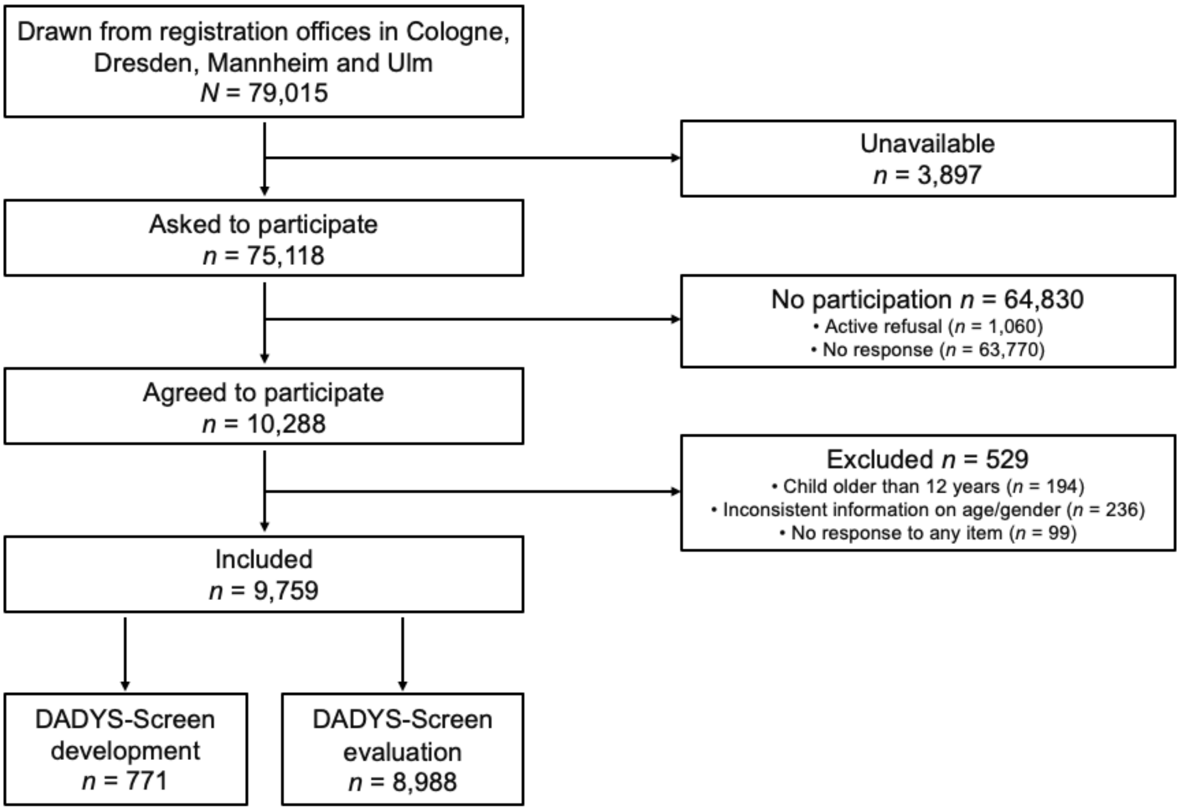

Figure 2. Development and evaluation process for the DADYS-Screen (CTT = classical test theory, PCA = principal component analysis, CFA = confirmatory factor analysis, PAA = principal axis analysis, IRT = item response theory, DIF = differential item functioning).

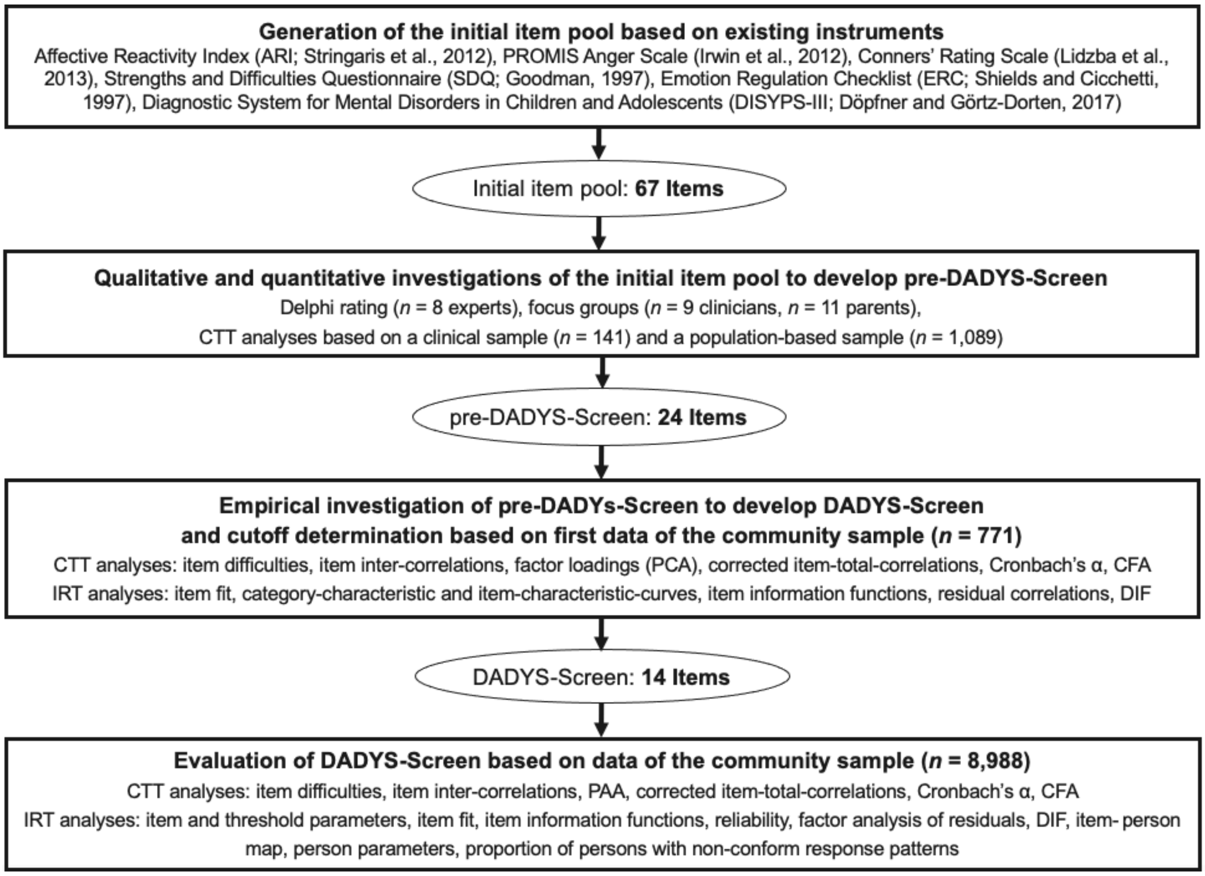

Figure 3. Location of persons and items on the latent trait affective dysregulation in a community sample of *n* = 8,966 children aged 8 to 12 years (axis = latent trait score, negative values indicate lower AD and vice versa; M = mean, S = 1 standard deviation unit, T = 2 standard deviation units, I = item with final item number).

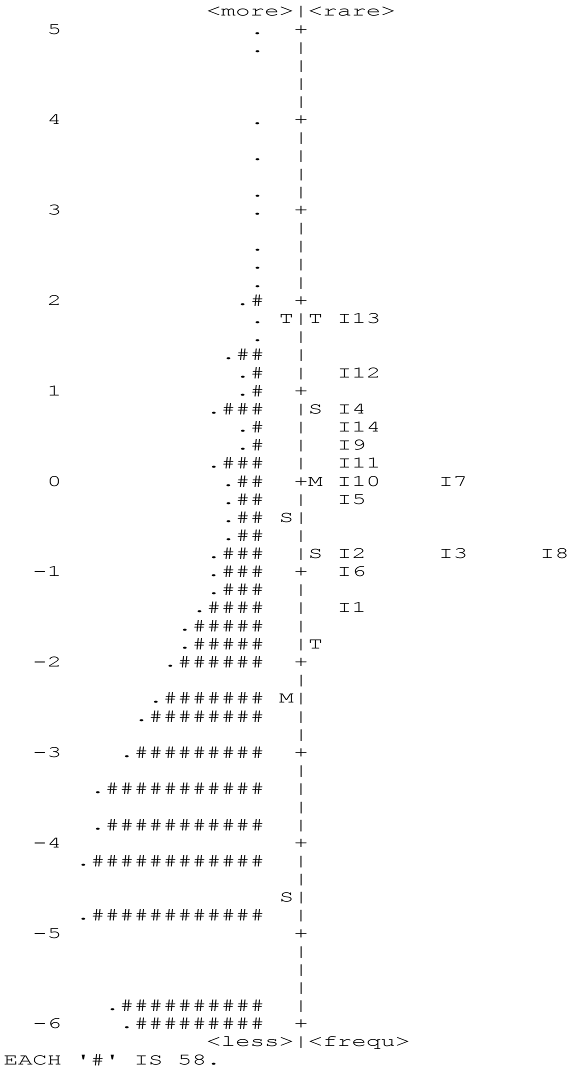

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Table 1. Characteristics of the samples used for developing and evaluating the DADYS-Screen, and for the total community sample

Characteristic	Development sample (*n* = 771)	Evaluation sample (*n* = 8,988)	Total sample (*n* = 9,759)
Age, *M (SD)*	10.02 (1.34)	10.00 (1.34)	10.00 (1.38)
Female, *n (%)*	383 (49.7)	4,373 (48.7)	4,756 (48.7)
Respondent, *n (%)*			
Mother	614 (79.6)	6,889 (76.8)	7,513 (77.0)
Father	125 (16.2)	1,547 (17.2)	1,672 (17.1)
Mother & father	25 (3.2)	457 (5.1)	482 (4.9)
Grand-/step-/adoptive/foster parents or other	7 (0.9)	85 (0.9)	92 (0.9)
Assessment mode, *n (%)*			
Paper-pencil	574 (74.4)	6,810 (75.8)	7,384 (75.7)
Online	196 (25.4)	2,168 (24.1)	2,364 (24.2)
Telephone	1 (0.1)	10 (0.1)	11 (0.1)
Educational level of parents, *n (%)*			
Low	24 (3.1)	289 (3.2)	313 (3.2)
Medium	204 (26.5)	2,395 (26.6)	2,599 (26.6)
High	510 (66.1)	6,026 (67.0)	6,536 (67.0)
Missing	33 (4.3)	278 (3.1)	311 (3.2)
General health state, n (%)			
Very good	519 (67.3)	5,912 (65.8)	6,431 (65.9)
Good	222 (28.8)	2,748 (30.6)	2,970 (30.4)
Moderate	22 (2.9)	256 (2.8)	278 (2.8)
Bad/very bad	5 (0.6)	31 (0.4)	36 (0.4)
Missing	3 (0.4)	41 (0.5)	44 (0.5)

Note. Data was assessed from February to March 2018 for the development sample and from April 2018 to August 2019 for the evaluation sample.

Table 2. Items included in the developed DADYS-Screen

Initial item no.	Final item no.	Item text	Response options
i31	1	Is easily annoyed by others.	0=not at all (true), 1=somewhat (true), 2=mostly (true), 3=especially / very (true)
i27	2	Is often upset and offended.	
i26	3	Is often irritable or easily annoyed.	
i37	4	Overall, irritability causes him/her problems.	
i64	5	Demands must be met immediately - easily frustrated.	
i14	6	Responds angrily to limit-setting by adults.	
i13	7	Is prone to disruptive outbursts of energy and exuberance.	
i20	8	Is impulsive.	
i32	9	Often loses temper.	
i8	10	Is prone to angry outbursts / tantrums easily.	
i35	11	Gets angry frequently.	
i28	12	Has strong or prolonged temper outbursts with loud scolding, screaming or crying several times a week.	
i33	13	Stays angry for a long time.	
i2	14	Exhibits wide mood swings (child's emotional state is difficult to anticipate because she/he moves quickly from positive to negative moods).	

Table 3. Item-specific results based on classical test theory and confirmatory factor analysis for the evaluation of the DADYS-Screen

Final item no.	Item difficulty (P_i)	Item-inter-correlations (r_{ii})	Factor loading from PAA (a_{ij})	Corrected item-total correlation ($r_{i(t-i)}$)	Internal consistency, if item deleted (α_i)	Factor loading from CFA (λ_i)	Residual correlations (r_{res})
1	.36	.36 – .69	.65	.63	.95	.76	-.11 – .11
2	.30	.45 – .76	.76	.74	.94	.85	-.08 – .09
3	.30	.46 – .76	.81	.79	.94	.90	-.08 – .11
4	.14	.50 – .68	.77	.76	.94	.87	-.06 – .08
5	.23	.40 – .61	.67	.66	.95	.74	-.09 – .15
6	.33	.42 – .61	.70	.68	.94	.76	-.09 – .15
7	.20	.48 – .67	.79	.77	.94	.84	-.06 – .07
8	.28	.43 – .68	.73	.71	.94	.79	-.08 – .06
9	.18	.50 – .76	.84	.82	.94	.91	-.08 – .03
10	.20	.49 – .78	.84	.81	.94	.91	-.11 – .05
11	.20	.52 – .78	.85	.82	.94	.91	-.08 – .05
12	.10	.41 – .70	.76	.73	.94	.90	-.11 – .08
13	.08	.36 – .62	.65	.62	.95	.78	-.09 – .08
14	.15	.43 – .61	.72	.69	.94	.79	-.06 – .07

Note. n = 8,966 children aged 8 to 12 years from the evaluation sample with less than three items missing, up to three missing values were replaced by the Expectation-Maximization (EM) algorithm; PAA = principal axis analysis; CFA = confirmatory factor analysis.

Table 4. Item statistics according to the probabilistic test theory (Partial Credit Model) for the evaluation of the DADYS-Screen

Final item no.	Item location	Threshold locations			Item fit (MNSQ)	DIF							
						Age		Sex		Parental education		Paper-pencil vs. online assessment	
		0/1	1/2	2/3		uniform	non-uniform	uniform	non-uniform	uniform	non-uniform	uniform	non-uniform
1	-1.24	-4.62	-0.49	1.39	1.25	.001	.002	.001	.002	.005	.006	.000	.001
2	-0.76	-3.56	-0.28	1.56	0.94	.008	.008	.000	.000	.004	.004	.000	.000
3	-0.80	-3.32	-0.47	1.39	0.80	.000	.000	.000	.000	.005	.005	.000	.000
4	0.71	-1.06	1.01	2.19	0.92	.000	.000	.007	.007	.011	.011	.000	.001
5	-0.20	-2.50	0.21	1.70	1.32	.001	.001	.001	.001	.003	.004	.001	.001
6	-0.96	-4.03	-0.18	1.34	1.15	.000	.000	.001	.001	.003	.004	.000	.000
7	0.05	-1.86	0.34	1.66	0.94	.000	.000	.000	.000	.004	.005	.000	.000
8	-0.66	-3.00	-0.34	1.37	1.13	.000	.000	.000	.000	.002	.005	.000	.000
9	0.36	-1.70	0.73	2.04	0.73	.000	.000	.004	.004	.003	.003	.002	.002
10	0.07	-1.88	0.39	1.70	0.78	.002	.003	.002	.002	.002	.003	.001	.001
11	0.12	-2.12	0.47	2.01	0.73	.000	.000	.001	.001	.003	.004	.000	.000
12	1.07	0.01	1.15	2.05	0.87	.001	.001	.001	.001	.005	.005	.000	.001
13	1.69	-0.16	2.00	3.23	1.17	.000	.000	.000	.000	.000	.000	.000	.001
14	0.54	-1.16	0.85	1.93	1.17	.003	.003	.003	.004	.001	.002	.000	.001

Notes. *n* = 8,966 children aged 8 to 12 years; DIF=Differential Item Functioning, Nagelkerke's R^2.

Supplementary Material

Manuscript title: The DADYS-Screen – Development and Evaluation of a Screening Tool for Affective Dysregulation in Children

Journal: Assessment

Table S1. Items included in the pre-DADYS-Screen

Initial item no.	Item text	Instrument of origin
i1	Is a cheerful child.	ERC
i2	Exhibits wide mood swings (child's emotional state is difficult to anticipate because s/he moves quickly from positive to negative moods).	ERC
i3	Responds positively to neutral or friendly approaches by adults.	ERC
i4	Transitions well from one activity to another; does not become anxious, angry, distressed or overly excited when moving from one activity to another.	ERC
i5	Can recover quickly from episodes of upset or distress (e.g. does not pout or remain sullen, anxious or sad after emotionally distressing events).	ERC
i6	Is easily frustrated.	ERC
i7	Responds positively to neutral or friendly approaches by peers.	ERC
i8	Is prone to angry outbursts / tantrums easily.	ERC
i9	Is able to delay gratification (wait for good things).	ERC
i10	Takes pleasure in the distress of others (e.g. laughs when another person gets hurt or punished; enjoy teasing others).	ERC
i11	Can modulate excitement in emotionally arousing situations (e.g. does not get 'carried away' in high-energy situations, or overly excited in inappropriate contexts.	ERC
i12	Is whiny or clingy with adults.	ERC
i13	Is prone to disruptive outbursts of energy and exuberance.	ERC
i14	Responds angrily to limit-setting by adults.	ERC
i15	Can say when s/he is feeling sad, angry or mad, fearful or afraid.	ERC
i16	Seems sad or listless.	ERC
i17	Is overly exuberant when attempting to engage other in play.	ERC
i18	Displays flat affect (expression is vacant and inexpressive; child seems emotionally absent).	ERC
i19	Responds negatively to neutral or friendly approaches by peers (e.g. may speak in an angry tone of voice or respond fearfully).	ERC
i20	Is impulsive.	ERC
i21	Is empathic towards others; shows concern when others are upset or distressed.	ERC
i22	Displays exuberance that others find intrusive or disruptive.	ERC
i23	Displays appropriate negative emotions (anger, fear, frustration, distress) in response to hostile, aggressive or intrusive acts by peers.	ERC
i24	Displays negative emotions when attempting to engage others in play.	ERC
i25	Gets angry quickly or has unusually frequent or severe temper outbursts for his age.	DISYPS

i26	Is often irritable or easily annoyed.	DISYPS
i27	Is often upset and offended.	DISYPS
i28	Has strong or prolonged temper outbursts with loud scolding, screaming or crying several times a week.	DISYPS
i29	Has strong or prolonged temper outbursts several times a week during which he/she becomes physically aggressive or destroys objects.	DISYPS
i30	Is in a bad or irritable mood most of the time.	DISYPS
i31	Is easily annoyed by others.	ARI
i32	Often loses temper.	ARI
i33	Stays angry for a long time.	ARI
i34	Is angry most of the time.	ARI
i35	Gets angry frequently.	ARI
i36	Loses temper easily.	ARI
i37	Overall, irritability causes him/her problems	ARI
i38	My child felt mad.	PROMIS Anger
i39	My child was so angry he/she felt like yelling at somebody.	PROMIS Anger
i40	My child was so angry he/she felt like throwing something.	PROMIS Anger
i41	My child felt upset.	PROMIS Anger
i42	When my child got mad, he/she stayed mad.	PROMIS Anger
i43	The problems mentioned have a significant impact on relationships with other family members (e.g. parents, siblings).	DISYPS
i44	The problems mentioned have a significant impact on relationships with adults not being part of the family (e.g. teachers).	DISYPS
i45	The problems mentioned have a significant impact on relationships with other children and adolescents and on the participation in leisure activities.	DISYPS
i46	The problems mentioned have a significant impact on school performance.	DISYPS
i47	She/he suffers considerably from the problems mentioned.	DISYPS
i48	Restless, overactive, cannot stay still for long.	SDQ
i49	Often loses temper.	SDQ
i50	Generally well behaved, usually does what adults request.	SDQ
i51	Constantly fidgeting or squirming.	SDQ
i52	Often fights with other youth or bullies them.	SDQ
i53	Easily distracted, concentration wanders.	SDQ
i54	Often lies or cheats.	SDQ
i55	Thinks things out before acting.	SDQ

i56	Steals from home, school or elsewhere.	SDQ
i57	Good attention span, sees work through to the end.	SDQ
i58	Restless or overactive.	CRS
i59	Excitable, impulsive.	CRS
i60	Disturbs other children.	CRS
i61	Fails to finish things he/she starts - short attention span.	CRS
i62	Constantly fidgeting.	CRS
i63	Easily distracted.	CRS
i64	Demands must be met immediately - easily frustrated.	CRS
i65	Cries often and easily.	CRS
i66	Mood changes quickly and drastically.	CRS
i67	Temper outbursts, explosive or unpredictable behaviour.	CRS

Note. ERC = Emotion Regulation Checklist (Shields & Cicchetti, 1997); DISYPS = Diagnostic System for Mental Disorders in Children and Adolescents (Döpfner & Görtz-Dorten, 2017); ARI = Affective Reactivity Index (Stringaris et al., 2012); PROMIS Anger = PROMIS Parent Proxy Anger Scale (Pilkonis et al., 2011); SDQ = Strengths and Difficulties Questionnaire (Goodman, 1997); CRS = Conners' Rating Scale (Lidzba et al., 2013)

Table S2. Development of pre-DADYS-Screen based on results of qualitative and quantitative methods (using clinical and population-based data)

	Qualitative analyses			Quantitative analyses based on classical test theory						
				Clinical sample			Population-based sample			
Initial item no.	Delphi rating (% of experts in consensus for inclusion)	Clinician FG (% who rated the item as relevant)	Parent FG (comprehensibility of item)	Item difficulty (P_i)	Factor loading (a_{ij})	Corrected Item-total correlation ($r_{i(t-i)}$)	Item difficulty (P_i)	Factor loading (a_{ij})	Corrected Item-total correlation ($r_{i(t-i)}$)	Decision based on final agreement among experts
i1	67%	22%	+	+	<.30	<.30				**pre-DADYS-Screen** (positively phrased)
i2	100%	56%	+	+	+	+				**pre-DADYS-Screen**
i3	33%	22%	difficult	+	<.30	<.30				excluded
i4	17%	11%	mostly	+	+	+				excluded
i5	83%	78%	+	+	+	+				**pre-DADYS-Screen**
i6	100%	100%	+	+	+	+				**pre-DADYS-Screen**
i7	33%	22%	difficult	+	<.30	<.30				excluded
i8	100%	89%	+	+	+	+				**pre-DADYS-Screen**
i9	50%	44%	+	+	+	+				**pre-DADYS-Screen**
i10	33%	22%	+	<.20	+	+				excluded
i11	67%	11%	difficult	+	+	+				excluded
i12	50%	0%	+	<.20	<.30	<.30				excluded
i13	100%	56%	difficult	+	+	+				**pre-DADYS-Screen** (content reasons)
i14	83%	89%	+	+	+	+				**pre-DADYS-Screen**
i15	17%	44%	+	+	<.30	<.30				excluded
i16	67%	33%	mostly	+	<.30	<.30				**pre-DADYS-Screen** (content reasons)
i17	33%	22%	+	+	+	+				excluded
i18	17%	22%	+	< .20	<.30	<.30				excluded
i19	50%	89%	+	< .20	+	+				excluded
i20	83%	78%	+	+	+	+				**pre-DADYS-Screen**
i21	17%	33%	+	+	+	+				**pre-DADYS-Screen**

i22	17%	11%	+	+	+	+				**pre-DADYS-Screen**
i23	80%	22%	mostly	+	<.30	<.30				excluded
i24	50%	67%	+	< .20	+	+				excluded
i25	100%	89%	mostly	+	+	+				**pre-DADYS-Screen**
i26	100%	100%	+	+	+	+				**pre-DADYS-Screen**
i27	100%	89%	+	+	+	+				**pre-DADYS-Screen**
i28	100%	100%	+	+	+	+				**pre-DADYS-Screen**
i29	100%	100%	+	< .20	+	+				excluded
i30	83%	100%	+	< .20	+	+				**pre-DADYS-Screen** (content reasons)
i31	83%	89%	+	+	+	+				**pre-DADYS-Screen**
i32	100%	100%	+	+	+	+				**pre-DADYS-Screen**
i33	67%	78%	mostly	+	+	+				**pre-DADYS-Screen**
i34	67%	67%	mostly	< .20	+	+				excluded
i35	100%	89%	+	+	+	+				**pre-DADYS-Screen**
i36	100%	89%	+	+	+	+				excluded
i37	83%	56%	+	+	+	+				**pre-DADYS-Screen**
i38	0%	13%	difficult	+	+	+				excluded
i39	0%	33%	difficult	+	+	+				excluded
i40	0%	33%	difficult	+	+	+				excluded
i41	17%	33%	difficult	+	+	+				excluded
i42	50%	56%	+	+	+	+				excluded
i43	83%	56%	+	+	+	+				excluded
i44	83%	56%	+	+	+	+				excluded
i45	83%	56%	mostly	+	+	+				excluded
i46	83%	44%	+	+	+	+				excluded
i47			+	+	+	+				excluded
i48	0%	0%	+	+	+	+	+	+	+	excluded
i49	100%	89%	+				+	+	+	excluded
i50	17%	11%	mostly				+	+	+	excluded
i51	17%	0%	+				< .20	+	+	excluded
i52	67%	33%	mostly				< .20	+	+	excluded

i53	17%	11%	+	+	+	+	excluded
i54	17%	25%	+	+	+	+	excluded
i55	17%	33%	mostly	+	+	+	**pre-DADYS-Screen**
i56	17%	22%	mostly	< .20	< .30	< .30	excluded
i57	0%	0%	mostly	+	+	+	excluded
i58	0%	0%	+	+	+	+	excluded
i59	100%	67%	mostly	+	+	+	excluded
i60	50%	11%	+	< .20	+	+	excluded
i61	0%	0%	+	+	+	+	excluded
i62	17%	0%	+	+	+	+	excluded
i63	17%	0%	+	+	+	+	excluded
i64	83%	44%	mostly	+	+	+	**pre-DADYS-Screen**
i65	100%	56%	+	< .20	< .30	< .30	excluded
i66	100%	89%	mostly	+	+	+	excluded
i67	100%	100%	+	< .20	+	+	excluded

Note. “+” indicates good item characteristics according to a priori defined criteria (see manuscript text, Methods/Analyses), otherwise more detailed information due to the respective threshold is given; FG=focus groups; difficult=difficult to comprehend; mostly=mostly comprehensible.

Table S3. Development of DADYS-Screen based on results of classical test theory, confirmatory factor analysis and item response theory (n = 771)

Initial item no.	Results of CTT analyses			Results of CFA		Results of IRT analyses						Decision based on final agreement among experts
	Item difficulty (P_i)	Item-inter-correlations (r_{ii})	Factor loading (a_{ij})	Factor loading (λ_i)	Residual correlations (r_{res})	Itemfit (MSNQ)	CCC	ICC	IIF	Residual correlations	DIF	
i1	+	+	+									early excluded
i2	< .20	+	+	+	+	+	+	+	+	+	+	**DADYS-Screen**
i5	+	+	+	+	+	1.78	+	+	+	.41–.51	+	excluded
i6	+	+	+	+	+	+	3/2	+	+	.40	+	excluded
i8	+	+	+	+	+	+	+	+	+	+	+	**DADYS-Screen**
i9	+	+	+	+	+	1.95	+	+	+	.51–.60	+	excluded
i13	< .20	+	+	+	+	+	+	+	+	+	+	**DADYS-Screen**
i14	+	+	+	+	+	+	+	+	+	+	+	**DADYS-Screen**
i16	< .20	+	+									early excluded
i20	+	<.10 with i21	+	+	+	+	+	+	+	+	+	**DADYS-Screen**
i21	+	<.10 with i20	+	.35	+	1.63	+	+	+	.41–.51	+	excluded
i22	< .20	+	+	+	+	+	3/2	+	+	+	+	excluded
i25	< .20	+	+	+	+	+	2/1	+	+	+	+	excluded
i26	+	+	+	+	+	+	+	+	+	+	+	**DADYS-Screen**
i27	+	+	+	+	+	+	+	+	+	+	+	**DADYS-Screen**
i28	< .20	+	+	+	+	+	2/1	+	+	.40	+	**DADYS-Screen**
i30	< .20	+	+									early excluded
i31	+	+	+	+	+	+	+	+	+	.40	+	**DADYS-Screen**
i32	< .20	+	+	+	+	+	+	+	+	+	+	**DADYS-Screen**
i33	< .20	+	+	+	+	+	+	+	+	+	+	**DADYS-Screen**
i35	+	+	+	+	+	+	+	+	+	+	+	**DADYS-Screen**
i37	< .20	+	+	+	+	+	3/2	+	+	+	+	**DADYS-Screen**
i55	+	+	+	+	+	1.86	+	+	+	.43–.60	+	excluded
i64	+	+	+	+	+	+	+	+	+	+	+	**DADYS-Screen**

Note. "+" indicates good characteristics due to a priori defined criteria (see manuscript text, Methods/Analyses), otherwise more detailed information is given; CCC=Category-Characteristic-Curve; ICC=Item-Characteristic-Curve; IFF=Item Information Function; DIF=Differential Item Functioning, Nagelkerke's R^2.

Publication 5: Risk and resource factors for ADHD symptoms in children and adolescents over time

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RESEARCH ARTICLE

Risk and protective factors for the development of ADHD symptoms in children and adolescents: Results of the longitudinal BELLA study

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Abstract

Background

Attention-deficit/hyperactivity disorder (ADHD) is one of the most common neurodevelopmental disorders in childhood worldwide, and causes significant impairments in overall functioning. In order to develop effective prevention and intervention programs, knowledge of the determinants that have an impact on the onset and development of ADHD symptoms is essential. So far, little is known about factors affecting ADHD symptoms in children and adolescents over time. Therefore, this study investigates potential psychosocial risk and protective factors for ADHD symptoms based on cross-sectional and longitudinal data of a German population-based study.

Methods

Data on children and adolescents ($n = 1{,}384$ aged 11 to 17 years) were collected at three measurement points (baseline, 1-year and 2-year follow-ups) covering a period of two years. We used latent growth modelling to investigate effects of parental mental health problems (risk factor) and self-efficacy, family climate and social support (protective factors) on symptoms of ADHD based on cross-sectional as well as longitudinal data. Sociodemographic factors, pre- and postnatal factors, and comorbid symptoms of internalizing and externalizing mental health problems were considered as covariates.

Results

At baseline, male gender, younger age, stronger aggressive behavior, and stronger parental mental health problems were related to more ADHD symptoms. Longitudinal analyses showed that female gender, migration status, increasing symptoms of generalized anxiety, increasing aggressive behavior and increasing parental mental health problems were associated with stronger increase of ADHD symptoms over time. However, improving family climate was related to decreasing ADHD symptoms over time. We further found moderator effects for social support.

Conclusion

The findings of the study provide important information concerning risk and protective factors in the context of ADHD. Hence, the results may be integrated into the planning and implementation of future prevention and early intervention strategies that target affected children and adolescents.

Introduction

Attention-deficit/hyperactivity disorder (ADHD) as defined by DSM-5 and ICD-10 is characterized by symptoms of inattention, hyperactivity and/or impulsivity that are present in different settings and cause significant impairments in social and academic functioning [1, 2]. ADHD is considered one of the most common neurodevelopmental disorders in childhood and adolescence worldwide. A meta-analysis including 135 studies found that the global prevalence rate of ADHD is relatively stable over time with an estimated prevalence of about 5% in children and adolescents aged 18 years or younger [3]. Similar prevalence rates were found in a German representative sample of children and adolescents aged 3 to 17 years, with boys being four times more likely to be diagnosed with ADHD than girls [4]. In about 25% of affected children, ADHD is first diagnosed before the age of six [5]. Even though a decrease in symptoms with age can be observed [6], persistence during adolescence and adulthood is high, with approximately two thirds of affected children showing ongoing symptoms [7, 8].

The etiology of ADHD is considered a multifactorial process, whereby the genetic predisposition and biological vulnerabilities are assumed to be most important [9, 10]. Comorbidity in children with ADHD is high, with oppositional defiant and conduct disorders [11, 12], as well as anxiety and depressive disorders [13] being the most common comorbid disorders. Moreover, children with ADHD often experience significant impairments in adolescence and young adulthood. ADHD has a negative impact on academic and educational achievement [14, 15], on social functioning and peer relationships [14, 16] and on family life [17]. Furthermore, experiencing ADHD symptoms has a significant impact on children's health-related quality of life [18]. Overall, ADHD creates a heavy burden for both individuals and society, resulting in a high relevance for public health.

The summarized findings highlight the importance of effective prevention and intervention programs for children suffering from ADHD in order to prevent the onset of ADHD symptoms and the associated long-term consequences. In this context, knowledge of the determinants that have an impact on the onset and the development of ADHD symptoms over time is essential. Within research on mental health, the investigation of risk and protective factors has become increasingly important in recent years [19]. While risk factors increase the probability of mental health problems, protective factors can strengthen children's mental health when being exposed to risks [20, 21]. In the literature, risk and protective factors are commonly divided into personal, familial, and social factors [20, 22].

Only few studies have investigated the effects of psychosocial risk and protective factors in the context of ADHD so far. Cross-sectional studies found protective effects of personal factors such as a high sense of coherence [23] and self-efficacy [24] on ADHD in children and adolescents. Self-efficacy is a concept that describes the extent of one's belief in one's own competence to reach goals. The protective effect arises from the fact that children with high self-efficacy believe in their personal competence and are therefore better able to cope with stress [25]. Similar findings can be drawn from Dvorsky et al. [26], who examined factors that promote resilience in children with ADHD and found that positive self-perceptions of one's own competence protect children from negative outcomes of ADHD. With respect to familial resources, positive parenting [26] and a positive family climate [27, 28] have been identified to have a positive impact on children's ADHD symptoms. Concerning social resources, social support has proven to be a strong protective factor against child mental health problems [29–32] and also in the context of ADHD [27, 28].

In addition, parental mental health problems have demonstrated to be a well-established risk factor for child psychopathology in general [29, 32–35] and in the context of ADHD. In particular, parental ADHD symptoms [36] and maternal depressive symptoms [37–39] have been associated with the development of childhood ADHD. Other familial risk factors include family conflicts [40] and adverse parenting conditions, characterized by a lack of warmth towards the child [36].

Apart from the psychosocial risk and protective factors mentioned above, further studies reported for instance that pre- and postnatal factors such as premature birth, low birth weight and maternal substance use during pregnancy are associated with a higher risk of ADHD [37, 39]. Besides, cross-sectional studies have demonstrated associations of socioeconomic factors such as financial difficulties and low parental education with ADHD symptoms in children and adolescents [37, 41].

The current state of research, however, demonstrates a lack of longitudinal studies on personal, familial, and social determinants for the development of ADHD symptoms. In particular, comparatively little information is available from population-based studies on risk and protective factors affecting the change in children's and adolescent's ADHD symptoms over time. Therefore, the current study aims to add to the existing literature by investigating the cross-sectional as well as longitudinal influences of risk and protective factors on the development of childhood ADHD symptoms. Based on the above mentioned findings, we expected that parental psychopathology as risk factor, and self-efficacy, family climate and social support as protective factors not only have an impact on initial ADHD symptoms, but also on the development of ADHD symptoms over time. Since research has shown that risk and protective factors not only have a direct effect on an outcome, but tend to interact in different ways [42], the study also aims to explore potential interaction effects between risk and protective factors over time. It is assumed that the investigated protective factors moderate the detrimental effect of parental mental health problems on ADHD symptoms initially and over time.

Materials and methods

Study

The longitudinal BELLA study is the mental health module of the German National Health Interview and Examination Survey for Children and Adolescents (KiGGS) [43]. The BELLA study gathers data on mental health, health-related quality of life, mental health care use, as well as on risk and protective factors for mental health problems for German children, adolescents, and young adults. Baseline assessments for the KiGGS and the BELLA study were both conducted from 2003 to 2006 in close cooperation. The final KiGGS study population included 17,641 children and adolescents aged 0 to 17 years (response rate: 66.6%) [43]. For the BELLA study, a subsample of the KiGGS baseline sample was randomly drawn ($n = 2,942$ children and adolescents aged 7 to 17 years). These children, adolescents and their parents were informed about the BELLA study and asked to participate. Finally, $n = 2,863$ (response rate:

97.3%) children and adolescents (aged 7 to 17 years) and their parents gave their written informed consent and participated in the BELLA baseline assessment. To follow up the baseline sample, further measurement points of the BELLA study were conducted including a 1-year (2004 to 2007) and a 2-year follow-up (2005 to 2008). Of the BELLA baseline participants, *n* = 2,423 (84.6%) participated in the 1-year follow-up and *n* = 2,190 (76.5%) participated in the 2-year follow-up. Detailed descriptions of the KiGGS and the BELLA study have already been published [43, 44]. Data were collected by computer-assisted telephone interviews and subsequent paper-pencil questionnaires. The telephone interviews were conducted by trained interviewers, who followed structured guidelines and were supervised by a child and adolescent psychologist. Self-reported data were gathered from participants aged at least 11 years, parent-reported data were additionally collected from one parent of each participant. Standardized, psychometrically sound and internationally tested measures were administered, if available. The BELLA study was approved by the ethics committee of the University Hospital Charité in Berlin and the Federal Commissioner for Data Protection in Germany. For further details on the design and methods of the longitudinal BELLA study, see Ravens-Sieberer et al. [44] and Klasen et al. [45].

Participants

In the present study, we analyzed data from the first three measurement points of the BELLA study (baseline, 1-year and 2-year follow-ups) covering a period of 2 years. Participants aged 11 to 17 years at baseline could be included in the analyses, if i) relevant information gathered only at baseline were completely available (on age, gender, socioeconomic status (SES), migration status, premature birth, and maternal smoking and alcohol use during pregnancy) and if ii) longitudinally measured data were available for at least one of the three measurement points (on symptoms of ADHD, parental mental health problems, self-efficacy, family climate, social support, and comorbid symptoms of depression, generalized anxiety, aggressive and dissocial behaviors). Further, cases were only analyzed if the same parent reported on parental mental health problems at each investigated measurement point in the BELLA study. The final sample under analysis included *n* = 1,384 children and adolescents (aged 11 to 17 years at baseline).

Measures

Sociodemographic variables. Age (in years), gender and the SES were determined at baseline. The SES was assessed using the parent-reported Winkler-index [46], which gathers information on education, profession and income of both parents. This index provides a sum-score ranging from 3 to 21, which was used in the following analyses. Only for the purpose of sample description, the sum-score was categorized to create groups of participants with low (scores from 3 to 8), middle (scores from 9 to 14) and high SES (scores from 15 to 21) [47]. Further, we assessed the migration status following Schenk [48]. Migration background was assumed, if i) the child or adolescent had immigrated to Germany and had at least one parent born in a country other than Germany, or if ii) both parents immigrated to Germany or did not hold German citizenship.

Pre- and postnatal factors. Parent-reported information on premature birth and maternal substance use (i.e., smoking and alcohol use) during pregnancy were gathered by means of items included in the paper-pencil questionnaire administered to the parents at baseline of the KiGGS study. Concerning premature birth, parents were asked if the child was born full-term (born in the period of three weeks before and two weeks after the predicted birth date), postmaturely or pre-maturely. For the presented analyses, item responses were collapsed resulting in a dichotomous score (0 = "full-term or postmature birth" and 1 = "premature birth"). For maternal substance use during pregnancy, two items (i.e., “Did the mother of the child smoke during pregnancy?” and “Did the mother of the child drink alcohol during pregnancy?”) were presented with three response options each (0 = “not at all”, 1 = “from time to time” and 2 = “regularly”). Responses were collapsed resulting in dichotomous scores for maternal smoking as well as for maternal alcohol use during pregnancy (0 = “not at all” and 1 = “from time to time or regularly”).

Symptoms of Attention-deficit/hyperactivity disorder. Symptoms of ADHD in children and adolescents were measured at each investigated measurement point based on a parent-reported Conners Global Index (C-GI) [49, 50]. A German version of the measure was developed and administered in the BELLA study [51–53]. The parent-reported subscale restless-impulsivity of the German version of the C-GI was used in the present analyses, which includes 7 items focusing on ADHD symptoms in children and adolescents such as inattention (e.g., “inattentive, easily distracted”), hyperactivity (“fidgeting”) and impulsivity (“excitable, impulsive”); items were offered with a 4-point response scale (0 = “not true at all” to 3 = “very much true”). We calculated the mean across the administered items with a higher mean indicating more severe symptoms of ADHD. Good internal consistency was found for the C-GI scale restless-impulsivity in the investigated sample (Cronbach’s α ranged from .77 to .82 across measurement points).

Comorbid symptoms of depression, generalized anxiety, aggressive and dissocial behaviors. Comorbid symptoms were assessed at each investigated measurement point. Depressive symptoms in the children and adolescents were measured using the self-reported German version of the established Center for Epidemiologic Studies Depression Scale (CES-DC) [54, 55]. By means of 20 items, the CES-DC gathers emotional, cognitive and behavioral aspects of depression (e.g., “I felt that everything I did was an effort”); items are presented with a 4-point response scale (0 = “not at all” to 3 = “a lot”). The mean across all CES-DC items was calculated with a higher mean indicating more severe depressive symptoms. The internal consistency for the CES-DC was good in the investigated sample (Cronbach’s α ranged from .83 to .88 across measurement points).

Self-reported symptoms of generalized anxiety in children and adolescents were assessed based on a German version of the Screen for Child Anxiety Related Disorders (SCARED-D) [56–58]. The scale on generalized anxiety of the SCARED-D was administered including 9 items (e.g., “I worry about what is going to happen in the future”) offered with a 3-point response scale (0 = “not true or hardly ever true” to 2 = “very true or often true”). We calculated the mean across the SCARED-D items with a higher mean indicating more severe symptoms of generalized anxiety. The internal consistency of the administered scale of the SCARED-D was good in the investigated sample (Cronbach’s α ranged from .81 to .85).

Parent-reported aggressive and dissocial behaviors in children and adolescents were assessed based on the German version of the well-established Child Behavior Checklist (CBCL) [59, 60]. This measure provides a scale on externalizing problems including the subscales aggressive behavior with 20 items (e.g., “Behavior of your child: Attacks others”) and dissocial behavior with 13 items (e.g., “Behavior of your child: Steals at home”). CBCL items are offered with three response options (0 = “not true” to 2 = “very true or often true”). We calculated the mean across the items for each subscale with higher means indicating more severe aggressive and dissocial behaviors. Good to excellent internal consistency was found for the CBCL subscale aggressive behavior (Cronbach’s α ranged from .88 to .90) and acceptable to good internal consistency was given for the subscale on dissocial behavior in the investigated sample (α ranged from .69 to .75).

Risk factor parental mental health problems. The Symptom-Check List 9-item Short version (SCL-S-9) [61] served to assess parental mental health problems reported by one parent of each participant at each investigated measurement point of the BELLA study. The SCL-S-9 is an abbreviated version of the SCL-90-R [62] assessing a wide range of psychopathologic symptoms by means of 9 items. Each item of the SCL-S-9 belongs to one dimension of the original SCL-90-R (i.e., somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism) and is presented with a 5-point response scale (0 = "none at all" to 4 = "very severe"). The mean across all SCL-S-9 items was calculated (i.e., the Global Severity Index); a higher mean indicates more severe psychopathologic symptoms. Good internal consistency was given for the SCL-S-9 in the investigated sample (Cronbach's α ranged from .81 to .84 across measurement points).

Protective factors self-efficacy, family climate and social support. Protective factors were measured at each investigated measurement point. To measure self-reported self-efficacy in children and adolescents, the General Self-Efficacy Scale (GSE) [63, 64] was used. The GSE includes 10 items (e.g., "I can usually handle whatever comes my way") offered with a 4-point response scale (0 = "not at all true" to 3 = "exactly true"). The mean across all GSE items was calculated with a higher mean indicating higher self-efficacy. The internal consistency was good for the GSE in the investigated sample (Cronbach's α ranged from .78 to .83 across measurement points).

The family climate was assessed in children and adolescents based on the German Family Climate Scale (FCS) [65]. The FCS is the German adaptation of the Family Environment Scale (FES) [66]. In the BELLA study, 8 items of the FCS related to active recreational organization and cohesion (e.g., "In our family everybody cares about each other's worries") were administered. Items were presented with a 4-point response scale (0 = "not true" to 3 = "exactly true"). The mean across the 8 FCS items was calculated with a higher score indicating a better family climate. Good internal consistency was found for the administered FCS in the investigated sample (Cronbach's α ranged from .78 to .83 across measurement points).

Self-reported social support in children and adolescents was measured by means of the German translation of the Social Support Survey (SSS) [67]. Items of the original SSS that were not applicable for children and adolescents were excluded from the BELLA study and the wording of some items was slightly modified. The administered SSS-short included 8 items assessing how frequent specific types of support were available (e.g., "How often is the following type of support available for you if you need it? Someone you can count on to listen to you, when you need to talk"). Items were offered with a 5-point response scale (0 = "none of the time" to 4 = "all of the time"). The mean across the 8 SSS-short items was calculated with a higher score indicating more available social support. The internal consistency was good to excellent for the SSS-short in the investigated sample (Cronbach's α ranged from .88 to .91 across measurement points).

Data analysis

We used latent growth modelling to analyze our cross-sectional and longitudinal data. This analyzing approach is used in social, psychological and health research frequently; it is especially recommended for analyses of change in behavior [68]. By means of a latent growth model (LGM), two latent factors can be calculated (i.e., intercept and slope) using a regression-type line of the variable under investigation over time. The intercept represents the initial status of the variable at baseline and the slope reflects the change in the variable over time.

In the present study, data analyses followed a two-step procedure. At first, we calculated an LGM for each longitudinally measured construct under analyses (i.e., for symptoms of ADHD, for the risk factor parental mental health problems, for protective factors self-efficacy, family climate and social support, and for comorbid symptoms of depression, generalized anxiety, aggressive and dissocial behaviors). Subsequently, we used intercepts and slopes resulting from LGMs in linear regression models. Regression Model A0 served to investigate whether initial symptoms of ADHD were predicted by initial parental mental health, self-efficacy, family climate and social support. Regression Model B0 was used to analyze if the change in ADHD symptoms was predicted by the initial state of parental mental health, self-efficacy, family climate and social support, as well as by the change in these variables over time. The following covariates were added to Models A0 and B0: i) sociodemographic variables (i.e., age, gender, SES, and migration status), ii) information on premature birth, and maternal smoking and alcohol use during pregnancy, and iii) comorbid symptoms of depression, generalized anxiety, aggressive and dissocial behaviors (we added corresponding intercepts to Model A0, and intercepts and slopes to Model B0). For each regression model, all included variables were entered simultaneously into the model.

Moreover, we aimed to explore whether potentially protective factors moderate the relationship between the risk factor parental mental health and ADHD symptoms in the children and adolescents. For this purpose, we additionally included interaction terms in our linear regression models. We thus examined if the association between initial ADHD symptoms and initial parental mental health problems was moderated by initial self-efficacy, initial family climate or initial social support (Model A1). Additionally, we investigated whether the associations between the change in ADHD symptoms and the initial state of parental mental health as well as the change in parental mental health were moderated by self-efficacy, family climate or social support (Model B1).

For all regression models, we centered metric variables. To evaluate the strengths of detected effects, we followed Cohen's rules of thumb [69]: a standardized regression weight (β) of .1 indicates a weak, β of .3 reflects a medium and β of .5 points out a strong effect. We used Mplus 8 [70] for calculating LGMs and IBM SPSS 22 for regression analyses.

Results

The analyzed sample including *n* = 1,384 children and adolescents aged 11 to 17 years at baseline is described in Table 1. About half of the investigated children and adolescents were female, the mean age was about 14 years, about half of the participants lived in families with a medium SES (low SES: 22%, *n* = 306; medium SES: 51%, *n* = 706; high SES: 27%, *n* = 372), and 4% of the analyzed children and adolescents had a migration status. Questions on parental mental health problems for each investigated measurement point were answered by the mothers of 92% of the participating children and adolescents (*n* = 1,274), by the fathers of 7% (*n* = 103) and by step-, foster- or grandparents for 1% (*n* = 7) of the participants. Concerning items on premature birth and maternal smoking and alcohol use (administered at baseline in the KiGGS study), for 89% (*n* = 1,233) of the participants the mothers, for 8% (*n* = 107) the fathers, and for 3% (*n* = 37) mother and father together responded (for *n* = 3 cases foster-/adoptive- or grandparents responded and for *n* = 4 cases information was missing).

Correlations between the score of the C-GI scale restless-impulsivity and the single items of the SCL-S-9 ranged from .15 to .29 based on baseline data. Small associations were found for psychoticism (r = .15), somatization (r = .16), phobic anxiety (r = .16), paranoid ideation (r = .16), obsessive-compulsive (r = .22), and anxiety (r = .24); nearly moderate associations were detected for hostility (r = .25), interpersonal sensitivity (r = .28), and depression (r = .29).

Results for Model A0 (see Table 2) based on cross-sectional data showed that male gender and younger age were both associated with stronger symptoms of ADHD. Further, stronger aggressive behavior was related to more ADHD symptoms. In addition, strong parental mental health problems were associated with stronger ADHD symptoms in the child. Effects of age,

Table 1. Description of the analyzed sample of children and adolescents aged 11 to 17 years (at baseline).

	Baseline		1-year follow-up		2-year follow-up	
	n (%)	*M (SD)*	*n*	*M (SD)*	*n*	*M (SD)*
Sociodemographic data[1]						
Female	706 (51%)					
Age (in years)		13.89 (1.991)				
Socioeconomic status		11.86 (4.106)				
Migration background	49 (4%)					
Pre- and postnatal factors[1]						
Premature birth	148 (11%)					
Maternal smoking during pregnancy	209 (15%)					
Maternal alcohol use during pregnancy	206 (15%)					
Symptoms of ADHD	1,369	0.68 (0.516)	1,100	0.59 (0.492)	1,086	0.55 (0.467)
Comorbid mental health problems						
Depressive symptoms	1,363	0.49 (0.340)	1,068	0.46 (0.342)	1,045	0.45 (0.361)
Symptoms of generalized anxiety	1,363	0.63 (0.377)	1,067	0.60 (0.394)	1,045	0.60 (0.405)
Aggressive behavior	1,305	0.31 (0.271)	1,110	0.28 (0.252)	947	0.27 (0.264)
Dissocial behavior	1,305	0.14 (0.180)	1,111	0.14 (0.166)	947	0.14 (0.182)
Risk factor						
Parental mental health	1,369	0.59 (0.510)	1,100	0.58 (0.516)	1,086	0.49 (0.491)
Protective factors						
Self-efficacy	1,363	2.14 (0.377)	1,066	2.16 (0.433)	1,045	2.17 (0.400)
Family climate	1,371	1.83 (0.528)	1,085	1.83 (0.524)	914	1.8 (0.528)
Social support	1,365	3.12 (0.734)	1,090	3.29 (0.669)	918	3.32 (0.642)

[1] Sociodemographic data and data on pre- and postnatal factors were available for the complete sample under analysis (n = 1,384).

ADHD = Attention-deficit/hyperactivity disorder.

M = mean, *SD* = standard deviation; for measures see text (Methods).

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gender and parental mental health problems on ADHD symptoms were small, but we found a strong effect for aggressive behavior on ADHD symptoms.

Based on longitudinal data, results for Model B0 (Table 2) showed for girls compared to boys as well as for participants with migration status compared to those without this status a stronger increase in symptoms of ADHD over time. Further, an increase in symptoms of generalized anxiety and increasing aggressive behavior over time were both associated with increasing ADHD symptoms over time. Additionally, increasing parental mental health problems (risk factor) were related to increasing ADHD symptoms over time. In contrast, an improvement in family climate (protective factor) over time was associated with a decrease in ADHD symptoms over time. We found only small effects by means of Model B0. Results of Models A0 and B0 on effects of risk and protective factors on symptoms of ADHD are gathered and graphically presented in Fig 1.

Further regression models were conducted to explore moderator effects of potentially protective factors on the relationship between parental mental health problems (risk factor) and ADHD symptoms. Results are provided as Supplementary Information (Table A in S1 File). Based on baseline data, we found no moderating effects for any investigated protective factor (Model A1). By means of longitudinal data, we detected moderating effects for social support, but not for self-efficacy and family climate (Model B1). Increasing social support over time attenuated the association between increasing parental mental health problems and increasing ADHD symptoms over time. Moreover, we unexpectedly found an association between

Table 2. Predictors of the initial state and the change of symptoms of attention-deficit/hyperactivity disorder in children and adolescents.

	Regression Model A0[1] predicting initial symptoms of ADHD			Regression Model B0[2] predicting change in symptoms of ADHD		
	b	β	*p*	*b*	β	*p*
Constant	*0.72*		*< .001*	*-0.07*		*< .001*
Sociodemographic data						
Female	-0.10	-.13	< .001	0.01	.08	.007
Age (in years at baseline)	-0.03	-.12	< .001	0.00	-.03	.471
Age by gender	0.00	.00	.985	0.00	.00	.994
Socioeconomic status (at baseline)	0.00	-.03	.101	0.00	.00	.896
Migration background	-0.07	-.03	.102	0.03	.07	.005
Pre- and postnatal factors						
Premature birth	0.03	.02	.246	0.00	-.02	.465
Maternal smoking during pregnancy	0.00	.00	.903	0.00	.01	.708
Maternal alcohol use during pregnancy	0.02	.02	.391	0.00	-.01	.604
Comorbid mental health problems						
Initial depressive symptoms (intercept)	0.03	.02	.534	0.01	.03	.419
Change in depressive symptoms (slope)				-0.05	-.03	.342
Initial symptoms of generalized anxiety (intercept)	0.04	.03	.213	-0.01	-.04	.258
Change in symptoms of generalized anxiety (slope)				0.05	.06	.049
Initial aggressive behavior (intercept)	1.12	.61	< .001	0.03	.09	.084
Change in aggressive behavior (slope)				2.44	.23	< .001
Initial dissocial behavior (intercept)	-0.02	-.01	.814	-0.01	-.02	.577
Change in dissocial behavior (slope)				0.07	.02	.594
Risk factor						
Initial parental mental health (intercept)	0.16	.15	< .001	0.01	.03	.425
Change in parental mental health (slope)				0.28	.14	< .001
Protective factors						
Initial self-efficacy (intercept)	-0.06	-.04	.073	0.01	.02	.521
Change in self-efficacy (slope)				-0.01	-.01	.669
Initial family climate (intercept)	0.00	.00	.866	-0.01	-.03	.326
Change in family climate (slope)				-0.04	-.07	.010
Initial social support (intercept)	0.03	.03	.239	0.00	.00	.953
Change in social support (slope)				0.02	.03	.231

For each regression model, all included variables were entered simultaneously into the model.

[1] Linear regression Model A0 (n = 1,384); model fit: adjusted R^2 = .52; F = 95.14.

[2] Linear regression Model B0 (n = 1,384); model fit: adjusted R^2 = .07; F = 5.40.

ADHD = Attention-deficit/hyperactivity disorder.

b = unstandardized regression coefficient; β = standardized regression coefficient; for measures see text (Methods).

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increasing ADHD symptoms and increasing social support over time only in children of parents with less severe mental health problems. Detected interaction effects were small.

Discussion

The present study investigated the effects of potential risk and protective factors on the symptoms of ADHD in children and adolescents based on cross-sectional and longitudinal data. As expected, we found that stronger parental mental health problems were associated with more ADHD symptoms at baseline. Additionally, increasing parental mental health problems were

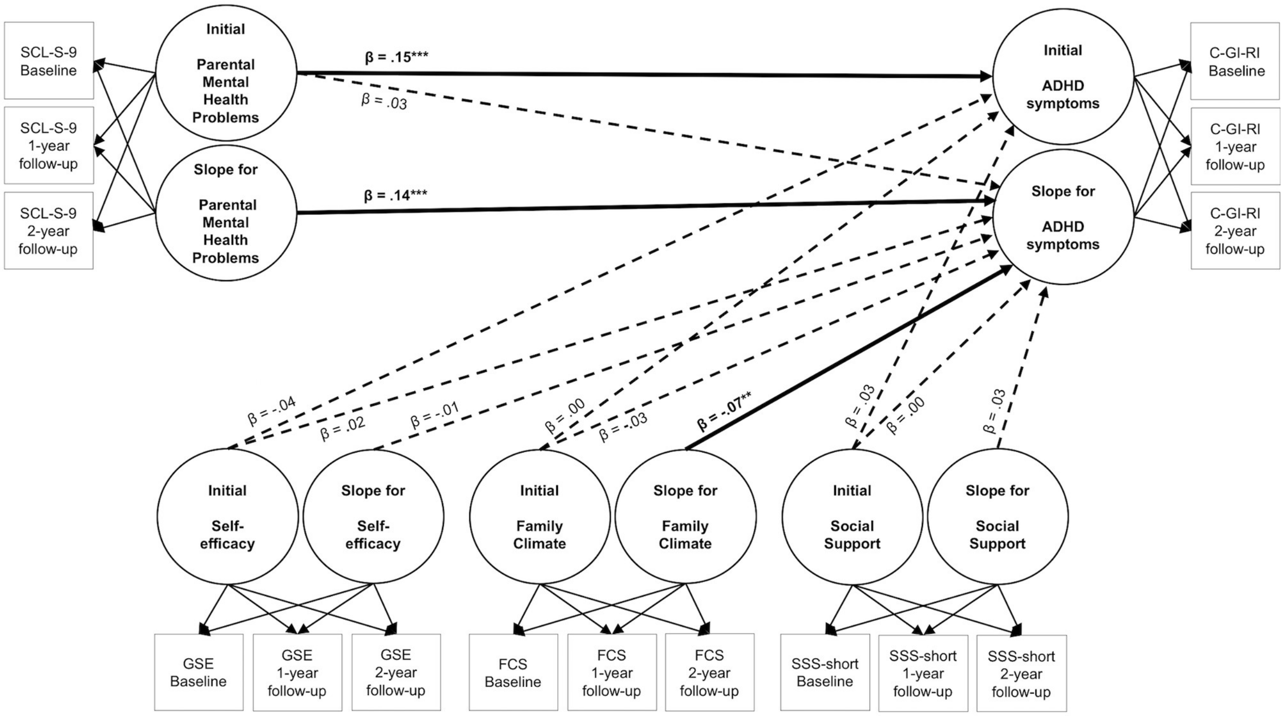

Fig 1. Effects of risk and protective factors on symptoms of attention-deficit/hyperactivity disorder in children and adolescents. Continuous lines mark significant effects, interrupted lines indicate non-significant effects, resulting from regression Models A0 and B0. n = 1,384. ADHD = attention-deficit/hyperactivity disorder; C-GI-RI = subscale restless-impulsivity of the Conners Global Index [49, 50]; SCL-S-9 = Symptom-Check List Short version-9 [61]; GSE = General Self-Efficacy Scale [63, 64]; FCS = an eight-item score based on the Family Climate Scale [65]; SSS-short = eight items of the German version of the Social Support Survey [67]; β = standardized regression coefficient; reported βs are resulting from Models A0 and B0; $^{***}p\leq 001$; $^{**}p\leq 01$;

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associated with increasing ADHD symptoms over time. Contrary to our hypothesis, we found no associations between the protective factors and ADHD initially. However, an improvement in family climate was associated with decreasing ADHD symptoms over time. We further detected moderating effects of social support on the relationship between parental psychopathology and ADHD symptoms over time. Moreover, as assumed, male gender, younger age and comorbid aggressive behaviour were associated with more ADHD symptoms at baseline.

In our baseline analysis, we found that stronger parental mental health problems (risk factor) were associated with more ADHD symptoms in children and adolescents. This result is in line with previous studies on parental psychopathology and child mental health [29, 32–35] as well as with research that points to a strong specific association of parental ADHD with child ADHD problems [71]. Moreover, in our longitudinal analysis, an increase in parental mental health problems was associated with increasing ADHD symptoms over time. The finding that parental psychopathology and ADHD symptoms are associated initially as well as in their development over time, underlines the importance to consider parental mental health in targeted interventions in children and adolescents. Particularly in case of a parental ADHD symptomatology, combined treatments for parents and their child have shown to be successful [72, 73].

Contrary to our assumption and to former research [24, 27, 28], the protective factors self-efficacy, family climate and social support did not predict initial symptoms of ADHD in our study. This might be due to the fact that ADHD is a highly heritable disorder and thus, a remarkable proportion of the variance in ADHD symptoms in our study may has been explained by genetic influences. It is estimated that environmental factors only account for 10 to 40% of the variance associated with ADHD [74]. However, in our longitudinal model, an improvement in family climate over time was associated with a decrease in ADHD symptoms over time. Consequently, our results support the approach of family-based interventions that address dysfunctional family processes and increase mutual support and communication. Such family-based interventions have proven to be effective in treating children and adolescents with ADHD symptoms [75–77].

Moreover, although we could not find any direct effects of the protective factors self-efficacy and social support on ADHD symptoms in our cross-sectional and longitudinal analyses, we detected moderating effects for social support on the relationship between parental mental health problems and children's and adolescent's ADHD. Increasing social support over time could attenuate the association between strong parental mental health problems and strong ADHD symptoms. Corresponding moderator effects were found by Klasen et al. [29] in their study on depressive symptoms based on the same longitudinal data set. This finding has important implications for prevention and intervention programs. Strengthening resources such as the availability of good social support in children and adolescents with a mentally ill parent is particularly important to support children and adolescents in coping with the mental illness of their parent. Thus, it is assumed that children of mentally ill parents may benefit particularly from cognitive-behavioral therapies (CBT) that focus on enhancing personal resources such as social skills in order to support positive peer relationships and friendships. The effectiveness of CBT for children and adolescents with ADHD has been widely researched and scientifically proven [78, 79]. Besides, a recent review and meta-analysis found that peer inclusion interventions are effective in enhancing social functioning in children and adolescents with ADHD [80].

In our moderator model based on longitudinal data, we further unexpectedly found an association between increasing ADHD symptoms and increasing social support over time only in children of parents with less severe mental health problems. This finding may at least partly reflect the direct and rather immediate supportive reaction of a healthy social environment on ADHD symptoms in children and adolescents.

Rose et al. [81] suggested a difference between protective factors and resources. Following this approach, family climate should be described as a resource factor based on our results, as we found a direct beneficial effect of family climate on child and adolescent ADHD symptoms. In contrast, social support can be described as protective factor based on our findings, as it moderates the relationship between the risk factor parental mental health problems and ADHD symptoms. Future studies may wish to further investigate other potential kinds of relationships between risk and protective factors and ADHD.

Based on baseline analysis, we further detected that male gender and younger age were associated with stronger symptoms of ADHD in line with results from previous population-based studies [5, 6]. This finding highlights the need for early prevention and intervention programs to be gender-sensitive. Unlike previous studies that reported that low parental education and financial difficulties predict more or stronger ADHD symptoms [37, 41], we did not find associations between SES and symptoms of ADHD. We further found no associations between premature birth, maternal smoking and alcohol use during pregnancy, although previous studies identified pre- and postnatal factors as important predictors of ADHD [37, 39]. However, the role of prenatal factors for the development of ADHD symptoms is somewhat ambiguous. While many studies found a roughly doubled risk for maternal smoking [82, 83], other studies did neither confirm maternal smoking nor the consumption of alcohol in pregnancy as a risk factor for the incidence of ADHD in the child [84, 85]. It should, however, also be noted that items on substance use may have been answered differently in this study, depending on who completed the questionnaire (mother, father or mother and father together). In addition, social desirability may have prevented the parents from reporting on smoking and alcohol use. Future studies may assess and analyze effects of pre- and postnatal factors more detailed.

Regarding the examined comorbid mental health problems, we found a strong association between externalizing symptoms of aggressive behavior and ADHD symptoms, confirming results from previous studies investigating this relationship [11, 12]. Yet, we did not detect any effects of comorbid internalizing symptoms of depression and anxiety at baseline, although it is well known from the literature that ADHD often co-occurs with these disorders [13]. This might be due to the fact that our analyses were based on a population-based sample in which the prevalence of depression and anxiety is generally lower compared to prevalences in clinical samples. However, in our longitudinal model, we found that increasing symptoms of generalized anxiety were associated with increasing ADHD symptoms over time, which coincides with results of former research on the co-occurrence of ADHD and anxiety [13].

Based on the analysis of longitudinal data, we further found that the increase of ADHD symptoms over time was more pronounced in girls compared to boys, which could be explained by the fact that girls are faced with different challenges during the transition from childhood and adolescence to young adulthood compared to boys. Moreover, children and adolescents with migration background also experienced a stronger increase of ADHD symptoms over time compared to youths without migration background. This is of particular concern for prevention and intervention efforts in migrant populations since data from the nationally representative KiGGS baseline study suggest that there might be migrant-specific barriers to the use of health care services, in particular for families with children and adolescents with ADHD symptoms [86]. Further, although previous studies have shown that ADHD symptoms decrease with age [6], no effect of age on the change of ADHD symptoms over time could be found in the present study, which may partly be explained by the fact that our study only covered a period of two years.

The present study has the following limitations. By means of the variables included in our baseline model, a proportion of 52% of the variance in ADHD symptoms was explained. However, we could only explain 7% of the variance in the slope of ADHD symptoms by the variables included in our longitudinal model. Further, we detected only small effects in our longitudinal model, if effects were given at all. This may be due to the fact that we investigated a general population sample with consistently rather low levels of mental health problems, and with rather good self-efficacy, family climate, and social support. Further, our study only covered a period of two years. This issue is reflected in the fact that the slopes for some investigated constructs did not vary significantly across individuals (e.g., for depressive symptoms and for symptoms of dissocial behavior). Future research may cover a longer period of time. However, these findings may as well indicate that the development of ADHD symptoms is associated with important factors that we did not consider in our model based on longitudinal data. These factors may include genetic risks [9, 10], adverse childhood experiences such as physical or sexual abuse [87–89], other pre- and postnatal risks such as low birth weight and young maternal age at birth [39] as well as other personal resources such as resilience [90] and social competence [28]. Apart from this, it would have been interesting to include the use of medication as control variable in our analyses. Future studies on the development of ADHD symptoms may take these aspects into account. Further, it should be noted that the BELLA study is an observational study that only identifies associations between risk and protective factors and ADHD symptoms. In order to investigate cause-effect relationships, other studies such as intervention studies would have to be performed. In addition, ADHD symptoms were assessed with a brief questionnaire in the present study. We chose to analyze the metric scale scores in order to provide information interesting for planning early interventions on systematic associations between risk and protective factors and ADHD symptoms without loss of information (due to potential categorization). However, it is still a limitation of our study, that we were not able to investigate clinical diagnoses on ADHD. Future clinical studies may wish to analyze associations with clinical ADHD diagnoses. Furthermore, our sample only included children and adolescents aged 11 to 17 years at baseline. In view of the fact that in about 25% of affected children, ADHD is first diagnosed before the age of six [5], future studies may also include younger children.

Our study has several strengths. Data was derived from the BELLA study, which is the first comprehensive longitudinal study to assess the mental health and well-being of children and adolescents in Germany. The strengths of the BELLA study include the large population-based cohort and the wide age range of the participants. Further, risk and protective factors were assessed using established measures. Self-reported data of children and adolescents was used to assess the protective factors and comorbid symptoms of internalizing problems. Parent-reported data was used to assess parental psychopathology, symptoms of ADHD and comorbid aggressive and dissocial behaviors since research has shown that externalizing disorders are better observable by parents [91, 92]. Moreover, we used an appropriate analyzing approach that allowed us to analyze changes in ADHD symptoms as well as changes in risk and protective factors over time. Lastly, we included pre- and postnatal factors as well as common comorbidities of ADHD as important covariates in our models.

To the best of our knowledge, this is one of the first studies to investigate the effects of personal, familial and social risk and protective factors on ADHD symptoms in children and adolescents over time. The results of our study indicate that parental mental health problems can have detrimental effects on ADHD symptoms, while a good family climate and social support can have beneficial effects on ADHD in children and adolescents over time.

Given that ADHD is highly prevalent and causes significant impairments in almost all areas of life, our findings have important implications for prevention and clinical practice. Besides family-based interventions, future prevention and early intervention programs should focus on supporting the availability of good social support and on enhancing social skills, particularly in children of mentally ill parents, in order to reduce risks and prevent the onset of ADHD symptoms.

Supporting information

S1 File. Moderator models. S1A Table. Protective factors self-efficacy, family climate, and social support moderating the relationship between parental mental health problems and symptoms of attention-deficit/hyperactivity disorder in children and adolescents.
(DOCX)

S2 File. Dataset.
(XLS)

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Supporting Information. S1 File. Moderator models.

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Risk and protective factors for the development of ADHD symptoms in children and adolescents: Results of the longitudinal BELLA study

Journal:

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S1A Table. Protective factors self-efficacy, family climate, and social support moderating the relationship between parental mental health problems and symptoms of attention-deficit/hyperactivity disorder in children and adolescents.

	Regression Model A1[1] predicting initial symptoms of ADHD			Regression Model B1[2] predicting change in symptoms of ADHD		
	b	**β**	***p***	***b***	**β**	***p***
Constant	*0.72*		*<.001*	*-0.07*		*<.001*
Sociodemographic data						
Female	-0.11	-.13	<.001	0.01	.08	.008
Age (in years at baseline)	-0.03	-.12	<.001	-0.00	-.04	.381
Age by gender	0.00	-.00	.982	0.00	.01	.874
Socioeconomic status (at baseline)	-0.00	-.03	.110	-0.02	-.00	.966
Migration background	-0.07	-.03	.108	0.03	.08	.003
Pre- and postnatal factors						
Premature birth	0.03	.02	.269	-0.00	-.02	.504
Maternal smoking during pregnancy	-0.00	-.00	.892	0.00	.02	.565
Maternal alcohol use during pregnancy	0.02	.02	.405	-0.00	-.02	.483
Comorbid mental health problems						
Initial depressive symptoms (intercept)	0.03	.02	.551	0.01	.02	.540
Change in depressive symptoms (slope)				-0.07	-.04	.232
Initial symptoms of generalized anxiety (intercept)	0.05	.03	.200	-0.01	-.03	.363
Change in symptoms of generalized anxiety (slope)				0.05	.06	.038
Initial aggressive behavior (intercept)	1.12	.61	<.001	0.02	.07	.176
Change in aggressive behavior (slope)				2.33	.22	<.001
Initial dissocial behavior (intercept)	-0.02	-.01	.836	-0.01	-.02	.703
Change in dissocial behavior (slope)				0.07	.02	.584
Risk factor						
Initial parental mental health problems (intercept)	0.16	.15	<.001	0.00	.02	.525
Change in parental mental health problems (slope)				0.26	.13	<.001

Protective factors						
Initial self-efficacy (intercept)	-0.06	-.04	.070	0.01	.02	.549
Change in self-efficacy (slope)				-0.01	-.02	.504
Initial family climate (intercept)	-0.01	-.01	.809	-0.01	-.04	.241
Change in family climate (slope)				-0.04	-.07	.009
Initial social support (intercept)	0.03	.03	.219	0.00	.01	.677
Change in social support (slope)				0.03	.05	.106
Interactions between the risk and protective factors						
Initial parental mental health problems by initial self-efficacy	-0.07	-.02	.391	0.02	.03	.501
Initial parental mental health problems by change in self-efficacy				-0.09	-.06	.116
Change in parental mental health problems by initial self-efficacy				0.30	.04	.313
Change in parental mental health problems by change in self-efficacy				-0.05	-.00	.940
Initial parental mental health problems by initial family climate	-0.03	-.01	.662	-0.01	-.01	.818
Initial parental mental health problems by change in family climate				0.05	.03	.353
Change in parental mental health problems by initial family climate				-0.27	-.05	.216
Change in parental mental health problems by change in family climate				-0.62	-.04	.250
Initial parental mental health problems by initial social support	-0.01	-.00	.847	-0.02	-.04	.336
Initial parental mental health problems by change in social support				-0.13	-.09	.012
Change in parental mental health problems by initial social support				0.18	.04	.352
Change in parental mental health problems by change in social support				-1.23	-.08	.036

[1] Linear regression Model A1 (n = 1,384); model fit: adjusted $R^2 = .52$; F = 80.13.

[1] Linear regression Model B1 (n = 1,384); model fit: adjusted $R^2 = .08$; F = 4.30.

ADHD = Attention-deficit/hyperactivity disorder.

b = unstandardized regression coefficient; β = standardized regression coefficient; for measures see text (Methods).

Publication 6: The challenge of the COVID-19 pandemic for mental health and behavioural problems in children and adolescents

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ORIGINAL CONTRIBUTION

Impact of the COVID-19 pandemic on quality of life and mental health in children and adolescents in Germany

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Abstract

The COVID-19 pandemic has caused unprecedented changes in the lives of 1.6 billion children and adolescents. First non-representative studies from China, India, Brazil, the US, Spain, Italy, and Germany pointed to a negative mental health impact. The current study is the first nationwide representative study to investigate the impact of the COVID-19 pandemic on health-related quality of life (HRQoL) and mental health of children and adolescents in Germany from the perspective of children themselves. A representative online survey was conducted among $n = 1586$ families with 7- to 17-year-old children and adolescents between May 26 and June 10. The survey included internationally established and validated instruments for measuring HRQoL (KIDSCREEN-10), mental health problems (SDQ), anxiety (SCARED), and depression (CES-DC). Results were compared with data from the nationwide, longitudinal, representative BELLA cohort study ($n = 1556$) conducted in Germany before the pandemic. Two-thirds of the children and adolescents reported being highly burdened by the COVID-19 pandemic. They experienced significantly lower HRQoL (40.2% vs. 15.3%), more mental health problems (17.8% vs. 9.9%) and higher anxiety levels (24.1% vs. 14.9%) than before the pandemic. Children with low socioeconomic status, migration background and limited living space were affected significantly more. Health promotion and prevention strategies need to be implemented to maintain children's and adolescents' mental health, improve their HRQoL, and mitigate the burden caused by COVID-19, particularly for children who are most at risk.

Keywords COVID-19 · Mental health · Quality of life · Anxiety · Depression · Children and adolescents

Introduction

The Coronavirus Disease 2019 (COVID-19) pandemic has led to rapid, unprecedented changes to the lives of billions of children and adolescents. Faced with countless deaths and hundreds of thousands of people worldwide being infected, most countries have implemented massive preventive measures. The prevalence of COVID-19 in children is low (between 0.8% and 3.3%) and most children only display mild physical symptoms or are asymptomatic [1–4]. However, while COVID-19 may not be as severe and deadly in children as it is in adults, its impact on their health-related quality of life (HRQoL) and mental health is not yet understood sufficiently well. Children and adolescents face massive changes in their daily lives, including school closures, home confinement, and social distancing rules, which can burden them substantially [5–7]. Furthermore, violence against children is reported to have increased under home confinement leaving children at risk of abuse and trauma [8].

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Particularly children with low socioeconomic status and pre-existing mental health problems may be exposed to cumulative risks. This assumption is based on a solid body of previous research demonstrating that a low socioeconomic status of children [9–11], low parental education and migration status [12, 13] are risk factors for mental health problems among children. Also when experiencing home confinement, it can be assumed that children living in small apartments are more stressed—concluding from the literature indicating that limited living space can affect mental health [14]. During the pandemic children also receive substantially less paediatric healthcare if outpatient daycare centers are closed, resulting in some children's diseases remaining untreated [15].

Childhood and adolescence involve numerous biopsychosocial changes and challenges, including gaining independence from parents, exploring various domains of identity, and coping with difficulties in everyday life and at school [16]. Adolescence is a sensitive period for social development with an increased need for social interactions [7]. Coping with the current situation and complying with the current restrictions on top of this can be especially difficult for children and adolescents since these circumstances can be experienced as being incongruent with their developmental tasks. The challenges and consequences of COVID-19 might therefore have a tremendous impact on their HRQoL and mental health.

Currently, there is a growing interest in research on the mental health of children and adolescents during the COVID-19 pandemic. First non-representative studies from China, where COVID-19 spread earliest and initially affected most people, reported increasing levels of stress, anxiety and depression. Jiao et al. [17] report that one-third of 3- to 18-year-old children and adolescents were clingy, inattentive, irritable and worried. Xie et al. [18] found that 23% of 2nd- to 6th-grade children had depressive symptoms and 19% had anxiety symptoms during the pandemic, while Zhou et al. [19] report that 44% of 12- to 18-year-olds displayed depressive symptoms, 37% showed anxiety, and 31% had both types of symptoms. High levels of depressive and anxiety symptoms were recently replicated by Duan et al. [20]. Two non-representative studies from India with children and adolescents aged 5–18 years [21, 22] and one study from Brazil with children and adolescents from 6 to 12 years [23] underline the negative impact of the pandemic on the mental health of children. They found that children and adolescents experienced severe psychological distress such as worries, helplessness, anxiety and fear. Moreover, recent nationwide studies from the US reported worsening psychological well-being and behavioural health of children and adolescents compared to the time before the pandemic [24, 25]. Further, two European non-representative studies from Italy and Spain found that mental health problems such as conduct problems, irritability and loneliness in children and adolescents increased during the COVID-19 lockdown [26, 27]. One non-representative survey among parents of German children and adolescents [28] and one qualitative German study [29] further found that children and adolescents are often worried about the COVID-19 pandemic and the associated changes.

Under normal circumstances, the worldwide prevalence of mental disorders is 13.4% as reported by a meta-analysis [30]. The above-mentioned studies thus indicate a significant increase in mental health problems in children during the pandemic, which may lead to manifest disorders over time. There is still a lack of knowledge about how this prevalence has or will increase while the pandemic continues.

This representative COPSY study (impact of **CO**VID-19 on **psy**chological health) aims to explore the HRQoL and mental health of children and adolescents aged 7–17 years during the COVID-19 pandemic and to compare it to pre-pandemic data of the nationwide representative study of the **be**haviour and we**ll**being of chi**l**dren and **a**dolescents in Germany (BELLA study) [31, 32].

Our main hypotheses were:

1. Children's and adolescents' HRQoL and mental health are impaired during the COVID-19 pandemic. Specifically, we expected that children and adolescents feel burdened by the pandemic, show a decrease in HRQoL, an increase in mental health problems, higher levels of anxiety, depression and more psychosomatic symptoms during the pandemic compared to before the pandemic.
2. Some children and adolescents are particularly impaired by the COVID-19 pandemic. We assumed that children and adolescents with low socioeconomic status, migration background and limited living space are affected significantly more.

We aim to identify children's and adolescents' needs during the pandemic and offer guidance to policymakers, paediatric professionals and parents for safeguarding the mental health of children.

Methods

Study design and sample

The nationwide, population-based COPSY study was conducted in Germany between May 26 and June 10, 2020, while the country was under a partial lockdown, with schools, leisure facilities and most stores closed and with preventive distancing measures in place. The COPSY study was approved by the Local Psychological Ethics Committee (LPEK-0151) and the Commissioner for Data Protection of the University of Hamburg. Overall, $n = 3597$ families with children and adolescents aged 7–17 years were invited to participate in the survey. They were contacted, informed about the study and asked for their informed consent. A total of $n = 1647$ families consented and completed the online survey via the survey software EFS Survey from Questback. The participation rate was 45.8% (calculated according to a formula by the American Association for Public Opinion Research, AAPOR [33]). After data cleaning ($n = 61$ participants were excluded due to implausible data), the final sample included $n = 1586$ families. Self-reports of children and adolescents were gathered if aged at least 11 years ($n = 1040$, 11–17 years old, one child per family). Parent proxy-reports were gathered of 11- to 17-year-olds who provided self-reports ($n = 1040$) and of younger children aged 7–10 years ($n = 546$). The weighted data of the final study sample matched the sociodemographic characteristics of the German population (based on the 2018 microcensus; the individual weights ranged from 0.2 to 3.8).

The COPSY study design and methodology is similar to the nationwide, longitudinal, representative BELLA study, though samples differed on the individual level across both studies. The BELLA study is the mental health module within the German Health Interview and Examination Survey for Children and Adolescents (KiGGS) [34] which administered established and validated questionnaires on HRQoL and mental health to children, adolescents and parents. Details of the BELLA study are described elsewhere [31, 32]. Extensive data from the BELLA study conducted in Germany in 2017 ($n = 1556$) were used to compare the data from the COPSY study with those of population-based reference samples surveyed prior to the COVID-19 pandemic. Due to the availability of data in different questionnaires, corresponding subsamples of the BELLA study were used for comparison.

Measures

Sociodemographic variables

Children and adolescents aged 11–17 years responded to the self-report version of the online survey, parents of children aged 7–17 years answered the parent proxy version of the online survey. For sociodemographic information, the child and adolescent survey included questions on age and gender, the parent proxy survey included questions on age, gender, marital status, occupational status, parental education and migration background.

COVID-19 burden

To explore the burden of the pandemic, both versions of the online survey (self- and parent proxy-reports) included self-developed pandemic-focused items (drawing from our expertise in developing the KIDSCREEN measures). We asked for the perceived overall burden of the COVID-19 pandemic and for the burden caused by social distancing and school closures as well as effects of the pandemic situation on family climate.

HRQoL and mental health

To assess the impact of the pandemic on HRQoL and mental health, internationally established, comparable and validated instruments following recommendations by the International Consortium for Health Outcomes Measurement (ICHOM) [35] were used. Self- and parent proxy-reports of the survey included the established KIDSCREEN-10 Index [36], the scale on generalized anxiety from the German version of the Screen for Child Anxiety Related Disorders (SCARED) [37] and selected items from the German version of the Center for Epidemiological Studies Depression Scale (CES-DC) [38]. The Strengths and Difficulties Questionnaire (SDQ) [39] on mental health problems in children and adolescents was only administered in the parent proxy survey of the COPSY study. These measures were not only used in the COPSY study but also in the BELLA study so that a comparison of HRQoL and mental health before and during the pandemic was possible.

The KIDSCREEN-10 Index provides a global HRQoL score covering the physical, psychological, and social facets of HRQoL [36]. Its ten items (e.g., “Have you felt full of energy?”) were presented with 5-point response scales (0 = “never” to 4 = “always” or 0 = “not at all” to 4 = “extremely”). The mean score ranges from 0 to 4. Scores one standard deviation below the population mean (before the pandemic) were categorized as “low” HRQoL. The Strengths and Difficulties Questionnaire (SDQ) [39] assesses mental health with four problem scales: emotional symptoms, conduct problems, hyperactivity, and peer problems. Each problem scale consists of five items presented with three response options (0 = “not true” to 2 = “certainly true”). According to published cut-offs, we categorized participants based on the sum scores into groups according to their mental health (noticeable/abnormal, borderline and normal) [40]. The German version of the Screen for Child Anxiety Related Disorders (SCARED) [37] includes nine items on symptoms of generalized anxiety (e.g., “I worry about what is going to happen in the future”) which are presented with a 3-point response scale (0 = “not true or hardly ever true” to 2 = “very true or often true”). These 9 items are gathered in a sum score with higher scores indicating more severe symptoms of generalized anxiety. The scale score was used to categorize participants into two groups (those with versus those without generalized anxiety) based on the provided cutoff by Birmaher et al. [37]. Seven items of the Geman version of the Center for Epidemiological Studies Depression Scale (CES-DC) [38] (e.g., “I felt sad”) were administered and presented with a 4-point response scale (0 = “not at all” to 3 = “a lot”). A mean score gathering all items was calculated with higher scores indicating more severe depressive symptoms. In the COPSY study, the internal consistency was good for the analyzed self-reported KIDSCREEN-10 Index, for the parent-reported SDQ total score, and for self-reported generalized anxiety and depression scores ($\alpha = 0.82, 0.84, 0.89, 0.84$). In the sample used from the BELLA study, the internal consistency for the scales was mainly comparable (in the order presented above: $\alpha = 0.80, 0.82, 0.83, 0.79$).

Finally, psychosomatic complaints were assessed in self- and parent proxy-reports using the HBSC symptom checklist [41]. The HBSC symptom checklist assesses how often children and adolescents experienced eight different psychosomatic complaints (e.g., headaches, sleeping problems, irritability) during the last week. Items were offered with a 5-point response scale (0 = “not at all” to 4 “daily”). The BELLA study did not provide comparison data for this scale.

Data analysis

To investigate the perceived burden of the pandemic, the pandemic-specific items were examined via descriptive statistics (frequencies, means and standard deviations). To evaluate differences in HRQoL and mental health before and during the pandemic, cross-sectional data from the pre-pandemic BELLA study (control group) and the pandemic COPSY study (index group) were pooled; depending on data availability, two different BELLA subsamples were used. Prior to multivariate regression analyses with pooled data, bivariate analyses were conducted (cross-tabulation, chi-square tests, t-tests and ANOVAs). The regression models with pooled data were controlled for age, gender, age*gender, parental education and migration status. We considered a p value ≤ 0.05 as an indicator for significant differences or effects.

Prior to conducting data analyses, a power analysis was conducted. Sample size was calculated to test for statistical significance with p (alpha) < 0.05 and a power of $p = 0.8$ for moderate effect ($d = 0.5$) between two groups in a particular age (7–10; 11–13; 14–17) and gender (females vs. males) group. This power calculation leads to $n = 612$ respondents at minimum. The power calculation was conducted with the G-Power 3.1 software.

As the BELLA study did not provide comparative data on psychosomatic complaints, the responses to the HBSC symptom checklist were presented using descriptive statistics only.

To examine which children are at higher risk of being particularly impaired by the pandemic, first age and gender differences were explored in detail. Then a high-risk analysis was conducted. Based on a-priori theoretical considerations, children with a certain sociodemographic and psychosocial profile were considered as being at higher risk and the resulting group was examined for impairments in the main study outcomes. Effects were described as mean differences and Cohens d-effect size measures.

All analyses were performed using SPSS version 26.

Results

Sociodemographics

Data from $n = 1586$ families with children aged 7–17 years (unweighted data: $M_{age} = 12.25$, $SD_{age} = 3.30$, $n = 793$ [50.0%] female) were analysed (self- and parent proxy-reports). The majority of the children and adolescents had no migration background [$n = 1332$ (84.0%)]. Most of their parents had a medium level of education [$n = 884$ (55.7%)], were married [$n = 1097$ (69.2%)] and were employed full-time [$n = 820$ (51.7%)]. Further details on the sociodemographic characteristics of the COPSY sample are presented in Table 1. The sociodemographic characteristics of the COPSY and BELLA subsamples used for the pooled regression analyses on HRQoL and mental health of children and adolescents before and during the COVID-19 pandemic are depicted in Supplementary Tables 1 and 2.

Perceived burden of the pandemic

Two-thirds [weighted data: $n = 735$ (70.7%)] of the children and adolescents (aged 11–17 years) stated that they felt burdened by the COVID-19 pandemic. More than half of the children and adolescents found homeschooling and learning to be more difficult than before the pandemic [$n = 670$ (64.4%)], the majority reported fewer social contacts during the pandemic [$n = 861$ (82.8%)], and nearly two-fifth of the children and adolescents stated that their relationships with their friends had been impaired [$n = 408$ (39.3%)]. About a fourth of the children and adolescents reported that arguments had increased in the family [$n = 287$ (27.6%)]. Using parent proxy-reported data (parents of 7- to 17-year-olds), about a third of the parents stated that disputes escalated more often [$n = 508$ (32.0%)].

HRQoL before vs. during the pandemic

Before the pandemic, 15.3% ($n = 146$; based on weighted data of the BELLA study) of children and adolescents reported low HRQoL; during the pandemic, 40.2% of the children and adolescents reported low HRQoL ($n = 418$; based on weighted self-reported data of the COPSY study).

Table 1 Sociodemographic characteristics of the COPSY sample

	Parents of children aged 7–17 years ($n = 1586$)		Children and adolescents aged 11–17 years ($n = 1040$)	
	n (%)	*M* (*SD*)	*n* (%)	*M* (*SD*)
Age of the child		12.25 (3.30)		14.33 (1.86)
7–10 years	546 (34.4)		–	
11–13 years	351 (22.1)		351 (33.8)	
14–17 years	689 (43.4)		689 (66.3)	
Gender of the child				
Male	791 (49.9)		508 (48.8)	
Female	793 (50.0)		531 (51.1)	
Diverse	1 (0.1)		1 (0.1)	
No information	1 (0.1)		–	
Age of the parent		43.99 (7.36)		46.28 (6.74)
Migration background				
No	1332 (84.0)		879 (84.5)	
Yes	254 (16.0)		161 (15.5)	
Parental education				
Low	288 (18.2)		192 (18.5)	
Medium	884 (55.7)		548 (52.7)	
High	383 (24.1)		277 (26.6)	
No information	31 (2.0)		23 (2.2)	
Marital status				
Unmarried	140 (8.8)		87 (8.4)	
Married	1097 (69.2)		717 (68.9)	
In a relationship	216 (13.6)		125 (12.0)	
In a registered partnership	13 (0.8)		8 (0.8)	
Divorced	108 (6.8)		92 (8.8)	
Widowed	12 (0.8)		11 (1.1)	
Occupational status				
Full-time employed	820 (51.7)		561 (53.9)	
Part-time employed	453 (28.6)		286 (27.5)	
Self-employed	67 (4.2)		49 (4.7)	
Other employment	32 (2.0)		22 (2.1)	
Housewife/househusband	109 (6.9)		61 (5.9)	
Retiree/pensioner	34 (2.1)		27 (2.6)	
On parental leave	29 (1.8)		7 (0.7)	
Unemployed	42 (2.6)		27 (2.6)	
COVID-19 infection				
A family member was infected	60 (3.8)		35 (3.4)	
A relative died of COVID-19	29 (1.8)		22 (2.1)	

Unweighted data

M mean, *SD* standard deviation

An analysis stratified by gender revealed that a higher proportion of girls reported low HRQoL than their male peers both before and during the pandemic (Table 2). Younger children were affected significantly more than older ones; the percentage of children reporting low HRQoL rose from 7.7% to 41.3% in 11- to 13-year-old children and from 17.1% to 39.3% in 14- to 17-year-olds ($p < 0.001$).

Mental health before vs. during the pandemic

Based on parent proxy-reports, 7- to 17-year-old children and adolescents suffered from more mental health problems compared to before the pandemic. The prevalence of noticeable mental health problems was 9.9% ($n = 153$) before the pandemic and increased to 17.8% ($n = 283$) during the

Table 2 HRQoL in children and adolescents before vs. during the COVID-19 pandemic, stratified by gender (self-report, 11–17 years)

	Low HRQoL[a]	Normal/high HRQoL[a]
Boys		
Before pandemic ($n = 492$)	10.4%	89.6%
During pandemic ($n = 524$)	35.7%	64.3%
	$p^b < .001$	
Girls		
Before pandemic ($n = 460$)	20.4%	79.6%
During pandemic ($n = 515$)	44.7%	55.3%
	$p < .001$	
Boys and girls		
Before pandemic ($n = 982$)	15.3%	84.7%
During pandemic ($n = 1039$)	40.2%	59.8%
	$p < .001$	

[a] Groups low and normal/high HRQoL according to the KID-SCREEN, for details, see Methods

[b] p values resulting from χ^2 test comparing the two groups of children and adolescents with low vs. normal/high HRQoL across the pre-pandemic BELLA study and the COPSY study during the pandemic

pandemic. This increase was significantly higher in 7- to 10-year-olds (from 7.4% to 26.8%) compared with 11- to 13-year-olds (from 12.8% to 14.5%) ($p < 0.001$).

Considerable rates for parent-reported hyperactivity [$n = 233$ (14.6%)], emotional problems [$n = 210$ (13.3%)], peer problems [$n = 183$ (11.5%)] and conduct problems [$n = 159$ (10.0%)] were found during the pandemic. In an analysis stratified by gender, different gender-specific patterns of mental health problems were found before and during the pandemic (Table 3).

Based on self-reported data of 11- to 17-year-olds, the children and adolescents experienced higher levels of generalized anxiety during the COVID-19 pandemic [$n = 251$ (24.1%)] compared with before the pandemic [$n = 198$ (14.9%)].

The children and adolescents also self-reported depressive symptoms: 62.1% ($n = 646$) had trouble concentrating, 58.4% ($n = 607$) had little interest or joy in activities, and 33.7% ($n = 351$) felt sad. Surprisingly, no significant increase ($p > 0.05$) was found in the prevalence of depressive symptoms before vs. during the pandemic.

Linear regression analyses indicated significant differences between COPSY (during pandemic) and BELLA (before pandemic) data on almost all mental health outcomes (Table 4). Effects were small for parent-reported total mental health problems, hyperactivity and peer problems (Cohen's $f^2 = 0.04$, 0.03, 0.05), and negligible for parent-reported conduct problems and self-reported generalized anxiety (Cohen's $f^2 = 0.01$).

With regard to the control variables, older age and female gender were each associated with fewer parent-reported mental health problems in total and on the SDQ subscales, except for peer problems, which increased with age and showed no gender-specific effect. A significant interaction effect indicated that higher age was related to stronger parent-reported emotional problems in girls only. Overall, higher self-reported HRQoL was found in girls, though it decreased with advancing age in this gender group. Higher parental education was associated with fewer parent-reported mental health problems in children. Migration background was related to more total mental health problems and to more severe peer problems (both parent-reported).

Psychosomatic complaints during the pandemic

Children and adolescents aged 11 to 17 years self-reported substantial psychosomatic complaints; about half of the sample [$n = 554$ (53.2%)] felt irritable and considerable proportions of the sample had sleeping problems [$n = 449$ (43.3%)], headaches [$n = 421$ (40.5%)], felt low [$n = 352$ (33.8%)], and/or reported stomache aches [$n = 317$ (30.5%)]. Girls were affected more than boys with regard to having headaches ($p = 0.036$), stomach aches ($p = -0.014$) and feeling low ($p = -0.002$).

Risk factors for mental health problems during the pandemic

The high-risk group analysis confirmed our hypotheses that children from families with (i) low education levels, or (ii) less than 20 square meters of living space per person, or (iii) a migration background were considered to be at a high risk of suffering a sizable impact due to the COVID-19 pandemic when the family climate, as a resource, was also low (the lowest 20% of all respondents). These high-risk children and adolescents ($n = 126$) reported being substantially burdened by the COVID-19 pandemic significantly more than their peers [42.5% (53.3–31.7) vs. 26.7% (29.4–24.4%), $p = 0.005$] and displayed lower self-reported HRQoL (d-ES = 0.67; $p < 0.001$) and more parent-reported total mental health problems (d-ES = 0.83; $p < 0.001$), emotional symptoms (d-ES = 0.59; $p < 0.001$), conduct problems (d-ES = 0.84; $p < 0.001$), hyperactivity (d-ES = 0.60; $p < 0.001$) and peer problems (d-ES = 0.47; $p < 0.001$) as well as self-reported anxiety (d-ES = 0.37; $p < 0.001$), depressive symptoms (d-ES = 0.64; $p < 0.001$), and psychosomatic complaints (d-ES = 0.67; $p < 0.001$).

Table 3 Mental health problems in children and adolescents before vs. during the COVID-19 pandemic, stratified by gender (parent-report, 7–17 years)

	Mental health problems (total)	Emotional symptoms	Conduct problems	Hyperactivity	Peer problems
Boys					
Before pandemic ($n = 793$)					
Normal[a]	81.3%	88.3%	84.5%	84.4%	88.9%
Borderline[a]	8.8%	4.3%	8.1%	5.4%	3.5%
Noticeable/abnormal[a]	9.8%	7.4%	7.4%	10.2%	7.6%
During pandemic ($n = 816$)					
Normal	66.2%	80.6%	77.5%	70.3%	76.2%
Borderline	14.1%	8.0%	10.9%	11.3%	10.3%
Noticeable/abnormal	19.7%	11.4%	11.6%	18.4%	13.5%
	$P^b < .001$	$p = .007$	$p = .004$	$p < .001$	$p < .001$
Girls					
Before pandemic ($n = 760$)					
Normal	83.4%	78.7%	89.5%	90.1%	88.3%
Borderline	6.7%	8.3%	4.9%	4.7%	4.3%
Noticeable/abnormal	9.9%	13.0%	5.7%	5.1%	7.4%
During pandemic ($n = 768$)					
Normal	73.3%	77.2%	84.4%	82.8%	80.4%
Borderline	10.8%	7.4%	7.3%	6.4%	10.1%
Noticeable/abnormal	15.9%	15.3%	8.3%	10.8%	9.5%
	$p < .001$	$p = .198$	$p = .042$	$p < .001$	$p = .137$
Boys and girls					
Before pandemic ($n = 1553$)					
Normal	82.4%	83.6%	86.9%	87.2%	88.6%
Borderline	7.8%	6.2%	6.5%	5.1%	3.9%
Noticeable/abnormal	9.9%	10.2%	6.6%	7.7%	7.5%
During pandemic ($n = 1585$)					
Normal	69.6%	79.0%	80.8%	76.4%	78.2%
Borderline	12.5%	7.7%	9.1%	8.9%	10.2%
Noticeable/abnormal	17.8%	13.3%	10.0%	14.6%	11.5%
	$p < .001$	$p = .007$	$p < .001$	$p < .001$	$p < .001$

[a] Groups due to mental health problems according to the SDQ, for details, see Methods

[b] p—values resulting from χ^2—tests comparing groups normal and borderline (gathered into one group) vs. noticeable/abnormal according to the SDQ across the pre-pandemic BELLA study and the COPSY study during the pandemic

Discussion

To our knowledge, this is the first nationwide representative study on the HRQoL and mental health of children and adolescents during the COVID-19 pandemic. We found that children and adolescents in Germany feel significantly burdened by lockdown, social distancing and homeschooling measures. They experience significantly lower HRQoL and more mental health problems, especially hyperactivity and peer problems. While younger children seem to be more negatively impacted by the pandemic than older children, emotional problems in girls seem to increase by age during the pandemic. Also (particularly young) children may express their stress via psychosomatic complaints, which increased during the pandemic compared to the time before, which is relevant for parents and doctors to take into account when children complain about bodily symptoms. Children and adolescents with low socioeconomic status, low parental education and migrant status are particularly burdened by the effects of the COVID-19 pandemic. Our results are highly relevant to public health and health policy. We suggest careful balancing lockdown/homeschooling measures against the mental health risks of children and strongly call for providing targeted mental health care in communities and kindergardens/schools as prevention and intervention measures to support those outlined children and adolescents being severely stressed by the pandemic.

Table 4 Mental health impact of COVID-19 measures on children and adolescents

	Constant	Age	Female	Age*female	Education	Migration background	During vs. before pandemic	*Adjusted* R^2
	B coeff (95% CI)	B coeff (95% CI)	B coeff (95% CI)	B coeff (95% CI)	B coeff (95% CI)	B coeff (95% CI)	B coeff (95% CI)	
HRQoL[a]	**51.74** (47.31;56.16)	0.08 (− 0.22;0.37)	**8.72** (2.96;14.48)	**− 0.72** (− 1.11;− 0.32)	− 0.00 (− 0.18;0.17)	− 1.03 (− 2.11;0.05)	**− 6.51** (− 7.28;− 5.74)	0.142
Mental health problems (total)[b]	**14.01** (12.71;15.31)	**− 0.33** (− 0.42; − 024)	**− 2.39** (− 3.96;− 0.82)	0.11 (− 0.02;0.23)	**− 0.35** (− 0.44;− 0.25)	**0.69** (0.13;1.25)	**2.18** (1.78;2.59)	0.105
Emotional symptoms[b]	**3.18** (2.71;3.65)	**− 0.10** (− 0.14;− 0.07)	**− 0.65** (− 1.22;− 0.08)	**0.08** (0.04;0.13)	**− 0.07** (− 0.10;− 0.03)	0.13 (− 0.08;0.33)	0.13 (− 0.02;0.27)	0.028
Conduct problems[b]	**3.16** (2.79;3.52)	**− 0.08** (− 0.11;− 0.06)	**− 0.69** (− 1.13;− 0.24)	0.03 (− 0.01;0.06)	**− 0.05** (− 0.08;− 0.03)	0.14 (− 0.02;0.29)	**0.42** (0.30;0.53)	0.063
Hyperactivity[b]	**6.40** (5.88;6.92)	**− 0.18** (− 0.22;− 0.15)	**− 1.01** (− 1.64;− 0.39)	0.01 (− 0.04;0.06)	**− 0.16** (− 0.20;− 0.12)	0.19 (− 0.04;0.41)	**0.80** (0.64;0.96)	0.161
Peer problems[b]	**1.28** (0.87;1.69)	**0.04** (0.01;0.07)	− 0.05 (− 0.54;0.45)	− 0.01 (− 0.05;0.02)	**− 0.07** (− 0.10;− 0.04)	**0.24** (0.07;0.42)	**0.84** (0.71;0.97)	0.079
Generalized anxiety[a]	**4.22** (2.59;5.86)	.00 (− 0.11;0.11)	− 0.64 (− 2.87;1.59)	0.15 (− 0.01;0.30)	− .00 (− 0.08;0.07)	0.11 (− 0.38;0.60)	**0.64** (0.32;0.95)	0.041

CI confidence interval, *HRQoL* health-related quality of life, significant effects are indicated in bold face

[a] Self-reported data (11- to 17-year-olds)

[b] Parent-reported data (7- to 17-year-olds)

The results concerning the negative impact of COVID-19 measures on HRQoL and mental health are in line with recent non-representative studies from China, India, Brazil, the US, Spain, Italy, and Germany [17–28]. However, comparing the impacts cross-culturally, children and adolescents in Germany do not seem to be affected as negatively as in other countries such as China, Spain and Italy. Surprisingly, our study did not reveal elevated levels of depression during the COVID-19 lockdown and though a higher level of generalized anxiety was found, the corresponding effect was only negligible compared to pre-pandemic data. In comparison to other countries, German children and adolescents may have been impacted less severely during the initial phase of the pandemic, possibly due to a lower incidence and mortality rate of COVID-19 and softer lockdown measures. A longitudinal study is planned to assess whether depressive and anxiety symptoms in German children and adolescents may increase during the ongoing situation.

Although we did not observe an increase in clinically relevant depressive symptoms, our findings indicate that children and adolescents feel highly burdened, have a significantly higher risk of mental health problems than before the pandemic and suffer from psychosomatic complaints. Our future research will therefore focus on psychosocial resources and resilience factors (e.g., family cohesion and social support) that strengthen the mental health of children and adolescents. Children and adolescents at risk of developing mental health problems need to be identified early on to prevent subclinical mental health problems from developing into manifest mental disorders. Targeted early prevention and intervention services are needed to support young people experiencing mental health problems and their access to health services.

Our study also shows that attention should be paid to children at higher risk of suffering from COVID-19 lockdown consequences, including children with low socioeconomic status (i.e., children from families with low education levels, migration background or limited financial resources), which is in line with research on social inequality and mental health [9]. To reduce the health inequalities identified, nationwide, targeted, and low-threshold preventive measures should be initiated, especially for children from socially deprived backgrounds. Further risk factors for mental health in children found in recent US studies are hardships during the crisis, including caregiving burden, job loss and income loss of the parents [25]. Studies show that parents and children's mental health and stress are closely intertwined [42, 43] with recent studies performed during the COVID-19 pandemic [44, 45] outlining that several factors lead to a higher stress of parents like being single, parenting young children or children with emotional or behavioral difficulties, having financial hardships or losing childcare. Parents with those risk factors are more likely to develop "burn-out" symptoms during the pandemic and need to be supported to avoid escalations in families including neglect and abuse and also to avoid an increase of parental mental disorders. In times of hardship, it has been shown that mental health deteriorates and aggression increases [46]. Our study indicates a deteriorating family climate, more externalizing behaviour among children and more escalating conflicts at home during the pandemic. Current research and previous health and economic disasters have shown that the risk of child abuse and neglect increases during such times [46, 47] and experts warn that parenting is becoming more violent during the COVID-19 pandemic [48]. Thus, UNICEF, politicians and paediatricians have called for support in maintaining children's health and welfare [5, 6, 15, 48].

Children and adolescents burdened by the pandemic and potentially at severe mental health risk need to be identified early on to prevent further exacerbation of psychopathology. Along with paediatric researchers, health care professionals and institutions [5, 6, 15, 48], we call for raising awareness of the negative impact this pandemic has on children and adolescents. Society, politicians, educational and health care professionals, as well as parents need to take action to reduce the mental health impact of COVID-19 on children and adolescents. Resources must be allocated and prevention and intervention programs need to be established to support vulnerable children and adolescents and to prepare for a potential second wave of COVID-19 or comparable future events. In addition, we suggest introducing mental health promotion and prevention programs that meet the needs of these children. Guidelines for coping with the pandemic aimed at children and parents, and programs to prevent domestic violence through community-based initiatives have been presented by the United States Centers for Disease Control (CDC) [49]. The European Society for Child and Adolescent Psychiatry (ESCAP) and the American Academy of Child and Adolescent Psychiatry (AACAP) have provided a range of materials for communicating about COVID-19 with children, coping with anxiety and stress, telepsychiatry, and school programs to support children in coping with the pandemic. Moreover, it is recommended that parents talk to their children about the situation and their children's concerns, listen carefully and create a flexible but consistent daily routine, which can give children stability and security.

The present study has the following limitations: (1) Differences between mental health before and during COVID-19 are attributed to the pandemic. However, a number of other individual and societal factors may have influenced these differences. (2) Due to social distancing measures, this study did not use clinical interviews to assess clinical diagnoses of mental disorders. We did, however, administer internationally recommended, established and validated screening instruments to assess HRQoL and mental health in children. Therefore, our study has the strength to report findings not only from parents but also from the perspective of children themselves. (3) The study results may be affected by response bias such as a social desirability bias or a non-response bias, i.e., this study only included German-speaking children, adolescents and parents with computer literacy and access to digital devices with internet. Thus, findings may not be generalizable to countries other than Germany or to other samples. The participation rate of 45.8% in our study was in the range of child health surveys in the US [50] and the UK [51].

Overall, our findings highlight the significant mental health burden of German children and adolescents during the COVID-19 pandemic. They allow conclusions to be drawn enabling health policy, prevention and clinical practice to provide suitable support in the present crisis and comparable future situations. A planned follow-up study will evaluate how children and adolescents react to the future trajectory of the COVID-19 pandemic, to assess long-term impacts of the pandemic and to investigate resources and resilience factors, which may help children to cope better.

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Author contributions URS is the principle investigator of the COPSY and BELLA studies, is responsible for their design, funding, data collection, analysis, and interpretation, and revised the manuscript critically; AK was involved in project administration, data collection, analysis and interpretation, and wrote the first draft of the manuscript; CO performed the data curation, statistical analyses, interpreted the data and revised the manuscript critically; ME performed the statistical analyses, interpreted the data and revised the manuscript critically; JD performed the literature search and contributed to the first draft of the manuscript; RS is involved in the KiGGS study which is conducted in close cooperation with the BELLA study and revised the manuscript critically. All authors contributed to and have approved the final manuscript.

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Data availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Compliance with ethical standards

Conflict of interest None of the authors has a conflict of interest to disclose.

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Supplementary Material

Manuscript title: Impact of the COVID-19 pandemic on quality of life and mental health in children and adolescents in Germany

Journal: European Child and Adolescent Psychiatry

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Supplementary Table 1. Sociodemographic characteristics of the COPSY and BELLA subsamples used for the pooled analysis of health-related quality of life in children and adolescents before and during the COVID-19 pandemic.

	COPSY subsample (*n* = 1,016)		**BELLA subsample (*n* = 941)**	
	***n* (%)**	***M (SD)***	***n* (%)**	***M (SD)***
Age		14.35 (1.86)		14.35 (1.91)
Gender				
Male	500 (49.2)		427 (45.4)	
Female	516 (50.8)		514 (54.6)	
Migration background				
No	861 (84.7)		824 (87.6)	
Yes	155 (15.3)		117 (12.4)	
Parental education				
Low	192 (18.9)		58 (6.2)	
Medium	547 (53.8)		509 (54.1)	
High	277 (27.3)		374 (39.7)	

Note. *M* = mean; *SD* = standard deviation. For the pooled analysis of generalized anxiety, a similar subsample of the BELLA study with comparable sociodemographic characteristics was used (*n* = 1,330). The sociodemographic characteristics are available from the authors upon request.

Supplementary Table 2. Sociodemographic characteristics of the COPSY and BELLA subsamples used for the pooled analysis of mental health problems in children and adolescents before and during the COVID-19 pandemic.

	COPSY subsample (*n* = 1,553)		**BELLA subsample (*n* = 1,556)**	
	***n* (%)**	***M (SD)***	***n* (%)**	***M (SD)***
Age		12.25 (3.32)		12.51 (2.94)
Gender				
Male	779 (50.2)		742 (47.7)	
Female	774 (49.8)		814 (52.3)	
Migration background				
No	1,309 (84.3)		1,365 (87.7)	
Yes	244 (15.7)		191 (12.3)	
Parental education				
Low	288 (18.5)		84 (5.4)	
Medium	882 (56.8)		819 (52.6)	
High	383 (24.7)		653 (42.0)	

Note. M = mean; *SD* = standard deviation

Publication 7: The challenge of the COVID-19 pandemic for mental health and behavioural problems in children and adolescents

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Seelische Gesundheit und psychische Belastungen von Kindern und Jugendlichen in der ersten Welle der COVID-19-Pandemie – Ergebnisse der COPSY-Studie

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Zusammenfassung

Hintergrund: Die mit der COVID-19-Pandemie einhergehenden Veränderungen und Kontaktbeschränkungen können das psychische Wohlbefinden von Kindern und Jugendlichen beeinflussen.

Ziel der Arbeit: COPSY ist die erste deutschlandweite repräsentative Studie, welche die psychische Gesundheit und Lebensqualität von Kindern und Jugendlichen während der Pandemie untersucht. Die Ergebnisse werden mit denen der repräsentativen longitudinalen BELLA-Studie aus der Zeit vor der Pandemie verglichen.

Material und Methoden: Vom 26. Mai bis zum 10. Juni 2020 wurden *n* = 1.586 Eltern mit 7- bis 17-jährigen Kindern und Jugendlichen, von denen *n* = 1.040 11- bis 17-Jährige auch Selbstangaben machten, befragt. Dabei wurden international etablierte Instrumente zur Erfassung von gesundheitsbezogener Lebensqualität, psychischen Auffälligkeiten, Ängstlichkeit und depressiven Symptomen eingesetzt. Die Daten wurden mittels deskriptiver Statistiken und bivariater Tests ausgewertet.

Ergebnisse: 71 % der Kinder und Jugendlichen und 75 % der Eltern fühlten sich durch die erste Welle der Pandemie belastet. Im Vergleich zu der Zeit vor der Pandemie gaben die Kinder und Jugendlichen eine geminderte Lebensqualität an, der Anteil von Kindern und Jugendlichen mit psychischen Auffälligkeiten hat sich in etwa verdoppelt und ihr Gesundheitsverhalten hat sich verschlechtert. Sozial benachteiligte Kinder erlebten die Belastungen durch die Pandemie besonders stark. Zwei Drittel der Eltern wünschten sich Unterstützung im Umgang mit ihrem Kind.

Diskussion: Die COVID-19-Pandemie führt zu einer psychischen Gesundheitsgefährdung der Kinder und Jugendlichen, auf die präventiv mit niedrigschwelligen und zielgruppenspezifischen Angeboten in der Schule, in der ärztlichen Praxis und in der Gesellschaft im Sinne des Kinderschutzes reagiert werden sollte.

Schlüsselwörter: COVID-19; psychische Gesundheit; gesundheitsbezogene Lebensqualität; Belastungen; Kinder und Jugendliche

Mental health and psychological burden of children and adolescents during the first wave of the COVID-19 pandemic – Results of the COPSY study

Abstract

Background: The drastic changes during the COVID-19 pandemic may have a negative impact on psychological well-being of children and adolescents.

Objectives: COPSY is the first national, representative German study to examine mental health and quality of life of children and adolescents during the pandemic. Results are compared with data of the representative longitudinal BELLA study conducted before the pandemic.

Materials and methods: Internationally established instruments for measuring health-related quality of life and mental health (including anxiety and depressive symptoms) were administered to *n* = 1,586 parents with 7- to 17-year-old children and adolescents, of whom *n* = 1,040 11- to 17-year-olds also provided self-reports, from May 26 to June 10, 2020. Data were analyzed using descriptive statistics and bivariate tests.

Results: 71 % of the children and adolescents and 75 % of the parents felt burdened by the first wave of the COVID-19 pandemic. Compared to the time before the pandemic, the children and adolescents reported a lower health-related quality of life, the percentage of children and adolescents with mental health problems almost doubled, and their health behavior worsened. Socially disadvantaged children felt particularly burdened by the COVID-19 pandemic. Two thirds of the parents would like to receive support in coping with their child during the pandemic.

Conclusions: The COVID-19 pandemic poses a mental health risk to children and adolescents. Schools, doctors and society are called to react by providing low-threshold and target group-specific prevention and mental health promotion programs.

Keywords: COVID-19; mental health; health-related quality of life; mental health problems; children and adolescents

Einleitung

Durch die COVID-19-Pandemie und die damit einhergehende Implementierung von Infektionsschutzmaßnahmen wie Quarantäne und Kontaktbeschränkungen kam es zu massiven Veränderungen des täglichen Lebens. Innerhalb weniger Tage hatte sich seit März 2020 das Leben von 13 Millionen Kindern und Jugendlichen in Deutschland schlagartig verändert. Schulen und Kitas wurden geschlossen, Spielplätze waren gesperrt, der Kontakt zu Freunden und Angehörigen war eingeschränkt und die Kinder und Jugendlichen konnten ihren gewohnten Freizeitaktivitäten nicht mehr nachgehen.

Diese abrupten Veränderungen können für Kinder und Jugendliche kritische Lebensereignisse sein. Aus der Forschungsliteratur ist bekannt, dass kritische Lebensereignisse zu psychischen Problemen bei Kindern und Jugendlichen führen können [1, 2]. Ein Rapid Review (schnelle Evidenzsynthese) fand sieben präpandemische Studien, die beschreiben, dass Quarantäne zu Isolationsgefühlen, Stigmatisierung und Angst führen kann. Als häufigste in dem Zusammenhang auftretende psychische Störungen wurden die akute Belastungsreaktion, Anpassungsstörungen, Trauer und posttraumatische Belastungsstörungen gefunden. Zwei Studien, die während der COVID-19-Pandemie durchgeführt wurden, berichten von Unruhe, Gereiztheit, Anhänglichkeit und Unaufmerksamkeit sowie von einem zunehmenden Medienkonsum bei Kindern und Jugendlichen während der Quarantäne [3, 4].

Nicht-repräsentative Studien aus China zeigen, dass die COVID-19-bedingten Isolations- und Lockdown-Maßnahmen mit depressiven Symptomen (23 % bis 44 %) und Angstsymptomen (19 % bis 37 %) bei Kindern einhergehen [5, 6]. Eine Studie aus Indien berichtet über Sorgen (69 %), Hilflosigkeit (66 %) und Angst (62 %) bei Kindern während des Lockdowns [7]. Zusammenhänge zwischen Angst und der COVID-19-Pandemie fanden sich auch in einer aktuellen Studie aus Brasilien [8]. In Studien aus den USA berichten Eltern von einer schlechteren psychischen Gesundheit ihrer Kinder [9, 10] und in einer deutschlandweiten Studie gaben 18 % der Eltern an, dass sich ihre Kinder häufig Sorgen wegen der Corona-Krise machen [11]. Nicht-repräsentative Studien aus Spanien und Italien weisen ebenfalls darauf hin, dass Verhaltensprobleme, Reizbarkeit und Einsamkeit bei Kindern und Jugendlichen während der Pandemie zugenommen haben [3, 12]. Die nach unseren Recherchen erste längsschnittliche Studie stammt aus England und belegt, dass depressive Symptome unter Kindern und Jugendlichen während des Lockdowns deutlich zugenommen haben [13].

Während Kinder und Jugendliche vergleichsweise selten an COVID-19 erkranken und meist einen milden oder asymptomatischen Krankheitsverlauf aufweisen [14], legen die oben genannten Studien nahe, dass deren psychische Gesundheit während der Pandemie deutlich gefährdet ist. Kinder und Jugendliche stehen vor entwicklungsbedingten Herausforderungen wie dem Erwerb von Bildung und sozialer Kompetenz [15], der während der COVID-19-Pandemie erschwert ist.

Um die psychische Gesundheit, Lebensqualität und Belastung von Kindern und Jugendlichen während der Pandemie zu erfassen, wurde die COPSY-Studie (**Co**rona und **Psy**che) initiiert. Sie ist unseres Wissens die erste deutschlandweite repräsentative Studie zur psychischen Gesundheit und Lebensqualität von Kindern und Jugendlichen während der COVID-19-Pandemie, in der auch die Kinder und Jugendlichen selbst befragt werden. Die COPSY-Studie nutzt dabei das Befragungsinventar der repräsentativen longitudinalen BELLA-Studie (**Be**fragung zum see**l**ischen Wohl**l**befinden und Verh**a**lten), wodurch ein Vergleich der psychischen Gesundheit vor und während der Pandemie möglich ist. Darüber hinaus soll untersucht werden, welche Kinder und Jugendlichen besonders durch die Auswirkungen der COVID-19-Pandemie belastet werden und welche Unterstützung nötig ist.

Methoden

Studiendesign und Stichprobe

Die COPSY-Studie wurde in Anlehnung an das Design und die Methodik der repräsentativen longitudinalen BELLA-Kohortenstudie konzipiert. Die BELLA-Studie ist das Modul zur psychischen Gesundheit der Studie zur Gesundheit von Kindern und Jugendlichen in Deutschland (KiGGS), welche seit 2003 in Kooperation mit dem Robert Koch-Institut durchgeführt wird [16, 17]. In der BELLA-Studie wurden Kinder und Jugendliche sowie deren Eltern mittels international etablierter Instrumente zur psychischen Gesundheit und Lebensqualität befragt (nähere Informationen zur BELLA-Studie finden sich bei [17, 18]). Die resultierenden umfangreichen Datensätze wurden als bevölkerungsbasierte Referenzdaten vor der COVID-19-Pandemie zum Vergleich mit der COPSY-Stichprobe genutzt.

Die COPSY-Studie wurde vom 26. Mai bis zum 10. Juni 2020 vom Universitätsklinikum Hamburg-Eppendorf (UKE) in Zusammenarbeit mit der Infratest dimap Gesellschaft für Trend- und Wahlforschung mbH bundesweit durchgeführt. Während dieser Zeit befand sich Deutschland noch unter einem moderaten Lockdown. Erste Schulen und Freizeiteinrichtigungen wurden langsam wieder geöffnet und Kontaktbeschränkungen wurden gelockert. Kinder und Jugendliche sowie deren Eltern wurden zu den Auswirkungen der ersten Welle der COVID-19-Pandemie und der damit verbundenen Maßnahmen auf die psychische Gesundheit und Lebensqualität befragt.

Ingesamt wurden *n* = 3.597 Familien mit Kindern und Jugendlichen im Alter von 7 bis 17 Jahren zur Teilnahme an der COPSY-Studie eingeladen. Die Familien wurden kontaktiert, über die Studie informiert und um ihre Einwilligung zur Teilnahme gebeten. Insgesamt haben *n* = 1.586 Eltern von 7- bis 17-jährigen Kindern und Jugendlichen sowie *n* = 1.040 Kinder und Jugendliche im Alter von 11 bis 17 Jahren an der Studie teilgenommen und den Fragebogen online ausgefüllt. Es wurde ein Gewichtungsfaktor berechnet, damit die Stichprobe in den wesentlichen Merkmalen der Struktur der Grundgesamtheit der Eltern von Kindern im Alter von 7 bis 17 Jahren in Deutschland laut aktuellem Mikrozensus (2018) entspricht. Die COPSY-Studie wurde vorab von der Lokalen Psychologischen Ethikkommission am Zentrum für Psychosoziale Medizin (LPEK) des UKE ethisch und fachrechtlich beraten (LPEK-0151) sowie vom Datenschutzbeauftragten des UKE begleitet.

Erhebungsverfahren

Gemäß den Empfehlungen des *International Consortium for Health Outcomes Measurement* (ICHOM) [19] wurden international etablierte Fragebögen eingesetzt, um die gesundheitsbezogene Lebensqualität (KIDSCREEN-10 Index [20]), psychische Auffälligkeiten (Strenghts and Difficulties Questionnaire, SDQ [21]), generalisierte Ängstlichkeit (Screen for Child Anxiety Related Emotional Disorders, SCARED [22]) und depressive Symptome (Center for Epidemiological Studies Depression Scale for Children, CES-DC [23] und Patient Health Questionnaire, PHQ [24]) zu erheben.

Darüber hinaus wurde das Belastungserleben der Kinder und Jugendlichen sowie von deren Eltern mithilfe eines selbst entwickelten Items erfasst („Wie belastend waren Veränderungen im Zusammenhang mit der Corona-Krise für Sie/dich insgesamt?“; 5-stufige Antwortskala von 1 = *gar nicht belastend* bis 5 = *äußerst belastend*). Des Weiteren wurden folgende Aspekte des Gesundheitsverhaltens der Kinder und Jugendlichen erfasst. Der Medienkonsum wurde anhand von zwei selbst entwickelten Items erfragt („Wie viele Stunden verbringst du zurzeit insgesamt pro Tag mit Computer, Smartphone, Tablets, Spielekonsole (d.h. digitalen Medien) für schulische Aufgaben/für private Angelegenheiten?“ (Angaben in Stunden) sowie „Und ist das im Vergleich zur Zeit vor der Corona-Krise...?“ (Antwortoptionen: 1 = *viel weniger* bis 5 = *viel mehr*)). Die körperliche Aktivität wurde unter Nutzung eines Items aus der internationalen HBSC-Studie erhoben („An wie vielen Tagen hast du dich in der letzten Woche für mindestens 60 Minuten körperlich angestrengt?“), welches auf einer 8-stufigen Skala beantwortet wurde (1 = *0 Tage* bis 8 = *7 Tage*). Das Ernährungsverhalten der Kinder und Jugendlichen wurde mithilfe eines selbst entwickelten Items erfasst („Wenn du nochmals an die Zeit vor der Corona-Krise denkst: Hast du in der letzten Woche weniger, gleich viel oder mehr Süßigkeiten als vor der Corona-Krise gegessen?“; Antwortoptionen: 1 = *viel weniger* bis 5 = *viel mehr*).

Des Weiteren wurden die Eltern mithilfe von drei selbst entwickelten Items zu ihrem Unterstützungsbedarf befragt („Würden Sie sich im Umgang mit Ihrem Kind während der Corona-

Krise Unterstützung wünschen?“ (Antwortoptionen: 1 = *nein, nie* bis 4 = *ja, immer*), „In welchen Bereichen hätten Sie gern Unterstützung?“ (Antwortoptionen siehe Abbildung 4) sowie „Wie möchten Sie diese Unterstützung bekommen?“ (Antwortoptionen: 1 = *Schriftliches Online-Material*, 2 = *Online Videos*, 3 = *Fernsehsendungen*, 4 = *Podcasts*, 5 = *Telefonische Hotline*, 6 = *Online-Hotline*, 7 = *Persönliche Unterstützung von anderen Eltern (online)*, 8 = *Unterstützung von Freunden, Bekannten oder der Familie*, 9 = *Persönliche Unterstützung von Experten (online oder telefonisch)*, 10 = *Persönliches Gespräch mit einem Experten*, 11 = *Online-Selbsthilfegruppe für Eltern*, 12 = *Schule/Lehrer*, 13 = *Sonstiges*)).

Statistische Analysen

Die Datenauswertung erfolgte mithilfe deskriptiver Statistiken (absolute und relative Häufigkeiten, Mittelwerte und Standardabweichungen) sowie bivariater Tests (Chi-Quadrat-Tests). Alle Analysen wurden mit SPSS Version 26 durchgeführt. Signifikante Unterschiede zwischen Gruppen wurden bei einem Signifikanzniveau von $p < 0{,}05$ angenommen. Es wurden keine statistischen Adjustierungen für Alter und Geschlecht vorgenommen, da die Alters- und Geschlechtsstruktur der untersuchten Kollektive aufgrund der Gewichtung auf die Bevölkerungsverhältnisse als vergleichbar angesehen werden kann. Auch für Subgruppenanalysen (Migrationshintergrund, Bildungsstatus) erfolgte keine Adjustierung, da sich diese Gruppen in A-priori-Analysen nicht nennenswert in ihrer Alters- und Geschlechtsstruktur unterschieden (Ergebnisse nicht berichtet). Zum Vergleich der T-Werte, die aus dem Eltern- und Selbstbericht des KIDSCREEN-10 Index resultieren, wurde ein gepaarter T-Test durchgeführt. Die zugehörige Interraterreliabilität wurde mithilfe der Intraklassenkorrelation geprüft (einzelne Rater, absolute Übereinstimmung).

Ergebnisse

Insgesamt nahmen $n = 1.586$ Familien mit Kindern im Alter von 7 bis 17 Jahren ($M = 12{,}25$; $SD = 3{,}30$; 50,0 % weiblich) an der COPSY-Studie teil. Das durchschnittliche Alter der Eltern betrug 43,99 Jahre ($SD = 7{,}36$). Die Mehrheit der Kinder und Jugendlichen hatte keinen Migrationshintergrund (84,0 %). Die meisten Eltern hatten ein mittleres Bildungsniveau (55,7 %), waren verheiratet (69,2 %) und in Vollzeit angestellt (51,7 %). Weitere Charakteristika der Studienpopulation sind in Tabelle 1 beschrieben.

Belastungserleben in der ersten Welle der COVID-19-Pandemie

Insgesamt fühlten sich 71,4 % der Kinder und Jugendlichen und 75,4 % der Eltern durch die Pandemie und die damit einhergehenden Veränderungen belastet. Die Kinder und Jugendlichen fühlten sich vor allem dadurch belastet, dass sie das Home-Schooling als anstrengend empfanden (64,4 %), weniger Kontakt zu ihren Freunden hatten (82,8 %) und es häufiger

Streit in der Familie gab (27,6 %). Drei Viertel der Eltern (79,0 %) empfanden die Veränderung ihrer beruflichen Situation belastend.

Lebensqualität in der ersten Welle der COVID-19-Pandemie

Die Lebensqualität der Kinder und Jugendlichen – gemessen mit dem KIDSCREEN-10 Index – hat sich im Vergleich zu der Zeit vor der COVID-19-Pandemie deutlich verschlechtert: So gaben 40,1 % (*n*=418 [37,1 %; 43,1 %]) der befragten 11- bis 17-jährigen Kinder und Jugendlichen (*n*=1.040) während der Corona-Krise selbst eine geminderte gesundheitsbezogene Lebensqualität an, in der BELLA-Studie vor der Krise war dies nur bei 15,3 % (*n*=146 [13,0 %; 17,6 %]) der Kinder und Jugendlichen der Fall [25]. Die in der COPSY-Studie befragten Eltern der 7- bis 17-Jährigen (*n*=1.586) berichteten für 41,9 % (*n*=664 [39,5 %; 44,3 %]) ihrer Kinder eine geminderte Lebensqualität, für 54,9 % (*n*=870 [52,5 %; 57,4 %]) eine mittlere und für 3,2 % (*n*=52 [29,7 %; 34,3 %]) eine hohe Lebensqualität. Folgend werden die Verteilungen der Itemantworten zur Lebensqualität aus der COPSY-Studie dargestellt (Abbildung 1 gemäß Selbstbericht der 11- bis 17-Jährigen, Abbildung 2 gemäß Elternbericht für 7- bis 17-Jährige). Der Mittelwert der Lebensqualität (KIDSCREEN-10 Index) aus dem Elternbericht liegt für 7- bis 17-Jährige bei 41,17. Betrachtet man ausschließlich 11- bis 17-Jährige findet sich ein Wert von 42,36 und der entsprechende selbstberichtete Wert liegt signifikant höher bei 45,38 ($p < 0,001$). Der zugehörige Intraklassenkorrelationskoeffizient von 0,72 weist laut Cicchetti [26] auf eine gute Übereinstimmung hin.

Psychische Auffälligkeiten in der ersten Welle der COVID-19-Pandemie

Die Prävalenz für psychische Auffälligkeiten stieg von 17,6 % (*n*=273 [15,7 %; 19,5 %]) vor der COVID-19-Pandemie auf 30,4 % (*n*=482 [28,1 %; 32,7 %]) während der Krise. Damit wurden während der Pandemie für fast jedes dritte Kind psychische Auffälligkeiten (erhoben mit dem SDQ) berichtet, während vor der Pandemie etwa jedes fünfte Kind betroffen war.

Darüber hinaus berichteten 24,1 % (*n*=255 [21,9 %; 27,1 %]) der Kinder und Jugendlichen während der COVID-19-Pandemie Symptome einer generalisierten Angststörung (erhoben mit der entsprechenden Subskala des SCARED), vor der Krise war dies nur bei 14,9 % (*n*=198 [13,0 %; 16,8 %]) der Fall [25]. Die Kinder und Jugendlichen gaben während der Pandemie für sieben Items signifikant höhere Ängstlichkeitswerte als vor der Pandemie an, allerdings war die Stärke der gefundenen Unterschiede klein (s. Tabelle 2).

Im Hinblick auf die Häufigkeit depressiver Symptome ergab sich bei der Analyse der Summenwerte über die eingesetzten Items des CES-DC kein interpretierbarer Unterschied im Vergleich zum Zeitraum vor der Pandemie ($p > 0,05$ [25]). Gemäß dem PHQ-2 berichteten lediglich 11,1 % (*n*=115 [9,2 %; 13,0 %]) der 11- bis 17-Jährigen, beinahe jeden Tag bzw. an mehr als der Hälfte der Tage *wenig Interesse oder Freude an ihren Tätigkeiten* gehabt zu haben; 47,3 % der Befragten gaben dies für einzelne Tage an (*n*=492 [44,3 %; 50,3 %]) (überhaupt nicht: 41,6 % (n=433 [38,6 %; 44,6 %]). Ein Anteil von 6,6 % (n=67 [5,1 %; 8,1 %]) der Kinder und Jugendlichen erlebte beinahe jeden Tag bzw. an mehr als der Hälfte der Tage *Niedergeschlagenheit, Schwermut oder Hoffnungslosigkeit*, 20,0 % (n=208 [17,6 %; 22,4 %]) erlebten dies nur nur an einzelnen Tagen (überhaupt nicht: 73,5 % (n=764 [70,8 %; 76,2 %]).

Risiken

Besonders belastet waren Kinder und Jugendliche, deren Eltern einen niedrigen Bildungsabschluss haben, die einen Migrationshintergrund haben und/oder die auf beengtem Raum leben (<20qm Wohnfläche/Person). So berichteten beispielsweise Kinder, deren Eltern einen niedrigen Bildungsabschluss haben, mehr als doppelt so häufig, dass die Veränderungen durch die COVID-19-Pandemie äußerst belastend seien (s. Abbildung 3). Darüber hinaus berichtete ein Drittel (33,2 %) der Kinder, deren Eltern einen niedrigen Bildungsabschluss aufweisen, das Lernen sei im Vergleich viel anstrengender, während nur ein Fünftel (20,4 %) der Kinder mit Eltern, die einen hohen Bildungsabschluss aufweisen, das Lernen viel anstrengender wahrnahmen. Von den Eltern mit Migrationshintergrund berichteten 38,4 %, dass das Lernen für ihre Kinder viel anstrengender geworden sei, was nur 30,5 % der Eltern ohne Migrationshintergrund so empfanden.

Gesundheitsverhalten in der ersten Welle der COVID-19-Pandemie

Das Gesundheitsverhalten der Kinder und Jugendlichen (erfasst mit den oben beschriebenen Items) hat sich während der Pandemie verschlechtert. So berichteten mehr als zwei Drittel (69,9 %) der Kinder und Jugendlichen eine Zunahme ihres Medienkonsums. Ein Drittel (33,3 %) der Kinder und Jugendlichen verbrachte pro Tag vier Stunden oder mehr mit der Nutzung von Medien. Darüber hinaus gab ein Fünftel (19,3 %) an, gar keinen Sport zu machen und ein Viertel (26,3 %) berichtete, etwas bis viel mehr Süßigkeiten als vor der COVID-19-Pandemie zu essen.

Unterstützungsbedarf

Knapp zwei Drittel (63,0 %) der befragten Eltern wünschten sich im Umgang mit ihrem Kind während der COVID-19-Pandemie Unterstützung. Am häufigsten wünschten sich Eltern Unterstützung bei der Bewältigung der schulischen Anforderungen ihres Kindes, bei der Rückkehr des Kindes aus der Isolation und im Umgang mit dem Verhalten, den Gefühlen und Stimmungen des Kindes (s. Abbildung 4). Auf die Frage, wie bzw. von wem sich die Eltern diese Unterstützung wünschen, wurden am häufigsten Schule/Lehrer (65,2 %), Freunde/Familie (26,6 %), online/telefonische Unterstützung von Experten (20,2 %), persönliches Gespräch mit Experten (19,2 %) sowie schriftliche Materialien/Ratgeber (19,2 %) genannt.

Diskussion

Die COPSY-Studie zeigt als erste deutschlandweite repräsentative Studie zur psychischen Gesundheit und Lebensqualität von Kindern und Jugendlichen während der COVID-19-Pandemie, dass sich die Mehrheit der Kinder und Jugendlichen in Deutschland durch die Pandemie belastet fühlt. Im Vergleich zum Zeitraum vor der Pandemie hat sich die Lebensqualität der Kinder und Jugendlichen verschlechtert, Ängstlichkeit und die Häufigkeit psychischer Auffälligkeiten haben zugenommen, die Depressivität ist (noch) nicht signifikant nachweisbar gestiegen, allerdings könnten die Ergebnisse auf Itemebene eine entsprechende Tendenz andeuten.

Die Resultate der COPSY-Studie bestätigen die Ergebnisse bisheriger Studien aus China, Indien, den USA, Spanien und Italien, in denen eine Zunahme von Angst, Stress und anderen Belastungsreaktionen bei Kindern und Jugendlichen während der ersten Welle der Pandemie festgestellt wurde [3, 5-7, 10-12]. Unsere Resultate zu depressiven Symptomen bei Kindern und Jugendlichen stehen in (vermeintlichem) Widerspruch zu den Ergebnissen einer aktuellen britischen Longitudinalstudie, wonach Depressionen bei Kindern und Jugendlichen während der Pandemie bereits zugenommen haben [13]. Aus klinischer Perspektive kann vermutet werden, dass die Pandemie zunächst eher zu Angstreaktionen führte und nun mit einem monatelangen (sozialen) Verstärkerverlust depressive Entwicklungen stärker zu Tage treten werden. Diese Vermutung gilt es in der COPSY-Folgebefragung, welche während der zweiten Infektionswelle durchgeführt wird, zu untersuchen.

Die vorliegende Arbeit aus der bundesweiten COPSY-Studie beschreibt im Vergleich zu Vorpublikationen [25, 27] Veränderungen in der Lebensqualität, Angst und Depressivität vertiefend (auf der Itemebene). Zudem werden erstmals Daten bezogen auf das zunehmend kritische Gesundheitsverhalten der Kinder und Jugendlichen sowie zum Unterstützungsbedarf der Eltern berichtet. In bisherigen Publikationen zur COPSY-Studie wurde gezeigt, dass während der ersten Welle der Pandemie auch eine Zunahme psychosomatischer Beschwerden und psychischer Auffälligkeiten wie Hyperaktivität und Problemen mit Gleichaltrigen zu verzeichnen ist [25, 27]. Diese Ergebnisse stehen im Einklang mit Ergebnissen von Jiao et al. [4], die bei Schulkindern, die in häuslicher Quarantäne waren, auch vermehrt Hyperaktivität und Probleme mit Gleichaltrigen fanden. Erwähnenswert ist, dass körperliche Bewegung bzw. Sport zuhause helfen konnten, Hyperaktivität abzumildern. Darüber hinaus fanden Jiao et al. [4], dass die Ängstlichkeit der Eltern einen negativen Einfluss auf die Emotionalität der

Kinder hatte. Das Wechselspiel zwischen der psychischen Gesundheit der Kinder und der der Eltern wird vielfach diskutiert.
Zur Einschätzung der Lebensqualität durch verschiedene Beurteiler zeigt eine Übersichtsarbeit von Upton et al. [28], dass Eltern von gesunden Kindern die Lebensqualität ihrer Kinder höher einschätzen als die Kinder selbst; hingegen schätzen Eltern von kranken Kindern die Lebensqualität ihrer Kinder geringer ein als diese selbst. Dies konnte auch in Studien zur Interrater-Übereinstimmung zwischen Kindern mit ADHS (Aufmerksamkeitsdefizit-Hyperaktivitätsstörung) und deren Eltern nachgewiesen werden [29]. Die Pandemie mit ihren Herausforderungen ist eine kritische Situation, in der Eltern scheinbar ähnlich wie bei vorliegender Erkrankung ihres Kindes, dessen Lebensqualität tendenziell eher geringer als ihr Kind selbst einschätzen. Die gute Übereinstimmung beider Urteile in der COPSY-Studie ist eventuell auf die während der Studiendurchführung geltenden Maßnahmen und die daraus resultierende ausgeprägte räumliche Nähe in den Familien zurückzuführen.
Die COPSY-Studie zeigt, dass sich drei Viertel der Eltern durch berufliche Veränderungen während der Pandemie belastet fühlen und sich mehr Unterstützung wünschen. Aktuelle Studien aus den USA zeigen, dass ein Arbeitsplatzverlust und finanzielle Belastungen sowie Schwierigkeiten, die Kinderbetreuung zu gewährleisten, Risikofaktoren für die psychische Gesundheit der Eltern selbst als auch ihrer Kinder darstellen [9, 10]. Andere aktuelle Studien beschreiben, dass Eltern besonders gestresst sind und hohe Neurotizismuswerte haben, wenn sie jüngere bzw. viele Kinder haben, alleinerziehend sind oder wenn ihre Kinder emotionale, behaviorale oder andere psychische Störungen haben [30, 31]. Diese Eltern sind gefährdet, sich während der Pandemie sehr zu erschöpfen und ein „Burn-Out“ zu entwickeln [32]. Dies sollte bei zukünftigen politischen Entscheidungen im Rahmen weiterer Infektionswellen berücksichtigt werden [33].

Nach unserem Kenntnisstand zeigt die COPSY-Studie erstmals, dass sich das Gesundheitsverhalten der Kinder während der Pandemie verschlechtert hat: der Medienkonsum ist hoch, ein Fünftel der Kinder treibt keinen Sport und ein Drittel isst mehr Süßigkeiten als vor der COVID-19-Pandemie. Aktuelle internationale Studien weisen in eine ähnliche Richtung. Beispielsweise zeigte eine italienische Studie, dass der Medienkonsum von Kindern und Jugendlichen während der Pandemie um vier Stunden pro Tag zunahm, während die körperliche Aktivität um mehr als zwei Stunden pro Tag abnahm [34]. Ein erhöhter Konsum von Computerspielen während der Pandemie wurde von King et al. [35] beschrieben. Eine frühere Studie zeigt, dass ein verstärkter Medienkonsum auch mit Veränderungen von Essgewohnheiten einhergehen kann und somit das Risiko für Übergewicht und zugehörige Folgeerkrankungen steigen kann [36]. Eine weitere Studie zur Mediensucht bei Kindern während der

COVID-19-Pandemie weist daraufhin, dass ein Medienmissbrauch nicht nur Schlafgewohnheiten negativ beeinflussen, sondern sich auch negativ auf die Lebensqualität auswirken kann. Diese Studien lassen vermuten, dass sich die beschriebenen ungünstigen Gesundheitsverhaltensweisen und die Entwicklung psychischer Erkrankungen gegenseitig bedingen und vermutlich verstärken können. Dieses Wechselspiel stellt mittel- bis langfristig ein Gesundheitsrisiko für die Kinder und Jugendlichen dar. Die Entwicklung entsprechender Präventionsmaßnahmen zum Einsatz während dieser bzw. zukünftiger Pandemien ist daher dringend geboten.

Darüber hinaus ist das Ergebnis der COPSY-Studie relevant, dass Streitigkeiten in den Familien zunehmen und öfter eskalieren. In anderen Studien konnte bereits gezeigt werden, dass das Risiko von Kindesmissbrauch und Vernachlässigung in Krisenzeiten steigt [37, 38], sodass UNICEF und der Deutsche Kinderschutzbund zu Recht dringende Unterstützung vom Erziehungs- und Bildungssystem, von Ärzten und Politikern fordern, um Kinder und Jugendliche zu schützen. Bei weiteren Entscheidungen der Regierung sollten daher familienpolitische sowie kinder- und jugendhilferechtliche Perspektiven stärker berücksichtigt werden [38, 39].

Die vorliegende Studie zeigt auch, dass sozial benachteiligte Kinder und Jugendliche besonders stark von den Auswirkungen der COVID-19-Pandemie betroffen sind. Soziale Ungleichheiten in Bezug auf die psychische Gesundheit wurden bereits in zahlreichen Studien belegt [1, 40]. Um diese Ungleichheiten zu verringern, werden flächendeckende, zielgruppenspezifische und niedrigschwellige Angebote der Prävention und Gesundheitsförderung benötigt.

Um die Bewältigung der Krise von Kindern und Jugendlichen zu unterstützen, haben die Bundeszentrale für gesundheitliche Aufklärung (BzgA) [41] und das Bundesamt für Bevölkerungsschutz und Katastrophenhilfe (BBK) [42] Empfehlungen zur Unterstützung von Familien veröffentlicht, wie z.B. dass Eltern mit ihren Kindern über die Situation und ihre Sorgen offen sprechen mögen, dass ein strukturierter Tagesablauf mit festen Schlaf- und Essenszeiten Kindern Halt und Sicherheit vermitteln kann und dass Zeit an der frischen Luft und Bewegung helfen können, das Belastungserleben und Risiken für die psychische Gesundheit von Kindern und Jugendlichen abzubauen. Diese und weitere Empfehlungen zur Förderung der psychischen Gesundheit von Kindern und Jugendlichen während der Pandemie finden sich auch zunehmend in wissenschaftlichen Publikationen [43-47].

Die Stärken der vorliegenden Studie liegen im Einsatz international etablierter Fragebögen sowie im Vergleich der Ergebnisse mit der repräsentativen longitudinalen BELLA-Studie aus der Zeit vor der Pandemie. Aufgrund des Querschnittdesigns konnten jedoch keine kausalen

Zusammenhänge untersucht werden. Zudem wurden psychische Auffälligkeiten nicht mit klinischen Interviews diagnostiziert, sondern mit Screening-Fragebögen erfasst.

Die Ergebnisse der COPSY-Studie, vor allem auch die Ergebnisse zum Unterstützungsbedarf der Eltern, sollten Ärzte/Therapeuten, Lehrer/Erzieher, Eltern und Politiker anregen, die psychische Gesundheit und Belastungen sowie die Bedürfnisse von Kindern und Jugendlichen bei zukünftigen Infektionswellen und Entscheidungen stärker mit in den Blick zu nehmen. Es ist dringend zu empfehlen, belastete Kinder, Jugendliche und Eltern zu unterstützen, um deren psychische Gesundheit zu schützen bzw. aufrechtzuerhalten.

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Alle Autoren erklären, dass keine Interessenskonflikte vorliegen.

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Einhaltung ethischer Richtlinien

Alle beschriebenen Untersuchungen am Menschen wurden mit Zustimmung der zuständigen Ethik-Kommission, im Einklang mit nationalem Recht sowie gemäß der Deklaration von Helsinki von 1975 (in der aktuellen, überarbeiteten Fassung) durchgeführt. Von allen beteiligten Patienten liegt eine Einverständniserklärung vor.

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Tabelle 1. Beschreibung der Stichprobe

	Eltern von Kindern im Alter von 7 bis 17 Jahren (*n* = 1.586)		**Kinder und Jugendliche im Alter von 11 bis 17 Jahren** (*n* = 1.040)	
	***n* (%)**	***M (SD)***	***n* (%)**	***M (SD)***
Alter des Kindes		12,25 (3,30)		14,33 (1,86)
Geschlecht des Kindes				
Männlich	791 (49,9)		508 (48,8)	
Weiblich	793 (50,0)		531 (51,1)	
Divers	1 (0,1)		1 (0,1)	
Keine Angabe	1 (0,1)		-	
Alter der Eltern		43,99 (7,36)		46,28 (6,74)
Migrationshintergrund der Kinder				
Nein	1332 (84,0)		879 (84,5)	
Ja	254 (16,0)		161 (15,5)	
Elterliche Bildung*				
Niedrig	288 (18,2)		192 (18,5)	
Mittel	884 (55,7)		548 (52,7)	
Hoch	383 (24,1)		277 (26,6)	
Keine Angabe	31 (2,0)		23 (2,2)	
Familienstand der Eltern				
Ledig	140 (8,8)		87 (8,4)	
Verheiratet	1097 (69,2)		717 (68,9)	
In einer festen Beziehung	216 (13,6)		125 (12,0)	
In einer eingetragenen Lebenspartnerschaft	13 (0,8)		8 (0,8)	
Geschieden	108 (6,8)		92 (8,8)	
Verwitwet	12 (0,8)		11 (1,1)	
Berufstätigkeit der Eltern				
Angestellt in Vollzeit	820 (51,7)		561 (53,9)	
Angestellt in Teilzeit	453 (28,6)		286 (27,5)	
Selbstständig	67 (4,2)		49 (4,7)	
Anderes Beschäftigungsverhältnis	32 (2,0)		22 (2,1)	
Hausfrau/Hausmann	109 (6,9)		61 (5,9)	
Rentner/Pensionär	34 (2,1)		27 (2,6)	
In Elternzeit	29 (1,8)		7 (0,7)	
Nicht berufstätig	42 (2,6)		27 (2,6)	

Anmerkung: M = Mittelwert, *SD* = Standardabweichung, * Die Differenzierung in Eltern mit niedrigem, mittlerem und hohem Bildungsniveau erfolgte anhand der international etablierten CASMIN-Klassifikation (Comparative Analysis of Social Mobility in Industrial Nations)

Tabelle 2. Ängstlichkeit vor und während der ersten Welle der COVID-19-Pandemie aus Sicht der Kinder und Jugendlichen. Daten der BELLA- und COPSY-Studie im Verleich.

		BELLA Studie (*n*=1.333) **„trifft genau oder häufig zu“**		**COPSY-Studie (*n*=1.040)** **„trifft genau oder häufig zu“**		**Teststatistik**			
	Items zur Erfassung generalisierter Ängstlichkeit (SCARED-D)	*n*	*% [95%-Konfidenzintervall]*	*n*	*% [95%-Konfidenzintervall]*	*Chi*^{2}	*df*	*p-Wert*	*Effektstärke* ϕ
1	Ich mache mir Sorgen darüber, ob andere Menschen mich mögen.	70	5,3% [4,1%; 6,4%]	136	13,1% [11,0%; 15,2%]	43,13	1	<0,001	**0,14**
2	Ich bin nervös.	62	4,7% [3,5%; 5,8%]	49	4,7% [3,4%; 6,0%]	<0,01	1	0,945	-
3	Ich mache mir Sorgen, ob ich genauso gut bin wie andere Kinder.	54	4,1% [3%; 5,1%]	140	13,5% [11,4%; 15,5%]	68,76	1	<0,001	**0,17**
4	Ich mache mir Sorgen, ob alles gut läuft.	114	8,6% [7,1%; 10,1%]	150	14,4% [12,3%; 16,6%]	20,31	1	<0,001	0,09
5	Ich bin jemand, der sich viele Sorgen macht.	130	9,8% [8,2%; 11,3%]	133	12,8% [10,8%; 14,8%]	5,46	1	0,019	0,05
6	Andere sagen mir, dass ich mir zu viele Sorgen mache.	61	4,6% [3,5%; 5,7%]	115	11,1% [9,2%; 13,0%]	35,74	1	<0,001	**0,12**
7	Ich mache mir Sorgen darüber, was in der Zukunft geschehen wird.	169	12,7% [10,9%; 14,5%]	140	13,5% [11,4%; 15,6%]	0,32	1	0,574	-
8	Ich bin unsicher, ob ich meine Sache gut mache.	71	5,3% [4,1%; 6,5%]	132	12,7% [10,7%; 14,8%]	40,52	1	<0,001	**0,13**
9	Ich mache mir Sorgen über Dinge, die bereits geschehen sind.	51	3,8% [2,8%; 4,9%]	92	8,9% [7,1%; 10,6%]	26,00	1	<0,001	**0,10**

Angegeben ist jeweils die Anzahl / der Anteil von Kindern und Jugendlichen, die “trifft genau oder häufig zu“ angegeben haben (Antwortoptionen: 0=“trifft nicht oder fast nie zu“, 1=“trifft manchmal oder etwas zu“, 2=“trifft genau oder häufig zu“). Effektstärken, die auf kleine Effekte hinweisen, sind fett gedruckt (die verbleibenden Effekte für Items 4 und 5 sind aufgrund der geringen Effektstärke zu vernachlässigen). Die Teststatistik zeigt Resultate von Chi^2*-Tests zum Vergleich der Items über beide Studien (Vier-Feldertafel; hierfür wurden je Item und je Studie zwei Gruppen gebildet (Antwortoption 0 versus 1 und 2))*

Abbildung 1. Lebensqualität von Kindern und Jugendlichen in der ersten Welle der COVID-19-Pandemie. Antworten der 11- bis 17-Jährigen (KIDSCREEN-10 Index, n=1.040), Zeitraum: 26.5.-10.06.2020, Ergebnisse der COPSY-Studie.

Anteile jeweils in ganzzahligen Prozentwerten.
*Antwortoptionen: „sehr“, „ziemlich“, „mittelmäßig“, „ein wenig“ und „überhaupt nicht“.

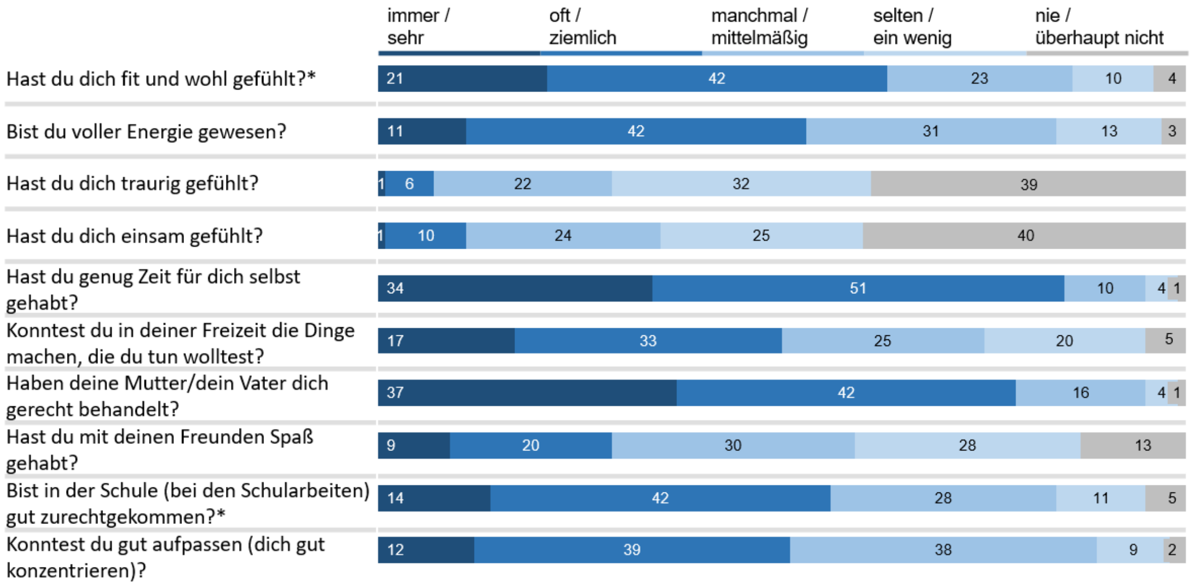


Abbildung 2. Lebensqualität von Kindern und Jugendlichen in der ersten Welle der COVID-19-Pandemie. Antworten der Eltern von 7- bis 17-Jährigen (KIDSCREEN-10 Index, n=1.568), Zeitraum: 26.5.-10.06.2020, Ergebnisse der COPSY-Studie.

Anteile jeweils in ganzzahligen Prozentwerten.
*Antwortoptionen: „sehr“, „ziemlich“, „mittelmäßig“, „ein wenig“ und „überhaupt nicht“.

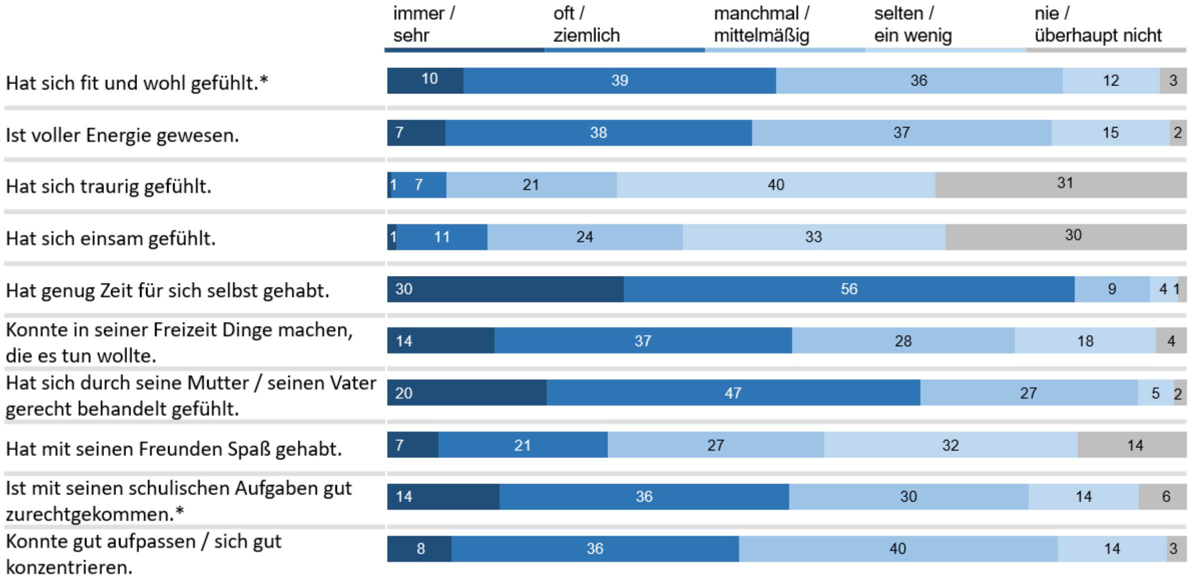


Abbildung 3. Belastungsempfinden der Kinder und Jugendlichen in der ersten Welle der COVID-19-Pandemie stratifiziert nach Bildungsstand der Eltern. Zeitraum: 26.5.-10.06.2020, Ergebnisse der COPSY-Studie

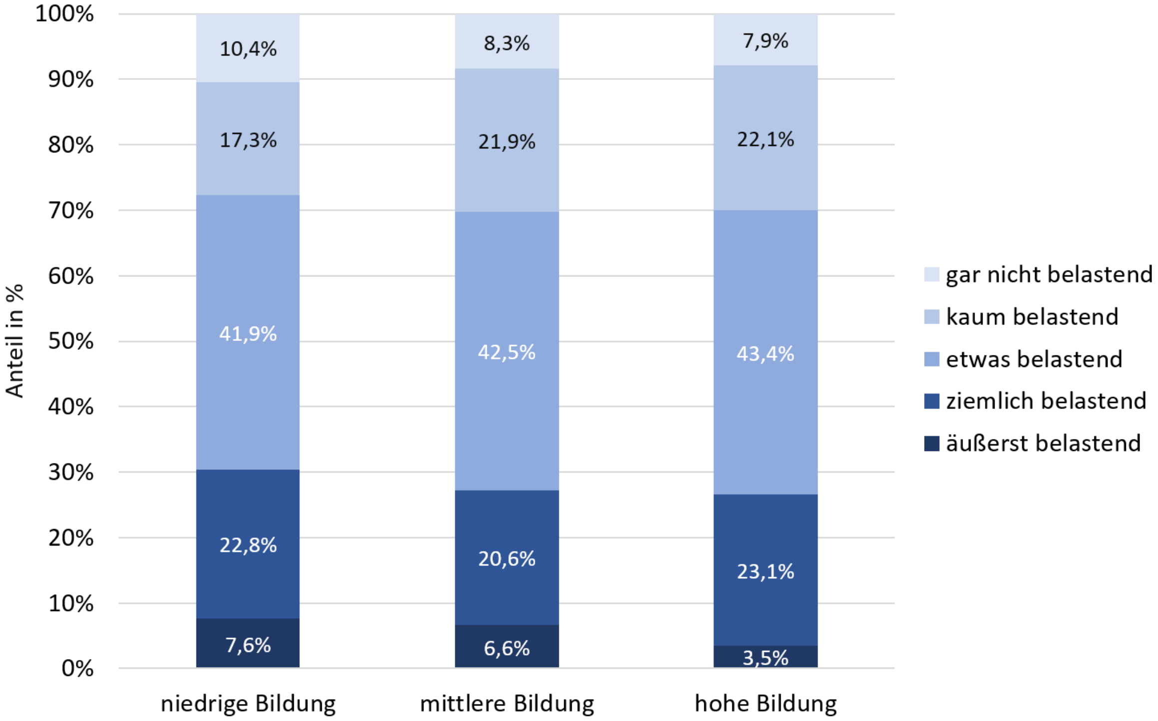
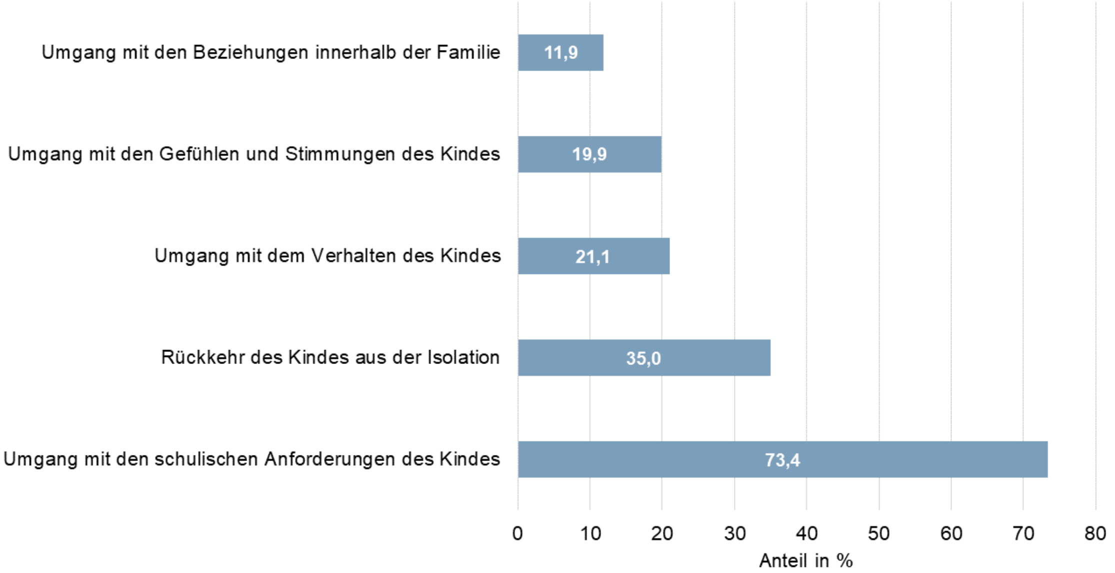


Abbildung 4. Bereiche, in denen Eltern sich Unterstützung wünschen im Zusammenhang mit ihrem Kind in der ersten Welle der COVID-19-Pandemie. Zeitraum: 26.5.-10.06.2020, Ergebnisse der COPSY-Studie

(Mehrfachnennungen waren möglich; angegeben ist der Prozentsatz der Eltern mit Unterstützungsbedarf, der sich die jeweils genannte Unterstützung wünschte)



VI Zusammenfassung auf Deutsch und Englisch

Background. The high prevalence of mental and behavioural health problems in children and adolescents is regarded as one of the global health challenges. The issue has grown in importance in light of the current COVID-19 pandemic. The thesis aims to increase knowledge about the epidemiology of mental health to inform the development of effective strategies for mental health promotion and prevention of mental disorders in children and adolescents. Findings on prevalences and trajectories of mental health, long-term effects of mental health problems, the assessment of and risk and resource factors associated with behavioural problems and the mental health impact of the COVID-19 pandemic are presented.

Methods. Analyses were based on data from the WHO's collaborative cross-national HBSC study, the longitudinal BELLA study, the interdisciplinary ADOPT study and the population-based representative COPSY study. Mental health, mental health problems and risk and resource factors were assessed using standardised and established measures. Descriptive analyses, bivariate comparisons, multiple linear and logistic regression analyses, individual and latent growth modeling were conducted to analyse the cross-sectional and longitudinal data. For instrument development and evaluation, qualitative analyses and psychometric analyses were performed.

Results. Age- and gender-specific prevalences and trajectories were identified, indicating that mental health and HRQoL are better in boys compared to girls and decrease with age. Longitudinal analyses further revealed that mental health problems in childhood predict impaired (mental) health in adulthood. The PROMIS Anger Scale and the DADYS-Screen proved to be psychometrically sound, reliable and valid measures of behavioural problems in children. Furthermore, parental psychopathology was identified as a risk factor, and family climate and social support were found to be resources for children and adolescents with behavioural problems. The COVID-19 pandemic was associated with a decrease in HRQoL and an increase in mental and behavioural health problems, particularly in socially disadvantaged children.

Discussion. The early detection of children who are at risk of experiencing mental health problems and the development of resource-oriented approaches to promote mental health and to prevent mental disorders in children and adolescents represent a public health priority. This is particularly important in times of crisis, such as the COVID-19 pandemic, to reduce the increasing burden of mental health problems worldwide.

Hintergrund: Die hohe Prävalenz psychischer Auffälligkeiten im Kindes- und Jugendalter gilt als eine der globalen gesundheitlichen Herausforderungen, die angesichts der COVID-19-Pandemie an Bedeutung gewonnen hat. Das Ziel der Dissertation ist es, das Wissen über die Epidemiologie psychischer Auffälligkeiten zu erweitern, um einen Beitrag zur Entwicklung von Angeboten der Gesundheitsförderung und Prävention zu leisten. Es werden Ergebnisse zu alters- und geschlechtsspezifischen Prävalenzen und Verläufen von psychischer Gesundheit, zu Langzeitfolgen von psychischen Auffälligkeiten, zur Erfassung von Verhaltensauffälligkeiten, zu Risiken und Ressourcen sowie zu den psychosozialen Folgen der COVID-19-Pandemie vorgestellt.

Methoden: Die Analysen basieren auf Daten der internationalen HBSC-Studie, der longitudinalen BELLA-Studie, der interdisziplinären ADOPT-Studie und der bevölkerungsbasierten, repräsentativen COPSY-Studie. Die psychische Gesundheit, psychische Auffälligkeiten sowie Risiken und Ressourcen wurden anhand standardisierter und etablierter Instrumente erfasst. Die Quer- und Längsschnittdaten wurden mittels deskriptiver Analysen, bivariater Vergleiche, multipler Regressionen sowie individueller und latenter Wachstumsmodelle analysiert. Die Entwicklung und Evaluation der Instrumente erfolgten anhand qualitativer sowie psychometrischer Analysen.

Ergebnisse: Alters- und geschlechtsspezifische Prävalenzen und Verläufe zeigten, dass Jungen im Vergleich zu Mädchen eine bessere psychische Gesundheit aufweisen und dass diese mit dem Alter abnimmt. Darüber hinaus gingen psychische Auffälligkeiten in der Kindheit mit Beeinträchtigungen in der (psychischen) Gesundheit im Erwachsenenalter einher. Die PROMIS Anger Scale und der DADYS-Screen erwiesen sich als reliable und valide Instrumente zur Erfassung von Verhaltensauffälligkeiten. Darüber hinaus wurde die elterliche Psychopathologie als Risikofaktor für Verhaltensauffälligkeiten bei Kindern und Jugendlichen identifiziert, wohingegen sich das Familienklima und die soziale Unterstützung als wichtige Ressourcen erwiesen. Die COVID-19-Pandemie ging mit einer geminderten Lebensqualität und einem erhöhten Risiko für psychische Auffälligkeiten einher, insbesondere bei sozial benachteiligten Kindern.

Diskussion: Die frühzeitige Diagnostik von psychischen Auffälligkeiten bei Kindern und Jugendlichen sowie die Entwicklung ressourcenorientierter Ansätze der Gesundheitsförderung und Prävention sind besonders in Krisenzeiten wie der COVID-19-Pandemie wichtig, um die zunehmende globale Belastung durch psychische Auffälligkeiten zu reduzieren.

VII Erklärung des Eigenanteils an den Publikationen

1. **Kaman, A.**, Ottová-Jordan, V., Bilz, L., Sudeck, G., Moor, I., & Ravens-Sieberer, U. (2020). Subjektive Gesundheit und Wohlbefinden von Kindern und Jugendlichen in Deutschland – Querschnittergebnisse der HBSC-Studie 2017/18. *Journal of Health Monitoring,* 5(3), 7-21. doi: 10.25646/6891
   Eigenanteil: Anne Kaman war substanziell an der Datenerhebung der HBSC-Studie beteiligt und erstellte die Konzeption des Artikels. Sie führte die Literaturrecherche sowie alle statistischen Analysen durch, interpretierte die Ergebnisse, verfasste das Manuskript und übernahm die Hauptverantwortung im Einreichungs- und Reviewprozess.

2. Otto, C., Reiss, F., Voss, C., **Wüstner, A.**, Meyrose, A.-K., Hölling, H., & Ravens-Sieberer, U. (2020). Mental health and well-being from childhood to adulthood: Design, methods and results of the 11-year follow-up of the BELLA study. *European Child & Adolescent Psychiatry.* doi: 10.1007/s00787-020-01630-4
   Eigenanteil: Anne Kaman war an der Datenerhebung des 11-Jahres Follow-up der BELLA-Studie beteiligt, führte Literaturrecherchen durch, diskutierte und interpretierte gemeinsam mit den Ko-Autorinnen die Ergebnisse, verfasste Teile des Manuskripts, redigierte das gesamte Manuskript und unterstütze im Reviewprozess.

3. **Kaman, A.**, Otto, C., Devine, J., Döpfner, M., Banaschewski, T., Görtz-Dorten, A., ... Ravens-Sieberer, U. (under review). Assessing anger and irritability in children: Translation, psychometric evaluation and normative data for the German version of the PROMIS® Parent Proxy Anger Scale. *Quality of Life Research*
   Eigenanteil: Anne Kaman erstellte die Konzeption für die Publikation und war substanziell an der Datenerhebung der ADOPT-Studie beteiligt. Sie führte die Literaturrecherche und alle statistischen Analysen durch, interpretierte die Ergebnisse, verfasste das Manuskript und übernahm die Einreichung.

4. Otto, C.*, **Kaman, A.***, Barkmann, C., Döpfner, M., Görtz-Dorten, A., Ginsberg, C., ... Ravens-Sieberer, U. (under review). The DADYS-Screen – Development and evaluation of a screening tool for affective dysregulation in children. *Assessment*.
   *shared first authorship
   Eigenanteil: Anne Kaman war substanziell an der Entwicklung des Screening-Instruments und an der Datenerhebung der ADOPT-Studie beteiligt. Sie erarbeitete gemeinsam mit Christiane Otto die Konzeption der Publikation, führte die Delphi-

Befragung und Fokusgruppeninterviews durch, analysierte die qualitativen Daten, diskutierte und interpretierte gemeinsam mit den Ko-Autor/innen die Ergebnisse, verfasste wesentliche Teile des Manuskripts und übernahm die Einreichung.

5. **Wüstner, A.**, Otto, C., Schlack, R., Hölling, H., Klasen, F., & Ravens-Sieberer, U. (2019). Risk and protective factors for the development of ADHD symptoms in children and adolescents: Results of the longitudinal BELLA study. *PLoS One,* 14(3), e0214412. doi: 10.1371/journal.pone.0214412
   Eigenanteil: Anne Kaman erarbeitete gemeinsam mit Christiane Otto die Konzeption und Modellbildung der Publikation, führte die Literaturrecherche durch und diskutierte und interpretierte gemeinsam mit Christiane Otto die Ergebnisse. Sie verfasste die Einleitung und Diskussion des Manuskripts, redigierte und ergänzte den Methoden- und Ergebnisteil und übernahm die Hauptverantwortung im Einreichungs- und Reviewprozess.
6. Ravens-Sieberer, U.*, **Kaman, A.***, Erhart, M., Devine, J., Schlack, R., & Otto, C. (2021). Impact of the COVID-19 pandemic on quality of life and mental health in children and adolescents in Germany. *European Child & Adolescent Psychiatry.* doi: 10.1007/s00787-021-01726-5 *shared first authorship
   Eigenanteil: Anne Kaman war substanziell an der Planung und Datenerhebung der COPSY-Studie sowie an der Konzeption des Artikels beteiligt. Sie führte Literaturrecherchen und einen Teil der statistischen Analysen durch, diskutierte und interpretierte gemeinsam mit den Ko-Autor/innen die Resultate, verfasste Teile des Manuskripts, redigierte das gesamte Manuskript, übernahm die Einreichung und unterstützte die erfolgreiche Überarbeitung des Manuskripts im Reviewprozess.
7. Ravens-Sieberer, U.*, **Kaman, A.***, Otto, C., Adedeji, A., Napp, A.-K., Becker, M., ... Hurrelmann, K. (in press). Seelische Gesundheit und psychische Belastungen von Kindern und Jugendlichen in der ersten Welle der COVID-19-Pandemie – Ergebnisse der COPSY-Studie. *Bundesgesundheitsblatt – Gesundheitsforschung – Gesundheitsschutz.* doi: 10.1007/s00103-021-03291-3 *shared first authorship
   Eigenanteil: Anne Kaman war an der Konzeption der Publikation sowie an der Datenerhebung der COPSY-Studie beteiligt. Sie führte Literaturrecherchen und einen Teil der statistischen Analysen durch, diskutierte und interpretierte gemeinsam mit den Ko-Autor/innen die Ergebnisse, erstellte den ersten Manuskriptentwurf, übernahm die Einreichung sowie wesentliche Arbeit im Reviewprozess.

VIII Danksagung

An dieser Stelle möchte ich mich bei allen Personen bedanken, die mich in den letzten drei Jahren begleitet und bei der Anfertigung meiner Dissertation unterstützt haben.

Mein besonderer Dank gilt meiner Doktormutter Frau Prof. Dr. Ulrike Ravens-Sieberer, die mich mit viel Engagement und stetiger Unterstützung begleitet hat und mir mit wertvollen Diskussionen und Anregungen zur Seite stand. Auch möchte ich den Mitgliedern meines Thesis-Komitees, Frau Prof. Dr. Monika Bullinger und Herrn Prof. Dr. Michael Schulte-Markwort, für die Betreuung und den konstruktiven Austausch danken.

Meinen Kolleginnen und Kollegen der Forschungssektion *Child Public Health* am UKE gilt ebenfalls mein ganz besonderer Dank. Frau PD Dr. Christiane Otto danke ich für die beispiellose Unterstützung, die vielen anregenden Gespräche und die hervorragende Zusammenarbeit in unseren Projekten und bei Publikationen. Frau Dr. Ann-Katrin Meyrose und Frau Dr. Franziska Reiß gilt mein Dank für die wertschätzende Zusammenarbeit und Herrn Dr. Claus Barkmann danke ich für den fachlichen Austausch und die vielen hilfreichen methodischen Ratschläge.

Darüber hinaus danke ich allen studentischen Mitarbeiterinnen und Mitarbeitern für die Unterstützung bei den Datenerhebungen, allen beteiligten Kooperationspartnern für die konstruktive Zusammenarbeit und allen Familien, Kindern und Jugendlichen für die Teilnahme an den Studien.

Mein tiefster Dank gilt meinem Mann und meiner Familie, die mich bedingungslos unterstützt haben, mich stets auf meinem Weg ermutigt und an mich geglaubt haben.

IX Lebenslauf

Der Lebenslauf wurde aus datenschutzrechtlichen Gründen entfernt.

X Schriftenverzeichnis

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Adedeji, A., Otto, C., **Kaman, A.**, Reiss, F., Devine, J., & Ravens-Sieberer, U. (under review). Peer relationships and depressive symptoms among adolescents: Results from the German BELLA study. *Depression and Anxiety*

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XI Eidesstattliche Erklärung

Ich versichere ausdrücklich, dass ich die Arbeit selbständig und ohne fremde Hilfe verfasst, andere als die von mir angegebenen Quellen und Hilfsmittel nicht benutzt und die aus den benutzten Werken wörtlich oder inhaltlich entnommenen Stellen einzeln nach Ausgabe (Auflage und Jahr des Erscheinens), Band und Seite des benutzten Werkes kenntlich gemacht habe.

Ferner versichere ich, dass ich die Dissertation bisher nicht einem Fachvertreter an einer anderen Hochschule zur Überprüfung vorgelegt oder mich anderweitig um Zulassung zur Promotion beworben habe.

Ich erkläre mich einverstanden, dass meine Dissertation vom Dekanat der Medizinischen Fakultät mit einer gängigen Software zur Erkennung von Plagiaten überprüft werden kann.

Hamburg, den 12.02.2021

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