Aus dem Zentralinstitut für Seelische Gesundheit

Institut für Neuropsychologie und Klinische Psychologie (Seniorprofessorin: Prof. Dr. Dr. h.c. Dr. h.c. Herta Flor)

The Relation Between Risk Factors for Adolescent Alcohol Use in the Context of Problem Behavior Theory

Inaugural dissertation

zur Erlangung des Doctor scientiarum humanarum (Dr. sc. hum.)

an der

Medizinischen Fakultät Mannheim

der Ruprecht-Karls-Universität

zu

Heidelberg

vorgelegt von Maren Prignitz

aus

Freital

2024

Dekan: Prof. Dr. med. Sergij Goerdt Referentin: Frau Prof. Dr. rer. soc. Dr. h.c. Dr. h.c. Herta Flor

To Linda

Words cannot express what your support means to me

TABLE OF CONTENTS

A	BBR	EVATION	IS	6		
P]	REFA	ACE		7		
1	INT	RODUCTI	ION			
	1.1	Forms of m	aladaptation and problem behaviors			
		1.1.1	Alcohol use	16		
		1.1.2	Bullying			
	1.2	Biological	requirements and problem behavior: bio-psychologica	al developmental		
		processes d	uring adolescence			
	1.3	.3 The behavioral system as a condition for problem behavior				
		1.3.1	Subsystem emotion	21		
		1.3.2	Emotional changes during adolescence	25		
		1.3.3	Emotion regulation			
	1.4 Social context of problem behavior					
		1.4.1	Microsocial context			
		1.4.2	Macrosocial factors			
	1.5	Aims and h	ypotheses			
2	ORIGINAL CONTRIBUTIONS					
	2.1	1 The Role of Empathy in Alcohol Use of Bullying Perpetrators and Victims: Lower				
		Personal Er	npathic Distress Makes Male Perpetrators of Bullying M	ore Vulnerable to		
		Alcohol Us	e			
	2.2	The Association Between Emotion Regulation and Alcohol Use in Adolescence Is				
		Moderated by Interoception and Affective Empathy76				
2.3 Jugendliches Alkoholkonsumverhalten während der			es Alkoholkonsumverhalten während der COVID-19-P	andemie und die		
		Bedeutung	von Achtsamkeit			
3	GENERAL DISCUSSION148					
	3.1	Summary o	f findings			

	3.2	Integration	of the findings	
		3.2.1	Bullying	
		3.2.2	Empathy	
		3.2.3	Interoception	
		3.2.4	Emotion regulation	
		3.2.5	Macrosocial factors: the COVID-19 pandemic	
	3.3	Limitations	and implications	
4	COl	NCLUSION	۱	
5	SUN	MMARY		
	5.1	Summary		
	5.2	Zusammenf	assung	
6	REF	FERENCES		
7	CUI	RRICULU	A VITAE	
8	ACI	KNOWLEI	DGEMENTS	

ABBREVATIONS

PBT = Problem Behavior Theory

PREFACE

This publication-based cumulative dissertation includes two previously published papers and on manuscript in preparation for submission.

The first publication "The Role of Empathy in Alcohol Use of Bullying Perpetrators and Victims: Lower Personal Empathic Distress Makes Male Perpetrators of Bullying More Vulnerable to Alcohol Use" (section 2.1 of the dissertation), of which I am the sole first author, was published in the *International Journal of Environmental Research and Public Health* (impact factor: none since April 2023, previously 4.614) in July 2023. For this original research, I contributed 90% of the conceptual design, 100% each of literature research and data analysis, 95% if the interpretation of results, and 90% each of drafting and revising the manuscript. I was not involved in ethics approval and data collection for this study. The data used in this study was acquired as part of a large longitudinal cohort study. The data are complex and multimodal, which required an in-depth data quality control and review process, which I have conducted to prepare the data for analyses in relation to the research question. All calculations, tables and research results in the publication are my own work.

The second publication "Jugendliches Alkoholkonsumverhalten während der COVID-19-Pandemie und die Bedeutung von Achtsamkeit" (section 2.3 of the dissertation, English title: "Adolescence Alcohol Use Behaviours During the COVID-19 Pandemic and the Role of Mindfulness"), of which I am the sole first author, was published in the journal *SUCHT* (impact factor: 1.8) in December 2021. For this original research, I contributed 75% of the conceptual design, 60% of literature research and 50% of the ethical application. In addition, I was responsible for 90% of the data collection, 90% of the data analysis, 90% of the interpretation of the results, and 70% of the drafting of the manuscript, and was involved in revising the manuscript with 90%.

The manuscript of the original research paper "The Association Between Emotion Regulation and Alcohol Use in Adolescence Is Moderated by Interoception and Affective Empathy" (section 2.2 of the dissertation), of which I am the sole first author, is in preparation for submission to the journal *Addictive Behaviors* (impact factor 4.591). I contributed 80% to the conceptual design, 100% to the literature research, 90% to the data collection, 100% each to the data analysis and interpretation of results, and 90% to the drafting of the manuscript. I was not involved in the ethics application for the study. Detailed information on my participation in the respective publications can also be found in the attached form.

Darstellung der Eigenleistung der Doktorandin/des Doktoranden

bei kumulativen Dissertationen

Name der Doktorandin/des Doktoranden
Titel der Dissertation
Betreut durch

- □ Ich möchte eine kumulative Dissertation einreichen und bitte den Promotionsausschuss zu prüfen, ob die vorgeschlagenen Publikationen quantitativ und qualitativ ausreichen, um die Anforderungen an eine kumulative Dissertation zu erfüllen.
- □ Der Promotionsausschuss hat zuvor geprüft, ob meine Publikationen für eine kumulative Dissertation geeignet sind, und dies ist eine abschließende Übersicht über die in meiner kumulativen Dissertation enthaltenen Publikationen.

1. Liste der peer-reviewed Publikationen, die in die kumulative Dissertation aufgenommen werden. Geben Sie für jede Publikation eine vollständige Liste der Autoren, den Titel, die Zeitschrift, den Impact Factor der Zeitschrift an und ob das Manuskript zur Veröffentlichung angenommen wurde, sich nach der Begutachtung in Überarbeitung befindet oder eingereicht wurde und zur Begutachtung ansteht. Geteilte Erstautorenschaften sollten deutlich angegeben werden. Bitte geben Sie auch an, ob es sich bei der Publikation um einen Original-Forschungsbericht, einen Review oder eine andere Art von Artikel handelt.

Publikation 1	 	 	
Publikation 2	 	 	
Publikation 3	 	 	

2. Zusammenfassung des Beitrags der Doktorandin/des Doktoranden zu der in jedem Manuskript berichteten Arbeit

Arbeitsschritte	Publikation 1	Publikation 2	Publikation 3
Konzeption (%)			
Literaturrecherche (%)			
Ethikantrag (%)			
Tierversuchsantrag (%)			
Datenerhebung (%)			
Datenauswertung (%)			
Ergebnisinterpretation (%)			
Verfassen des Manuskripttextes (%)			
Revision (%)			
Geben Sie an, welche Abbildungen/			
Tabellen aus Ihrer Doktorarbeit entstanden			
sind.			
Geben Sie im Einzelnen an, welche			
Daten/Zahlen/Tabellen auf Forschungser-			
gebnissen von anderen beruhen.			

3. Die Mindestanzahl der Publikationen, die für eine publikationsbasierte kumulative Dissertation erforderlich sind, ist in den "Ausführungsbestimmungen zu publikationsbasierten Dissertationen" festgelegt. Im Falle einer gemeinsamen Erstautorenschaft oder einer Letztautorenschaft begründen Sie bitte unten, warum die Veröffentlichung einer einzelnen Erstautorenschaft gleichgestellt werden soll.

4. Ich bestätige hiermit, dass dies eine wahrheitsgetreue Darstellung des Beitrags der Doktorandin/des Doktoranden zu den aufgeführten Publikationen ist.

Unterschrift der Doktorandin bzw. des Doktoranden

Unterschrift der Betreuerin bzw. des Betreuers

Anlage 1

Detaillierte Informationen zu den in der kumulativen Dissertation verwendeten Publikationen

1. Publikation:

Titel: The Role of Empathy in Alcohol Use of Bullying Perpetrators and Victims: Lower Personal Empathic Distress Makes Male Perpetrators of Bullying More Vulnerable to Alcohol use

Autorenliste:

Maren Prignitz, Tobias Banaschewski, Arun L. W. Bokde, Sylvane Desrivières, Antoine Grigis, Hugh Garavan, Penny Gowland, Andreas Heinz, Jean-Luc Martinot, Marie-Laure Paillère Martinot, Eric Artiges, Dimitri Papadopoulos Orfanos, Luise Poustka, Sarah Hohmann, Juliane H. Fröhner, Lauren Robinson, Michael N. Smolka, Henrik Walter, Jeanne M. Winterer, Robert Whelan, Gunter Schumann, Frauke Nees, Herta Flor and on behalf of the IMAGEN Consortium

Zeitschrift: International Journal of Environmental Research and Public Health

Impact-Factor der Zeitschrift: seit April 2023 keinen, zuvor: 4,614

Status des Manuskripts: Veröffentlicht am 03.07.2023

Art des Artikels: Original-Forschungsbericht

Angaben zum Beitrag der Doktorandin am Manuskript: "Geben Sie im Einzelnen an, welche Daten/Zahlen/Tabellen auf Forschungsergebnissen von anderen beruhen":

Die Daten für diese Publikation stammen aus einer großen, längsschnittlichen Studie. Es handelt sich hierbei um komplexe und multimodale Daten, die für das Verfassen der Publikation von mir in einem aufwändigen Verfahren kontrolliert und aufbereitet wurden, um sie für meine Datenanalysen in Hinblick auf die Fragestellung nutzbar zu machen. Alle Zahlen/Berechnungen, Tabellen und Forschungsergebnisse der Publikation sind wiederum eine eigenständige Leistung meinerseits.

2. Publikation:

Titel: Jugendliches Alkoholkonsumverhalten während der COVID-19-Pandemie und die Bedeutung von Achtsamkeit

Autorenliste: Maren Prignitz, Stella Guldner, Frauke Nees und IMAC-Mind Konsortium

Zeitschrift: SUCHT

Impact-Factor der Zeitschrift: 1,8

Status des Manuskripts: Veröffentlicht am 10.12.2021

Art des Artikels: Original-Forschungsbericht

3. Publikation:

Titel: The Association Between Emotion Regulation and Alcohol Use in Adolescence Is Moderated by Interoception and Affective Empathy

Autorenliste:

Maren Prignitz, Stella Guldner, Michaela Ruttorff, Frauke Nees and the IMAC-Mind Consortium

Zeitschrift: geplant ist Einreichung bei "Addictive Behaviors"

Impact-Factor: der geplanten Zeitschrift ist 4,591

Status des Manuskript: In Vorbereitung für Einreichung

Art des Artikel: Original-Forschungsbericht

1 INTRODUCTION

"Most of us remember adolescence as a kind of double negative: no longer allowed to be children, we are not yet capable of being adults."

Julian Barnes (2012)

Every human being goes through developmental stages over the course of their life. Adolescence, as the transitional period between childhood and adulthood, is an especially important step in a person's life, with not only physical development but also important social changes in a comparatively short time span.

At this crucial stage of development, adolescents are not only confronted with these biological and social changes but also have to cope with the resulting developmental tasks in order to integrate themselves into society. In his psychosocial *theory of developmental crises*, Erikson (1973) identified adolescence as an important stage in the developmental process during which individuals seek to establish an identity that will enable them to successfully navigate the adult world. Similarly, Havighurst's (1948) *theory of developmental tasks* suggests that we face different developmental tasks at different stages of life, which include biological, sociological and psychological aspects (Oerter & Dreher, 2002). Within this theory, development is seen as a learning process that prepares individuals to successfully meet the demands of society through the acquisition of skills and competencies (Oerter & Dreher, 2002). According to Havighurst (1948), the developmental tasks associated with adolescence include dealing with the changing body, building relationships with peers of both sexes, gaining emotional independence from parents, adopting cultural norms and gender roles, considering one's professional future, and developing one's own values and moral concepts (Dreher & Dreher, 1985).

Given the abundance of change and challenges this phase brings with it, it is easy to understand what Julian Barnes means when he describes something that most of us have indeed experienced in one way or another: adolescence as a phase of finding ourselves in an area of conflict between the old (childhood) and the new (adulthood), muddling our way through it. This time of conflict can and often will lead to successful development and an integration into the adult world – but we also find a range of maladaptive behaviors in adolescence, such as depression, anxiety, substance use, aggressive behavior, drunk driving, unprotected sexual intercourse or truancy. In addition, these problem behaviors mostly do not occur in isolation but often go hand in hand with each other (Weichold & Blumenthal, 2018; Jessor, 1991).

In their *Problem Behavior Theory* (PBT), Jessor and Jessor (1977) consider behavior that does not conform to social or legal norms and is usually sanctioned with some form of (mild) social control as problem behavior or risk behavior (Jessor, 1987). In addition, PBT describes risk and protective factors that may explain the occurrence of both problem behavior and health-enhancing behaviors, such as regular exercise and adequate sleep (Jessor, 2014). Risk factors are those factors that increase the likelihood of problem behavior, whereas protective factors reduce the likelihood of problem behavior both directly (proximal factors) and indirectly by mitigating the influence of risk factors (distal factors) (Jessor, 1987, 1991). It should be emphasized that risk and protective factors are not conceptualized as residing on the same dimensions of a continuum, but rather as conceptually distinct and orthogonal dimensions (F. M. Costa et al., 2007).

PBT centers around three main domains of risk and protective factors: "perceived environment", "personality" and "behavior", in all of which there are strong influences at play by biological requirements and social background and context (Jessor, 1991; Weichold & Blumenthal, 2018). The interactions and indirect influences between these domains, as well as the risk and protective factors they contain, all result in a general "psychosocial proneness", i.e., the likelihood of problem behavior occurring (Jessor, 1987, 1991).

The basic relations are shown schematically in Figure 1. Not included therein are the important further modifications and extensions that Jessor (1991) added to his model: first, the role of changes *within* domains, such as developmental changes during adolescence (biological requirements), or social and historical changes in the social context. The second extension is the dynamic bidirectional influence of problem behaviors and domains, as problem behaviors are also feeding back unto these domains and reshape their biological, social and psychological contexts (Jessor, 1991).

Figure 1

Scheme of Problem Behavior Theory domains of risk and protective factors



Note. Figure adapted from Weichold and Blumenthal (2018) and based on Jessor (2016).

With this concept, PBT goes far beyond mere genetic and biological considerations and includes not only psychological but also social and behavioral characteristics in a comprehensive representation (Jessor, 1987; Weichold & Blumenthal, 2018). From a neurobiological perspective, an imbalance in brain development is thought to predict problem behavior in adolescents (M. Ernst & Fudge, 2009), including substance use and particularly alcohol use. At the same time, the PBT suggests that adolescent problem behavior can also be seen as a solution to some of the various developmental tasks arising in this phase (Jessor, 1991). For example, the use of alcohol can be seen as a means to gain peer approval. Therefore, problem behavior should always be assessed on the basis of a cost-benefit analysis, taking into account the personal and social functions of the behavior at display, rather than just looking at the costs (Jessor, 1991).

This PBT perspective suggests that alcohol use, particularly during adolescence, is a complex behavioral phenomenon, and that it should be considered in relation with other problem behaviors like bullying (section 1.1.2). Despite extensive research in alcohol use over the last decades, the range of potential risk factors and their interactions is vast, and not all of them have been exhaustively studied so far (Marshall, 2014; Nees et al., 2012; Stautz & Cooper, 2013). One example for such an interaction is the following: an inability to regulate emotions

(section 1.3.3) due to an imbalance in brain maturation (section 1.2), coupled with increased emotionality in adolescence (section 1.3.2), may lead to an increased risk of alcohol use. This may be particularly relevant in the social context (section 1.4), which becomes increasingly important during adolescence as interactions change due to macrosocial influences (section 1.4.2). This thesis therefore examines risk factors of alcohol use, focusing on the "behavior systems", which includes emotions and emotion regulation abilities, and links this to the "social context" and bullying, another problem behavior that often co-occurs with alcohol use.

The current dissertation includes a detailed presentation of the individual risk factors, followed by a summary of the aim and research question of the thesis. The research part includes a study of bullying and empathy and their interaction on alcohol use (original paper 1, published in International Journal of Environmental Research and Public Health, 2023), a study of interoception, empathy and emotion regulation in relation to alcohol use (original paper 2, in preparation for submission to Addictive Behaviors) and a third study evaluating the effects of the COVID-19 pandemic on adolescent alcohol use (original paper 3, published in SUCHT, 2021). Following the presentation of these papers, the thesis concludes with a comprehensive discussion of findings and limitations in the framework of PBT, and provides implications for future research.

1.1 Forms of maladaptation and problem behaviors

In the transition from childhood to adulthood, adolescents face a variety of developmental tasks, the successful completion of which will enable them to integrate into the adult world. However, the abundance of crises and developmental challenges can also be accompanied by uncertainty, anxiety and stress (Weichold & Blumenthal, 2018), which are considered risk factors for the development of problem behavior in terms of PBT. Indeed, it has been shown that these forms of maladaptation often begin in early adolescence, increase during this period, and only decrease again in young adulthood (Mahalik et al., 2013; Weichold & Blumenthal, 2018). Furthermore, as PBT postulates, problem behaviors appear to occur rarely in isolation and often arise simultaneously and interdependently (Jessor, 1991). According to PBT, this is due to common risk factors and the lack of sufficient protective factors that cause different problem behaviors equally (Jessor, 1991).

Adolescent problem behavior can be divided into internalizing internalizing problem behavior, which is "characterized by emotional problems being experienced internally", (Babicka-Wirkus et al., 2023, p. 2) and externalizing problem behavior, which "involve[s] a high occurrence of destructive and/or aggressive behaviors directed at others and/or the

immediate environment" (Babicka-Wirkus et al., 2023, p. 1) and can be classified into eight syndromes (Achenbach, 1966; Wysocka & Ostafińska-Molik, 2014; Babicka-Wirkus et al., 2023). For example, anxiety and depression as internalizing behaviors belong to the third syndrome of "anxious-depressed" behavior; in contrast bullying as a form of externalizing behavior belongs to the eighth syndrome "aggressive behavior" (Wysocka & Ostafińska-Molik, 2014; Babicka-Wirkus et al., 2023). As can be seen from these examples, the syndrome definitions not only include behavior but also symptoms of mental disorders such as depression or anxiety. These disorders may themselves begin in adolescence and can emerge from problem behavior during this phase, sometimes burdening individuals over a lifetime. For example, research has already shown that excessive alcohol use during adolescence can lead to alcohol addiction (McCambridge et al., 2011), and depression can develop from negative moods (Schubert et al., 2017). Following this taxonomy, two externalizing problem behaviors, alcohol use and bullying, are examined in more detail in the following sections.

1.1.1 Alcohol use

In addition to internalizing behavior at the core of mental health problems such as depression and anxiety, externalizing problem behaviors appear to play a significant role in adolescence. Substance use, and especially alcohol use, seem to be particularly prevalent in adolescence (see Figure 2) and can therefore be considered a significant problem behavior in terms of PBT.



Figure 2

Prevalence rates of mental health problems in adolescents aged 11-17 years in Germany

Note. The figure was created on prevalence rates reported by Ravens-Sieberer et al. (2008). Only heavy alcohol use is shown in the figure, indicating a higher rate of general alcohol use among adolescents. ADHD = Attention Deficit Hyperactivity Disorder.

Like other problem behaviors, alcohol use often begins in adolescence. The first exposure to alcohol usually occurs between the ages of 11 and 17 (Zeiher et al., 2018), and exposure increases throughout adolescence, typically peaking in late adolescence around the age of 21 and decreasing until the late 20s (Johnston et al., 2003). A comparison of prevalence rates from 2008 (see Figure 2) with more recent data from 2018 indicate an increase in risky or heavy alcohol use among adolescents: in 2018 12.1% of alcohol using adolescents show a risky form of alcohol use and 7% report binge drinking on a regular basis, with sex differences present at this early stage of alcohol experience (Zeiher et al., 2018). Furthermore, these risky forms of alcohol use can rapidly become clinically significant (Wittchen et al., 2008), as we find that 34% of patients in alcohol use treatment are under the age of 25 years (EMCDDA, 2011).

Early initiation of alcohol use in adolescence is associated with the development of alcohol use disorders later in life (McCambridge et al., 2011). In addition, early and heavy alcohol use may also have negative consequences for the development of the adolescent brain (Squeglia et al., 2015), which is undergoing critical maturation during this life period (see section 1.2.1), and other domains of adolescent health (Kuntsche et al., 2005) and life (Diego

et al., 2003). It is therefore important not only to understand the trajectories of alcohol use during this period of life, but also to identify the risk factors that influence early alcohol use, in order to provide early prevention and intervention.

Factors influencing adolescent alcohol use are manifold and often cumulative (Appleyard et al., 2005), as suggested by PBT. The following sections will therefore focus on risk factors for the development of alcohol use, which is the central topic of this thesis.

1.1.2 Bullying

In the framework of PBT, bullying is a form of problem behavior that has a negative impact on others and can therefore be described as externalizing behavior. Bullying often occurs during adolescence as a form of peer harassment at school (Olweus, 2013), but it can also occur in private contexts, for example between siblings (Wolke & Skew, 2012). Due to technological developments, bullying is also conducted through social platforms and electronic devices, in the new form of so-called cyberbullying (Salmon et al., 2018). Bullying, in its traditional form, is defined as a repeated negative action towards another person where there is an imbalance of power between the perpetrator and the victim (Olweus, 2013). It can take different forms. On the one hand, one can experience direct bullying, such as physical aggression or robbery of personal belongings (Nansel et al., 2004). On the other hand, actions such as spreading rumors, name-calling, rejection and isolation are known as indirect or relational forms of bullying (Nansel et al., 2004; Carbone-Lopez et al., 2010). There also appear to be sex differences in the experience of bullying (both as victims and perpetrators), with boys typically being more involved in bullying and more likely to report direct forms of bullying, whereas girls are more likely to experience indirect forms of bullying.

The experience of being a victim of bullying mainly poses a risk factor in the "social context" domain of PBT, but it may also influence how victims perceive their environment and is therefore an example of how the risk factors within PBT are interdependent. As a result of this risk factor, a range of problem behaviors can be observed in victims of bullying. These include internalizing problems such as depression and anxiety (Hong et al., 2014; Kretschmer, 2016), low self-esteem and negative self-concept (Tharp-Taylor et al., 2009; Olweus, 2013), feelings of isolation and hopelessness (Carvalho et al., 2017), and also social, academic (Nansel et al., 2004; Hong et al., 2014) and health problems (Nansel et al., 2004). Furthermore, victims of bullying report more psychological distress (Thomas et al., 2011; Radliff et al., 2012).

Interestingly, perpetrators, those individuals who actively "create" these challenging interpersonal situations, also show negative outcomes, providing a good example of how problem behavior affects risk and protective factors in the central components of PBT. In addition to poor relationships with classmates, health problems and poor academic and psychological adjustment (Nansel et al., 2004), perpetrators show externalizing behaviors to a particularly high degree, such as delinquency (Olweus, 2013), aggression and antisocial behavior (Solberg & Olweus, 2003). Furthermore, several studies have shown that perpetrators use more alcohol (Kelly et al., 2015; Vieno et al., 2011). In addition to the effects on risk factors, this shows a striking parallel between both perpetrators and victims of bullying, in that both groups show alcohol use as a problem behavior, as described as co-occurrence of problem behaviors in the PBT.

1.2 Biological requirements and problem behavior: bio-psychological developmental processes during adolescence

Adolescence is characterized by various changes not only in the social area, but adolescents are also confronted with many physical changes that need to be evaluated and integrated. Here, a brief outline of these bio-psychological development will be given, as these can contribute to problem behaviors, such as alcohol use and its preconditions.

As Jessor (1991) pointed out, physical changes are also a central feature of the "biological requirements" that can have an impact on the three central domains of PBT, but also directly on problem behaviors of adolescents (see Figure 1), such as alcohol. These changes affect not only physical development, but also adolescents' circadian rhythms and brain maturation.

In this context, puberty is not only the biological development towards sexual maturity, but it also marks the beginning of adolescence (Sisk & Foster, 2004; Konrad & König, 2018). The hormonal changes involved not only initiate the development of sexual maturity, but are also responsible for physical changes (Breehl & Caban, 2023; Konrad & König, 2018). Primary and secondary sexual characteristics develop, accompanied by physical growth that starts with the extremities and leads to a shift in body proportions (Jenni, 2020; Konrad & König, 2018).

It is also assumed that the circadian rhythms observed in adolescents, particularly the commonly observed evening delay in falling asleep, are hormonally determined (Lucien et al., 2021; Konrad & König, 2018). Combined with inflexible environmental demands, such as schooling schedules, this shift often leads to a chronic sleep deprivation, which in turn is associated with a reduced ability to regulate emotions, as well as an increased reward sensitivity

and reduced behavioral inhibition (Konrad & König, 2018). All of these factors have been found to be associated with increased alcohol use (Simons et al., 2017; Urošević et al., 2015; van Hemel-Ruiter et al., 2015; Peeters et al., 2017).

Brain maturation

Unlike physical development, brain maturation is not primarily limited to puberty but is an ongoing process adolescence (Gogtay et al., 2004; Konrad & König, 2018). Maturation of various brain regions proceeds at different rates. M. Ernst et al. (2006) addressed this fact in their triadic model of motivated behavior, focusing on three neural systems and their underlying tasks (see Figure 3). These systems are the motivational or reward system, which includes the neural system around the striatum and is involved in approach motivation; the emotional system centered around the amygdala mediating for avoidance; and the networks centered on the prefrontal cortex, which is commonly addressed as the regulatory center, and which balance approach and avoidance, according to this model, and thus leads to motivated behavior (M. Ernst, 2014; M. Ernst et al., 2006; M. Ernst et al., 2009).

Figure 3



Triadic model of motivated behavior

Note. Figure adapted from M. Ernst and Fudge (2009).

However, due to the delayed maturation of the prefrontal cortex, the triadic model suggests that motivated behavior in adolescents is not mainly controlled and balanced by the prefrontal cortex; instead, adolescent behavior is primarily characterized by a domination of the reward system over the avoidance system (M. Ernst et al., 2006), as shown in Figure 3 on the

right side. This results in highly sensitive responses to social and affective stimuli (Konrad & König, 2018) and it increases the risk to develop problem behaviors such as sensation seeking and impulsivity (M. Ernst et al., 2009; M. Ernst, 2014). Thus, this imbalance also works in favor of drug and alcohol use and addiction (Stautz & Cooper, 2013; Adan et al., 2017). It is not until mid-adolescence that cortical structures, particularly the prefrontal cortex, mature, leading to increased control over emotional and motivational behavior (Konrad & König, 2018). Brain maturation is therefore also a good example of how "biological requirements" can have an effect on both the behavioral system and problem behavior, as described in PBT.

1.3 The behavioral system as a condition for problem behavior

According to PBT, the "behavior system" includes both protective and risk factors for problem behaviors in adolescents. Protective factors include behaviors that are either beneficial to health, such as regular physical activity, or prosocial and positive activities, such as involvement in school, in religion (e.g., church attendance), or involvement in other conventional social groups, such as participation in a club (F. M. Costa et al., 2007). Risk factors in the area of the "behavior system" are involvement in other risk behaviors, such as bullying (see section 1.1.1), the use of illegal drugs, or other behaviors that amount to problem behavior or that can lead into problem behavior (F. M. Costa et al., 2007; Egondi et al., 2013). This would also include, for example, hanging out in a bar, which as a behavioral component increases the risk of the problem behavior of alcohol use.

1.3.1 Subsystem emotion

Beyond the volitional behavior described above, emotions are also included in the PBT "behavior system" (Singh, 2022) because of their strong association with behavior. They can be both motivators and consequences of behavior and also include a behavioral component, the expression of the felt emotion (Kleinginna & Kleinginna, 1981).

According to Kleinginna and Kleinginna's (1981) working definition, emotions are not one-dimensional, but consist of four components that play a role at different points in the process of emotional occurrence. Emotions are associated with an objectively measurable *physiological response* of the body that, in combination with the perceived *feeling* (experience component), an *evaluation* of it (cognitive component), and the *behavioral* component, should prepare the person for goal-directed, adaptive behavior resulting from the emotion (Kleinginna & Kleinginna, 1981; Brandstätter et al., 2018a). In contrast to general moods, emotions are related to specific objects, situations or events and can therefore be triggered by a variety of situations and stimuli, such as interactions with other people, thoughts, activities or the consumption of food or drugs, including alcohol (Brandstätter et al., 2018a). At the same time, emotions also influence a wide range of factors such as attentional control, memory, problem-solving and decision-making (Brandstätter et al., 2018a). They can be functional or dysfunctional in these contexts (e.g., Levine & Pizarro, 2004; J. S. Lerner et al., 2015; Coombes et al., 2009), and from an evolutionary perspective, they serve survival-related (Darwin, 1872) and communicative purposes (Scherer & Wallboot, 1990).

In addition to these functions, the question of what an emotion actually is may lead to an understanding of how emotions function in motivating problem behavior in the sense of the PBT. Various neurophysiological and psychophysiological approaches address this question. Most theories assume that each emotion is based on a physiological reaction of the body that must be perceived (James, 1884; Lange, 1887). In addition, there is an unconscious and rough evaluation component, which is highly relevant for the development of emotions and which puts the body in a state of readiness to act (e.g., fight or flight reaction). This happens before the stimulus even reaches conscious awareness (LeDoux, 1996), where it is processed more precisely and evaluated against the background of previous experiences and knowledge (Brandstätter et al., 2018a), and along dimensions such as novelty, intrinsic pleasantness, goal significance, coping potential and compatibility standards (Scherer, 1984, 1999, 2009). These unconscious and conscious evaluations are related to different regions of the brain, which are involved in different stages of the processing of the stimulus (LeDoux, 2001; Brandstätter et al., 2018d). This also reflects the diversity of cognitive processes in the development of emotions, which can unfold at different levels of awareness, automaticity and complexity (Brandstätter et al., 2018d).

Emotions can therefore not only influence our behavior through conscious experience, but can also motivate different behaviors, such as alcohol use as a problem behavior in the sense of PBT, through non-conscious processes. This could be particularly relevant during adolescence, which is characterized by brain changes (see section 1.2) and changes in emotionality (see section 1.3.2).

Interoception

Although emotional processing is very complex, one aspect that seems to be important in the context of alcohol use as a problem behavior along the PBT framework is the physiological change (physiological component) and its processing, i.e. awareness (subjective component) related to an emotion. This is because physiological change not only plays a crucial role in the perceived intensity of emotions (Schachter & Singer, 1962), but also because adolescence can be seen as a period of heightened emotional intensity (see section 1.3.2 below), associated with heightened alcohol use behavior (Lannoy et al., 2021; Linn et al., 2021; Simons et al., 2017; Wiśniewski et al., 2021). Therefore, the perception of physiological changes will be the main focus of this thesis.

The ability to perceive physiological changes, i.e. signals from within the body, is also known as interoception (Schandry, 1998). Interoception is not only crucial for maintaining the well-being and homeostasis of the organism (Vaitl, 1996), but also exerts critical influence on our emotional experience (Vaitl, 1996; Herbert & Pollatos, 2008; Craig, 2003). Furthermore, interoception has recently been understood in a psychobiological sense as a process that can influence our psychological experience and behavior (Roggenhofer, 2017) and can therefore also be understood as a risk or protective factor for problem behavior in the sense of PBT.

Cameron (2002) divides interoception into a neural representation of visceral signals and a conscious experience of this activation. In this model, therefore, signals can enter conscious awareness through interoceptive perception and influence behavior directly or indirectly. In addition, Vaitl (1996, 2000) categorizes three sources of interoceptive signals, namely respiratory interoception, i.e. the perception of breathing, gastrointestinal interoception, i.e. the perception of processes in the gastrointestinal tract, and cardiovascular interoception, i.e. the perception of the cardiovascular system. In this classification, cardiovascular interoception seems to be the most intensely researched form of interoception, which may be related to the complexity of recording physiological data from the other systems (e.g., Garfinkel et al., 2016; van den Houte et al., 2021; Peralta-Palmezano et al., 2021). Furthermore, Schandry (2003) describes cardiovascular interoception as a temporally stable but highly individual phenomenon (i.e., it is highly variable between individuals) that can be considered as a global indicator of interoception in general, due to its high correlation with other interoceptive systems (e.g., Harver et al., 1993; Herbert et al., 2012).

However, factors such as age (Cameron, 2001; Khalsa et al., 2009) or body weight (Montgomery & Jones, 1984) can influence interoceptive *accuracy*, i.e. the sensitivity with which interoceptive signals can be perceived and discriminated (Herbert & Pollatos, 2008;

Garfinkel et al., 2015). In addition to the component of interoceptive accuracy, which has long been equated with interoception and is measurable objectively, two further components have been proposed, namely interoceptive *sensibility* and interoceptive *awareness* (Garfinkel et al., 2015), which are schematically presented in Figure 4. Here, interoceptive *sensibility* ("self-report and beliefs" in Figure 4) is understood as the evaluation of one's own ability to perceive interoceptive signals, and interoceptive *awareness* ("interoceptive insight" in Figure 4) is understood as a metacognitive association between accuracy and sensibility (Garfinkel et al., 2015; Wiśniewski et al., 2021). However, the accuracy component in particular still seems to be highly relevant, due to its function as the basis of the other two mechanisms.

Figure 4



Note. The figure was created by Suksasilp and Garfinkel (2022).

Given that adolescence is a period of significant physical change (see section 1.2), interoceptive accuracy in this context can be challenging as these changing and sometimes new physical experiences need to be successfully integrated. There are surprisingly few studies that examine the development of interoception during adolescence, but evidence from childhood research suggests that interoception improves with age (Li et al., 2017; Murphy et al., 2017) and is positively associated with health behaviors (Brewer et al., 2021; Murphy et al., 2017). Interoception, particularly accuracy, also appears to be related to alcohol use in adolescence:

Adolescents with an alcohol use disorder show increased activation in brain areas associated with interoception when confronted with aversive internal cues (Berk et al., 2015; Migliorini et al., 2013). However, whether interoceptive accuracy in the sense of PBT might also be a causal risk factor for alcohol use has not yet been investigated. In terms of PBT, it is conceivable that, following the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984), alcohol is used as an emotion-oriented coping mechanism to deal with increased arousal (Bengel & Jerusalem, 2009), and this may particularly be the case for adolescents who are characterized by increased interoceptive accuracy.

1.3.2 Emotional changes during adolescence

In addition to these aspects of emotions, their perceived intensity is also important in the development of problem behavior such as alcohol use (Lannoy et al., 2021). Adolescence in particular is considered a period of heightened emotionality. Emotionality refers to inter- and intra-individual differences in the duration, fluctuation, threshold and dynamics of the intensity of emotions (Zimmermann et al., 2018). In particular, negative emotions become more prominent during this period of life, although this should not be mistaken as suggesting a general and predominant negative mood among adolescents (Zimmermann et al., 2018).

For example, mood swings, i.e. fluctuations of the emotions experienced, are more common during adolescence (Zimmermann et al., 2018), with sadness being more variable than anger, fear and happiness (Silk et al., 2003; Maciejewski et al., 2015; Zimmermann et al., 2018). Moreover, some emotions such as fear and sadness, are experienced more intensely compared to anger, and female adolescents consistently report higher emotional intensity than males (Silk et al., 2003; Zimmermann et al., 2018). In addition, emotional triggers change during adolescence due to the developmental tasks that adolescents face. While children are still primarily afraid of external threats such as animals, the 'unknown' and punishment, after the transition into adolescence, fear of social judgement (Westenberg et al., 2004; Westenberg et al., 2007) and an increased experience of shame play a greater role and are experienced more intensely than in childhood (Zimmermann et al., 2018).

This specific pattern of emotionality in adolescents also seems to be a consequence of biological changes (see section 1.2, Steinberg et al., 2006). At the same time increased emotionality, particularly in adolescence, is a risk factor for problem behavior such as alcohol use and abuse (Lannoy et al., 2021), as better cognitive control of emotional and behavioral processes is associated with delayed maturation of the prefrontal cortex (Steinberg et al., 2006; M. Ernst, 2014; Zimmermann et al., 2018, see section 1.2).

1.3.3 Emotion regulation

Strategies of emotion regulation help us to manage our emotions and keep us functioning. This may be particularly relevant in adolescence as the period of heightened emotionality, and thus, successful emotion regulation may function as a protective factor of the "behavior system" in the sense of PBT, which may mediate the relationship between adolescent' emotionality and problem behavior.

Emotion regulation encompasses all processes that influence the development of both positive and negative emotions and regulate their intensity (Gross, 2002). These regulatory processes can be both automatic and consciously controlled (Brandstätter et al., 2018c) and serve intra-individual hedonistic (Brandstätter et al., 2018c) and inter-individual social goals (Fischer et al., 2004), depending on culture, sex and work-related norms (Brandstätter et al., 2018c).

Depending on their function, emotion regulation strategies can intervene at different points in the development of emotions (see Figure 5) and can be divided into antecedent-focused and response-focused strategies (Gross, 1998, 2007). In addition to situation selection and modification, antecedent-focused strategies include attentional control and cognitive reappraisal, all of which aim to select or influence the situation or cognitive evaluation of it, in order to reduce emerging emotions or even replace them with other emotions (Brandstätter et al., 2018c). Response-focused strategies, in contrast, aim to reduce the physiological component of emotions, for example by using alcohol or aim to regulate the subjective experience of an emotion, either by suppressing thoughts that accompany emotions (suppression) or by paying increased attention to them (Brandstätter et al., 2018c), also known as rumination (Nolen-Hoeksema, 2012). In particular, suppression and rumination appear to be risk factors for problem behavior in the sense of PBT, as they are associated with increased alcohol use (Norberg et al., 2016; Devynck et al., 2019).

Figure 5

Schematic presentation of the process model of emotion regulation



Note. Adapted from Guthrie Yarwood (2022) based on Gross and Thompson (2007)

Emotion regulation in adolescence

Emotion regulation strategies are considered to be a stable construct (Zimmermann et al., 2018), and the choice of regulation strategies can affect the quality (e.g., in reappraisal) and intensity (e.g., in suppression) of emotions (Zimmermann & Thompson, 2014). Additionally, different emotions of different intensities need to be regulated differently (Zimmermann et al., 2018). This requires a broad repertoire of emotion regulation strategies to enable adaptive coping with high-emotionality situations.

However, this essential repertoire seems to be reduced in adolescence (Zimmermann & Iwanski, 2014). Compared to children and adults, adolescents tend to use fewer adaptive strategies but more dysfunctional strategies such as rumination (Zimmermann et al., 2018). Rumination in particular appears to be clinically associated with adolescent psychopathology, particularly substance use (Aldao et al., 2010).

The ability to regulate emotions during adolescence also depends on biological changes (see section 1.2), with areas of the brain becoming more responsive to social and emotional stimuli during adolescence, leading to increased sensitivity to rewards and, in the context of peers, to more impulsive behavior (Paus, 2005; Del Piero et al., 2016; Herd & Kim-Spoon, 2021; A. Powers & Casey, 2015; Chein et al., 2011; Albert et al., 2013). It is therefore not surprising that difficulties in emotion regulation are considered a risk factor for the development

of problem behavior such as substance use and addiction in the context of PBT (Nawi et al., 2021; Estévez et al., 2017; King et al., 2023).

1.4 Social context of problem behavior

In addition to intra-individual aspects and the development of adolescent problem behavior, which have already been considered in detail, social aspects in the domains "social background and context" and "perceived environment system" also play a crucial role in the framework of PBT. Although these two systems are interdependent and go hand in hand, the social context is an essential requirement for the perceived environment (see Figure 1), and is therefore the primary subject of this thesis. The social context of problem behavior can be divided into a microsocial context, i.e. the direct interaction partners of adolescents, and macrosocial influences from society. In the following section, these two factors are examined in more detail, in order to derive their influence on adolescent problem behavior.

1.4.1 Microsocial context

As mentioned earlier, adolescents go through many biological as well as social changes. According to Havighurst (1948), two central developmental tasks are the detachment from parents and the development of peer relationships. Due to these developmental tasks, parents and peers play a primary role in development during adolescence and are therefore considered in more detail here, even though the microsocial system of adolescents also includes other reference groups and people, such as grandparents and siblings, the school/ work situation, or co-participants in religious or leisure activities. However, parents and peers are not independent reference systems, but are interrelated (Bronfenbrenner, 1979), although they will be considered separately for the sake of clarity. Emotions will also be discussed again in the context of social influencing factors, as they also play a special role in the social context and in the context of adolescence, as already described in section 1.3.

Parents

Adolescence is seen as a period of increasing emotional and practical independence from parents (Walper et al., 2018). This is particularly evident in the fact that adolescents spend less time with their families than during childhood (Larson et al., 1996). As adolescents' need for autonomy increases and they gain more independence, new scopes and responsibilities have to be negotiated in the context of the family and especially with the parents (Walper, 2008; Walper et al., 2018). This primarily concerns issues of everyday organization (e.g., tidying up the room, helping with the housework) and newly demanded freedoms (e.g., what time the adolescent has to be home on evenings) (Silbereisen & Schmitt-Rodermund, 1998). However, contrary to what might be expected, empirical research indicates that there is no increase in conflict between parents and adolescents (Laursen et al., 1998). One explanation for this states that the family system is characterized by mutual support and the satisfaction of needs, and that any disruption of this system should be avoided (Laursen & Collins, 1994; Silbereisen & Schmitt-Rodermund, 1998). Furthermore, adolescents still see their parents as important reference persons in important or difficult life situations, and direct contact with parents, for example through conversations, also increases during adolescence (Larson et al., 1996; Silbereisen & Schmitt-Rodermund, 1998).

Additionally, adolescents' relationships with their parents are understood as a function of both developmental changes and enduring characteristics (Grotevant & Cooper, 1986). Therefore, it is assumed that adolescents develop beneficially when increasing autonomy desires can develop while adolescents remain emotionally attached to their parents (Jiang et al., 2017; Walper et al., 2018). Studies support this assumption with findings that adolescents largely describe a harmonious relationship with their parents, which is characterized by a curvilinear progression on the continuum between closeness and distance in the course of adolescence (Leven et al., 2015; Koepke & Denissen, 2012; Pinquart & Silbereisen, 2002; Goede et al., 2009; Walper et al., 2018).

Peers

Peers are a central reference system in adolescence and play a more important role than parents in some socialization tasks (Vierhaus & Wendt, 2018; Oerter & Dreher, 2002). This is mainly due to the fact that, unlike the relationship with parents, the relationship with peers is characterized by symmetry and reciprocity (Oerter & Dreher, 2002; Silbereisen & Schmitt-Rodermund, 1998; Vierhaus & Wendt, 2018), which is also accompanied by a higher degree of attention and effort to maintain the relationship (Vierhaus & Wendt, 2018). During adolescence, the peer group provides a platform for self-expression and the achievement of goals, which may also be group goals (Oerter & Dreher, 2002; Vierhaus & Wendt, 2018). The peer group thus facilitates the step towards autonomy and realizes independence and interdependence in equal proportions (Oerter & Dreher, 2002), as rules and values are developed and modified together (Juvonen & Cardigan, 2002). In addition, the peer group serves as a foundation for first contact with the opposite sex, facilitate fist partnership experiences, and provides orientation and stabilization, emotional security and support (Oerter & Dreher, 2002). Close friendships in particular, which are characterized by mutual familiarity and emotional support (Buhrmester, 1990; Selman, 1980), can contribute to identity stabilization through understanding, trust and reliability (Oerter & Dreher, 2002).

In addition to the developmental tasks already mentioned, the most central issue during adolescence is probably that of popularity, that is, of being liked and accepted by one's peers (Vierhaus & Wendt, 2018). This has a particular impact on adolescents' self-concept and self-esteem (LaFontana & Cillessen, 2010; Vierhaus & Wendt, 2018). In general, high popularity is strongly associated with adaptive behavior and social-emotional competence (Mavroveli et al., 2007). Controversially, it appears that aggressive behavior among peers seems to increase during adolescence and is more likely to be accepted by peers (Bukowski et al., 2000). According to Bowker et al. (2010), this is primarily related to the need to maintain status (Vierhaus & Wendt, 2018). They showed that it is more difficult for male adolescents to maintain social status during adolescence, and that aggressive and arrogant peer behaviors are positively associated with maintaining and gaining status (Bowker et al., 2010; Vierhaus & Wendt, 2018). However, these behaviors have also been shown to be associated in the long term with low popularity, membership in deviant groups and low academic achievement or even dropping out of school (Bowker et al., 2010).

The point of this example is to illustrate that the peer group fulfils many functions for positive development in adolescence but at the same time peer relation pose risk of negative development leading towards problem behavior, such as aggressive behavior in the form of bullying. For example, adolescents who are rejected by their peers are at increased risk of externalizing (e.g., delinquency and dropping out of school, Kupersmidt & Coie, 1990) and internalizing problem behaviors (e.g., depression, Platt et al., 2013). However, if an adolescent is successfully integrated into a peer group that expresses problem behavior, the pressure to conform, i.e. the social norms that the group requires its members to adhere to in order to belong, can also be seen as a risk for the development of problem behavior (Faller & Schowalter, 2019). For example, it can be assumed that certain drinking habits leave little room for adolescents to opt out without becoming unpopular or, worse, being excluded from the social group (Faller & Schowalter, 2019). Therefore, as already mentioned in the PBT model, the social context in the form of the peer group and its beliefs and expectations, referred to as the "perceived environment system", can be both a protective and a risk factor.

Emotions in social context

As mentioned in the previous section, popularity is a central theme of adolescence and is associated with inter-individual differences in social-emotional competencies (Bukowski et al., 2011; Meijs et al., 2010), which grow rapidly and in different ways during the transition from late childhood to adolescence (Vierhaus & Wendt, 2018). As it is precisely these competencies that can be seen as central to adolescence, this section will focus on emotional competencies, especially empathy, which is particularly important in a social context.

In general, social skills are those that enable us to be effective in social interactions by serving long- and short-term developmental needs (Rose-Krasnor, 1997; Klinkhammer et al., 2022). Within social skills, emotional skills are an essential component that, together with cognitive skills, values and goals, form the basis for the ability to act in different contexts (Rose-Krasnor, 1997). Emotional competencies can be divided into eight domains (Saarni, 1999), whereby in addition to the ability to recognize (see section 1.3.1), express and regulate one's own emotions (see section 1.3.3), a central component is empathy, i.e. recognizing and empathizing with the emotions of others (Saarni, 1999; Salovey & Mayer, 1990).

The understanding of one's own emotional experiences, their triggers and causes also serves as a basis for better understanding and empathizing with the emotions of others (Klinkhammer et al., 2022). At the same time, it allows us to understand that emotional reactions can be different for different people, depending on their personalities, past experiences and situational conditions (Klinkhammer et al., 2022). The ability to empathize thus comprises of two components (see Figure 6), which should be considered in their own right (Weisz & Cikara, 2021; Stietz et al., 2019). First, the cognitive component enables us to correctly identify the emotions of others by understanding and comprehending the situation of others through perspective-taking and forming a theory of mind (Roth et al., 2016). On the other hand, the affective component allows us to share and experience the emotions of others (Roth et al., 2016), partly through emotional contagion (Hatfield et al., 1994), which is a rather automatic and non-conscious process (Preston & Waal, 2002). Thanks to the cognitive component and the self-other distinction, we are able to recognize that the emotions experienced originate from the other person (Roth et al., 2016) and thus regulate our emotions accordingly (Preston & Waal, 2002; Roth et al., 2016). Recent neuropsychological research not only confirms that affective empathy is an automatic process and cognitive empathy rather a conscious, executively controlled process (Roth et al., 2016). It also shows that we can map the different empathic processes to neural activity in different areas of the brain (Decety & Moriguchi, 2007), which are also responsible for processing our own emotions (Roth et al., 2016). Thus, interoception

(see section 1.3.1) appears to underlie not only our own experienced emotions, but also for the emotions that arise from observing the emotional states of others (J. Ernst et al., 2013; Grynberg & Pollatos, 2015).

Figure 6

Visualization of the empathic components and the associated mechanisms



We discussed in section 1.2 that brain areas involved in affectivity mature earlier than brain areas involved in conscious control and emotion regulation, which, according to the neuropsychological model of empathy, are relevant for attenuating the effects of emotional contagion (Decety & Moriguchi, 2007). Empathy may therefore be seen as a double-edged sword. On the one hand, it appears to be particularly important in adolescence and helpful in trust-building, and developing intimate and emotionally supportive friendships by promoting prosocial and altruistic behavior (e.g., Block-Lerner et al., 2007). On the other hand, it could be a risk factor for alcohol use according to PBT, especially during adolescence when brain areas mature at different speeds. This assumption is based on the increased emotionality of adolescents (section 1.3.2), which is less easily regulated in this phase (section 1.3.3). Thus, observing people in distress can cause one's own distress, known as a part of affective empathy called personal distress (Davis, 1980; Batson, 2011), and increase the desire to reduce this personal distress (Davis, 1980). In the absence of an adaptive regulatory strategy, this increased experience of distress may then lead, for example, to the use of alcohol to reduce the distress experienced. Research on the relationship between empathy and alcohol has primarily shown deficits in cognitive and affective empathy in alcohol-dependent individuals (Nachane et al., 2021; Le Berre, 2019). However, whether in the PBT framework, high empathy can also be considered a risk factor for the development of alcohol use in adolescence needs to be investigated.

1.4.2 Macrosocial factors

As discussed in the previous section, adolescents experience many social changes, including changes in the relationship with their parents and the increasing importance of their peers. However, these processes cannot be considered in isolation from their wider societal context (Walper et al., 2018). For example, the period of adolescence has been significantly extended through an increasingly early onset of puberty over the last generations (Steinberg, 2005), and the economic independence from parents has shifted into early adulthood due to the extension of education (BMFSFJ, 2017), a phenomenon referred to as "emerging adulthood" (Arnett, 2015). At the same time, we are witnessing a change in family constellations (e.g., more single children due to the decline in birth rates, changes in parental constellations with a tendency towards more single parents or patchwork families), but also in the guiding principles of parenting (Walper et al., 2018). In terms of PBT, all these developments represent a "change" in the social context (Jessor, 1991).

Other macro-social changes within the "social background and context" of the PBT occur more abruptly and unexpectedly compared to the long-term trends described above. Such disruptive, temporally limited phases also have a number of long-reaching social consequences. Throughout history, such stressful societal experiences have been abundant. For example, global economic crises, such as the Great Depression of the 19030s or the Great Financial Crisis of 2008, did not only affect one country, but had global aftermaths and negative effects on people's mental health (S. Lee et al., 2010; Sargent-Cox et al., 2011; Lindström & Giordano, 2016).

Pandemic diseases, such as the outbreak of SARS in 2003, can also be considered global crises and are accompanied by extreme conditions that lead to an increased stress experience and a rise in post-traumatic stress disorders and depressive symptoms (Chua et al., 2004; T. M. C. Lee et al., 2006; Reynolds et al., 2008), factors associated with increased risk potential for the development of alcohol (ab)use (R. J. Powers & Kutash, 1985; Veenstra et al., 2007; Dixit & Crum, 2000; Smith & Cottler, 2018).

A more recent macrosocial crisis is the COVID-19 pandemic from 2020 to 2023. The COVID-19 pandemic involved many public restrictions and changes in social functioning, accompanied by economic burdens at the community level, changes in social behavior, fear of infection and uncertainty about the future (Ellis et al., 2020). The results were increased feelings

of loneliness and isolation (Ellis et al., 2020), an increase in depressive symptoms (Bignardi et al., 2020) and stress (Twenge & Joiner, 2020; Qiu et al., 2020), to name just some especially prominent effects in the field of mental health.

At the beginning of the COVID-19 pandemic, it was rather unclear how adolescents might be affected by the conditions of restriction and the changes in social behavior. There was great concern that adolescents might experience increased negative emotions and distress, as they are going through a developmental phase during which social interactions with peers become more important (see section 1.4.1). This may lead to poor psychological adjustment and, as considered in the PBT, therefore would increase the risk of problem behaviors like alcohol use. In fact, research showed that adolescents reacted with heightened stress (Jones et al., 2021), reported more psychological problems due to the social isolation (Liang et al., 2020) and more depressive symptoms (Ellis et al., 2020; Loades et al., 2020). These factors are in turn associated with an increased risk of alcohol (ab)use (Dumas et al., 2020; Pelham et al., 2021), even in pre-pandemic conditions (Dixit & Crum, 2000; Kuntsche et al., 2005; Canham et al., 2016). Thus, the COVID-19 pandemic could also function as a risk factor in the "social context and background" system along the PBT.

1.5 Aims and hypotheses

As shown above, there are various risk factors, as defined by PBT, for the development of adolescent alcohol use, which can be considered as a problem behavior in the sense of the PBT framework. These include other problem behaviors, such as bullying, which in the context of PBT is a risk factor within the same domain of "problem behavior". However, influences from the "social background and context", such as the COVID-19 pandemic as a macrosocial crisis, can also be seen as a risk factor for the emergence of problem behavior. In the "behavior system", emotions such as socially relevant empathy, together with important underlying factors, such as interoception, may also function as a risk factor of adolescent alcohol use, as there are difficulties with emotion regulation (e.g., Zimmermann & Iwanski, 2014; Zimmermann et al., 2018) during this life period.

So far, the risk factors mentioned seem to be mainly investigated in isolation with respect to their relation to alcohol use, but PBT postulates a reciprocal influence of the different systems and the inherent risk factors (Jessor, 1991). This raises the question of how the individual risk factors interact in their influence on adolescent drinking behavior. This thesis therefore attempts to evaluate the reciprocal relationship of individual risk factors within the

"social context", "behavior system" and "problem behavior" in their interaction and their effect on adolescents' drinking behavior in three studies (see Figure 7).

Figure 7

Scheme of Problem Behavior Theory adapted for the aim of the current thesis



Note. The figure is based on Figure 1. The PBT systems of primary interest for this thesis are highlighted in black. The risk factors for adolescent alcohol use relevant to each study are integrated and highlighted in color: study 1 = green, study 2 = blue and study 3 = purple.

Study 1 explores the possible relationship between the problem behavior of bullying and the socially relevant emotion of empathy, and examines the development of alcohol use in relation to these risk factors over the course of a longitudinal study. The specific hypotheses are as follows:

- 1.1 Victims and perpetrators of bullying use more alcohol than noninvolved adolescents do.
- 1.2 Affective empathy further increases the association between the bullying role and alcohol use.

In Study 2, the aspect of affective empathy is taken up again and examined in relation to interoception and emotion regulation. Here, the following hypotheses are guiding the analyses:

2.1 Emotion regulation, interoception and affective empathy independently lead to increased alcohol use.

Considering the sparsity of adaptive emotion regulation strategies in adolescence (Zimmermann & Iwanski, 2014), it is also hypothesized that

2.2 Interoception and affective empathy independently modulate the association between emotion regulation and alcohol use.

Study 3 analyzes a recent macro-social crisis in terms of its impact on a risk factor for alcohol use, namely negative thoughts as part of maladaptive emotion regulation, and the associated alcohol use. In contrast to most of the existing work in the field of COVID-19 (e.g., Liang et al., 2020; Ellis et al., 2020), a longitudinal survey on the first wave of the pandemic in Germany is used in order to better map the development over time. It is assumed that:

3. There is a positive association between the intensity of negative thoughts and alcohol use among adolescents during the COVID-19 pandemic.

This study uses a sub-sample of the adolescents recruited in Study 2. Study 3 also sheds light on a possible protective factor in the context of adolescent alcohol use, namely mindfulness. However, as this thesis focuses primarily on risk factors, mindfulness has not been included in the considerations so far, but will be discussed as an implication of the findings in the general discussion.
2 ORIGINAL CONTRIBUTIONS

2.1 The Role of Empathy in Alcohol Use of Bullying Perpetrators and Victims: Lower Personal Empathic Distress Makes Male Perpetrators of Bullying More Vulnerable to Alcohol Use¹

Prignitz, M., Banaschewski, T., Bokde, A. L. W., Desrivières, S., Grigis, A., Garavan, H., Gowland, P., Heinz, A., Martinot, J.-L., Paillère Martinot, M.-L., Artiges, E., Papadopoulos Orfanos, D., Poustka, L., Hohmann, S., Fröhner, J. H., Robinson, L., Smolka, M. N., Walter, H., ... Winterer, J. M. (2023). The Role of Empathy in Alcohol Use of Bullying Perpetrators and Victims: Lower Personal Empathic Distress Makes Male Perpetrators of Bullying More Vulnerable to Alcohol Use. *International Journal of Environmental Research and Public Health*, *20*(13), 6286. https://doi.org/10.3390/ijerph20136286

Abstract:

Bullying often results in negative coping in victims, including an increased consumption of alcohol. Recently, however, an increase in alcohol use has also been reported among perpetrators of bullying. The factors triggering this pattern are still unclear. We investigated the role of empathy in the interaction between bullying and alcohol use in an adolescent sample (IMAGEN) at age 13.97 (±0.53) years (baseline (BL), N = 2165, 50.9% female) and age 16.51 (± 0.61) years (follow-up 1 (FU1), N = 1185, 54.9% female). General empathic distress served as a significant moderator of alcohol use in perpetrators ($F_{9, 493} = 17.978$, p < 0.01), which was specific for males and FU1. Male perpetrators, who are generally less sensitive to distress, might thus be more vulnerable to alcohol abuse.

Keywords: bullying; alcohol; empathy; distress; adolescence

1. Introduction

Bullying is a major issue in many domains of our social lives. Considering the definition of bullying from Olweus [1], someone is being bullied when he or she has to suffer over time from repeated, negative actions towards himself/herself by one or more other people. As a form of peer harassment at school [2], bullying has its main impact on adolescence and results in serious and diverse negative outcomes for victims. This includes internalizing problems, such as depression [3], together with an increase in alcohol use as a potential externalizing coping strategy [4]. However, studies also report on negative outcomes for perpetrators, mainly showing externalizing problems such as an increase in aggressive behavior [5,6], and also, similar to victims, an increase in alcohol use [7,8].

While the increase in alcohol use found in victims of bullying rather confirms expectations, it is still not clear why perpetrators often respond along those lines. One aspect that might come into play is emotional reactivity [9]. This develops in adolescence and is an important aspect of social challenges [10]. In this respect, emotional reactivity might either be beneficial for or hinder coping with negative events, including events of bullying. If victims' coping fails due to strong emotional responses, they may develop or regress to alternative coping strategies such as alcohol use. This has already been shown in response to the experience of general negative events [11] as well as in response to highly stressful interpersonal situations [8,12,13].

If we consider the whole bullying process as a socially challenging situation, similar coping dynamics might also account for perpetrators. Even if perpetrators actively "create" such situations, those who are highly emotionally responsive might nevertheless also strongly react to these highly challenging events, similar to victims, and might fail in handling these situations [8,12,13]. This is in line with results from a meta-analysis by Kowalski et al. [14], who showed that perpetrators also tend to have higher levels of psychosocial distress and associated negative outcomes in bullying situations [15]. Moreover, if a perpetrator has higher general levels of personal empathic distress or empathic concern in intense interpersonal situations [16–18], he or she may also more strongly perceive any bullying situation as interpersonally challenging and stressful [12,15]. Thus, aside from emotional reactivity, for perpetrators, more general aspects of empathic distress or concern might specifically come into play. Empathy can be seen as a critical facet in regulating our social behavior [19], and indeed, it is defined as the ability to cognitively and affectively understand and share the emotions of others [20]. In this respect, general personal empathic distress, as an aspect of affective empathic processing, is supposed to reflect an individual disposition of a stronger self-focused and aversive emotional response

when another person is under stress, which also includes the desire to reduce the accompanied stress in such a situation [16,18]. Thus, higher empathic personal distress can be seen as a "negative side" of empathic experience, which may be associated with other risk factors of heightened alcohol use [21]. This also fits with observations that, although perpetrators are mostly attributed with specific negative behavioral traits such as aggression [5], they still seem to have positive social skills [22] and are socially integrated into groups [23,24]. It can therefore be expected that being a perpetrator is more similar to a continuum of characteristics and influencing factors [25] in a situation-dependent manner rather than an all-or-none phenomenon, where handling in terms of "coping" with bullying situations might also be conceivable for perpetrators.

For empathy, it has also been shown that victims of bullying are characterized by significantly higher empathy compared to noninvolved participants [26]. Fabris et al. [15] postulate that this association is driven by the continuous experience of victimization, which may lead to better recognition of signals of other people's suffering and where personal empathic distress might then come into play. If such associations exist, this might explain previous findings of increased alcohol use in both victims and perpetrators of bullying and thus explain alcohol use as a common medium for both bullying groups. Indeed, the disposition for empathic distress has been shown to be associated with a higher tendency to initiate negative coping behaviors, including alcohol use [27,28]. This tendency might even be increased in females, who usually score higher on measures of empathy than males [29,30]. A higher pattern of alcohol use among perpetrators react with higher alcohol use and that this might be driven by higher levels of empathy. The former has just been found in a very recent study [31]. Whether and how this is related to facets of empathy has, however, not been investigated.

In the present study, we, therefore, aimed to disentangle the so far under-represented role of empathy as a potential moderator in the association between bullying and alcohol use, compare both adolescent victims and perpetrators of bullying, and consider potential sex differences in a longitudinal dataset, which has so far rarely been used in research on bullying. We assumed perpetrators and victims would use more alcohol than noninvolved adolescents and have higher empathic personal distress, resulting in a further increase in this association (see Figure 1). Additionally, we expected to see differences driven by sex in these associations. Since internalizing and externalizing problems have been strongly observed in perpetrators and victims of bullying [12], we controlled for these characteristics.



Figure 1. Graphical illustration of the hypotheses: 1.) perpetrators and victims are assumed to consume more alcohol than noninvolved individuals and 2.) higher empathic personal distress is assumed to increase this association.

2. Materials and Methods

2.1. Participants

Data for the current work were taken from the IMAGEN project, a longitudinal European multicenter study, with the aim of identifying genetic and neurobiological risk factors for developing psychological disorders in an ethnically homogenous but socioeconomically diverse sample [32]. Participants were assessed from adolescence to early adulthood along different waves (baseline (BL), follow-up 1 (FU1), follow-up 2, and follow-up 3) in eight cities in three European countries (the United Kingdom, France, and Germany). In the current work, we used data from BL and FU1. We only included participants, from whom complete datasets were available, leaving a total sample of 2165 participants at BL (mean age 13.98 ± 0.487 years, 50.9% female) and 1185 participants at FU1 (mean age 16.493 ± 0.643 years, 54.9% female). A detailed description of the present sample can be found in Tables 1 and 2. Additionally, country-specific information on bullying distribution can be found in Supplementary Table S1.

			Total	Male	Female
			N (%)	N (%)	N (%)
BL	Participants		2165	1062 (49.1)	1103 (50.9)
	Language	English	853 (39.4)	431 (40.6)	422 (38.3)
		French	261 (12.1)	130 (12.2)	131 (11.9)
		German	1050 (48.5)	500 (47.1)	550 (49.9)
	Bullying role	Perpetrator	106 (4.9)	77 (7.3)	29 (2.6)
		Victim	276 (12.7)	115 (10.8)	161 (14.6)
		PerpVictims	72 (3.3)	55 (5.2)	17 (1.5)
		Noninvolved	1711 (79.0)	815 (76.7)	896 (81.2)
FU1	Participants		1185	533 (45.0)	650 (54.9)
	Bullying role	Perpetrator	32 (2.7)	17 (3.2)	15 (2.3)
		Victim	63 (5.3)	16 (3.0)	46 (7.1)
		PerpVictims	15 (1.3)	10 (1.9)	5 (0.8)
		Noninvolved	1075 (90.7)	490 (91.9)	584 (89.8)
OL	Bullying role	Perpetrator	8 (25.0)*	5 (29.4)*	3 (20.0)*
		Victim	28 (44.4)*	9 (56.3)*	19 (41.3)*
		PerpVictims	3 (20.0)*	2 (20.0)*	1 (20.0)*
		Noninvolved	873 (81.3)*	383 (78.3)*	489 (83.7)*
37	DI 1 1'	TTT1 C 11	1 01 0	1 1 11 1	

Table 1. Sample distribution.

Note. BL = baseline, FU1 = follow-up 1, OL = Overlap bullying cases between BL and FU1, N = total number of cases, % = percentage of all cases, * = percentage of cases compared to groups at FU1.

			Total	Male	Female	Sex Differences
		_	M (SD)	M (SD)	M (SD)	t (df)
BL	Age		13.973 (0.532)	13.981 (0.502)	13.964 (0.560)	0.715 (2221)
	$Q \times F$		1.091 (1.559)	1.074 (1.576)	1.115 (1.548)	-0.611 (2177)
	SDQ	Ι	4.490 (2.951)	3.879 (2.817)	5.083 (2.959)	-9.766 (2194)***
		Е	6.156 (3.115)	6.287 (3.255)	6.027 (2.969)	1.953 (2194)
FU1	Age		16.511 (0.611)	16.509 (0.633)	16.514 (0.591)	-0.154 (1650)
	$Q \times F$		2.863 (2.330)	3.166 (2.528)	2.581 (2.088)	5.211 (1695)***
	SDQ	Ι	4.729 (3.149)	3.844 (2.848)	5.562 (3.194)	-11.695 (1690)***
		E	5.290 (3.089)	5.224 (3.124)	5.355 (3.058)	-0.871 (1690)
	IRI	РТ	15.218 (3.033)	14.900 (3.142)	15.478 (2.918)	-3.319 (1214)***
		EC	14.760 (2.367)	14.544 (2.560)	14.931 (2.189)	-2.801 (1214)**
		PD	13.487 (3.128)	12.750 (3.082)	14.087 (3.042)	-7.58 (1213)***
		F	15.113 (3.442)	14.504 (3.706)	15.608 (3.124)	-5.55 (1216)***

 Table 2. Sample description.

Note. BL = Baseline; FU1 = follow-up 1; Q x F = Alcohol Use Disorder Identification Test quantity × frequency sub score; SDQ = Strengths and Sifficulties Questionnaire; I = subscale Internalizing Problems; E = subscale Externalizing Problems; IRI = Interpersonal Reactivity Index; PT = subscale Perspective Taking; EC = subscale Empathic Concern; PD = subscale Personal Distress; F = subscale Fantasy; M = mean; SD = standard deviation; t = t value; df = degrees of freedom; ** p < 0.01; *** p < 0.001.

2.2. Procedure

Participants underwent a large test battery, including neuropsychological measures (e.g., CANTAB), cognitive tasks (e.g., PALP), functional tasks (e.g., face task, monetary incentive delay task, stop signal task), structural magnetic resonance imaging tasks (volumetry, diffusion tensor imaging), and blood sampling for genotyping [32]. They also went through a large interview and questionnaire battery (e.g., on clinical characterization, personality, alcohol and drug use, and environmental factors) [32], assessed both at the study centers and online at home via the Psytools software [33]. For the present work, we selected questionnaire data on alcohol, empathy, bullying, and internalizing and externalizing problems.

2.3. Psychometric Assessments

Due to the multicenter and multilingual structure of the study, we used measures "based on three criteria: validation across [the] three languages, validation for use with adolescents, and suitability for electronic assessment" ([32], p. 1131) in the respective first language of the participants. Measures that did not meet these criteria were piloted and tested within the IMAGEN centers [32]. For the current work, we used three already validated questionnaires for empathy, alcohol use, internalizing/externalizing problems, and one questionnaire for bullying, which was piloted and tested within the IMAGEN study.

2.3.1. Bullying

To measure bullying, a 12-item self-report questionnaire based on [34] was used at BL and FU1. Participants had to judge how often certain situations occurred in the past six months. Six items measure bullying perpetration (four items in peer context) and six items measure victimization (four items in peer context, see Supplementary Materials). All items were answered on a 5-point scale from 0 = "None" to 4 = "Several times a week". Cronbach's alpha was acceptable, with $\alpha = 0.778$ at BL and $\alpha = 0.693$ at FU1.

For the present work, only bullying regarding peers was of interest. Therefore, we included the eight items asking for peer context in the categorization process and determined cutoffs in line with suggestions from Solberg and Olweus [35]: answers to items with "2 or 3 times a month" or more often. Participants were categorized into four bullying roles: pure perpetrators (responding to at least one perpetrator item), pure victims (responding to at least one victimization item), perpetrator-victims (responding to at least one victimization item), and noninvolved students [35]. In our study, we are specifically interested in the differences between perpetrators and victims. The perpetrator-victim category,

therefore, does not allow for a clear classification [12], nor does it add critical information, but rather noise to the data with respect to our research question. Therefore, we did not include this group in our analyses but decided to apply a three-group design with pure perpetrators, pure victims, and participants who were noninvolved in bullying as controls (see Table 1).

2.3.2. Empathy

To measure trait empathy, we used the Interpersonal Reactivity Index (IRI by [36]) from FU1. The IRI has 28 items, evenly divided into four subscales: Perspective Taking (PT), Fantasy (F), Empathic Concern (EC), and Personal Distress (PD; see Supplementary Materials), which reflect cognitive (PT and F) and affective aspects (EC and PD) of empathic processing [16]. Each item is rated on a 5-point scale from 1 = "does not describe me well" to 5 = "describes me very well". The IRI is a well-validated and often-used instrument in empathy research. Cronbach's alpha for each subscale was low (PT: $\alpha = 0.338$, F: $\alpha = 0.292$, EC: $\alpha = 0.115$, PD: $\alpha = 0.378$), but similar to other studies using the IRI in adolescent samples [37]. The IRI represents a trait-like disposition that is stable over time [16,38]. Based on previous studies [12,15,27], we were mainly interested in the subscale of Personal Distress. However, since it can also be argued that the different subscale-based dimensions interact and personal distress is not the sole factor in an empathic process, we also included the other subscales in our analyses. This allows a comparison and weighting of the empathic subfactors.

2.3.3. Alcohol Use

To assess alcohol use, the Alcohol Use Disorder Identification Test (AUDIT by [39]) was used, both at BL and FU1. The AUDIT is a 10-item self-report measure to recognize risky and harmful alcohol use. Therefore, each item gets a score, and the sum score of all items is used to judge the alcohol use behavior. The AUDIT is a well-validated measurement and contains three conceptual axes (consumption pattern, dependency symptoms, and feature of harmful use) to capture a wide range of alcohol-associated problems. Cronbach's alpha was good with $\alpha = 0.800$ at BL and acceptable with $\alpha = 0.732$ at FU1.

For alcohol use, we used AUDIT conceptual axis "consume pattern" as outcome [40]. This sum score of 3 items, also called "Quantity, frequency and hazardous use" ($Q \times F$), reflects the intensity of drinking behavior, from no drinking (0) to heavy drinking (12).

2.3.4. Internalizing and Externalizing Problems

To control for a potential role of internalizing and externalizing problems in the effect of bullying roles on alcohol use, we included the Strengths and Difficulties Questionnaire (SDQ by [41]), which was assessed at BL and FU1. The SDQ includes 25 items, equally divided into five subscales (emotional problems, conduct problems, hyperactivity/inattention, peer relationship problems, and prosocial behavior; see Supplementary Materials). For the present work, we used the subscales externalizing problems (SDQ Extern, sum of emotional symptoms and peer relationship problems) and internalizing problems (SDQ Intern, sum of conduct problems and hyperactivity) pursuant to Goodman et al. [42].

2.4. Data Analysis

Analyses were conducted with SPSS for Windows, Version 25.0 [43], and a significance level of p < 0.05. Differences in sociodemographic data were explored using T-tests for independent samples. Based on previous studies, we first tested the main effect of bullying role (perpetrator vs. victim vs. noninvolved) on alcohol use. For this, we used (1) general linear models for baseline and follow-up 1 separately to also see the stability of this effect over time, with bullying role as 3-level and covariate sex as 2-level between-subject factors. In these models, SDQ Intern and SDQ Extern (for both models) and baseline alcohol use and baseline bullying role (for the FU1 model) were also entered as covariates. Then, we applied (2) general linear model for repeated measures, with time points (BL, FU1) as within-subject factors, bullying role at baseline as 3-level and covariate sex as 2-level between-subject factors, as well as covariates at baseline SDQ Intern and baseline SDQ Extern to test for effects on alcohol use as it increases over time. Post hoc tests were performed with univariate general linear model for baseline bullying role on alcohol use at follow-up 1 with bullying role at follow-up 1, SDQ Intern and SDQ Extern for baseline and follow-up 1, and sex as covariates, as well as with a difference score of alcohol use (FU1-BL) as dependent variable. To explore the moderating role of trait facets of empathy on the association between bullying role and alcohol use, both at baseline and follow-up 1, the SPSS plugin PROCESS macro version 3.4 [44] was used, and different models for each IRI subscale (PT, F, EC, and PD), with the covariates sex, SDQ Intern, and SDQ Extern for baseline alcohol use, and additional covariates follow-up 1 SDQ Intern, follow-up 1 SDQ Extern, baseline alcohol use, and baseline bullying role for follow-up 1 alcohol use, were calculated. In a post hoc analysis, we tested (1) if the effects are also present in the alcohol difference score (FU1 Q \times F–BL Q \times F) by 3-level-factor baseline bullying role and 3-level-factor follow-up 1 bullying role, with covariates sex, baseline alcohol use, and SDQ Intern and SDQ Extern, both at baseline and follow-up 1 and (2) if the bullying roles (3-levelbetween factor), each at baseline and follow-up 1, differ in internalizing and externalizing problems, using covariates sex for both models and additionally baseline bullying role and baseline SDQ Intern and baseline SDQ Extern, respectively, for follow-up 1 models.

3. Results

3.1. General Sample Information

We found no significant sex differences in age at baseline and follow-up 1 and alcohol use at baseline (all p > 0.05), but a significant difference in alcohol use at follow-up 1: males had higher scores than females (see Table 2). We also observed significant sex differences in all IRI subscales and for SDQ Intern, both at baseline and follow-up 1, with females having higher scores than males (see Table 2).

3.2. Main Effect of Bullying Role on Alcohol Use

3.2.1. Baseline Bullying Role on Baseline Alcohol Use

There was a significant main effect of baseline bullying role on alcohol score at baseline (see Table 3). Pairwise comparisons showed that perpetrators (M = 1.736, SD = 2.117) had a significantly higher score than victims (M = 1.0, SD = 1.373) with p < 0.01 and noninvolved (M = 1.042, SD = 1.483) with p < 0.001. There was no significant difference between victims and noninvolved (p > 0.05) (see Figure 2), but a significant difference between females and males, as well as significant effects for the covariates SDQ Intern and SDQ Extern. Information on sex-separated models can be found in Supplementary Materials.

Dependent Variable	Covariates/ Predictor	F	(df1, df2)	р	η²
$\frac{Variable}{BL O \times F}$	sex	5.587	(1.2073)	0.018	0.003
	BL SDO I	10.617	(1,2073)	0.001	0.005
	BL SDO E	92.418	(1,2073)	< 0.001	0.043
	BL BR	6.557	(2,2073)	0.001	0.006
FU1 Q × F	sex	18.687	(1,1542)	<0.001	0.012
	BL SDQ I	0.000	(1,1542)	0.998	0.000
	BL SDQ E	0.162	(1,1542)	0.687	0.000
	BL BR	0.381	(1,1542)	0.537	0.000
	$BLQ \times F$	297.321	(1,1542)	<0.001	0.162
	FU1 SDQ I	22.206	(1,1542)	<0.001	0.014
	FU1 SDQ E	41.455	(1,1542)	<0.001	0.026
	FU1 BR	7.686	(2,1542)	<0.001	0.010
$Q \times F$ over Time	time	165.785	(1,1617)	<0.001	0.093
	time \times sex	37.328	(1,1617)	<0.001	0.023
	time × BL SDQ I	1.581	(1,1617)	0.209	0.001
	time × BL SDQ E	2.866	(1,1617)	0.091	0.002
	time × BL BR	0.685	(2,1617)	0.504	0.001
	sex	3.329	(1,1617)	0.068	0.002
	BL SDQ I	9.825	(1,1617)	0.002	0.006
	BL SDQ E	56.914	(1,1617)	<0.001	0.034
	BL BR	9.588	(2,1617)	<0.001	0.012
FU1 Q × F	sex	17.895	(1,1542)	<0.001	0.011
	BL SDQ I	0.103	(1,1542)	0.748	0.000
	BL SDQ E	45.192	(1,1542)	<0.001	0.028
	FU1 BR	9.946	(1,1542)	0.002	0.006
	$BLQ \times F$	292.428	(1,1542)	<0.001	0.159
	FU1 SDQ I	26.472	(1,1542)	<0.001	0.017
	FU1 SDQ E	45.192	(1,1542)	<0.001	0.028
	BL BR	2.514	(2,1542)	0.081	0.003

Table 3. Statistical values of all general linear models for the effects of bullying on alcohol use.

Note. BL = baseline, FU1 = follow-up 1, $Q \times F$ = Alcohol Use Disorder Identification Test Quantity \times Frequency subscore, SDQ I = Strengths and Difficulties Questionnaire subscale "Internalizing Problems", SDQ E = Strengths and Difficulties Questionnaire subscale "Externalizing Problems", BR = bullying role, main predictor of each model is italic, bold marked values are significant at p < 0.05 or below.



Figure 2. Alcohol Use Disorder Identification Test "Quantity × Frequency" ($Q \times F$) score separated by measurement point. Structure of bars represent measurement point of bullying with BL = baseline and FU1 = follow-up 1, error bar represents standard error.

3.2.2. Follow-Up 1 Bullying Role on Follow-Up 1 Alcohol Use

There was a significant main effect of follow-up 1 bullying role on the alcohol score at follow-up 1. Pairwise comparisons showed that perpetrators (M = 4.500, SD = 2.918) had a significantly higher score than victims (M = 2.523, SD = 2.274) with p < 0.01 and noninvolved (M = 2.800, SD = 2.301) with p < 0.001. There was no significant difference between victims and noninvolved (p > 0.05) (see Figure 2), but a significant effect of the covariates sex, baseline alcohol score, follow-up 1 SDQ Intern, and follow-up 1 SDQ Extern (see Table 3). Information on sex-separated models can be found in Supplementary Materials.

3.3. Alcohol Use Increases Over Time

A significant main effect of time was found, indicating that participants had a higher score in alcohol use at follow-up 1 compared to baseline, and of bullying role, indicating perpetrators to have a higher alcohol score than victims (p < 0.001) and noninvolved (p < 0.001). Moreover, the interaction between time and sex reached significance, indicating a change in alcohol score in both sexes over time, and the main effects of the covariates sex, baseline SDQ Intern, and baseline SDQ Extern were found (all p < 0.01) (see Table 3).

Baseline Bullying Role on Follow-Up 1 Alcohol Use

There was no significant main effect of baseline bullying role on alcohol use at followup 1 (p > 0.05, see Figure 2), but a significant effect of covariates sex, baseline alcohol use, follow-up 1 bullying role, baseline SDQ Extern, follow-up 1 SDQ Intern, and follow-up 1 SDQ Extern (all p < 0.01, see Table 3). Due to the lack of a significant main effect of the baseline bullying role, we did not test the models separated for sex.

3.4. Moderation of the Relationship between Baseline Bullying Role and Baseline Alcohol Use by Empathy

We observed a significant interaction effect between baseline bullying role and the moderator for IRI F ($F_{6,1163} = 8.854$, p < 0.001, $R^2 = 0.044$) (see Figure 3). Specifically, we found a significant main effect of IRI F, a significant interaction between baseline bullying role and F, and significant covariates sex, SDQ Extern, and SDQ Intern. For a detailed overview of the statistical values of all models, see Supplementary Table S3.



Figure 3. Moderation effect of IRI subscale Fantasy on the association between bullying role and Alcohol Use Disorder Identification Test Quantity \times Frequency score (Q \times F) both measured at baseline.

3.5. Moderation of the Relationship between Follow-Up 1 Bullying Role and Follow-Up 1 Alcohol Use by Empathy

We observed significant models for all empathy scores (see Table 4), however, mainly driven by significant effects of covariates sex, baseline alcohol use, SDQ Extern, and SDQ Intern at follow-up 1 (see Table 5). Only for the moderation model with IRI PD as moderator,

we found a main effect of follow-up 1 bullying role in alcohol use in males, but not in females (see Figure 4), and a significant interaction between follow-up 1 bullying role and moderator IRI PD for males, but not females. Details on statistical values can be found in Tables 4 and 5.

Table 4. General model information of separated moderator models for each IRI subscale as moderators on the association between FU1 bullying role and FU1 alcohol use, separated by sex.

	Total				Male			Female		
Model	F	р	R^2	F	р	R^2	F	р	R^2	
РТ	32.512	< 0.001	0.225	16.841	< 0.001	0.235	18.427	< 0.001	0.211	
F	32.693	< 0.001	0.226	16.980	< 0.001	0.236	18.089	< 0.001	0.208	
EC	32.280	< 0.001	0.223	16.935	< 0.001	0.236	18.021	< 0.001	0.208	
PD	33.061	< 0.001	0.228	17.978	< 0.001	0.247	17.910	< 0.001	0.210	

Note. "Model" refers to the applied moderator, PT = Perspective Taking, F = Fantasy, EC = Empathic Concern, PD = Personal Distress.

Table 5. Detailed description of separated moderator models for each IRI subscale as moderators on the association between FU1 bullying role and FU1 alcohol use, separated by sex.

		_	Total			Male			Female	
Model	<i>Predictors/</i> Covariates	b	t	р	b	t	р	b	t	р
PT	constant	5.637	3.235	0.001	3.369	1.161	0.246	5.834	2.685	0.007
	BR	-0.654	-1.467	0.143	-0.136	-0.186	0.853	-0.995	-1.780	0.076
	PT	-0.119	-1.082	0.279	0.045	0.236	0.813	-0.236	-1.761	0.079
	$BR \times PT$	0.025	0.869	0.385	-0.016	-0.321	0.748	0.053	1.524	0.128
	BL BR	-0.054	-0.756	0.500	-0.106	-0.995	0.320	0.010	0.101	0.920
	$BLQ \times F$	0.647	14.431	<0.001	0.766	10.131	< 0.001	0.546	10.098	< 0.001
	BL SDQ E	-0.027	-1.038	0.299	-0.058	-1.415	0.158	0.001	0.041	0.968
	BL SDQ I	0.019	0.713	0.476	0.035	0.798	0.425	-0.001	-0.044	0.965
	FU1 SDQ E	0.157	6.231	< 0.001	0.182	4.480	<0.001	0.138	4.340	<0.001
	FU1 SDQ I	-0.113	-4.504	< 0.001	-0.169	-3.792	<0.001	-0.066	-2.249	0.025
	sex	-0.440	-3.427	0.001						
F	constant	4.928	2.676	0.007	5.375	1.744	0.082	2.052	0.903	0.367
	BR	-0.667	-1.441	0.150	-0.796	-1.025	0.306	-0.283	-0.494	0.622
	F	-0.066	-0.594	0.553	-0.085	-0.444	0.657	0.003	0.025	0.980
	$BR \times F$	0.025	0.879	0.380	0.028	0.571	0.568	0.008	0.232	0.816
	BL BR	-0.045	0.632	0.528	-0.104	-0.980	0.328	0.025	0.260	0.795
	$BLQ \times F$	0.648	14.474	< 0.001	0.757	10.025	< 0.001	0.552	10.147	< 0.001
	BL SDQ E	-0.025	-0.941	0.347	-0.056	-1.371	0.171	0.002	0.050	0.960
	BL SDQ I	0.014	0.544	0.587	0.032	0.738	0.461	-0.004	-0.121	0.904
	FU1 SDQ E	0.155	6.160	<0.001	0.180	4.467	< 0.001	0.143	4.497	< 0.001
	FU1 SDQ I	-0.116	-4.591	< 0.001	-0.173	-3.877	<0.001	-0.074	-2.493	0.013
	sex	-0.480	-3.732	<0.001						

Tabl	e 5.	Cont.
------	------	-------

			Total			Male			Female	
Model	<i>Predictors/</i> Covariates	b	t	р	b	t	р	b	t	р
EC	constant	3.512	1.469	0.142	7.121	1.681	0.093	-1.185	-0.419	0.676
	BR	-0.259	-0.424	0.672	-1.241	-1.148	0.252	0.659	0.906	0.365
	EC	0.024	0.150	0.881	-0.209	-0.728	0.467	0.217	1.193	0.234
	$BR \times EC$	-0.001	-0.028	0.978	0.060	0.815	0.416	-0.054	-1.138	0.256
	BL BR	-0.049	-0.686	0.493	-0.110	-1.027	0.305	0.031	0.315	0.753
	$BLQ \times F$	0.647	14.413	<0.001	0.760	10.060	< 0.001	0.545	10.065	< 0.001
	BL SDQ E	-0.028	-1.051	0.294	-0.057	-1.385	0.167	-0.002	-0.052	0.959
	BL SDQ I	0.014	0.538	0.590	0.033	0.750	0.454	-0.005	-0.152	0.879
	FU1 SDQ E	0.156	6.209	<0.001	0.180	4.457	< 0.001	0.147	4.628	< 0.001
	FU1 SDQ I	-0.113	-4.519	<0.001	-0.172	-3.880	< 0.001	-0.070	-2.372	0.018
	sex	-0.457	-3.566	<0.001						
PD	constant	7.304	4.951	< 0.001	10.060	4.110	< 0.001	3.425	1.794	0.073
	BR	-1.218	-3.232	0.001	-2.035	-3.256	0.001	-0.442	-0.967	0.334
	PD	-0.252	-2.443	0.015	-0.477	-2.529	0.012	-0.092	-0.737	0.462
	$BR \times PD$	0.069	2.585	0.010	0.133	2.752	0.006	0.022	0.660	0.510
	BL BR	-0.054	-0.759	0.448	-0.114	-1.080	0.281	0.015	0.153	0.879
	$BLQ \times F$	0.649	14.503	<0.001	0.767	10.232	< 0.001	0.54	10.049	< 0.001
	BL SDQ E	-0.207	-1.027	0.305	-0.060	-1.477	0.140	-0.001	-0.019	0.985
	BL SDQ I	0.016	0.591	0.554	0.038	0.864	0.388	-0.001	-0.027	0.978
	FU1 SDQ E	0.154	6.131	<0.001	0.182	4.516	< 0.001	0.144	4.550	< 0.001
	FU1 SDQ I	-0.110	-4.374	<0.001	-0.179	-4.047	< 0.001	-0.066	-2.228	0.026
	sex	-0.463	-3.589	<0.001						

Note. "Model" refers to the applied moderator, PT = Perspective Taking, F = Fantasy, EC = Empathic Concern, PD = Personal Distress, BR = bullying role at follow-up 1, BL BR = bullying role at baseline, BL Q × F = Alcohol Use Disorder Identification Test Quantity × Frequency score at baseline, BL SDQ E = Strengths and Difficulties Questionnaire subscale "Externalizing Problems" at baseline, BL SDQ I = Strengths and Difficulties Questionnaire subscale "Internalizing Problems" at baseline, FU1 SDQ E = Strengths and Difficulties Questionnaire subscale "Externalizing subscale "Externalizing Problems" at follow-up 1, FU1 SDQ I = Strengths and Difficulties Questionnaire subscale "externalizing Problems" at follow-up 1, FU1 SDQ I = Strengths and Difficulties Questionnaire subscale "externalizing Problems" at follow-up 1, FU1 SDQ I = Strengths and Difficulties Questionnaire subscale "externalizing Problems" at follow-up 1, FU1 SDQ I = Strengths and Difficulties Questionnaire subscale "Externalizing Problems" at follow-up 1, FU1 SDQ I = Strengths and Difficulties Questionnaire subscale "Externalizing Problems" at follow-up 1, FU1 SDQ I = Strengths and Difficulties Questionnaire subscale "Internalizing Problems" at follow-up 1, main predictors are written in italic, bold marked coefficients are significant at <math>p < 0.05 or below.

3.6. Post-Hoc Analysis with a Difference Score (FU1-BL) of Alcohol Use

There was a significant main effect of bullying role on the change in alcohol use (FU1 Q × F–BL Q × F, BL: $F_{2,1537} = 4.518$, p < 0.05, $\eta^2 = 0.006$; FU1: $F_{2,1537} = 7.826$, p < 0.001, $\eta^2 = 0.010$), with significant effects of the covariates baseline alcohol use ($F_{1,1537} = 97.281$, p < 0.001, $\eta^2 = 0.060$), follow-up 1 SDQ Extern ($F_{1,1537} = 43.269$, p < 0.001, $\eta^2 = 0.027$), follow-up 1 SDQ Intern ($F_{1,1537} = 23.576$, p < 0.001, $\eta^2 = 0.015$) and sex ($F_{1,1537} = 17.457$, p < 0.001, $\eta^2 = 0.011$). This association was not significantly moderated by empathy (all models p > 0.05).

3.7. Post-Hoc Analysis: Do Perpetrators, Victims, and Noninvolved Differ in Internalizing and Externalizing Problems?

There was a significant main effect of bullying in the SDQ subscale Internalizing Problems (BL: $F_{2,2083} = 129.803$, p < 0.001, $\eta^2 = 0.111$; FU1: $F_{2,1556} = 33.344$, p < 0.001, $\eta^2 = 0.041$), with significant effects of the covariate sex (BL: $F_{1,2083} = 97.710$, p < 0.001, $\eta^2 = 0.045$; FU1: $F_{1,1556} = 66.405$, p < 0.001, $\eta^2 = 0.041$) in both models. For follow-up 1 SDQ Intern, the covariate baseline SDQ Intern ($F_{1,1556} = 436.763$, p < 0.001, $\eta^2 = 0.219$), but not the baseline bullying role (p > 0.05), reached significance. Pairwise comparisons showed that victims (BL: M = 6.932, SD = 3.432, FU1: M = 8.253, SD = 3.593) have significantly higher scores than perpetrators (BL: M = 4.141, SD = 2.990, FU1: M = 4.146, SD = 3.062) and noninvolved (BL: M = 4.048, SD = 2.613, FU1: M = 4.464, SD = 2.976) (all p < 0.001), whereas scores between perpetrators and noninvolved were not significantly different (all p > 0.05).



Figure 4. Moderation effect of Interpersonal Reactivity Index subscale of Personal Distress on the association between follow-up 1 bullying role and Alcohol Use Disorder Identification Test Quantity x Frequency score ($Q \times F$), separated by sex: (A) male participants, (B) female participants.

There was a significant main effect of bullying in the SDQ subscale Externalizing Problems (BL: $F_{2, 2083} = 20.851$, p < 0.001, $\eta^2 = 0.020$, FU1: $F_{2, 1556} = 3.446$, p < 0.05, $\eta^2 = 0.004$) for both models. Pairwise comparison showed that perpetrators (BL: M = 7.755, SD = 3.601; FU1: M = 6.195, SD = 3.558) have significantly higher scores than victims (BL: M = 6.441, SD = 3.198; FU1: M = 5.943, SD = 3.404, p < 0.01) and noninvolved (BL: M = 5.896, SD = 2.948; FU1: M = 5.105, SD = 2.971, p < 0.001), and that victims have significantly higher scores than noninvolved for baseline (p < 0.05), but not for follow-up 1 (all p > 0.05). The covariate sex did not reach significance in both models (both p > 0.05). Additionally, for

follow-up 1 SDQ Extern, we found a significant effect of the covariate baseline SDQ Extern $(F_{1,1556} = 652.332, p < 0.001, \eta^2 = 0.295)$, but not of the baseline bullying role (p > 0.05).

4. Discussion

Bullying behavior is associated with various individual risk outcomes for victims, but also perpetrators. While most of them, like depression and aggression, vary between victims and perpetrators, an increase in alcohol use has mostly been found in both [3,5,45]. Studies so far have tried to disentangle drinking motives as possible moderators of associations between different bullying roles and alcohol use and found enhancement and social motives to moderate alcohol use in perpetrators (in both sexes) and coping motives to moderate alcohol use in victims in males and at least partly also in females [8]. In this vein, we tested the role of trait empathy, in a large longitudinal sample of healthy adolescents.

We found an increase in alcohol use from BL to FU1 in our sample, with higher levels in males compared to females at FU1 [46–48] as well as higher levels of trait empathy scores in females compared to males [29,30]. This corroborates previous findings, and our sample might therefore be comparable with those from other studies in the distribution of our main variables.

When looking at the association between bullying role and alcohol use, perpetrators had not only higher levels of alcohol use than noninvolved, as previously reported [6], but also compared to victims. This was observed both at BL and FU1 and for the increase in alcohol use over time. Moreover, those associations were specific for males and not found in females, and also only in males a significant moderating effect of trait empathy, particularly of empathic personal distress at follow-up 1, was observed. In females, therefore other factors might play a role for the use of alcohol as a potential handling or coping mechanism in bullying. In male perpetrators, less empathic distressed ones had higher levels of alcohol use and alcohol use decreased with increasing empathy scores for this bullying role. This indicates that, in contrast to victims, where alcohol use usually serves as a coping mechanism in response to negative experiences of bullying [4], in perpetrators alcohol use may rather reflect a correlate of a "negative" trait with low empathic distress, as an aspect of affective emotional processing. This might be indicative of a potentially aggressive and/or psychopathic personality characteristic [18] and might result in less sensitivity to the social environment or social feedback. This is also supported by our results that perpetrators showed a significant increase in alcohol use over time, but without any effect of empathy. Previous studies already reported that males try to gain or maintain their status by showing aggressive behavior [23]. Moreover, adolescents with

psychopathy traits score low on cognitive and affective empathy [49], show higher antisocial behavior [50] and positive associations to alcohol use [51]. This is related to our result that heightened fantasy, as a cognitive aspect of empathy, was associated with enhanced alcohol use in perpetrators at baseline. The IRI subscale Fantasy is defined as a tendency to identify oneself with fictional characters [36] rather than with real life situations. Therefore the heightened effect of fantasy on alcohol use in perpetrators might reflect the tendency to "create their own world", which would go along with research showing perpetrators to consume media suiting their own beliefs and preferences, i.e., for aggression [52,53]. Taken together our results substantially amend these previous findings.

In contrast to previous studies [7], we found no significant difference in alcohol use between victims and noninvolved in our sample. Our sample of bullying victims might therefore rather be characterized by a stronger use of internalizing facets as coping strategies, indicated by our post hoc results and also found in previous research [3,54]. We also found no significant effect of trait empathy on alcohol use in bullying victims, indicating that empathy might indeed serve as a perpetrator-specific trait in the context of alcohol use. Moreover, different forms of bullying may be differentially be affected by trait empathy, which could also explain the sexspecific effects: for example, physical aggression is more strongly used by males, whereas relational aggression has more often been observed for females [6,13] and also bullying intensity is often stronger when bullying is performed by males vs. females [55]. It might therefore be assumed that bullying intensity has an effect on changing the use of alcohol to handle or cope with bullying. This also indicates the presence of subgroups of perpetrators and victims with different empathic abilities and therefore different patterns of alcohol use. However, these aspects still need to be tested explicitly in future studies.

Some limitations of the current study should be mentioned. We did not control for possible confounders like general drinking motives [8], socioeconomic status variables like educational level or household income [56–60], cultural background [61], personality facets [62,63], popularity [64,65] or other forms of peer victimization [66]. Taking all these contributing factors into account, future studies might benefit from a comprehensive approach and complex analyses like structural equation modeling.

Moreover, we had a rather large dropout rate with respect to the bullying data. This resulted in rather small bullying groups with an unequal size, and thus also a smaller overlap between BL and FU1 (see Table 1). However, they also map previously reported lower prevalence rates for bullying behavior in adolescence [35]. Given that we have longitudinal data, which are still rather rare, our data can thus still add valid information in the context of

bullying, empathy and alcohol use during adolescence. Finally, the lower number of female participants in the perpetrator group should be considered when interpreting sex effects. Nevertheless, we mainly included sex as a covariate in our models, due to previous research suggesting differences in bullying behavior [31], empathy [30], and alcohol use [47] between sexes. Future studies on the association of bullying and alcohol use should therefore look at a younger age, where bullying behavior occurs more frequently and the lasting effects of (state) empathy might be further followed in longitudinal designs.

Additionally, self-report on bullying behavior could be seen as an undesirable behavior, and research showed only a small overlap between self-report and peer nomination in bullying behavior [67]. Furthermore, the self-reported trait empathic score, which showed low internal consistency in the current work, could be empowered by using other empathy questionnaires (e.g., Questionnaire of Cognitive and Affective Empathy [68] or Basic Empathy Scale [69]) and additional state-like measures, both on a behavioral as well as physiological level [70]. This could also provide further information in terms of sex-specific differences in empathy based on self-reports [71]. Nevertheless, at the start of the IMAGEN project, the IRI was the best-validated and most used questionnaire in empathy research, and due to the longitudinal assessment strategy, it was kept within the project.

Moreover, for the present study, we excluded the perpetrator-victims group as it does not allow a clear classification in terms of our specific research question [12]. Additionally, the size of this group in our sample was rather small, which does not allow any add-on analyses. However, in terms of alcohol abuse, one could also argue that specifically this double role serves an interesting aspect, which is also underlined by some previous work showing that perpetrator-victims might be even more at risk for negative outcomes associated with bullying [72]. Future research on empathy and bullying behavior might therefore benefit from including this high-risk group, if it is meaningful with respect to the research question and if the sample size is large enough. Along with this, future research should also disentangle how stressful and negative perpetrators experience bullying situations they are involved in [73] and if this (co-) modulates their alcohol use in dealing with the bullying situation.

Finally, our results can also be discussed in the context of bullying and related negative outcome prevention in adolescence [74–77], where empathy enhancement might be a promising target to decrease the risk of alcohol use in a bullying situation and potentially also decrease bullying itself. Along those lines, promising interventions might be the Olweus Bullying Prevention Program [78] and mindfulness-based stress reduction programs [79], which may also function as prevention approaches.

5. Conclusions

The current paper aimed to disentangle whether empathy has an impact on the alcohol use behavior of adolescents when they are perpetrators or victims of bullying. We found perpetrators, but not victims, to use more alcohol than noninvolved adolescents. In males, this association was moderated by personal empathic distress; perpetrators with decreasing personal empathic distress showed an increase in alcohol use. With decreasing empathic distress, behaviors, such as aggression or psychopathic characteristics, often described in perpetrators, might prevail over any empathic feeling for the victims' situation. As a consequence, this might provoke more inappropriate and harmful behaviors, which could be reflected in an increase in alcohol use. On the other hand, our findings suggest that females and bullying victims may use more internalizing strategies to cope with bullying experiences. Therefore, empathy enhancement might be relevant in preventing bullying and its negative consequences in adolescents.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/ijerph20136286/s1. Table S1: Distribution of bullying roles at baseline (BL) and follow-up 1 (FU1) separated by country; Table S2 Statistical values of univariate general linear models, separated for sex, and with dependent variables baseline alcohol use and follow-up 1 alcohol use; Figure S1 AUDIT quantity _ frequency (QxF) score separated by measurement point and sex; Table S3: Moderation of the relation between baseline bullying role (predictor) and alcohol use (criterium) by empathy (moderator) for the total sample with covariates sex and SDQ subscales internalizing problems and externalizing problems.

Author Contributions: Conceptualization, M.P. and F.N.; methodology, M.P.; validation, M.P., F.N. and H.F.; formal analysis, M.P.; investigation, T.B., A.L.W.B., S.D., A.G., H.G., P.G., A.H., J.-L.M., M.-L.P.M., E.A., D.P.O., L.P., S.H., J.H.F., L.R., M.N.S., H.W., J.M.W., R.W., G.S., H.F. and F.N.; resources, T.B., A.L.W.B., S.D., A.G., H.G., P.G., A.H., J.-L.M., M.-L.P.M., E.A., D.P.O., L.P., S.H., J.H.F., L.R., M.N.S., H.W., J.M.W., R.W. and G.S.; data curation, T.B., A.L.W.B., S.D., A.G., H.G., P.G., A.H., J.-L.M., M.-L.P.M., E.A., D.P.O., L.P., S.H., J.H.F., L.R., M.N.S., H.W., J.M.W., R.W. and G.S.; data curation, T.B., A.L.W.B., S.D., A.G., P.G., A.H., J.-L.M., M.-L.P.M., E.A., D.P.O., L.P., S.H., J.H.F., L.R. and G.S.; writing—original draft preparation, M.P. and F.N.; writing—review and editing, M.P., F.N., H.F.; visualization, M.P.; supervision, F.N.; project administration, T.B., A.L.W.B., S.D., A.G., H.G., P.G., A.H., J.-L.M., M.-L.P.M., E.A., D.P.O., L.P.M., E.A., D.P.O., L.P.M., E.A., D.P.O., L.P.M., S.D., A.G., H.G., P.G., H.G., P.G., A.H., J.-L.M., M.-L.P.M., E.A., D.P.O., L.P., S.H., J.H.F., L.R., M.N.S., H.W. and G.S.; writing—original draft preparation, M.P. and F.N.; writing—review and editing, M.P., F.N., H.F.; visualization, M.P.; supervision, F.N.; project administration, T.B., A.L.W.B., S.D., A.G., H.G., P.G., A.H., J.-L.M., M.-L.P.M., E.A., D.P.O., L.P., S.H., J.H.F., L.R., M.N.S., H.W., J.M.W., R.W. and G.S.; funding

acquisition, T.B., A.L.W.B., S.D., A.G., H.G., P.G., A.H., J.-L.M., M.-L.P.M., E.A., D.P.O., L.P., S.H., J.H.F., L.R., M.N.S., H.W., J.M.W., R.W. and G.S. All authors have read and agreed to the published version of the manuscript.

Funding: This work received support from the following sources: the European Union-funded FP6 Integrated Project IMAGEN (Reinforcement-related behaviour in normal brain function and psychopathology) (LSHM-CT-2007-037286), the Horizon 2020 funded ERC Advanced Grant 'STRATIFY' (Brain network based stratification of reinforcement-related disorders) (695313), Human Brain Project (HBP SGA 2, 785907, and HBP SGA 3, 945539), the Medical Research Council Grant 'c-VEDA' (Consortium on Vulnerability to Externalizing Disorders and Addictions) (MR/N000390/1), the National Institute of Health (NIH) (R01DA049238, a decentralized macro and micro gene-by-environment interaction analysis of substance use behavior and its brain biomarkers), the National Institute for Health Research (NIHR) Biomedical Research Centre at South London and Maudsley NHS Foundation Trust and King's College London, the Bundesministeriumfür Bildung und Forschung (BMBF grants 01GS08152; 01EV0711; Forschungsnetz AERIAL 01EE1406A, 01EE1406B; Forschungsnetz IMACMind 01GL1745B), the Deutsche Forschungsgemeinschaft (DFG grants SM 80/7-2, SFB 940, TRR 265, NE 1383/14-1, FL 156/44-1), the Medical Research Foundation and Medical Research Council (grants MR/R00465X/1 and MR/S020306/1), the National Institutes of Health (NIH) funded ENIGMA (grants 5U54EB020403-05 and 1R56AG058854-01), NSFC grant 82150710554 and European Union funded project 'environMENTAL', grant No: 101057429. Further support was provided by grants from the ANR (ANR-12-SAMA-0004, AAPG2019-GeBra), the Eranet Neuron (AF12-NEUR0008-01- WM2NA, and ANR-18-NEUR00002-01-ADORe); the Fondation de France (00081242), the Fondation pour la Recherche Médicale (DPA20140629802), the Mission Interministérielle de Lutte-contre-les-Drogues-et-les-Conduites-Addictives (MILDECA), the Assistance-Publique-Hôpitaux-de-Paris and INSERM (interface grant), Paris Sud University IDEX 2012, the Fondation de l'Avenir (grant APRM-17-013), the Fédération pour la Recherche sur le Cerveau, the National Institutes of Health, Science Foundation Ireland (16/ERCD/3797), U.S.A. (Axon, Testosterone and Mental Health during Adolescence; RO1 MH085772-01A1), and by the NIH Consortium grant U54 EB020403, supported by a cross-NIH alliance that funds Big Data to Knowledge Centres of Excellence. ImagenPathways "Understanding the Interplay between Cultural, Biological and Subjective Factors in Drug Use Pathways" is a collaborative project supported by the European Research Area Network on Illicit Drugs (ERANID). This paper is based on independent research commissioned and funded in England by the National Institute for Health Research (NIHR) Policy Research Programme (project ref. PR-ST-0416-10001). The views expressed in this article are those of the authors and not necessarily those of the national funding agencies or ERANID.

Institutional Review Board Statement: The study was approved by the local ethics committees of the study centers (Ethics Committee of the Medical Faculty Mannheim: 2007-024N-MA) and was conducted according to the guidelines of the Declaration of Helsinki.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Ethical restrictions to protect participant confidentiality prevent us from making anonymized study data publicly available. This also refers to the analysis/experimental code, and any other digital materials, where participant-related anonymized information are also included. Readers seeking access to the study data and materials should contact the corresponding author based on a formal collaboration agreement. The data and materials will be released to requestors after approval of this formal collaboration agreement by the local ethics committees.

Acknowledgments: The following authors are part of the IMAGEN Consortium: T.B., A.L.W.B., S.D., A.G., H.G., P.G., A.H., J.-L-M., M.-L-P.M., E.A., D.P.O., L.P., S.H., J.H.F., L.R., M.N.S., H.W., J.M.W., R.W., G.S., F.N. and H.F. Additional members of the IMAGEN-Consortium are Gareth J. Barker, Rüdiger Brühl, Herve Lemaitre, Tomáš Paus, Nathalie Holz and Nilakshi Vaidya.

Conflicts of Interest: T. Banaschewski served in an advisory or consulting role for ADHS Digital, Infectopharm, Lundbeck, Medice, Neurim Pharmaceuticals, Oberberg GmbH, Roche, and Takeda. He received conference support or speaker's fee from Medice and Takeda. He received royalties from Hogrefe, Kohlhammer, CIP Medien, and Oxford University Press; the present work is unrelated to these relationships. L. Poustka served in an advisory or consulting role for Roche and Viforpharm and received a speaker's fee from Shire. She received royalties from Hogrefe, Kohlhammer, The present work is unrelated to the above grants

and relationships. The other authors report no biomedical financial interests or potential conflicts of interest.

References

- 1. Olweus, D. *Bullying at School: What We Know and What We Can Do*, 1st ed.; Blackwell Publishers: Oxford, UK, 1993.
- Olweus, D. School Bullying: Development and Some Important Challenges. *Annu. Rev. Clin. Psychol.* 2013, *9*, 751–780. https://doi.org/10.1146/annurev-clinpsy-050212-185516.
- Hong, J.S.; Davis, J.P.; Sterzing, P.R.; Yoon, J.; Choi, S.; Smith, D.C. A Conceptual Framework for Understanding the Association between School Bullying Victimization and Substance Misuse. *Am. J. Orthopsychiatry* 2014, 84, 696–710. https://doi.org/10.1037/ort0000036.
- Topper, L.R.; Castellanos-Ryan, N.; Mackie, C.; Conrod, P.J. Adolescent bullying victimisation and alcohol-related problem behaviour mediated by coping drinking motives over a 12month period. *Addict. Behav.* 2011, 36, 6–13. https://doi.org/10.1016/j.addbeh.2010.08.016.
- Haynie, D.L.; Nansel, T.R.; Eitel, P.; Crump, A.D.; Saylor, K.; Yu, K.; Simons-Morton, B. Bullies, Victims, and Bully/Victims: Distinct Groups of At-Risk Youth. *J. Early Adolesc.* 2001, *21*, 29–49. https://doi.org/10.1177/0272431601021001002.
- Nansel, T.R.; Craig, W.; Overpeck, M.D.; Saluja, G.; Ruan, W.J. and the Health Behavior in School-aged Children Bullying Analyses Working Group. Cross-national Consistency in the Relationship Between Bullying Behaviors and Psychosocial Adjustment. *Arch. Pediatr. Adolesc. Med.* 2004, *158*, 730–736. https://doi.org/10.1001/archpedi.158.8.730.
- Peleg-Oren, N.; Cardenas, G.A.; Comerford, M.; Galea, S. An Association Between Bullying Behaviors and Alcohol Use Among Middle School Students. *J. Early Adolesc.* 2012, *32*, 761–775. https://doi.org/10.1177/0272431610387144.
- Archimi, A.; Kuntsche, E. Do offenders and victims drink for different reasons? Testing mediation of drinking motives in the link between bullying subgroups and alcohol use in adolescence. *Addict. Behav.* 2014, 39, 713–716. https://doi.org/10.1016/j.addbeh.2013.11.011.
- Somerville, L.H. Special issue on the teenage brain: Sensitivity to social evaluation. *Curr. Dir. Psychol. Sci.* 2013, 22, 121–127. https://doi.org/10.1177/0963721413476512.

- Silvers, J.A.; McRae, K.; Gabrieli, J.D.E.; Gross, J.J.; Remy, K.A.; Ochsner, K.N. Agerelated differences in emotional reactivity, regulation, and rejection sensitivity in adolescence. *Emotion* 2012, *12*, 1235–1247. https://doi.org/10.1037/a0028297.
- Veenstra, M.Y.; Lemmens, P.H.H.M.; Friesema, I.H.M.; Tan, F.E.S.; Garretsen, H.F.L.; Knottnerus, J.A; Zwietering, P.J. Coping style mediates impact of stress on alcohol use: A prospective population-based study. *Addiction* 2007, *102*, 1890–1898. https://doi.org/10.1111/j.1360-0443.2007.02026.x.
- Kelly, E.V.; Newton, N.C.; Stapinski, L.A.; Slade, T.; Barrett, E.L.; Conrod, P.J.; Teesson, M. Concurrent and prospective associations between bullying victimization and substance use among Australian adolescents. *Drug Alcohol Depend.* 2015, *154*, 63–68. https://doi.org/10.1016/j.drugalcdep.2015.06.012.
- Tharp-Taylor, S.; Haviland, A.; D'Amico, E.J. Victimization from mental and physical bullying and substance use in early adolescence. *Addict. Behav.* 2009, *34*, 561–567. https://doi.org/10.1016/j.addbeh.2009.03.012.
- Kowalski, R.M.; Giumetti, G.W.; Schroeder, A.N.; Lattanner, M.R. Bullying in the digital age: A critical review and meta-analysis of cyberbullying research among youth. *Psychol. Bull.* 2014, *140*, 1073–1137. https://doi.org/10.1037/a0035618.
- Fabris, M.A.; Longobardi, C.; Morese, R.; Marengo, D. Exploring Multivariate Profiles of Psychological Distress and Empathy in Early Adolescent Victims, Bullies, and Bystanders Involved in Cyberbullying Episodes. *Int. J. Environ. Res. Public Health* 2022, *19*, 9871. https://doi.org/10.3390/ijerph19169871.
- 16. Davis, M.H. The effects of dispositional empathy on emotional reactions and helping: A multidimensional approach. J. Personal. 1983, 51, 167–184. https://doi.org/10.1111/j.1467-6494.1983.tb00860.x.
- Wolgast, A.; Tandler, N.; Harrison, L.; Umlauft, S. Adults' Dispositional and Situational Perspective-Taking: A Systematic Review. *Educ. Psychol. Rev.* 2020, *32*, 353–389. https://doi.org/10.1007/s10648-019-09507-y.
- Eisenberg, N.; Eggum, N.D.; Di Giunta, L. Empathy-related Responding: Associations with Prosocial Behavior, Aggression, and Intergroup Relations. *Soc. Issues Policy Rev.* 2010, *4*, 143–180. https://doi.org/10.1111/j.1751-2409.2010.01020.x.
- Bach, R.A.; Defever, A.M.; Chopik, W.J.; Konrath, S.H. Geographic variation in empathy: A state-level analysis. *J. Res. Personal.* 2017, 68, 124–130. https://doi.org/10.1016/j.jrp.2016.12.007.

- 20. Altmann, T. Empathie. Available online: https://portal.hogrefe.com/dorsch/empathie/ (accessed on 4 June 2018).
- Kim, H.; Han, S. Does personal distress enhance empathic interaction or block it? *Personal*. *Individ. Differ.* 2018, *124*, 77–83. https://doi.org/10.1016/j.paid.2017.12.005.
- De Sousa, M.L.; Peixoto, M.M.; Cruz, S.F. The Association between Externalizing and Internalizing Problems with Bullying Engagement in Adolescents: The Mediating Role of Social Skills. *Int. J. Environ. Res. Public Health* **2021**, *18*, 10444. https://doi.org/10.3390/ijerph181910444.
- Witvliet, M.; Olthof, T.; Hoeksma, J.B.; Goossens, F.A.; Smits, M.S.I.; Koot, H.M. Peer Group Affiliation of Children: The Role of Perceived Popularity, Likeability, and Behavioral Similarity in Bullying. *Soc. Dev.* 2010, *19*, 285–303. https://doi.org/10.1111/j.1467-9507.2009.00544.x.
- Sijtsema, J.J.; Veenstra, R.; Lindenberg, S.; Salmivalli, C. Empirical test of bullies' status goals: Assessing direct goals, aggression, and prestige. *Aggress. Behav.* 2009, *35*, 57–67. https://doi.org/10.1002/ab.20282.
- Kljakovic, M.; Hunt, C. A meta-analysis of predictors of bullying and victimisation in adolescence. J. Adolesc. 2016, 49, 134–145. https://doi.org/10.1016/j.adolescence.2016.03.002.
- Zych, I.; Baldry, A.C.; Farrington, D.P.; Llorent, V.J. Are children involved in cyberbullying low on empathy? A systematic review and meta-analysis of research on empathy versus different cyberbullying roles. *Aggress. Violent Behav.* 2019, 45, 83–97. https://doi.org/10.1016/j.avb.2018.03.004.
- 27. Nachane, H.B.; Nadadgalli, G.V.; Umate, M.S. Cognitive and affective empathy in men with alcohol dependence: Relation with clinical profile, abstinence, and motivation. *Indian J. Psychiatry* 2021, 63, 418–423. https://doi.org/10.4103/indianjpsychiatry.indianjpsychiatry 1101 20.
- Holahan, C.J.; Moos, R.H.; Holahan, C.K.; Cronkite, R.C.; Randall, P.K. Drinking to cope, emotional distress and alcohol use and abuse: A ten-year model. *J. Stud. Alcohol* 2001, *62*, 190–198. https://doi.org/10.15288/jsa.2001.62.190.
- Eisenberg, N.; Lennon, R. Sex Differences in Empathy and Related Capacities. *Psychol. Bull.* 1983, *94*, 100–131. https://doi.org/10.1037/0033-2909.94.1.100.

- Baron-Cohen, S.; Wheelwright, S. The empathy quotient: An investigation of adults with Asperger syndrome or high functioning autism, and normal sex differences. *J. Autism Dev. Disord.* 2004, *34*, 163–175. https://doi.org/10.1023/b:jadd.0000022607.19833.00.
- Lee, J.; Choi, M.J.; Thornberg, R.; Hong, J.S. Exploring Sex Differences in the Association between Bullying Involvement and Alcohol and Marijuana Use among U.S. Adolescents in 6th to 10th Grade. *Subst. Use Misuse* 2020, 55, 1203–1213. https://doi.org/10.1080/10826084.2020.1725054.
- Schumann, G.; Loth, E.; Banaschewski, T.; Barbot, A.; Barker, G.J.; Büchel, C.; Conrod, P.J.; Dalley, J.W.; Flor, H.; Gallinat, J.; et al. The IMAGEN study: Reinforcement-related behaviour in normal brain function and psychopathology. *Mol. Psychiatry* 2010, *15*, 1128– 1139. https://doi.org/10.1038/mp.2010.4.
- Delosis. *Psytools* (Version 1.24) [Computer Software]; London, UK, 2020. http://www.delosis.com/
- Olweus, D. *The Olweus Bully/Victim Questionnaire*; University Bergen: Bergen, Norway, 1986.
- Solberg, M.E.; Olweus, D. Prevalence estimation of school bullying with the Olweus Bully/Victim Questionnaire. *Aggress. Behav.* 2003, 29, 239–268. https://doi.org/10.1002/ab.10047.
- Davis, M.H. A multidimensional approach to individual differences in empathy. JSAS Cat. Sel. Doc. Psychol. 1980, 10, 85.
- 37. Mestre, M.V.; Samper, P.; Frías, M.D.; Tur, A.M. Are women more empathetic than men?
 A longitudinal study in adolescence. *Span. J. Psychol.* 2009, *12*, 76–83. https://doi.org/10.1017/s1138741600001499.
- Thompson, N.M.; Di Luft, C.B.; Banissy, M.J. Empathy. In *Neuroimaging Personality,* Social Cognition, and Character, 1st ed.; Absher, J.R., Cloutier, J., Eds.; Elsevier: Amsterdam, The Netherlands, 2016, pp. 289–303.
- Babor, T.F.; Grant, M. From clinical research to secondary prevention: International collaboration in the development of the Alcohol Disorders Identification Test (AUDIT). *Alcohol Health Res. World* 1989, *13*, 371–374.
- Bradley, K.A.; DeBenedetti, A.F.; Volk, R.J.; Williams, E.C.; Frank, D.; Kivlahan, D.R. AUDIT-C as a brief screen for alcohol misuse in primary care. *Alcohol. Clin. Exp. Res.* 2007, *31*, 1208–1217. https://doi.org/10.1111/j.1530-0277.2007.00403.x.

- 41. Goodman, R. Psychometric Properties of the Strengths and Difficulties Questionnaire. J. Am. Acad. Child Adolesc. Psychiatry 2001, 40, 1337–1345. https://doi.org/10.1097/00004583-200111000-00015.
- 42. Goodman, A.; Lamping, D.L.; Ploubidis, G.B. When to use broader internalising and externalising subscales instead of the hypothesised five subscales on the Strengths and Difficulties Questionnaire (SDQ): Data from British parents, teachers and children. *J. Abnorm. Child Psychol.* 2010, *38*, 1179–1191. https://doi.org/10.1007/s10802-010-9434-x.
- 43. IBM Corp. IBM SPSS Statistics for Windows; IBM Corp.: Armonk, NY, USA, 2017.
- 44. Hayes, A.F. Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach; Guilford Publications: New York, NY, USA, 2017.
- 45. O'Moore, M.; Kirkham, C. Self-esteem and its relationship to bullying behaviour. *Aggress. Behav.* **2001**, *27*, 269–283. https://doi.org/10.1002/ab.1010.
- 46. Substance Abuse and Mental Health Services Administration (SAMHSA). *Results from the 2007 National Survey on Drug Use and Health: National Findings*; NSDUH Series H-34, DHHS Publication No. SMA 08-4343; Office of Applied Studies: Rockville, MD, USA, 2008.
- Song, E.-Y.; Smiler, A.P.; Wagoner, K.G.; Wolfson, M. Everyone says it's ok: adolescents' perceptions of peer, parent, and community alcohol norms, alcohol consumption, and alcohol-related consequences. *Subst. Use Misuse* 2012, 47, 86–98. https://doi.org/10.3109/10826084.2011.629704.
- Young, S.E.; Corley, R.P.; Stallings, M.C.; Rhee, S.H.; Crowley, T.J.; Hewitt, J.K. Substance use, abuse and dependence in adolescence: Prevalence, symptom profiles and correlates. *Drug Alcohol Depend.* 2002, *68*, 309–322. https://doi.org/10.1016/s0376-8716(02)00225-9.
- Dadds, M.R.; Hawes, D.J.; Frost, A.D.J.; Vassallo, S.; Bunn, P.; Hunter, K.; Merz, S. Learning to 'talk the talk: The relationship of psychopathic traits to deficits in empathy across childhood. *J. Child Psychol. Psychiatry Allied Discip.* 2009, 50, 599–606. https://doi.org/10.1111/j.1469-7610.2008.02058.x.
- Fanti, K.A.; Frick, P.J.; Georgiou, S. Linking Callous-Unemotional Traits to Instrumental and Non-Instrumental Forms of Aggression. *J. Psychopathol. Behav. Assess.* 2009, *31*, 285–298. https://doi.org/10.1007/s10862-008-9111-3.

- Anderson, S.L.; Zheng, Y.; McMahon, R.J. Do Callous-Unemotional Traits and Conduct Disorder Symptoms Predict the Onset and Development of Adolescent Substance Use? *Child Psychiatry Hum. Dev.* 2018, 49, 688–698. https://doi.org/10.1007/s10578-018-0789-5.
- Dittrick, C.J.; Beran, T.N.; Mishna, F.; Hetherington, R.; Shariff, S. Do Children Who Bully Their Peers Also Play Violent Video Games? A Canadian National Study. *J. Sch. Violence* 2013, *12*, 297–318. https://doi.org/10.1080/15388220.2013.803244.
- Stavrinides, P.; Tsivitanou, A.; Nikiforou, M.; Hawa, V.; Tsolia, V. Longitudinal Associations Between Bullying and Children's Preference for Television Violence. *Int. J. Criminol. Sociol.* 2013, *2*, 72–78. https://doi.org/10.6000/1929-4409.2013.02.7.
- Kelly, E.V.; Newton, N.C.; Stapinski, L.A.; Slade, T.; Barrett, E.L.; Conrod, P.J.; Teesson, M. Suicidality, internalizing problems and externalizing problems among adolescent bullies, victims and bully-victims. *Prev. Med.* 2015, 73, 100–105. https://doi.org/10.1016/j.ypmed.2015.01.020.
- 55. Carbone-Lopez, K.; Esbensen, F.-A.; Brick, B.T. Correlates and Consequences of Peer Victimization: Gender Differences in Direct and Indirect Forms of Bullying. *Youth Violence Juv. Justice* 2010, *8*, 332–350. https://doi.org/10.1177/1541204010362954.
- Jolliffe, D.; Farrington, D.P. Development and validation of the Basic Empathy Scale. J. Adolesc. 2006, 29, 589–611. https://doi.org/10.1016/j.adolescence.2005.08.010.
- Greitemeyer, T.; Sagioglou, C. Does Low (vs. High) Subjective Socioeconomic Status Increase Both Prosociality and Aggression? *Soc. Psychol.* 2018, 49, 76–87. https://doi.org/10.1027/1864-9335/a000331.
- Katikireddi, S.V.; Whitley, E.; Lewsey, J.; Gray, L.; Leyland, A.H. Socioeconomic status as an effect modifier of alcohol consumption and harm: Analysis of linked cohort data. *Lancet Public Health* 2017, *2*, e267–e276. https://doi.org/10.1016/S2468-2667(17)30078-6.
- Alkan, Ö.; Abar, H.; Gençer, Ö. Analysis of factors affecting alcohol and tobacco concurrent use by bivariate probit model in Turkey. *Environ. Sci. Pollut. Res. Int.* 2021, 28, 30168–30175. https://doi.org/10.1007/s11356-021-12849-2.
- 60. Alkan, Ö.; Güney, E. Investigation of factors that affect the frequency of alcohol use of employees in Turkey. J. Subst. Use 2021, 26, 468–474. https://doi.org/10.1080/14659891.2020.1846811.

- 61. Cantrijn, M. The Contribution of Smoking, Obesity and Alcohol Consumption to Country Mortality Differences and Life Expectancy in Western Europe. Master's Thesis, University of Groningen, The Netherlands, July 2020.
- Peeters, M.; Monshouwer, K.; van de Schoot, R.; Janssen, T.; Vollebergh, W.A.M.; Wiers, R.W. Personality and the prediction of high-risk trajectories of alcohol use during adolescence. *J. Stud. Alcohol Drugs* 2014, 75, 790–798. https://doi.org/10.15288/jsad.2014.75.790.
- Stautz, K.; Cooper, A. Impulsivity-related personality traits and adolescent alcohol use: A meta-analytic review. *Clin. Psychol. Rev.* 2013, 33, 574–592. https://doi.org/10.1016/j.cpr.2013.03.003.
- Peeters, M.; Laninga-Wijnen, L.; Veenstra, R. Differences in Adolescents' Alcohol Use and Smoking Behavior between Educational Tracks: Do Popularity Norms Matter? *J. Youth Adolesc.* 2021, *50*, 1884–1895. https://doi.org/10.1007/s10964-021-01467-3.
- Tucker, J.S.; Miles, J.N.V.; D'Amico, E.J.; Zhou, A.J.; Green, H.D.; Shih, R.A. Temporal associations of popularity and alcohol use among middle school students. *J. Adolesc. Health Off. Publ. Soc. Adolesc. Med.* 2013, 52, 108–115. https://doi.org/10.1016/j.jadohealth.2012.04.012.
- Maniglio, R. Bullying and Other Forms of Peer Victimization in Adolescence and Alcohol Use. *Trauma Violence Abus.* 2017, 18, 457–473. https://doi.org/10.1177/1524838016631127.
- Malamut, S.T.; van den Berg, Y.H.M.; Lansu, T.A.M.; Cillessen, A.H.N. Dyadic nominations of bullying: Comparing types of bullies and their victims. *Aggress. Behav.* 2020, *46*, 232–243. https://doi.org/10.1002/ab.21884.
- Reniers, R.L.E.P.; Corcoran, R.; Drake, R.; Shryane, N.M.; Völlm, B.A. The QCAE: A Questionnaire of Cognitive and Affective Empathy. *J. Personal. Assess.* 2011, *93*, 84–95. https://doi.org/10.1080/00223891.2010.528484.
- Zych, I.; Farrington, D.P.; Nasaescu, E.; Jolliffe, D.; Twardowska-Staszek, E. Psychometric properties of the Basic Empathy Scale in Polish children and adolescents. *Curr. Psychol.* 2022, *41*, 1957–1966. https://doi.org/10.1007/s12144-020-00670-y.
- Dimitroff, S.J.; Kardan, O.; Necka, E.A.; Decety, J.; Berman, M.G.; Norman, G.J. Physiological dynamics of stress contagion. *Sci. Rep.* 2017, *7*, 6168. https://doi.org/10.1038/s41598-017-05811-1.

- 71. Löffler, C.S.; Greitemeyer, T. Are women the more empathetic gender? The effects of gender role expectations. *Curr. Psychol.* 2021, 42, 220–231. https://doi.org/10.1007/s12144-020-01260-8.
- Nansel, T.R.; Overpeck, M.D.; Pilla, R.S.; Ruan, W.J.; Simons-Morton, B.G.; Scheidt, P.C. Bullying Behaviors Among US Youth: Prevalence and Association with Psychosocial Adjustment. *JAMA* 2001, *285*, 2094–2100. https://doi.org/10.1001/jama.285.16.2094.
- Swearer, S.M.; Hymel, S. Understanding the psychology of bullying: Moving toward a social-ecological diathesis-stress model. *Am. Psychol.* 2015, 70, 344–353. https://doi.org/10.1037/a0038929.
- Merrill, R.M.; Hanson, C.L. Risk and protective factors associated with being bullied on school property compared with cyberbullied. *BMC Public Health* 2016, *16*, 145. https://doi.org/10.1186/s12889-016-2833-3.
- Wittchen, H.-U.; Behrendt, S.; Höfler, M.; Perkonigg, A.; Lieb, R.; Bühringer, G.; Beesdo, K. What are the high risk periods for incident substance use and transitions to abuse and dependence? Implications for early intervention and prevention. *Int. J. Methods Psychiatr. Res.* 2008, *17* (Suppl. S1), S16–S29. https://doi.org/10.1002/mpr.254.
- 76. Arseneault, L. Annual Research Review: The persistent and pervasive impact of being bullied in childhood and adolescence: Implications for policy and practice. J. Child Psychol. Psychiatry Allied Discip. 2018, 59, 405–421. https://doi.org/10.1111/jcpp.12841.
- 77. Nees, F.; Tzschoppe, J.; Patrick, C.J.; Vollstädt-Klein, S.; Steiner, S.; Poustka, L.; Banaschewski, T.; Barker, G.J.; Büchel, C.; Conrod, P.J. et al. Determinants of early alcohol use in healthy adolescents: The differential contribution of neuroimaging and psychological factors. *Neuropsychopharmacol. Off. Publ. Am. Coll. Neuropsychopharmacol.* **2012**, *37*, 986–995. https://doi.org/10.1038/npp.2011.282.
- Limber, S.P.; Olweus, D.; Wang, W.; Masiello, M.; Breivik, K. Evaluation of the Olweus Bullying Prevention Program: A large scale study of U.S. students in grades 3-11. *J. Sch. Psychol.* 2018, 69, 56–72. https://doi.org/10.1016/j.jsp.2018.04.004.
- Birnie, K.; Speca, M.; Carlson, L.E. Exploring self-compassion and empathy in the context of mindfulness-based stress reduction (MBSR). *Stress Health* 2010, *26*, 359–371. https://doi.org/10.1002/smi.1305.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the

editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

The Role of Empathy in Alcohol Use of Bullying Perpetrators and Victims: Lower Personal Empathic Distress Makes Male Perpetrators of Bullying More Vulnerable for Alcohol Use – Supplementary Material

Table S1 – Distribution of bullying roles at baseline (BL) and follow up 1 (FU1) separated by country

			United Kingdom	France	Germany
			N (%)	N(%)	N(%)
BL	Participants		853	261	1,050
	Bullying role	Perpetrator	21 (2.5)	12 (4.6)	72 (6.9)
		Victim	137 (16.1)	22 (8.4)	117 (11.1)
		PerpVictims	36 (4.2)	8 (3.1)	28 (2.7)
		Noninvolved	659 (77.3)	219 (83.9)	833 (79.3)
FU1	Participants		423	153	605
	Bullying role	Perpetrator	7 (1.7)	5 (3.3)	20 (3.3)
		Victim	35 (8.3)	3 (2.0)	25 (4.1)
		PerpVictims	5 (1.2)	2 (1.3)	8 (1.3)
		Noninvolved	376 (88.9)	143 (93.5)	552 (91.2)

Item examples for the used questionnaires of bullying, empathy and internalizing and externalizing problems

Bullying: Bullying questionnaire based on Olweus (1986)

Example for bullying perpetration in peer context:

"I took part in bullying another student/ peer at school"

Example for bullying victimization in peer context:

"I was bullied at school (a student/ peer said or did nasty or unpleasant things to me)"

Empathy: Interpersonal Reactivity Index (Davis, 1980)

Perspective Taking:

"I try to look at everybody's side of a disagreement before I make a decision."

Fantasy:

"When I watch a good movie, I can very easily put myself in the place of a leading character."

Empathic Concern:

"I often have tender, concerned feelings for people less fortunate than me."

Personal Distress:

"I sometimes feel helpless when I am in the middle of a very emotional situation."

Internalizing and Externalizing Problems: Strengths and Difficulties Questionnaire (SDQ; Goodman, 2001)

Each item is rated on a three-point scale with options "not true", "somewhat true" and "certainly true".

Emotional Problems:

"I worry a lot"

Conduct Problems:

"I fight a lot"

Hyperactivity/Inattention:

"I am constantly fidgeting"

Peer Relationship Problems:

"I am usually on my own"

Prosocial Behavior:

"I try to be nice to other people"

Sex-separated general linear models for the effect of baseline bullying role (perpetrator vs. victim vs. noninvolved) on baseline alcohol use with covariates baseline SDQ subscale "externalizing problems" and baseline SDQ subscale "internalizing problems"

For males, but not females (p > 0.05), we observed a significant main effect of BL bullying role on BL alcohol score (see Table S2 and Figure S1). Perpetrators (M = 1.688, SD = 2.148) had a significantly higher alcohol score than victims (M = 0.861, SD = 1.242) with p < 0.05 and noninvolved (M = 1.004, SD = 1.427) with p < 0.01. In males and females the covariates SDQ Intern and SDQ Extern reached significance (see Table S2).

Sex-separated general linear models for the effect of follow up 1 bullying role (perpetrator vs. victim vs. noninvolved) on follow up 1 alcohol use and covariates baseline bullying role, baseline alcohol use, SDQ subscale "externalizing problems" and SDQ subscale "internalizing problems" (both measured at baseline and follow up 1)

For males, but not females (p > 0.05), we observed a significant main effect of bullying role at FU1 on alcohol score at FU1 (see Table S2 and Figure S1). Perpetrators (M = 5.240, SD = 3.059) showed significantly higher scores than victims (M = 2.778, SD = 2.636), with p < 0.01, and noninvolved (M = 3.074, SD = 2.506), with p < 0.001). In males and females the

covariates BL alcohol use, FU1 SDQ Intern and FU1 SDQ Extern reached significance (see Table S2).
S
ent
SC
le
١q
L A
.⊟.
JS
hc
<u>5</u>
A
nd
/ a
ţ
рa
B
ing
lly.
Bu
$\overline{\ldots}$
>
pn
$\overline{\mathbf{v}}$
s
on
Ē
ī
Ę,
0
$\overline{\mathbf{C}}$
na
. <u></u>
Ē
\mathbf{U}

nud	
ISC 3	
lot	
alcol	
ine :	
asel	
les b	
riab	
it va	
nden	
ebei	
ith d	
d w	
x, an	
r se	
d fo	
ırate	
sepa	
lels,	
moč	
lear	
al lin	
nera	
te ge	
ariat	
univ	
of 1	
alues	
al vi	use
listic	loho
Stat	alco
52 –	up 1
ble (low
Ta	fol

			Ma	le			Fem	ale	
Dependent variable	Covariates/ predictor	\mathbf{F}	(df1,df2)	d	η^2	F	(df1,df2)	d	η^2
BL AUDIT Q×F	BL SDQ Intern	4.408	(1,999)	0.036	0.004	6.427	(1,1070)	0.011	0.006
	BL SDQ Extern	26.586	(1,999)	<0.001	0.026	72.434	(1,1070)	<0.001	0.063
	BL BR	5.366	(2,999)	0.005	0.011	2.203	(2, 1070)	0.111	0.004
FU1 AUDIT Q×F	BL SDQ Intern	0.101	(1, 729)	0.750	0.000	0.241	(1, 805)	0.623	0.000
	BL SDQ Extern	0.647	(1, 729)	0.421	0.001	0.111	(1,805)	0.739	0.000
	BL BR	0.387	(1, 729)	0.534	0.001	0.087	(1,805)	0.769	0.000
	BL AUDIT Q×F	142.198	(1,729)	<0.001	0.163	149.991	(1,805)	<0.001	0.157
	FU1 SDQ Intern	17.692	(1,729)	<0.001	0.024	5.555	(1, 805)	0.019	0.007
	FU1 SDQ Extern	20.189	(1, 729)	<0.001	0.027	22.679	(1,805)	<0.001	0.027
	FUI BR	5.395	(2, 729)	0.005	0.015	1.236	(2,805)	0.291	0.003
Note. $BL = Baseline$	FU1 = Follow Up 1, A	NUDIT Q×F	= AUDIT Q	uantity × Fre	squency sub	score, SDQ	Intern = Str	rengths and	Difficulties
Questionnaire subsca	le "Internalizing Problems	s", SDQ Exte	rn = Strength	s and Difficu	ulties Questic	onnaire subso	cale "Externa	llizing Probl	ems", BR =
Bullying Role, main I	predictor of each model is	italic, bold m	larked values	are significat	it at $p < 0.05$	or below.			



Figure S1 – AUDIT Quantity × Frequency (Q×F) score separated by measurement point and sex

Note. X-axis shows the measurement point of $Q \times F$ and y-axis shows $Q \times F$ score. Structure of bars represent point of bullying role with BL = baseline and FU1 = follow up 1.

Table S3 – Moderation of the relation between baseline bullying role (predictor) and baseline alcohol use (criterium) by empathy (moderator) for the total sample with covariates sex and SDQ subscales Internalizing Problems and Externalizing Problems

Model	predictors/	F	р	R^2	b	t	p
	covariates						
PT		7.820	<0.001	0.039			
	constant				1.323	1.723	0.085
	BR				-0.273	-1.307	0.191
	PT				-0.027	-0.564	0.564
	$BR \times PT$				0.009	0.656	0.512
	sex				0.161	1.937	0.053
	SDQ Extern				0.082	5.745	<0.001
	SDQ Intern				-0.040	-2.714	0.007
F		8.834	<0.001	0.044			
	constant				-0.786	-1.067	0.286
	BR				0.340	1.722	0.085
	F				0.109	2.396	0.017
	$BR \times F$				-0.031	-2.504	0.012
	sex				0.166	1.990	0.047
	SDQ Extern				0.083	5.809	<0.001
	SDQ Intern				-0.042	-2.839	0.005
EC		7.949	<0.001	0.040			
	constant				0.843	0.867	0.386
	BR				-0.195	-0.730	0.466
	EC				0.006	0.095	0.924
	$BR \times EC$				0.003	0.205	0.837
	sex				0.162	1.955	0.051
	SDQ Extern				0.080	5.614	<0.001
	SDQ Intern				-0.043	-2.892	0.004
PD		7.759	<0.001	0.039			
	constant				0.680	1.033	0.302
	BR				-0.073	-0.407	0.684
	PD				0.017	0.362	0.718
	$BR \times PD$				-0.005	-0.387	0.699
	sex				0.164	1.946	0.052
	SDQ Extern				0.082	5.715	<0.001
	SDQ Intern				-0.041	-2.728	0.006

Note. "Model" refers to the applied Interpersonal Reactivity Index subscale as moderator, PT = Perspective Taking, F = Fantasy, EC = Empathic Concern, PD = Personal Distress. BR = bullying role at baseline, SDQ Extern = Strengths and Difficulties Questionnaire Subscale "Externalizing Problems", SDQ Intern = Strengths and Difficulties Questionnaire Subscale "Internalizing Problems". Main predictors are written in italic, bold marked values are significant at <math>p < 0.05 or below.

2.2 The Association Between Emotion Regulation and Alcohol Use in Adolescence Is Moderated by Interoception and Affective Empathy²

2

In preparation for submission to the journal Addictive Behaviors

Association Between Emotion Regulation and Alcohol Use in Adolescence Is Moderated by Interoception and Affective Empathy

Maren Prignitz¹, Stella Guldner², Michaela Ruttorff^{3,4}, Frauke Nees^{2,5} and the IMAC-Consortium

¹ Institute of Cognitive and Clinical Neuroscience, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Square J5, Mannheim, Germany;

² Department of Child and Adolescent Psychiatry and Psychotherapy, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Square J5, 68159 Mannheim, Germany;

³ Computer Assisted Clinical Medicine, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany;

⁴ Mannheim Institute for Intelligent Systems in Medicine, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany;

⁵ Institute of Medical Psychology and Medical Sociology, University Medical Center Schleswig Holstein, Kiel University, Kiel, Germany;

Abstract

Background: The first contact with alcohol often occurs in early adolescence and increases rapidly, but the motives of this early alcohol use are still not fully understood, and may depend on several individual factors. When adolescents are highly emotional sensitive, emotion regulation may become most relevant, but often fail and alcohol might be used as an alternative coping strategy. Whether this comes into play only for emotions based on own internal perceptions (interoception) or also when emotions are triggered by others (empathy) is not clear. **Objective:** Therefore, the present study aimed to investigate the association between emotion regulation and adolescent' alcohol use and its interaction with interoception and empathy.

Method: 70 adolescents (34 female, mean 15.11 (*SD* 1.0) years) completed an emotion regulation task, the Heartbeat Counting Task (HCT, measure of interoception) and the EmpaToM (measure of empathy) as well as a self-report measure of interoception and alcohol use.

Results: Interoception was significantly positively associated with frequency of drinking, while emotion regulation was significant negatively associated with amount of drinking. Additionally, self-report interoception and empathy, but not HCT, significantly moderated the association between emotion regulation and amount of drinking.

Conclusion: Emotion regulation is related to the amount of alcohol used, but varies depending on empathy and interoceptive sensibility. Emotion regulation becomes increasingly relevant when empathy is low, whereas interoceptive sensibility might act as a protective factor. Moreover, increased interoceptive accuracy is a motive of more frequent alcohol use.

Keywords: adolescence, alcohol use, emotion regulation, interoception, empathy

Introduction

Alcohol (ab)use causes a major health problem. The first contact to alcohol often occurs already in early adolescence (Wittchen et al., 2008) and increases rapidly with a peak in late adolescence (Brown et al., 2009). In Germany, 51% of 11 to 17 year-olds have already consumed alcohol, with 12.1% showing risky alcohol use and 7% binge drinking on a regular basis (Zeiher et al., 2018). Boys were observed to show higher levels of binge drinking compared to girls, who instead show stronger risky use of alcohol (Zeiher et al., 2018). These early alcohol use patterns are suggested as risk factors for later and even rapidly developing alcohol abuse and the development of an alcohol use disorder (Wittchen et al., 2008).

Although there is strong evidence for such developmental patterns of alcohol use, the motives of adolescents to use alcohol are still not fully clear and appear to be complex. Social motives, such as belonging to a peer group (Bremner et al., 2011; Brown et al., 2009), seem to play a role during this phase of intense social and physical changes (Özdemir et al., 2016). Moreover, emotion regulation has often been identified as another potential motive for alcohol use (e.g. Aurora & Klanecky, 2016). Emotion regulation is defined as the ability to influence the experience, intensity, duration, timing and expression of emotions (Gross, 2008). Difficulties in emotion regulation are considered as risk factor not only for the development of alcohol use (Shadur & Lejuez, 2015), but also of an alcohol use disorder (AUD) (Petit et al., 2015; Norberg et al., 2016). According to arousal theory, here alcohol is used as strategy to regulate unpleasant or negative emotions (Lannoy et al., 2021). Since adolescence is a period of high emotionality, it is not surprising that adolescents tend to use alcohol as emotion regulation strategy more often than adults (Casey et al., 2010; Cooper et al., 1995). Interestingly, alcohol is even more often used to regulate emotions when individuals show high level of interoception, depending on the method used to assess interoception (Jakubczyk et al., 2020). However, whether and how emotion regulation and the different components of interoception interact and significantly contribute to alcohol use in adolescents is still not clear.

Interoception, or more precisely interoceptive accuracy, is the ability to accurately perceive internal signals (Garfinkel et al., 2015), such as heart rate. It therefore forms a basis of emotions (Ainley et al., 2015) and emotion perception (Löffler et al., 2018) and is associated with increased arousal during emotional experiences (Wiens, 2005; Füstös et al., 2012). Interoception may thus also contribute to the increased emotionality during adolescence, and influence the ability to regulate emotions.

However, in our social world, emotion regulation does not only relate to emotions triggered by our internal feelings, but is also sensitive to emotions triggered by feelings stemming from others. For example when we observe others suffering from distress, we often feel distressed ourselves (Davis, 1983; Eisenberg et al., 2010). This feeling is much stronger pronounced when individuals are highly interoceptive (Fukushima et al., 2011; Heydrich et al., 2020; Ernst et al., 2013). This phenomenon is known as emotional contagion or personal distress (Ainley et al., 2015; Davis, 1983) and is a core aspect of affective empathy (Dalvi-Esfahani et al., 2021; Davis, 1983). One could therefore assume that the need for emotion regulation may be particularly relevant when experiencing increased affective empathy in the sense of personal distress, and this could then trigger the use of alcohol as a potential source of coping. However, research actually shows that increased personal distress is associated with a lack of emotion regulation (Grynberg & López-Pérez, 2018; Ardenghi et al., 2023). In this sense, it could make a difference whether interoception or empathy are the driving forces behind emotion regulation, and both could act as independent factors when it comes to the motivation to use alcohol.

Therefore, the present study addresses the question of whether, in addition to poor emotion regulation abilities, higher interoception and higher affective empathy are also possible motives for alcohol use among adolescents. Moreover, we hypothesise that increased interoception and increased affective empathy have a moderating effect on the relationship between emotion regulation difficulties and alcohol use. As alcohol frequency and quantity may be subject of different processes (incentive motivation vs. hedonic purpose) (Robinson & Berridge, 1993; Berridge & Robinson, 2016; Wardell et al., 2016) and might therefore be influenced differently by emotion regulation, interoception and empathy, these alcohol measures are considered separately in the present study.

Method

Participants

Participants were part of a subproject (TP2) of the IMAC-Mind consortium (https://www.imac-mind.de/). Recruitment was done via advertisements in schools of metropolitan area Rhine-Neckar, in social media, as well as with help of the registration office Mannheim, Germany (see also Prignitz et al., 2021). Inclusion criteria were: being age 14 or 16, speaking German, being right handed (for MRI tasks), no current or history of psychological or psychiatric disorders, no ongoing medication (Prignitz et al., 2021). Overall, 72 participants

were recruited of whom 70 participants (34 female, mean age 15.11 (*SD* 1.0) years) underwent the whole assessment in the study.

Procedure

Participants were screened for inclusion criteria via telephone and invited to take part in the study. After written informed consent of the participants and their primary caretaker was obtained, participants were assessed with a large test battery, including questionnaires, MRI tasks, ecological momentary assessment, and physiology measures within behavioural tasks (see also Prignitz et al., 2021) during August 2018 and October 2020. For the current analyses, we used the Heartbeat counting task, the EmpaToM task, the Emotion Regulation task, the Time Line Follow Back interview, as well as a questionnaire assessing trait interoception. The study was approved by the ethics committee of Medical Faculty Mannheim, University of Heidelberg (2007-024N-MA).

Psychometric assessments

Emotion Regulation

To assess emotion regulation, participants underwent an Emotion Regulation task (adapted from Silvers et al., 2012) using functional magnetic resonance imaging in a 3T Siemens PrismaFit MRI scanner. For the present work, we used behavioral data only.

Participants were presented with an instructional cue (2 s), followed by a picture of a human face with a neutral or negative emotional expression (8 s), i.e. a neutral or emotionally aversive stimulus. The instructional cue required participants to either engage with the emotional content of the stimuli fully (e.g. focus on the expressed emotion) (close) or to disengage from the emotional content (focussing on neutral content of the stimuli, such as hair or eye colour) (far) (Silvers et al., 2012). After an interstimulus interval (3 s) following the picture, participants were asked to respond to the question "How bad do you feel?" on a 5-point Likert scale from 1 = "not at all" to 5 = "very bad", followed by another intertrial interval (~3 s). A total of 32 pictures were presented, equally divided into eight pictures per condition (close/neutral, close/neutral, far/negative).

We calculated emotion regulation ability (ER) by averaging the ratings for each condition, controlling for the effect of neutral emotional expressions using the following formula:

ER = (negative/far – neutral/far) – (negative/close – neutral/close) Lower values indicate stronger ability to regulate emotions.

Interoception

The interoceptive ability to feel one's own heartbeat was assessed with an adapted version of the Heartbeat Counting Task (HCT) by Schandry (1981). After two test trials (lasting 10 and 15 s), to familiarise participants with the procedure, the task consisted of five trials (lasting 25 s, 30 s, 35 s, 40 s and 45 s) presented in a randomized order (Garfinkel et al., 2015). Each trial began with a visual "start" signal and ended with a visual "stop" signal presented on a black screen, both accompanied by an acoustic signal. Sitting relaxed in a chair, participants were instructed to silently count their heartbeats, without touching their pulse or manipulating their heartbeat (e.g., by stopping breathing) (De Witte et al., 2016). After each trial, participants were asked "How many heartbeats did you feel?" and "How confident are you, that you hit all the heartbeats that actually occurred?" and were given a 9-point Likert scale from 0 = "not at all sure" to 8 = "completely sure" (De Witte et al., 2016). During the task, the actual heartbeat was assessed using ECG electrodes placed on the participant's chest.

Interoceptive accuracy (IAcc) was calculated by matching the reported heartbeats to actual heartbeats using the following formula, with a higher scores indicating higher IAcc (De Witte et al., 2016):

$$\frac{1}{5}\sum(1 - \frac{|acutual\ heartbeats - reported\ heartbeats|}{actual\ heartbeats})$$

In line with Garfinkel et al. (2015), interoceptive sensibility (IS) was calculated by averaging the confidence scores across all trials, with higher scores indicating higher IS. Interoceptive awareness (IAw) was calculated as the within-person correlation between IAcc and IS for each trial, with higher correlations indicating higher IAw (Garfinkel et al., 2015).

Eleven participants had to be excluded from the analyses due to errors in the ECG signal, and five participants had to be excluded due to an inability to feel their own heartbeat, leaving a sample of 59 participants with valid HCT data.

Additionally, we assessed interoception using the self-report Multidimensional Assessment of Interoceptive Awareness questionnaire (MAIA, by Mehling et al., 2012; for the German version see Bornemann et al., 2014) (see Supplement S1).

Empathy

To assess empathy, we used the EmpaToM task by Kanske et al. (2015). The EmpaToM assesses affective empathy, compassion and cognitive empathy via theory of mind (ToM). Starting with a fixation cross (1-3 s), the person's name (1 s) and then a video (~15 s) of that person is presented, in which the person talks about either an emotional or neutral situation that he/she has experienced (negative/neutral). The video is followed by two questions: "How do you feel?" (measure of affective empathy on a visual analogue scale from "negative" to "positive", 4 s) and "How much compassion do you feel for the person in the video?" (measure of compassion on a visual analogue scale from "none" to "very much", 4 s). After an interstimulus interval (1-3 s), the participant has to choose one of three options in a multiplechoice question (either with ToM content or factual reasoning (FR), presented for 14 s), followed by another interstimulus interval (0-2 s) and the question "How confident are you, that you chose the correct answer?" (visual analogue scale ranging from "not sure" to "sure", 4 s). The complete task contains 48 trials, with 12 trials per condition (negative/ToM, neutral/ToM, negative/FR, neutral/FR) (Kanske et al., 2015). For the present work, we used the affective empathy component by creating an empathy score (ET). The ET was calculated by subtracting participants' mean affect in the neutral videos from participants mean affect in the emotional videos, with lower scores indicating more empathic feelings for videos with emotional content.

Alcohol use

Alcohol use was assessed using the Time-Line Follow-Back interview for alcohol and drugs (TLFB, Sobell & Sobell, 1992). Participants were asked to retrospectively review their alcohol use for the 30 days prior to study participation and, if alcohol was used, to report how much they drank. The TLFB provides a differentiated picture of alcohol use, as it can provide information on frequency and quantity of alcohol used and additionally the frequency of binge drinking. Based on this information, we calculated alcohol frequency by summing all days of alcohol use and alcohol quantity by transforming alcoholic drinks into standard units and summing all standard units. Binge drinking was calculated by summing all days on which boys (girls) consumed five (four) or more standard units of alcohol (Sobell & Sobell, 1992). One

participant had to be excluded from the analyses because the values deviated more than three standard deviations from the mean (Sarmad, 2006), leaving a total sample of 58 participants for analysis (28 females, mean age 15.1 (*SD* 1.0) years, see Table 1).

Data analysis

SPSS for Windows, version 27.0 (IBM Corp., 2020) and the SPSS plug-in PROCESS macro version 3.5.3 (Hayes, 2017) were used to analyse the data. All analyses were conducted at a significance level of p < .05.

Sociodemographic differences between age groups, sexes and experience with COVID-19 were examined using t-test for independent samples. The test for differences in COVID-19 experience was included in the analyses as the data acquisition partly coincided with the COVID-19 pandemic in Germany (Robert-Koch Institut, 2021) and research could show the impact of the COVID-19 pandemic on risk factors for alcohol misuse and alcohol use as such (e.g. Prignitz et al., 2021; Liang et al., 2020; Dumas et al., 2020).

The effect of emotion regulation, interoception and empathy on alcohol use was examined in separate hierarchical linear regression models, with ER, HCT IAcc and ET as predictors and TLFB alcohol frequency and alcohol quantity as outcome. For all models, age and sex were included as covariates in a first step and additionally HCT IS and IAw as covariates for the HCT IAcc model, and the main predictor was added in a second step. This analysis was repeated for 14-year-olds and 16-year-olds separately, with sex as a covariate and HCT IS and IAw as additional covariates for the HCT IAcc model.

Whether interoception and empathy have a moderating effect on the association between emotion regulation and alcohol use was tested by separate moderation models for significant main effects of ER on TLFB alcohol quantity with either HCT IAcc or ET as moderator. For the moderator HCT IAcc, sex, age, HCT IS and IAw were used as covariates.

Because interoception has been found to be differentially associated with alcohol use in previous studies depending on the choice of the method (self-report vs. behavioural measure) (Jakubczyk et al., 2020), we examined the main and moderation effects of the MAIA, specifically the Attention Regulation subscale (see Supplement S1) as attention regulation enhance interoceptive feelings (Mehling et al., 2012), in post-hoc analyses. Similar to the main analyses, MAIA Attention Regulation was examined as a predictor of TLFB alcohol frequency and alcohol quantity in hierarchical linear regressions. Age and sex as well as the other seven MAIA subscales were included in the model as covariates in a first step and in a second step

the main predictor MAIA Attention Regulation was included. Similar to the main analyses, MAIA Attention Regulation was also examined as a possible moderator between emotion regulation and TLFB alcohol quantity and binge drinking, with age and sex as well as the other seven MAIA subscales as covariates.

The focus of this study is not on alcohol misuse in adolescents. Nevertheless, as binge drinking is often prevalent in adolescence (Zeiher et al., 2018), it was also examined in posthoc analyses using the methods already described for alcohol frequency and alcohol quantity.

Results

General sample information

General sample information can be found in Table 1 and Table S1. We found significant differences between age-groups for TLFB alcohol frequency (t(43.658) = -5.183, p < .001) with 14-year-olds having a lower score than 16-year-olds, for TLFB alcohol quantity (t(32.645) = -4.161, p < .001) with 14-year-olds having a lower score than 16-year-olds and TLFB binge drinking (t(31.0) = -4.478, p < .001) with 14-year-olds having a lower score than 16-year-olds (see Table 1).

Additionally, we found significant differences between sexes for HCT IS (t(56)=2.761, p < .01) with males ($M = 4.560 \pm 1.421$) having a higher scores than females ($M = 3.457 \pm 1.619$) and for ET (t(56) = 2.947, p < .01) with males ($M = -1.718 \pm .867$) having a higher scores than females ($M = -2.340 \pm .731$, see Table S1).

To check whether experience with COVID-19 had an influence on alcohol use, we compared participants assessed before COVID-19 onset (n = 45) and participants assessed during COVID-19 conditions (n = 13). We found no effect of COVID-19 in our sample (alcohol frequency: t(56) = -1.127, p = .264; alcohol quantity: t(56) = -.878, p = .384; binge drinking: t(56) = -.850, p = .399) so this variable was excluded from further analyses.

cents
lolesc
Αd
ш.
Use
Ξ
coho
ž
v put
١ <u>ک</u>
ath
Simp
ц Т
ior
cpt
roc
Inte
'n,
atio
guli
Re
on
loti
En
<i>.</i> ;
ıdy
Stu
ns
tio
ibu
ntri
C
al
jin
Ľ.
\mathbf{O}

Table 1

General sample description and distribution

		Total	14	-year-olds	1	6-year-olds	age difference	
Ι	Ν	M(SD)	Ν	M(SD)	Ν	M(SD)	<i>t</i> (df)	
sex (male/female)	(30/28)		(15/11)		(15/17)			
TLFB alcohol frequency	58	2.12 (2.399)	26	0.69(1.087)	32	3.28 (2.556)	-5.183 (43.658)***	
alcohol quantity	58	7.877 (13.526)	26	1.196(2.390)	32	13.305 (16.246)	-4.161 (32.645)***	
Binge drinking	58	0.538(1.032)	26	(000)(000)	32	0.975 (1.232)	$-4.478(31.0)^{***}$	
HCT Interoceptive Accuracy	58	.673 (.179)	26	.628 (.168)	32	.709 (.182)	-1.741 (56)	
Interoceptive Sensibility	58	4.023(1.606)	26	4.154(1.632)	32	3.925(1.603)	0.536(56)	
Interoceptive Awareness	58	.228 (.529)	26	.187 (.453)	32	.261 (.589)	-0.523 (56)	
ET	58	-2.018 (0.857)	26	-1.884 (0.828)	32	-2.127 (0.877)	1.075 (56)	
ER	58	-0.452 (0.729)	26	-0.291 (0.695)	32	-0.583 (0.740)	1.537(56)	
<i>Note</i> . TLFB = Time Line Follow Ba	ack interv	iew; HCT = Heart	beat Cour	nting Task; $ET = F$	umpathy	measured as Empa'	ToM affect difference (emo	otional
- neutral); ER = Emotion Regulatic	on measu	ired as affect differ	ence (far	- close) in the en	notion re	gulation task; $* = H$	p < .05, ** = p < .01, *** p	<.001.

86

Effects of emotion regulation, interoception and empathy on TLFB alcohol frequency *No association between emotion regulation and TLFB alcohol frequency*

For the whole sample we found a significant general model for ER on TLFB alcohol frequency (F(3,54)=8.317, p < .001), with covariate age as the significant component (b = 1.331, p < .001). The main predictor ER did not reach significance (p > .05, see Table 2), neither in the whole sample, nor in age separated models (both p > .05, see Table S2). Hence no moderation models where calculated for whole or age separated samples.

Positive association between interoceptive accuracy and TLFB alcohol frequency

We found a significant model for HCT IAcc on TLFB alcohol frequency within the whole sample (F(5,52) = 6.182, p < .001), with significant main effect HCT IAcc (b = 3.674, p < .05) and significant covariate age (b = 1.164, p < .001, see Table 2 and Figure 1). Age separated models revealed no significant model for 14-year-olds (p > .05), but we found a significant model for HCT IAcc on TLFB alcohol frequency for 16-year-olds (F(4,27) = 2.944, p < .01), with a significant main effect of HCT IAcc (b = 6.979, p < .05, see Table S2 and Figure 1). See Table S3 for post-hoc analyses of the main effect of MAIA Attention Regulation on TLFB alcohol frequency.

Figure 1



Effect of Heartbeat counting task (HCT) Interoceptive Accuracy on TLFB alcohol frequency.

Note. Black line represents regression line for the whole sample; blue (16-year-olds) and green (14-year-olds) lines represent regression lines for each age group.

No association between empathy and TLFB alcohol frequency

For the whole sample the general model for ET on TLFB alcohol frequency was significant (F(3,54) = 8.317, p < .001), with covariate age as the significant component (b = 1.333, p < .001). The main predictor ET did not reach significance (p > .05, see Table 2) and neither did the age separated models (both p > .05, see Table S2).

Original Contributions – Study 2: Emotion Regulation, Interoception, Empathy and Alcohol Use in Adolescents

Table 2

Main effect models of predictors emotion regulation, interoception and empathy on TLFB alcohol frequency.

)		•		•	•				
model	F	(dfl,df2)	d	$\mathbb{R}^{2}/$	predictors/	q	SE	β	d	62%	CI
				ΔR^2	covariates				I	TT	UL
Emotion Regulation	8.317	(3,54)	000.	.278	constant	-16.913	4.147		000.	-25.227	-8.599
					age	1.331	0.276	.557	000.	0.778	1.884
					sex	-0.728	0.540	153	.183	-1.811	0.355
				000.	Emotion Regulation	-0.019	0.379	006	.961	-0.778	0.741
HCT Interoceptive Accuracy	6.182	(5,52)	000.	.312	constant	-16.493	4.171		000.	-24.864	-8.123
					age	1.164	0.277	.487	000.	0.608	1.719
					sex	-0.583	0.565	122	.308	-1.717	0.552
					Interoceptive Sensibility	-0.138	0.193	092	.476	-0.525	0.248
					Interoceptive Awareness	-0.047	0.504	010	.925	-1.058	0.963
				.056	Interoceptive Accuracy	3.674	1.704	.274	.036	0.254	7.095
Empathy	8.317	(3,54)	000.	.278	constant	-16.944	4.090		000.	-25.145	-8.744
					age	1.333	0.272	.557	000.	0.787	1.879
					sex	-0.734	0.577	154	.209	-1.890	0.423
				000.	Empathy	-0.012	0.341	004	.972	-0.695	0.671
Note. Model refers to the app.	olied pre-	dictor, italic	s values	refer	to changes in R^2 when predic	tor is adde	d to the n	nodel, bo	ld marke	d variables	are
significant at $p < .05$ or below,	HCT =	Heartbeat c	ounting	task, S	E = standard error, 95% $CI = 9$)5% Confid	lence inter	val, <i>LL</i> =	lower lir	nit, $UL = up$	per
limit.											

89

Effects of emotion regulation, interoception and empathy on TLFB alcohol quantity Emotion regulation is positively associated with TLFB alcohol frequency, and is moderated by empathy

With covariates age (b = 7.002, p < .001) and sex (b = -7.707, p < .05) as significant components, the general model for ER on TLFB alcohol quantity reached significance for the whole sample (F(3,54) = 8.748, p < .001). The main predictor ER did not reach significance (p > .05, see Table 3). Therefore, no moderation model was calculated for the whole sample.

While we did not find a significant model of ER on TLFB alcohol quantity in 14-yearolds (p > .05) in the age separated models, we found significant main effect of ER (b = 8.491, p < .05) and covariate sex (b = -15.805, p < .01) in the 16-year-olds (significant main model fit: F(2,29) = 7.635, p < .01, see Table S4 and Figure 2). Due to the non-significant model of ER on TLFB alcohol quantity, no moderation model was calculated for 14-year-olds. For 16-yearolds we found a significant model for the moderation of ER and TLFB alcohol quantity with ET as moderator, with significant main effect of ER (b = 27.512, p < .01), significant interaction ER × ET (b = 8.364, p < .05) and significant covariate sex (b = -17.835, p < .01) (see Table S5, Figure 3 and Figure S1). The moderation model with HCT IAcc as moderator did not reach significance for 16-year-olds (p > .05), but we observed a significant moderation of MAIA Attention Regulation on the association between emotion regulation and TLFB quantity in 16year-olds (see Table S5).

Figure 2

Effect of Emotion Regulation on TLFB alcohol quantity.



Note. Black line represents regression line for the whole sample; blue (16-year-olds) and green (14-year-olds) lines represent regression lines for each age group.

Figure 3

Moderation effect of empathy on the association between Emotion Regulation and TLFB quantity in 16 year-olds



Note. Lower empathy scores indicate higher affective empathy during the EmpaToM task.

No association between interoception and TLFB alcohol quantity

We found a significant model for HCT IAcc on TLFB alcohol quantity (F(5,52) = 5.074, p < .01) in the whole sample, with covariates age (b = 5.790, p < .001) and sex (b = -8.516, p < .05) as significant components. The main predictor HCT IAcc did not reach significance (p > .05, see Table 3). Models separated by age revealed no significant effect in 14-year-olds (p > .05), but a significant model for HCT IAcc on TLFB alcohol quantity for 16-year olds (F(4,27) = 3.264, p < .05), with covariate sex (b = -16.056, p < .05) as significant component (see Table S4). See Table S6 for post-hoc analyses of the main effect of MAIA on TLFB alcohol quantity.

No association between empathy and TLFB alcohol quantity

We found a significant model for ET on TLFB alcohol quantity (F(3,54) = 7.369, p < .001) within the whole sample, with covariates age (b = 6.479, p < .001) and sex (b = -8.112, p < .05) as significant components. The main predictor ET did not reach significance (p > .05, see Table 3). Looking at age separated models, we found no significant model for ET on TLFB alcohol quantity for 14-year-olds (p > .05), but we found a significant model for 16-year-olds (F(2,29) = 3.575, p < .05), with covariate sex (b = -14.347, p < .05) as significant component (see Table S4).

Original Contributions – Study 2: Emotion Regulation, Interoception, Empathy and Alcohol Use in Adolescents

Table 3

Main effect models of predictors emotion reculation interocention and emorthy on alcohol auantity

model	F	(df1,df2)	d	$\mathbb{R}^{2/}$	predictors/	q	SE	β	d	95%	CI
				ΔR^2	covariates					TT	UL
Emotion Regulation	8.748	(3,54)	000.	.290	constant	-84.812	23.189		.001	-131.303	-38.322
					age	7.002	1.543	.519	000.	3.909	10.096
					sex	-7.707	3.019	287	.014	-13.760	-1.654
				.037	Emotion Regulation	3.633	2.119	.196	.092	-0.616	7.882
HCT Interoceptive Accuracy	5.074	(5,52)	.001	.263	constant	-72.013	24.342		.005	-120.858	-23.167
					age	5.790	1.616	.430	.001	2.547	9.034
					sex	-8.516	3.300	317	.013	-15.137	-1.894
					Interoceptive Sensibility	-0.952	1.124	113	.401	-3.208	1.303
					Interoceptive Awareness	3.542	2.940	.139	.234	-2.357	9.441
				019	Interoceptive Accuracy	12.028	9.946	.159	.232	-7.930	31.986
Empathy	7.369	(3,54)	000.	.251	constant	-78.189	23.484		.002	-125.272	-31.106
					age	6.479	1.564	.481	000.	3.343	9.614
					sex	-8.112	3.312	302	.018	-14.751	-1.472
				000.	Empathy	-0.120	1.957	008	.951	-4.044	3.804

υ IOWER IIMIT, UL = upper2.2% COIIIINGING IIINGI VAI, LL Stallual u ellor, 93% U nearweat countille lask, DE significant at p < .05 or below, HCT limit.

Post-hoc analyses: Effects of emotion regulation, interoception and empathy on TLFB binge drinking

The analyses of emotion regulation, interoception and empathy on TLFB binge drinking can be found in Table S7 to Table S10 and Figure S2 and Figure S3.

Discussion

The motives for adolescent alcohol use are complex but one important function of alcohol use might be related to managing aversive emotions. However, the mechanisms underlying this process are not well understood. Adolescents with higher interoceptive awareness and higher affective empathy capacities, might experience negative emotions more strongly and more often, thus rendering them particularly vulnerable to alternative coping strategies to regulate these emotions. Here, we investigated if in addition to poor emotion regulation, higher interoception, and higher affective empathy function as motives for increased alcohol use among adolescents. Moreover, we tested whether the relation between emotion regulation and alcohol use is moderated by higher interoception and increased affective empathy. We examined alcohol frequency and quantity separately, as these two parameters may be subject of different processes and therefore affected differently.

We found lower emotion regulation, but not interoception and empathy, to be a significant predictor for higher alcohol quantity, especially among 16-year-olds. Similar significant results were found for alcohol misuse in the form of binge drinking (see Table S7 and Table S9), but not for the frequency of drinking. These findings support previous work, particularly of alcohol misuse (e.g. Aurora & Klanecky, 2016), and suggest that adolescence with poorer ability to regulate negative emotions are more prone to binge drink on drinking occasions. On the one hand, this might point to alcohol use as an alternative strategy for coping with negative emotions when emotion regulation abilities are poor, on the other, it might be due to generally lower ability for self-regulation (i.e. impulse-inhibition, Schreiber et al., 2012). This is in line with arousal theory and provide an indication of the coping mechanism even before the development of an AUD (Shadur & Lejuez, 2015; Lannoy et al., 2021). Moreover, our results support the assumption that alcohol frequency and alcohol quantity may be subject to different processes (Robinson & Berridge, 1993; Berridge & Robinson, 2016). This is also supported by the significant positive association between increased interoceptive accuracy and more frequent drinking, but not the amount of alcohol or binge drinking, especially among 16year-olds in our sample. According to these findings, interoception is more important for the

onset of alcohol use, i.e. how often adolescents drink, with the rewarding effects of alcohol being "liked" (Robinson & Berridge, 1993), such as lowering the experience of arousal triggered by heightened interoception (Wiens, 2005; Füstös et al., 2012; Peacock et al., 2015). But once drinking starts, the amount of alcohol serves a more instrumental purpose, that of coping with emotions when emotion regulation is poor, i.e. the wanting mechanism (Robinson & Berridge, 1993).

Interestingly, although empathy was not found to directly predict alcohol outcomes, it had an indirect effect, by significantly moderating the association between emotion regulation and alcohol quantity in 16-year-olds. Interestingly, we found a strong effect of emotion regulation ability on quantity of alcohol use in 16-year-olds, if their affective empathy was lower. That is, better emotion regulation was associated with smaller amounts of alcohol, but only in adolescents where affective empathy was low (see Figure 3). This was quite surprising as it was contrary to our assumption, but may be explained by a number of factors. First, it may indicate an underlying factor such as alexithymia, which is associated with lack in emotion regulation and empathy and higher alcohol use (Bird & Viding, 2014; Linn et al., 2021; Mul et al., 2018). Second, social competence, which is characterized by high levels of emotion regulation and empathy (Klinkhammer et al., 2022), contributes to adolescents popularity (Bukowski et al., 2011). In turn, higher popularity is associated with increased alcohol use in adolescence (Choukas-Bradley et al., 2015; Gommans et al., 2017). Thus, affective empathy, in the sense of coping with emotions triggered by feelings stemming from others (Davis, 1983; Ainley et al., 2015), seems to play a subordinate role in the relationship between emotion regulation and alcohol use.

The findings on the influence of interoception on the relation between emotion regulation and alcohol quantity point in a similar direction. In the present findings, however, a distinction must be made between interoceptive accuracy and interoceptive sensibility, as has been shown in previous studies (Jakubczyk et al., 2020; Garfinkel et al., 2015). While, contrary to expectations, interoceptive accuracy (as measured by the HCT) had no moderating effect on the relation between emotion regulation and alcohol quantity, there was a significant moderating effect for interceptive sensibility (as measured by the MAIA), particularly in 16-year-olds (see Table S5 and Figure S1). Intriguingly, adolescents with higher levels of interoceptive sensibility tended to drink less with increasing emotion regulation abilities. In contrast, those with lower levels of interoceptive sensibility tended to drink more with higher levels of emotion regulation ability. Similarly, this effect was also true for binge drinking (see

Table S8 and Table S10). These findings, however, were contrary to expectations and previous findings of higher interoceptive sensibility in AUD patients (Jakubczyk et al., 2019; Jakubczyk et al., 2020), but interestingly, indicate that emotion regulation abilities are particularly important and positively influence alcohol intake, when bodily (and emotional) awareness is high. This is in line with our proposed hypothesis and could be due to the fact that the MAIA and attention regulation in particular, the capacity to focus and sustain attention to internal experiences (Mehling et al., 2012), are closely related to the concept of mindfulness (Burg & Wolf, 2012) and thus could be an indicator of a possible protective factor (Garland & Howard, 2018).

Finally, it is important to recognize some of the study's limitations. Only two age groups - 14 and 16 years old - were included in our cross-sectional sample and our findings were primarily true for 16-year-olds. The low variance in alcohol frequency and quantity among 14year-olds may be the reason for the lack of effect in this age group. Nevertheless, the drinking pattern of 14-year-olds, but also 16-year-olds, is consistent with previous literature (Brown et al., 2009; Zeiher et al., 2018). Future investigations using a longitudinal design would not only provide a clearer picture of how adolescent alcohol use evolves over time, it would allow us to examine the development of emotion regulation, interoception and empathy during adolescence, and assess the (causal) relation between these factors and alcohol use. To better understand how emotion regulation and alcohol drinking patterns relate to each other, future work might benefit from examining additional factors, such as drinking motives (Kuntsche et al., 2005). Nevertheless, our findings provide a preliminary evidence that emotion regulation interacts with adolescents' interoception and empathy, thereby influencing early patterns of risky drinking behavior such as binge drinking. Lastly, our results are partly based on selfreport judgments made by adolescents. Further research could examine whether these assessments can also be mapped to involuntary processes and provide information about the actual arousal experienced (Peacock et al., 2015), using physiological markers like heart rate variability or electro dermal activity.

Implications for clinical work

The results of this study imply that it might be useful to strengthen adolescent' emotion regulation ability, as social stimuli are particularly relevant during adolescence (quelle) and adolescent face increased difficulties with emotion regulation due to protracted development of frontal brain networks involved in self-regulation (quelle). However, emotion regulation becomes particularly relevant as adolescents are more aware of their emotions and less able to

empathize with others. Mindfulness, as a factor that has already been shown to strengthen selfregulation and emotion regulation skills (quelle), may be a useful starting point. Our results support this with the findings on attention regulation. Given that attention regulation is a crucial aspect of mindfulness (Burg & Wolf, 2012; Kabat-Zinn, 1990), the significant moderation effect of the MAIA Attention Regulation subscale in our sample implies that it may mitigate the relationship between poorer emotion regulation ability and increased alcohol use (Cavicchioli et al., 2019). However, more research is required as mindfulness in adolescents and at an early stage of alcohol use has only recently been discussed (e.g. Arnaud et al., 2020). It is possible, nevertheless, that increasing mindfulness in preventive approaches may already have a beneficial effect and thus reduce the risk of developing an alcohol use disorder in adolescence. This may be particularly relevant during pandemic situations. Although the COVID-19 experience did not directly affect alcohol use in our sample, it may have a negative effect on factors that are predictive of alcohol use (Prignitz et al., 2021; Ellis et al., 2020; Liang et al., 2020), making prevention particularly relevant in this context.

Conclusion

Emotion regulation abilities have been suggested to be an important risk factor in the development of unhealthy drinking habits in adolescents – particularly, when adolescent use alcohol to cope with negative emotions. Here we investigated which factors might drive this association in healthy adolescent and found that the adolescents' level of interoceptive sensibility and affective empathy moderated the association between alcohol use and emotion regulation. Depending on lower empathy, the ability to regulate emotions becomes increasingly relevant for the amount of alcohol used, whereas interoceptive sensibility might have a protective effect on the relationship. The results also show that the effect of alcohol on body perception, i.e. interoceptive accuracy, is relevant for initiation of drinking, while the amount of alcohol becomes relevant for emotion regulation. This suggests that alcohol frequency and alcohol quantity are controlled by two different mechanisms already at the onset of alcohol use.

Acknowledgments:

The authors would like to thank Antonia Fritsch for support in the data preprocessing procedure.

Funding:

With the public-funded research project IMAC-Mind: Improving Mental Health and Reducing Addiction in Childhood and Adolescence through Mindfulness: Mechanisms, Prevention and Treatment (2017–2023; 01GL1745A; subproject TP0), the Federal Ministry of Education and Research (BMBF) contributes to improving the prevention and treatment of children and adolescents with substance use disorders and associated mental disorders. The funders had no role in the study design, data collection, analysis, decision to publish, or preparation of the manuscript. Project coordination was realized by the German Center of Addiction Research in Childhood and Adolescence at the University Medical Center Hamburg-Eppendorf. The consortium comprises seven projects in Germany. Principal Investigators are Rainer Thomasius (Coordinator, University Medical Center Hamburg-Eppendorf), Tobias Banaschewski, Herta Flor (Central Institute of Mental Health, Mannheim), Frauke Nees (Central Institute of Mental Health, Mannheim, and University Medical Center Schleswig Holstein, Kiel University), Johannes Kornhuber (Friedrich-Alexander-Universität Erlangen-Nürnberg), Michael Klein (Catholic University of Applied Sciences, Cologne), Olaf Reis (University Medicine of Rostock), Tanja Legenbauer (Ruhr-University Bochum), and Antonia Zapf (University Medical Center Hamburg-Eppendorf). Further members of the consortium are Nicolas Arnaud, Christiane Baldus, Anne Daubmann, Amra Hot, Sabrina Kunze, Kathrin Simon-Kutscher, Anna-Lena Schulz, Michael Supplieth (University Medical Center Hamburg-Eppendorf), Karina Jansone, Stella Guldner, Sabina Millenet, Maren Prignitz, Bernd Lenz (Central Institute of Mental Health, Mannheim), Peter Fasching, Matthias Beckmann, Verena Nadine Buchholz, Eva-Maria Siegmann, Anna Eichler, Jenny Gerlach, Christiane Mühle, Adriana Titzmann (Friedrich-Alexander University Erlangen-Nürnberg), Lina-Sophia Falkenberg, Daria Kunst (Catholic University of Applied Sciences, Cologne), Lucie Waedel, Katrin Bogumil (University Medicine of Rostock), Martin Holtmann, Regina Herdering, Carina Maria Huhn, Lea Kretschmar, and Laura Mokros (Ruhr-University Bochum). For more information, please visit our homepage https://imac-mind.de/

The work was also funded by Deutsche Forschungsgemeinschaft (FL 156/44-1).

References

- Ainley, V., Maister, L., & Tsakiris, M. (2015). Heartfelt empathy? No association between interoceptive awareness, questionnaire measures of empathy, reading the mind in the eyes task or the director task. *Frontiers in Psychology*, 6, 554. https://doi.org/10.3389/fpsyg.2015.00554
- Ardenghi, S., Russo, S., Bani, M., Rampoldi, G., & Strepparava, M. G. (2023). The role of difficulties in emotion regulation in predicting empathy and patient-centeredness in preclinical medical students: A cross-sectional study. *Psychology, Health & Medicine*, 28(5), 1215–1229. https://doi.org/10.1080/13548506.2021.2001549
- Arnaud, N., Banaschewski, T., Nees, F., Bucholz, V. N., Klein, M., Reis, O., Legenbauer, T., Zapf, A., & Thomasius, R. (2020). Achtsamkeit in der entwicklungsorientierten Suchtprävention und -therapie: Rational, Design und Ziele des Forschungsverbundes IMAC-Mind [Mindfulness in Development-oriented Approaches to Substance Use Prevention and Therapy: Rationale, Design and Objectives of the Research Consortium IMAC-Mind]. *Praxis der Kinderpsychologie und Kinderpsychiatrie*, *69*(4), 353–374. https://doi.org/10.13109/prkk.2020.69.4.353
- Aurora, P., & Klanecky, A. K. (2016). Drinking motives mediate emotion regulation difficulties and problem drinking in college students. *The American Journal of Drug and Alcohol Abuse*, 42(3), 341–350. https://doi.org/10.3109/00952990.2015.1133633
- Berridge, K. C., & Robinson, T. E. (2016). Liking, wanting, and the incentive-sensitization theory of addiction. *The American Psychologist*, 71(8), 670–679. https://doi.org/10.1037/amp0000059
- Bird, G., & Viding, E. (2014). The self to other model of empathy: Providing a new framework for understanding empathy impairments in psychopathy, autism, and alexithymia. *Neuroscience and Biobehavioral Reviews*, 47, 520–532. https://doi.org/10.1016/j.neubiorev.2014.09.021
- Bornemann, B., Herbert, B. M., Mehling, W. E., & Singer, T. (2014). Differential changes in self-reported aspects of interoceptive awareness through 3 months of contemplative training. *Frontiers in Psychology*, *5*, 1504. https://doi.org/10.3389/fpsyg.2014.01504
- Bremner, P., Burnett, J., Nunney, F., Ravat, M., & Willm Mistral, W. (2011). Young people, alcohol and influences: A study of young people and their relationship with alcohol. Joseph Rowntree Foundation. https://www.jrf.org.uk/report/young-people-alcohol-and-influences

- Brown, S. A., McGue, M., Maggs, J., Schulenberg, J., Hingson, R., Swartzwelder, S., Martin, C., Chung, T., Tapert, S. F., Sher, K., Winters, K. C., Lowman, C., & Murphy, S. (2009). Underage alcohol use: Summary of developmental processes and mechanisms: Ages 16–20. *Alcohol Research & Health*, *1*(32), 41–52.
- Bukowski, W. M., Buhrmester, D., & Underwood, M. K. (2011). Peer relations as a developmental context. In M. K. Underwood & L. H. Rosen (Eds.), *Social development: Relationships in infancy, childhood, and adolescence* (pp. 153–179). Guilford Press.
- Burg, J. M., & Wolf, O. T. (2012). Mindfulness as self-regulated attention. Swiss Journal of Psychology, 71(3), 135–139. https://doi.org/10.1024/1421-0185/a000080
- Casey, B. J., Jones, R. M., Levita, L., Libby, V., Pattwell, S. S., Ruberry, E. J., Soliman, F., & Somerville, L. H. (2010). The storm and stress of adolescence: Insights from human imaging and mouse genetics. *Developmental Psychobiology*, *52*(3), 225–235. https://doi.org/10.1002/dev.20447
- Cavicchioli, M., Movalli, M., & Maffei, C. (2019). Difficulties with emotion regulation, mindfulness, and substance use disorder severity: The mediating role of self-regulation of attention and acceptance attitudes. *The American Journal of Drug and Alcohol Abuse*, 45(1), 97–107. https://doi.org/10.1080/00952990.2018.1511724
- Choukas-Bradley, S., Giletta, M., Neblett, E. W., & Prinstein, M. J. (2015). Ethnic differences in associations among popularity, likability, and trajectories of adolescents' alcohol use and frequency. *Child Development*, 86(2), 519–535. https://doi.org/10.1111/cdev.12333
- Cooper, M. L., Frone, M. R., Russell, M., & Mudar, P. (1995). Drinking to regulate positive and negative emotions: A motivational model of alcohol use. *Journal of Personality and Social Psychology*, 69(5), 990–1005. https://doi.org/10.1037//0022-3514.69.5.990
- Dalvi-Esfahani, M., Niknafs, A., Alaedini, Z., Barati Ahmadabadi, H., Kuss, D. J., & Ramayah, T. (2021). Social media addiction and empathy: Moderating impact of personality traits among high school students. *Telematics and Informatics*, 57, 101516. https://doi.org/10.1016/j.tele.2020.101516
- Davis, M. H. (1983). The effects of dispositional empathy on emotional reactions and helping: A multidimensional approach. *Journal of Personality*, *51*(2), 167–184. https://doi.org/10.1111/j.1467-6494.1983.tb00860.x
- De Witte, N. A. J., Sütterlin, S., Braet, C., & Mueller, S. C. (2016). Getting to the heart of emotion regulation in youth: The role of interoceptive sensitivity, heart rate variability, and

parental psychopathology. *PloS One*, *11*(10), e0164615. https://doi.org/10.1371/jour-nal.pone.0164615

- Dumas, T. M., Ellis, W., & Litt, D. M. (2020). What does adolescent substance use look like during the covid-19 pandemic? Examining changes in frequency, social contexts, and pandemic-related predictors. *The Journal of Adolescent Health : Official Publication of the Society for Adolescent Medicine*, 67(3), 354–361. https://doi.org/10.1016/j.jadohealth.2020.06.018
- Eisenberg, N., Eggum, N. D., & Di Giunta, L. (2010). Empathy-related responding: Associations with prosocial behavior, aggression, and intergroup relations. *Social Issues and Policy Review*, 4(1), 143–180. https://doi.org/10.1111/j.1751-2409.2010.01020.x
- Ellis, W. E., Dumas, T. M., & Forbes, L. M. (2020). Physically isolated but socially connected: Psychological adjustment and stress among adolescents during the initial covid-19 crisis. *Canadian Journal of Behavioural Science / Revue Canadienne Des Sciences Du Comportement*, 52(3), 177–187. https://doi.org/10.1037/cbs0000215
- Ernst, J., Northoff, G., Böker, H., Seifritz, E., & Grimm, S. (2013). Interoceptive awareness enhances neural activity during empathy. *Human Brain Mapping*, *34*(7), 1615–1624. https://doi.org/10.1002/hbm.22014
- Fukushima, H., Terasawa, Y., & Umeda, S. (2011). Association between interoception and empathy: Evidence from heartbeat-evoked brain potential. *International Journal of Psychophysiology : Official Journal of the International Organization of Psychophysiology*, 79(2), 259–265. https://doi.org/10.1016/j.ijpsycho.2010.10.015
- Füstös, J., Gramann, K., Herbert, B. M., & Pollatos, O. (2012). On the embodiment of emotion regulation: Interoceptive awareness facilitates reappraisal. *Social Cognitive and Affective Neuroscience*, 8(8), 911–917. https://doi.org/10.1093/scan/nss089
- Garfinkel, S. N., Seth, A. K., Barrett, A. B., Suzuki, K., & Critchley, H. D. (2015). Knowing your own heart: Distinguishing interoceptive accuracy from interoceptive awareness. *Biological Psychology*, 104, 65–74. https://doi.org/10.1016/j.biopsycho.2014.11.004
- Garland, E. L., & Howard, M. O. (2018). Mindfulness-based treatment of addiction: Current state of the field and envisioning the next wave of research. *Addiction Science & Clinical Practice*, 13(1), 14. https://doi.org/10.1186/s13722-018-0115-3
- Gommans, R., Müller, C. M., Stevens, G. W. J. M., Cillessen, A. H. N., & Bogt, T. F. M. ter (2017). Individual popularity, peer group popularity composition and adolescents' alcohol

consumption. *Journal of Youth and Adolescence*, *46*(8), 1716–1726. https://doi.org/10.1007/s10964-016-0611-2

- Gross, J. J. (2008). Emotion regulation. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 497–512). Guilford Press.
- Grynberg, D., & López-Pérez, B. (2018). Facing others' misfortune: Personal distress mediates the association between maladaptive emotion regulation and social avoidance. *PloS One*, *13*(3), e0194248. https://doi.org/10.1371/journal.pone.0194248
- Hayes, A. F. (2017). Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach. Guilford Publications.
- Heydrich, L., Walker, F., Blättler, L., Herbelin, B., Blanke, O., & Aspell, J. E. (2020). Interoception and empathy impact perspective taking. *Frontiers in Psychology*, *11*, 599429. https://doi.org/10.3389/fpsyg.2020.599429
- IBM Corp. (2020). IBM SPSS Statistics for Windows (Version 27.0) [Computer software]. IBM Corp. Armonk, NY.
- Jakubczyk, A., Skrzeszewski, J., Trucco, E. M., Suszek, H., Zaorska, J., Nowakowska, M., Michalska, A., Wojnar, M., & Kopera, M. (2019). Interoceptive accuracy and interoceptive sensibility in individuals with alcohol use disorder-different phenomena with different clinical correlations? *Drug and Alcohol Dependence*, 198, 34–38. https://doi.org/10.1016/j.drugalcdep.2019.01.036
- Jakubczyk, A., Trucco, E. M., Klimkiewicz, A., Skrzeszewski, J., Suszek, H., Zaorska, J., Nowakowska, M., Michalska, A., Wojnar, M., & Kopera, M. (2020). Association between interoception and emotion regulation in individuals with alcohol use disorder. *Frontiers in Psychiatry*, 10, 1028. https://doi.org/10.3389/fpsyt.2019.01028
- Kabat-Zinn, J. (1990). Full catastrophe living: How to cope with stress, pain, and illness using mindfulness meditation. Doubleday.
- Kanske, P., Böckler, A., Trautwein, F.-M., & Singer, T. (2015). Dissecting the social brain: Introducing the empatom to reveal distinct neural networks and brain-behavior relations for empathy and theory of mind. *NeuroImage*, *122*, 6–19. https://doi.org/10.1016/j.neuroimage.2015.07.082
- Klinkhammer, J., Voltmer, K., & Salisch, M. von. (2022). Emotionale Kompetenz bei Kindern und Jugendlichen: Entwicklung und Folgen (2., erweiterte und überarbeitete Auflage). Verlag W. Kohlhammer.

- Kuntsche, E., Knibbe, R., Gmel, G., & Engels, R. (2005). Why do young people drink? A review of drinking motives. *Clinical Psychology Review*(25), 841–861. https://doi.org/10.1016/j.cpr.2005.06.002
- Lannoy, S., Duka, T., Carbia, C., Billieux, J., Fontesse, S., Dormal, V., Gierski, F., López-Caneda, E., Sullivan, E. V., & Maurage, P. (2021). Emotional processes in binge drinking: A systematic review and perspective. *Clinical Psychology Review*, *84*, 101971. https://doi.org/10.1016/j.cpr.2021.101971
- Liang, L., Ren, H., Cao, R., Hu, Y., Qin, Z., Li, C., & Mei, S. (2020). The effect of covid-19 on youth mental health. *The Psychiatric Quarterly*, 91(3), 841–852. https://doi.org/10.1007/s11126-020-09744-3
- Linn, B. K., Zhao, J., Bradizza, C. M., Lucke, J. F., Ruszczyk, M. U., & Stasiewicz, P. R. (2021). Alexithymia disrupts emotion regulation processes and is associated with greater negative affect and alcohol problems. *Journal of Clinical Psychology*, 77(12), 2915–2928. https://doi.org/10.1002/jclp.23279
- Löffler, A., Foell, J., & Bekrater-Bodmann, R. (2018). Interoception and its interaction with self, other, and emotion processing: Implications for the understanding of psychosocial deficits in borderline personality disorder. *Current Psychiatry Reports*, 20(4), 28. https://doi.org/10.1007/s11920-018-0890-2
- Mehling, W. E., Price, C., Daubenmier, J. J., Acree, M., Bartmess, E., & Stewart, A. (2012). The multidimensional assessment of interoceptive awareness (MAIA). *PloS One*, 7(11), e48230. https://doi.org/10.1371/journal.pone.0048230
- Mul, C.-L., Stagg, S. D., Herbelin, B., & Aspell, J. E. (2018). The feeling of me feeling for you: Interoception, alexithymia and empathy in autism. *Journal of Autism and Developmental Disorders*, 48(9), 2953–2967. https://doi.org/10.1007/s10803-018-3564-3
- Norberg, M. M., Ham, L. S., Olivier, J., Zamboanga, B. L., Melkonian, A., & Fugitt, J. L. (2016). Pregaming and emotion regulation's relationship to alcohol problems in college students: A cross-sectional study. *Substance Use & Misuse*, *51*(8), 1024–1033. https://doi.org/10.3109/10826084.2016.1152498
- Özdemir, A., Utkualp, N., & Pallos, A. (2016). Physical and psychosocial effects of the changes in adolescence period. *International Journal of Caring Sciences*, *9*(2), 717–723.

- Peacock, A., Cash, C., Bruno, R., & Ferguson, S. G. (2015). Day-by-day variation in affect, arousal and alcohol consumption in young adults. *Drug and Alcohol Review*, 34(6), 588– 594. https://doi.org/10.1111/dar.12238
- Petit, G., Luminet, O., Maurage, F., Tecco, J., Lechantre, S., Ferauge, M., Gross, J. J., & Timary, P. de (2015). Emotion regulation in alcohol dependence. *Alcoholism, Clinical and Experimental Research*, 39(12), 2471–2479. https://doi.org/10.1111/acer.12914
- Prignitz, M., Guldner, S., & Nees, F. (2021). Jugendliches Alkoholkonsumverhalten während der Covid-19-Pandemie und die Bedeutung von Achtsamkeit. SUCHT, 67(6), 287–297. https://doi.org/10.1024/0939-5911/a000734
- Robert-Koch Institut (2021). Retrospektive Phaseneinteilung der Covid-19-Pandemie in Deutschland bis Februar 2021. *Epidemiologisches Bulletin* (15).
- Robinson, T. E., & Berridge, K. C. (1993). The neural basis of drug craving: An incentivesensitization theory of addiction. *Brain Research Reviews*, *18*(3), 247–291.
- Sarmad, M. (2006). *Robust data analysis for factorial experimental designs: Improved methods and software* [Durham theses]. Durham University. Available at Durham E-Theses Online: http://etheses.dur.ac.uk/2432/
- Schandry, R. (1981). Heart beat perception and emotional experience. *Psychophysiology* (18), 483–488.
- Schreiber, L. R. N., Grant, J. E., & Odlaug, B. L. (2012). Emotion regulation and impulsivity in young adults. *Journal of Psychiatric Research*, 46(5), 651–658. https://doi.org/10.1016/j.jpsychires.2012.02.005
- Shadur, J. M., & Lejuez, C. W. (2015). Adolescent substance use and comorbid psychopathology: Emotion regulation deficits as a transdiagnostic risk factor. *Current Addiction Reports*, 2(4), 354–363. https://doi.org/10.1007/s40429-015-0070-y
- Silvers, J. A., McRae, K., Gabrieli, J. D. E., Gross, J. J., Remy, K. A., & Ochsner, K. N. (2012). Age-related differences in emotional reactivity, regulation, and rejection sensitivity in adolescence. *Emotion (Washington, D.C.)*, *12*(6), 1235–1247. https://doi.org/10.1037/a0028297
- Sobell, L. C., & Sobell, M. B. (1992). Timeline followback: A technique for assessing selfreported alcohol consumption. In R. Z. Litten & J. Allen (Eds.), *Measuring alcohol consumption: Psychosocial and biological methods* (pp. 41–72). Humana Press.

- Wardell, J. D., Ramchandani, V. A., & Hendershot, C. S. (2016). Drinking motives predict subjective effects of alcohol and alcohol wanting and liking during laboratory alcohol administration: A mediated pathway analysis. *Alcoholism, Clinical and Experimental Research*, 40(10), 2190–2198. https://doi.org/10.1111/acer.13174
- Wiens, S. (2005). Interoception in emotional experience. *Current Opinion in Neurology*, *18*(4), 442–447. https://doi.org/10.1097/01.wco.0000168079.92106.99
- Wittchen, H.-U., Behrendt, S., Höfler, M., Perkonigg, A., Lieb, R., Bühringer, G., & Beesdo, K. (2008). What are the high risk periods for incident substance use and transitions to abuse and dependence? Implications for early intervention and prevention. *International Journal of Methods in Psychiatric Research*, 17 Suppl 1, S16-29. https://doi.org/10.1002/mpr.254
- Zeiher, J., Lange, C., Starker, A., Lampert, T., & Kuntz, B. (2018). Tabak- und Alkoholkonsum bei 11- bis 17-Jährigen in Deutschland – Querschnittergebnisse aus KIGGS Welle 2 und Trends. *Journal of Health Monitoring*, 3(2), 23–44. https://doi.org/10.17886/RKI-GBE-2018-066

The Association Between Emotion Regulation and Alcohol Use in Adolescence Is Moderated by Interoception and Affective Empathy Supplement

S1 – detailed description of the self-report questionnaires MAIA

As interoceptive accuracy is influenced by situations and person-situation interactions (Wittkamp et al., 2018), we decided to additionally assess interoceptive ability using a self-report measure, the Multidimensional Assessment of Interoceptive Awareness questionnaire (MAIA, by Mehling et al., 2012; for the German version see Bornemann et al., 2014). Specifically, we were interested in the Attention Regulation subscale, which is defined as the ability to focus and maintain attention on internal bodily signals (7 items, e.g. "I can pay attention to my breath without being distracted by things happening around me.") and is considered a particularly important skill in interoceptive processing due to its ability to enhance interoception (Mehling et al., 2012). The MAIA consists of seven additional subscales, namely Noticing (4 items), Not-Distracting (3 items), Emotional Awareness (5 items), Self-Regulation (4 items), Body Listening (3 items) and Trusting (3 items). Each item is rated on a 6-point Likert scale from 0 = "never" to 5 = "always". Items for each subscale are averaged with higher scores indicating greater interoceptive awareness.

Tables

sex	
þ	
5	
Ğ.	
÷Ē	
ţ;	
С	
Б	
Ē	
цр.	
5	
ŝ	
H.	
<u>e</u>	
q	
В	
aı	
Ś	
5	
O)	
E.	
γR	
\cup	
_	
-	
e	
a	
H	

		Male		Female	Sex difference
	Ν	M(SD)	Ν	M(SD)	<i>t</i> (df)
Age (14/16 years)	(15/15)	15.0 (1.017)	(11/17)	15.21 (.995)	-0.810(56)
TLFB Alcohol frequency	30	2.33 (2.746)	28	1.89(1.988)	0.703 (52.821)
Alcohol quantitiy	30	11.087 (17.315)	28	4.438(6.363)	1.966 (37.163)
Binge drinking	30	0.773 (1.307)	28	0.286 (.535)	1.882(38.988)
HCT Interoceptive Accuracy	30	0.706 (.167)	28	0.637 (.187)	1.486(56)
Interoceptive Sensibility	30	4.560(1.421)	28	3.457 (1.619)	$2.761(56)^{**}$
Interoceptive Awareness	30	0.172 (.526)	28	0.287 (.536)	-0.826 (56)
ET	30	-1.718 (.867)	28	-2.340 (.731)	$2.947(56)^{**}$
ER	30	393 (.764)	28	-0.515 (.697)	0.632(56)
<i>Note</i> . TLFB = Time-Line Follow-	Back inter	rview; HCT = Hear	theat Count	ting Task; $ET = Em$	paToM Affect difference (

(emotional – neutral); ER

= Emotion Regulation task affect difference (negative – neutral); * = p < .05, ** = p < .01.

Original Contributions – Study 2: Emotion Regulation, Interoception, Empathy and Alcohol Use in Adolescents

ible S2. Mage	ain effect models for emotion model	n regula F	tion, inter (dfl, df2)	rocept <i>p</i>	ion ar R^2	nd empathy on TLFB alco	hol freque	ncy sepa SE	ırated by β	/ age.	95%	CI
						covariates					TT	UL
year-olds	Emotion Regulation	0.825	(2, 23)	.451	014	constant	0.262	0.664		769.	-1.111	1.635
						sex	0.238	0.458	.110	.608	-0.710	1.186
						Emotion Regulation	-0.315	0.332	202	.352	-1.002	0.372
	HCT Interocept. Accuracy	0.409	(4, 21)	.800	104	constant	1.374	1.578		.394	-1.907	4.655
	1					Sex	0.097	0.544	.045	.860	-1.035	1.229
						Interoceptive Sensibility	-0.132	0.175	199	.458	-0.496	0.231
						Interoceptive Awareness	0.097	0.527	.040	.856	-1.000	1.194
						Interoceptive Accuracy	-0.459	1.589	071	.776	-3.764	2.846
	Empathy	1.353	(2, 23)	.278	.027	constant	0.486	0.683		.484	-0.927	1.900
						Sex	0.680	0.479	.315	.169	-0.310	1.671
						Empathy	0.404	0.291	.308	.178	-0.198	1.007
year-olds	Emotion Regulation	1.916	(2, 29)	.165	.056	constant	6.111	1.511		000.	3.021	9.201
						sex	-1.683	0.887	334	.068	-3.497	0.130
						Emotion Regulation	0.433	0.607	.125	.482	-0.810	1.675
	HCT Interocept. Accuracy	2.944	(4, 27)	.038	.201	constant	1.140	2.239		.615	-3.455	5.735
						Sex	-1.509	0.847	299	.086	-3.248	0.229
						Interoceptive Sensibility	-0.151	0.306	095	.626	-0.778	0.476
						Interoceptive Awareness	0.363	0.743	.084	.629	-1.161	1.887
						Interoceptive Accuarcy	6.979	2.649	.496	.014	1.544	12.414
	Empathy	1.699	(2, 29)	.201	.043	constant	5.483	1.606		.002	2.199	8.768
						SeX	-1.693	0.923	336	077	-3.580	0.194
						Empathy	-0.183	0.533	063	.733	-1.274	0.907
te. Model	refers to the applied predicto	or; mark	ted values	are si	gnific	ant at $p < .05$ or below; H	CT = Hear	tbeat coi	unting ta	isk; SE	= standar	d error;

95% *CI* = 95% Confidence interval, *LL* = lower limit, *UL* = upper limit.

108
F	(df1, df2)	d	$\mathbb{R}^{2}/$	predictors/	q	SE	β	d	95%	CI
		I	ΔR^2	covariates			,	I	TL	UL
2.823	(10, 47)	.008	.242	constant	-14.243	5.046		.007	-24.394	-4.093
				age	1.277	0.313	.534	000.	0.647	1.907
				Sex	-0.954	0.620	200	.131	-2.201	0.293
				Noticing	0.254	0.380	.104	.507	-0.510	1.018
				Not-Distracting	-0.167	0.340	060	.625	-0.852	0.517
				Not-Worrying	-0.283	0.312	109	.368	-0.911	0.344
				Emotional Awareness	0.116	0.409	.041	.778	-0.707	0.939
				Self-Regulation	0.190	0.359	.091	.600	-0.533	0.912
				Body Listening	-0.200	0.370	098	.592	-0.944	0.545
				Trusting	0.085	0.308	.040	.784	-0.535	0.705
			.038	Attention Regulation	-0.674	0.398	259	760.	-1.474	0.126

hol fe TI FD 1 1.1.4.0 È . V ++ V ÷ 4 VIVIVJ 4 с Ц N. 1 . . . 5 Table

Original Contributions – Study 2: Emotion Regulation, Interoception, Empathy and Alcohol Use in Adolescents

en predictor is added ņ 2 rei ucepuive A

to the model; bold marked values are significant at p < .05 or below.

Original Contributions – Study 2: Emotion Regulation, Interoception, Empathy and Alcohol Use in Adolescents

Table S4. Mai	in effect models for emotio	n regul	ation, interocej	otion an	d empathy on alcohol que	antity sep	arated b	y age.			
age	model	F	(df1,df2) p	\mathbb{R}^2 p	predictors/	q	SE	β	d	95%	CI
				S	ovariates					TT	UL
14-year-olds	Emotion Regulation	0.314	(2, 23) .734	058 c	constant	1.731	1.491		.258	-1.353	4.815
				S	ex	-0.490	1.029	103	.638	-2.619	1.638
				F	Emotion Regulation	-0.560	0.746	163	.460	-2.103	0.983
	HCT Interocept. Accuracy	0.115	(4, 21) .976	165 c	constant	3.170	3.563		.384	-4.239	10.579
				S	ex	-0.649	1.230	137	.603	-3.207	1.908
				I	interoceptive Sensibility	-0.226	0.395	154	.573	-1.048	0.595
				Ţ	interoceptive Awareness	0.034	1.191	.006	.978	-2.443	2.511
				Ι	nteroceptive Accuracy	-0.185	3.589	013	.959	-7.649	7.278
. –	Empathy	1.242	(2, 23) $.307$.019 c	constant	2.358	1.509		.132	-0.764	5.480
				S	ex	0.508	1.057	.107	.636	-1.679	2.695
				F	Empathy	1.000	0.643	.346	.134	-0.331	2.331
16-year-olds	Emotion Regulation	7.635	(2,29) .002	.300 c	constant	42.456	8.271		000.	25.540	59.373
				S		-15.805	4.854	493	.003	-25.734	-5.877
				F	Emotion Regulation	8.491	3.326	.387	.016	1.690	15.293
- -	HCT Interocept. Accuracy	3.264	(4,27) .026	.226 c	constant	21.711	14.006		.133	-7.028	50.449
				S		-16.056	5.299	501	.005	-26.929	-5.183
				I	interoceptive Sensibility	-1.752	1.911	173	.367	-5.674	2.169
				Ĥ	interoceptive Awareness	8.296	4.645	.301	.085	-1.236	17.827
				Ι	nteroceptive Accuracy	29.465	16.567	.330	.087	-4.528	63.458
[Empathy	3.575	(2, 29) .041	.142 c	constant	34.831	9.665		.001	15.064	54.597
				S		-14.347	5.552	448	.015	-25.702	-2.992
				F	Empathy	-0.208	3.209	011	.949	-6.772	6.356
Mata Madal	afar to the analied aradiat	tor ma	rad wariables	0.00 010 010	$\frac{1}{10000000000000000000000000000000000$		- Hannt		mting	tocle. CE	- ctondo

Note. Model refers to the applied predictor; marked variables are significant at p < .05 or below; HCT = Heartbeat counting task; SE = standard error; 95% CI = 95% Confidence interval, LL = lower limit, UL = upper limit.

Б
Ö
S
ö
0
q
\triangleleft
Ц
•=
õ
5
Ξ.
6
Ę.
8
Ч.
\triangleleft
Ч
ğ
а
\geq
Ę
a
P.
H
Ш
ĥ,
H
·Ξ
E
e.
8
ŭ
Ę
Ц
Ξ.
ц,
<u> </u>
ET.
12
R
õ
2
2
5
Ξ
Q
Ξ
Ē
·
0
y 2
ldy 2
tudy 2
Study 2
- Study 2:
s – Study 2:
ns – Study 2:
ions – Study 2:
ttions – Study 2:
outions – Study 2:
ibutions – Study 2:
tributions - Study 2:
ntributions – Study 2:
ontributions - Study 2:
Contributions - Study 2:
I Contributions – Study 2:
al Contributions - Study 2:
inal Contributions – Study 2:
iginal Contributions – Study 2:
riginal Contributions – Study 2:
Original Contributions – Study 2:

Table S5. Moderation effect of interoception and empathy on the effect between emotion regulation and alcohol quantity for the subgroup of 16year-olds

year-0143.								
model	F	(df1,df2)	d	$R^2/\Delta R^2$	<i>predictors</i> /covariates	q	t	d
HCT Interoceptive Accuracy	3.594	(6,25)	.011	.463	constant	31.406	1.707	.100
					Emotion Regulation	6.966	0.432	.670
					HCT Interoceptive Accuracy	25.112	1.208	.238
				000.	<i>Emotion Regulation</i> \times <i>HCT Interoceptive Accuarcy</i>	1.763	0.085	.933
					SeX	-17.840	-3.592	.001
					HCT Interoceptive Sensibility	-1.574	-0.875	.390
					HCT Interoceptive Awareness	8.986	2.070	.049
Empathy	5.558	(4,27)	.002	.451	constant	55.028	5.240	000.
					Emotion Regulation	27.512	3.086	.005
					Empathy	4.206	1.194	.243
				.105	Emotion Regulation \times Empathy	8.364	2.274	.031
					SeX	-17.835	-3.670	.001
MAIA Attention Regulation	2.749	(11, 20)	.024	.602	constant	55.311	2.642	.016
					Emotion Regulation	-28.975	-1.894	.073
					MAIA Attention Regulation	4.931	1.033	.314
				.105	Emotion Regulation \times Attention Regulation	11.027	2.295	.033
					SeX	-20.816	-3.863	.001
					Noticing	-0.511	-0.142	.888
					Not-Distracting	-5.228	-1.530	.142
					Not-Worrying	-0.491	-0.160	.875
					Emotional Awarness	-0.076	-0.021	.984
					Self-Regulation	-0.978	-0.242	.811
					Body Listening	0.633	0.140	.890
					Trusting	-1.915	-0.637	.531
<i>Note</i> . Model refers to the applied	modera	tor; italic va	lues r	efer to th	z changes in R^2 by adding the interaction term; bold ma	rked valu	es are sigr	ificant

111

at p < .05 or below; HCT = Heartbeat Counting Task; MAIA = Multidimensional Assessment of Interoceptive Awareness questionnaire.

F (df1, df2)	d	$\mathbb{R}^{2}/$	predictors/	\overline{q}	SE	β	d	95%	CI
	I	ΔR^2	covariates				I	TT	UL
2.660 (10,47)	.012	.226	constant	-51.733	28.756		.078	-109.583	6.117
			age	5.826	1.784	.432	.002	2.236	9.415
			sex	-9.147	3.533	341	.013	-16.255	-2.040
			Noticing	0.034	2.165	.002	.987	-4.321	4.390
			Not-Distracting	-3.003	1.938	192	.128	-6.902	0.896
			Not-Worrying	0.017	1.777	.001	.993	-3.558	3.591
			Emotional Awareness	0.233	2.331	.015	.921	-4.457	4.923
			Self-Regulation	0.973	2.047	.083	.637	-3.145	5.091
			Body Listening	-0.778	2.108	068	.714	-5.020	3.463
			Trusting	-0.946	1.757	080	.593	-4.480	2.588
		.013	Attention Regulation	-2.216	2.266	151	.333	-6.774	2.343

. -÷ -TI ED 104:0 È . V ++ V ÷ -VIVIVJ S . 2 Table

Original Contributions – Study 2: Emotion Regulation, Interoception, Empathy and Alcohol Use in Adolescents

hen predictor is added p D 2 No

to the model; bold marked values are significant at p < .05 or below.

Original Contributions – Study 2: Emotion Regulation, Interoception, Empathy and Alcohol Use in Adolescents

Table S7. Main effect models of	different	predictors	emotio	n regula	tion, interoception and empa	thy on TLF	B binge	drinkin	g for th	e whole s	ample
model	F	(df1, df2)	d	$\mathbb{R}^{2}/$	predictors/	q	SE	β	d	95%	CI
			I	ΔR^2	covariates			·		TL	UL
Emotion Regulation	10.659	(3, 54)	000.	.337	constant	-7.083	1.709		000.	-10.508	-3.658
					age	0.571	0.114	.555	000.	0.343	0.799
					sex	-0.566	0.222	277	.014	-1.012	-0.120
				.062	Emotion Regulation	0.361	0.156	.256	.024	0.049	0.675
HCT Interoceptive Accuracy	5.509	(5,52)	000.	.283	constant	-5.976	1.831		.002	-9.650	-2.302
					age	0.466	0.122	.453	000.	0.222	0.710
					sex	-0.629	0.248	307	.014	-1.127	-0.131
					Interoceptive Sensibility	-0.070	0.085	110	.409	-0.240	0.099
					Interoceptive Awareness	0.258	0.221	.132	.249	-0.186	0.702
				.020	Interoceptive Accuracy	0.947	0.748	.164	.211	-0.554	2.448
Empathy	8.100	(3, 54)	.000	.272	constant	-6.418	1.766		.001	-9.958	-2.878
•					age	0.517	0.118	.502	000.	0.281	0.752
					sex	-0.622	0.249	304	.016	-1.121	-0.123
				100.	Empathy	-0.038	0.147	031	.799	-0.333	0.257
MAIA Attention Regulation	2.956	(10, 47)	900.	.256	constant	-4.552	2.150		.040	-8.877	-0.226
					Age	0.467	0.133	.454	.001	0.198	0.735
					Sex	-0.676	0.264	330	.014	-1.207	-0.144
					Noticing	0.018	0.162	.017	.910	-0.307	0.344
					Not-Distracting	-0.232	0.145	194	.117	-0.523	0.060
					Not-Worrying	0.005	0.133	.005	.969	-0.262	0.273
					Emotional Awareness	0.069	0.174	.057	.693	-0.281	0.420
					Self-Regulation	0.020	0.153	.023	.895	-0.288	0.328
					Body Listening	-0.075	0.158	086	.634	-0.393	0.242
					Trusting	-0.022	0.131	025	.866	-0.287	0.242
				.017	Attention Regulation	-0.194	0.169	174	.257	-0.535	0.174
Note. Model refers to the applied	d predicto	or, italic v	alues re	efer to c	hanges in R ² when predicto	r is added 1	to the m	odel, bo	old mar	ked varia	oles are

significant at p < .05 or below, HCT = Heartbeat counting task, SE = standard error, 95% CI = 95% Confidence interval, LL = lower limit, UL = upper limit. 113

Original Contributions – Study 2: Emotion Regulation, Interoception, Empathy and Alcohol Use in Adolescents

Table S8. Moderation effects	of intero	ception an	d empath	ly on the	effect between emotion regulation and alcohol binge dri	nking for the	whole sa	mple.
model	F	(df1, df2)	d	$R^2/\Delta R^2$	predictors/covariates	q	t	d
HCT Interoceptive Accuracy	5.129	(1,50)	000.	.418	constant	-6.633	-3.719	.001
		k Y			Emotion Regulation	-0.010	-0.017	.987
					HCT Interoceptive Accuracy	1.146	1.470	.148
				.006	Emotion Regulation × HCT Interoceptive Accuracy	0.570	0.686	.496
					age	0.514	4.318	000.
					sex	-0.632	-2.635	.011
					HCT Interoceptive Sensibility	-0.080	-0.965	.339
					HCT Interoceptive Awareness	0.261	1.222	.228
Empathy	6.212	(5,52)	000.	.374	constant	-7.099	-4.076	000.
					Emotion Regulation	0.291	0.784	.437
					Empathy	-0.068	-0.409	.684
				000.	Emotion Regulation \times Empathy	-0.037	-0.216	.830
					age	0.567	4.874	000.
					Sex	-0.602	-2.470	.017
MAIA Attention Regulation	4.484	(12,45)	000.	.545	constant	-7.698	-3.686	.001
					Emotion Regulation	-1.815	-2.895	900 .
					MAIA Attention Regulation	0.157	0.855	.397
				.124	Emotion Regulation × MAIA Attention Regulation	0.720	3.494	.001
					age	0.638	4.992	000.
					Sex	-0.807	-3.394	.001
					MAIA Noticing	-0.016	-0.109	.914
					MAIA Not-Distracting	-0.156	-1.171	.248
					MAIA Not-Worrying	-0.101	-0.840	.405
					MAIA Emotional Awareness	0.072	0.459	.648
					MAIA Self-Regulation	-0.081	-0.592	.557
					MAIA Body Listening	0.001	0.004	766.
					MAIA Trusting	0.018	0.154	.879
<i>Note</i> . Model refers to the appl	lied mode	erator: itali	ic values	refer to	the changes in R^2 by adding the interaction term; bold m	larked values	s are signi	ficant

b ņ , p D 111

at p < .05 or below; HCT = Heartbeat Counting Task; MAIA = Multidimensional Assessment of Interoceptive Awareness questionnaire.

nts
sce
oles
Ade
ш,
Jse
2
ho
S
Ρ
and
hy
oat
Em
'n,
tio
cep
roč
nte
ı, E
ior
ılat
g
Å
on
loti
Em
3
dy
Stu
Ĩ
SU
tio
pn
ıtri
0U
I C
na
E
õ

Table S9. Main effect models	for emot	ion regulati	on, inte	erocep	tion and empathy on TLFB bin	inge drinki	ng for 16	-year-o	lds.		
model	F	(df1,df2)	d	\mathbb{R}^2	predictors/	q	SE	β	d	95%	CI
					covariates				l	TT	UL
Emotion Regulation	9.895	(2,29)	.001	.365	constant	3.286	0.597		000.	2.064	4.508
I					sex	-1.217	0.351	501	.002	-1.934	-0.500
					Emotion Regulation	0.768	0.240	.461	.003	0.276	1.259
HCT Interoceptive Accuracy	3.295	(4,27)	.025	.228	constant	1.592	1.060		.145	-0.583	3.768
					sex	-1.215	0.401	500	.005	-2.038	-0.392
					Interoceptive Sensibility	-0.142	0.145	185	.336	-0.439	0.155
					Interoceptive Awareness	0.626	0.352	.299	.086	-0.095	1.348
					Interoceptive Accuracy	2.309	1.254	.341	.077	-0.264	4.882
Empathy	3.543	(2,29)	.042	.141	constant	2.602	0.733		.001	1.102	4.102
					Sex	-1.083	0.421	446	.016	-1.945	-0.222
					Empathy	-0.015	0.244	011	.952	-0.513	0.483
Note. In 14-year-olds no binge	e drinkin	ig was obse	rved, s	o no 1	nodels were calculated; mode	el refers to	the app]	lied pre	dictor;	marked v	alues are
significant at $p < .05$ or below;	HCT =	Heartbeat co	ounting	; task;	MAIA = Multidimensional As	ssessment	of Intero	ceptive	Aware	ness quest	ionnaire;
SE = standard error; 95% <i>CI</i> =	= 95% Co	nfidence int	terval,	LL = 1	ower limit, $UL = upper limit$.						

CO.
÷
8
e e
Š
ő
-
0
p
<
7
n
•
O
Ś
\Box
_
7
z
1
8
<u> </u>
1
4
Ч
ā
a
~
$\mathbf{\tilde{c}}$
<u>+</u>
a
õ.
ū
Ę.
Ш
ō
٠Æ
5
5
ŏ
ŏ
Ĕ
e)
+
_
Е
In
ı, In
on, In
ion, In
tion, In
lation, In
ulation, In
gulation, In
egulation, In
Regulation, In
Regulation, In
n Regulation, In
on Regulation, In
tion Regulation, In
otion Regulation, In
notion Regulation, In
motion Regulation, In
Emotion Regulation, In
: Emotion Regulation, In
2: Emotion Regulation, In
⁷ 2: Emotion Regulation, In
ly 2: Emotion Regulation, In
dy 2: Emotion Regulation, In
udy 2: Emotion Regulation, In
study 2: Emotion Regulation, In
Study 2: Emotion Regulation, In
- Study 2: Emotion Regulation, In
s - Study 2: Emotion Regulation, In
ns – Study 2: Emotion Regulation, In
ons - Study 2: Emotion Regulation, In
ions – Study 2: Emotion Regulation, In
tions - Study 2: Emotion Regulation, In
utions – Study 2: Emotion Regulation, In
butions - Study 2: Emotion Regulation, In
ributions - Study 2: Emotion Regulation, In
tributions - Study 2: Emotion Regulation, In
ntributions - Study 2: Emotion Regulation, In
ontributions - Study 2: Emotion Regulation, In
Contributions - Study 2: Emotion Regulation, In
Contributions – Study 2: Emotion Regulation, In
I Contributions – Study 2: Emotion Regulation, In
al Contributions – Study 2: Emotion Regulation, In
nal Contributions – Study 2: Emotion Regulation, In
jinal Contributions – Study 2: Emotion Regulation, In
iginal Contributions - Study 2: Emotion Regulation, In
riginal Contributions - Study 2: Emotion Regulation, In
Driginal Contributions – Study 2: Emotion Regulation, In

Table S10. Moderation effect (of interod	ception on 1	the effe	sct betwee	in emotion regulation and TLFB binge drinking i	n 16-year-o	olds.	
model	F	(df1, df2)	d	$R^2/\Delta R^2$	predictors/ covariates	q	t	d
HCT Interoceptive Accuracy	4.604	(6,25)	.003	.525	constant	2.633	2.006	.056
					Emotion Regulation	0.838	0.728	.474
					HCT Interoceptive Accuracy	1.734	1.170	.253
					Emotion Regulation \times HCT Intero. Accuracy	-0.107	-0.073	.943
					sex	-1.379	-3.893	.001
					HCT Interoceptive Sensibility	-0.130	-1.010	.322
					HCT Interoceptive Awareness	0.683	2.207	.036
Empathy	5.953	(4,27)	.001	.469	constant	3.984	5.084	000.
					Emotion Regulation	1.868	2.808	600 .
					Empathy	0.221	0.842	.407
				.061	Emotion Regulation \times Empathy	0.483	1.760	060.
					Sex	-1.345	-3.709	.001
MAIA Attention Regulation	3.329	(11, 20)	.010	.647	constant	4.080	2.730	.013
					Emotion Regulation	-1.562	-1.430	.168
					Attention Regulation	0.140	0.411	.685
				.068	Emotion Regulation \times Attention Regulation	0.672	1.958	.064
					Sex	-1.494	-3.881	.001
					Noticing	-0.045	-0.177	.862
					Emotional Awareness	0.127	0.484	.634
					Not-Worrying	-0.114	-0.520	609.
					Body Listening	-0.275	-0.850	.406
					Not-Distracting	-0.374	-1.532	.141
					Self-Regulation	0.044	0.154	.880
					Trusting	0.066	0.308	.761
Note. In 14-year-olds no binge	drinking	g was obser	ved, sc	o no mode	Is were calculated; model refers to the applied π	oderator; it	talic values	trefer to

the changes in R^2 by adding the interaction term; bold marked values are significant at p < .05 or below; HCT = Heartbeat Counting Task; MAIA = Multidimensional Assessment of Interoceptive Awareness questionnaire.

Figures



Figure S1. Moderation effect of MAIA subscale Attention Regulation (MAIA – AR) on the association between Emotion Regulation and TLFB alcohol quantity in 16-year olds.

Note. Higher MAIA-AR scores indicate higher attention regulation abilities.

Figure S2. Effect of Emotion Regulation on TLFB Binge Drinking.



Note. Black line represents regression line for the whole sample; blue line represent regression line for 16-year-olds, no binge drinking was observed in 14-year-olds.

Figure S3. Moderation effect of MAIA subscale Attention Regulation (MAIA-AR) on the association between Emotion Regulation and TLFB Binge Drinking for the whole sample.



Note. Higher MAIA-AR scores indicate higher attention regulation abilities.

2.3 Jugendliches Alkoholkonsumverhalten während der COVID-19-Pandemie und die Bedeutung von Achtsamkeit³

Prignitz, M., Guldner, S., & Nees, F. (2021). Jugendliches Alkoholkonsumverhalten während der COVID-19-Pandemie und die Bedeutung von Achtsamkeit. *Sucht, 67*(6), 287-297. https://doi.org/10.1024/0939-5911/a000734

Zusammenfassung:

Zielsetzung: Kognitive und psychosoziale Faktoren können zu individuellen Veränderungen im Alkoholmissbrauch beitragen und führen im Jugendalter zu einer erhöhten Vulnerabilität. In diesem Kontext spielt die aktuelle COVID-19 Pandemie eine wichtige Rolle. In der aktuellen Studie wird untersucht, ob ein Anstieg negativer Gedanken in der Pandemie einen Risikofaktor für einen erhöhten Alkoholkonsum darstellt und welche Rolle hierbei Achtsamkeit spielt.

Methodik: An der Untersuchung nahmen 72 Jugendliche (36 weiblich, Alter 15.13 ± 1.0 Jahre) teil, von denen N = 21 einen Onlinefragebogen vollständig während der ersten Lockdown-Phase der Pandemie (Frühjahr 2020) und dem Übergang in die zweite Welle im Abstand von jeweils 14 Tagen und über 6 Wochen zu ihrem Alkoholkonsum, Kognitionen, Emotionserleben und ihrer sozialen Belastung ausfüllten.

Ergebnisse: Während sich der Alkoholkonsum der Jugendlichen im Verlauf der Pandemie nicht signifikant veränderte, zeigten sich deutlichere Veränderungen in den kognitiven und psychosozialen Belastungen der Jugendlichen. Negative Gedanken waren hierbei ein signifikanter Prädiktor für den Alkoholkonsum zu Beginn der zweiten COVID-19-Welle (b = 1.314, p < .01). Dieser Zusammenhang wurde durch Trait-Achtsamkeit signifikant moderiert (b = -.283, p < .01).

Diskussion: Negative Gedanken scheinen ein wichtiger Faktor für das Alkoholkonsumverhalten im ersten Verlauf der COVID-19 Pandemie zu sein und könnten somit das Risiko eines Alkoholmissbrauchs im weiteren Verlauf der Pandemie deutlich erhöhen. Achtsamkeit scheint solchen negativen Entwicklungen entgegenwirken zu können.

Schlüsselwörter: Alkoholkonsum, Achtsamkeit, Jugendalter, COVID-19, Emotion

Adolescence Alcohol Use Behaviours During the COVID-19 Pandemic and the Role of Mindfulness Abstract:

Objective: Cognitive and psychosocial factors contribute to individual differences in alcohol (mis)use and increase the risk of alcohol abuse during adolescence. In this context, the COVID-19 pandemic is of high importance. The current study investigates whether an increase in negative thoughts during the COVID-19 pandemic is a risk factor for heightened alcohol use, and the extent to which mindfulness plays a role.

Methods: We examined 72 adolescents (36 female, age 15.13 ± 1.0 years), with N = 21 completing an online survey over 6 weeks, with an interval of 14 days, during the first lock-down in Germany (Spring 2020) and the transition into the second wave, to examine alcohol use, emotional factors and social burdens during the COVID-19 pandemic.

Results: While alcohol use did not significantly change during the first wave of the pandemic, more clear changes were observed for cognitive and psychosocial factors. Negative thoughts at the end of the first lock down hereby significantly predicted alcohol use at the beginning of the second wave (b = 1.314, p < .01). Trait mindfulness served as a significant moderator in this context (b = -.283, p < .01).

Conclusion: Negative thoughts seem to play an important role for alcohol use during the first wave of the COVID-19 pandemic and could therefore increase the risk of substance abuse considerably in the following course of the pandemic. Mindfulness seems to counteract such negative developments.

Keywords: alcohol use, mindfulness, adolescence, COVID-19, emotion

Identifikation neurobehavioraler Risiko- und Resilienzprofile des Suchtverhaltens bei Jugendlichen (TP1) & Entwicklung von suchtrelevanten Screening und Präventionsinstrumenten in einem mechanismen-orientierten Ansatz (TP2)

Zusammenfassung der Teilprojekte 1 und 2 im IMAC-Mind Verbund: Die bisherige Forschung hat eine Reihe von Faktoren identifiziert, die vermutlich zu individuellen Unterschieden in der Vulnerabilität für Substanzmissbrauch und -abhängigkeit beitragen. Diese Faktoren erstrecken sich über soziale, neurobiologische sowie psychologische Bereiche und scheinen vor allem im Jugendalter, als ein kritischer Lebensbereich für die Entwicklung psychischen Störungen, von besonderer Bedeutung zu sein. Ca. 34 % der in Therapie zur Behandlung einer Substanzabhängigkeit befindlichen Personen sind unter 25 Jahren und 55 % der männlichen 18-Jährigen zeigen bereits einen gefährlichen Alkoholgebrauch.

Basierend auf einem Mechanismen orientierten Ansatz für psychische Störungen, zielen wir in zwei Projekten (TP1 und TP2) des IMAC-Mind Verbundes ("Improving Mental Health and Reducing Addiction in Childhood and Adolescence through Mindfulness: Mechanisms, Prevention and Treatment"; https://www. imac-mind.de) darauf ab, a) diese Vulnerabilitäts- und Resilienzfaktoren für Suchterkrankungen weiter anhand biopsychosozialer Komponenten zu klassifizieren, und b) evidenzbasierte Screening- und Präventionsinstrumente zu entwickeln, die Impulsivität, Belohnungsabhängigkeit und negative Affektivität auf neuronaler Ebene bei Kindern und Jugendlichen erfassen und es den Kindern und Jugendlichen ermöglichen sollen, diese zu regulieren.

Dies erfolgt durch den Rückgriff auf verschiedene längsschnittlich untersuchte Kohorten und die Bündelung der erhobenen individuellen, Umwelt- und neurobiologischen Datensätze entlang der folgenden zentralen Konstrukte: Selbstregulation, Belohnungssensitivität, Impulsivität und emotionale Reaktivität.

Darüber hinaus werden Familiengeschichte, negative Lebensereignisse, soziale und genetische Faktoren sowie Komorbiditäten (Depression, Angst) untersucht und bezüglich Suchtverhalten und Substanzmissbrauch evaluiert. Die Daten der verschiedenen Längsschnittstudien werden entlang eines multimodalen Ansatzes integriert und kreuzvalidiert.

Die zu untersuchenden Mechanismen stellen dabei auch zentrale Komponenten achtsamkeitsbasierter Mediation und Intervention dar, welche auf die Verbesserung der Aufmerksamkeitskontrolle, Emotionsregulation und Bewusstsein für das Selbst abzielt. In diesem Zusammenhang ist es auch wichtig, auf Strategien zu fokussieren, die im Alltag Anwendung finden können und somit eine hohe ökologische Validität besitzen, und die nicht durch retrospektive oder generalisierte Reaktionen beeinflusst sind, sondern dynamische Prozesse abbilden und intraindividuelle Variabilität erfassen können. Diese zentralen Bereiche werden auf Verhaltens- und neuronaler Ebene definiert und durch Computer/ Internet/Smartphone basierte Technologie für die Entwicklung der Screeningund Präventionsinstrumente ("Ecological Momentary Assessment" [EMA], "Ecological Momentary Intervention" [EMI]) eingesetzt, die leicht zu handhaben sind und eine personalisierte Intervention ermöglichen.

Einführung

Die Risiken für die Entstehung von Substanzmissbrauch und Sucht sind multifaktoriell und häufig kumulativ (z. B. Appleyard, Egeland, van Dulmen & Sroufe, 2005). Sie umfassen Faktoren wie das soziale Umfeld, neurobiologische und psychologische Prozesse (Conrod & Nikolaou, 2016). Hierbei spielen Mechanismen wie Belohnungssensitivität, Impulskontrolle, Risikobereitschaft und emotionale Regulation eine wichtige Rolle (z. B. Nees et al., 2012), aber auch das emotionale Erleben und kognitive Faktoren wie vermehrt auftretende negative Gedanken können das Alkoholkonsumverhalten negativ beeinflussen (Heinrich, Schumann, Flor & Nees, 2016; Nees et al., 2012; Whelan et al., 2014; White, Xie, Thompson, Loeber & Stouthamer-Loeber, 2001; Disner, Beevers, Haigh & Beck, 2011). Solche Faktoren sind vor allem im Jugendalter zentral, wo der Konsum von Alkohol häufig seinen Anfang nimmt (Wittchen et al., 2008; Brown, et al., 2008; Swendsen et al., 2012) und rapide klinisch bedeutsam werden kann (Wittchen et al., 2008): 34 % der Suchtpatienten in Behandlung sind unter 25 Jahre alt und ca. 55 % der männlichen 18-Jährigen zeigen bereits einen kritischen Alkoholgebrauch mit fünf oder mehr alkoholischen Getränken hintereinander (EMCDDA, 2011). Dies unterstreicht die Notwendigkeit der Entwicklung geeigneter Screening-, Präventions- und Interventionsinstrumente, die früh im Jugendalter ansetzen und auf für das Alkoholkonsumverhalten kritischen neurokognitiven und psychosozialen Mechanismen aufbauen (Zielsetzung in Teilprojekt 2 des IMAC-Mind Ver- COVIDbundes). Eine weitere mögliche Einflussgröße könnten achtsamkeitsorientierte Prozesse bzw. interindividuelle Unterschiede in dispositioneller (Trait-)Achtsamkeit sein (Karyadi, VanderVeen & Cyders, 2014), welche den Alkoholkonsum über die Assoziation mit den genannten Mechanismen mitbestimmen könnte. Trait-Achtsamkeit wird vermehrt als wichtiger Resilienzfaktor bei

Substanzmissbrauch und -sucht im Jugendalter diskutiert (Christopher, Ramsey & Antick, 2013; Bowen & Enkema, 2014) und scheint mit den zuvor genannten Mechanismen wie Impulskontrolle und Emotionsregulation assoziiert zu sein (Oberle, Schonert-Reichl, Lawlor & Thompson, 2012; Lyvers, Makin, Toms, Thorberg & Samios, 2014). Dies bedeutet, dass achtsamkeitsbezogene Aspekte auch für die Prävention und Intervention von Alkoholmissbrauch wirkungsvolle Ansatzpunkte bieten könnten (Goldberg, Riordan, Sun & Davidson, 2021; Dunning et al., 2019; Cavicchioli, Movalli & Maff ei, 2018). In diesem Zusammenhang ist es des Weiteren von großer Bedeutung, die Verläufe des Alkoholkonsumverhaltens zu charakterisieren, um so Prädiktoren und Moderatoren genauer bestimmen zu können. Dies kann durch den Rückgriff auf und die Bündelung von längsschnittlichen Kohorten realisiert werden, deren Daten dann entlang multimodaler Ansätze integriert und kreuzvalidiert werden können (Zielsetzung in Teilprojekt 1 im IMAC-Mind Verbund).

Im Kontext solcher Risikofaktoren wird aktuell auch die COVID-19-Pandemie als eine sensible Phase für die Entwicklung eines Alkoholmissbrauchs diskutiert. Forderungen nach geeigneten und wirkungsvollen, individuell angepassten Präventionsund Interventionsmaßnahmen werden daher momentan umso lauter (Figueiredo et al., 2021; Galea, Merchant & Lurie, 2020). Sie sollen helfen Kinder und Jugendliche rechtzeitig vor möglichen negativen Entwicklungen durch die multifaktorielle Belastung der Pandemie zu schützen (Ellis, Dumas & Forbes, 2020). Die Pandemie hat bereits jetzt einen deutlichen Einfluss auf das alltägliche Leben, vor allem hinsichtlich psychosozialer Faktoren wie beispielsweise Isolation und depressiver Symptome, die bisher als kritisch für einen erhöhten Alkoholkonsum identifiziert werden konnten (Le et al., 2021; Bravo et al., 2018). Bereits kurz nach Beginn der Pandemie in China zeigten sich dort bis zu 40 % der Jugendlichen starken negativen emotionalen Belastungen ausgesetzt (Liang et al., 2020). Hierbei scheint sich vor allem auch die Isolation im Rahmen von Lockdown-Maßnahmen und die dadurch entstehende vermehrte Einsamkeit negativ auf die kognitive und emotionale Belastung auszuwirken (Ensel & Lin, 1991; Saltzman, Hansel & Bordnick, 2020). Das vermehrte Auftreten depressiver Symptomatik scheint auch einen Risikofaktor für einen erhöhten Alkoholkonsum in der Pandemie darzustellen (Dumas, Ellis & Litt, 2020). Die Häufigkeit des Alkoholkonsums scheint bei jungen Menschen in der COVID-19 Pandemie generell zu steigen und dies nicht nur bei virtuellen Zusammenkünften mit der Peer-Gruppe, sondern vor allem auch in Situationen, wenn die Jugendlichen alleine waren (Dumas et al., 2020), und wurde verstärkt, wenn bei

Jugendlichen prä-pandemisch bereits depressive Symptome vorlagen (Dumas et al., 2020), was wiederum das Stresserleben negativ zu beeinflussen scheint (Shanahan et al., 2020).

Welche Faktoren in dieser Hinsicht spezifisch durch die COVID-19 Pandemie wirken ist bisher, vor allem im Jugendalter, allerdings noch nicht hinreichend untersucht. Bezüglich depressionsbezogener Faktoren haben sich negative Gedanken und -prozesse schon länger als zentraler Faktor gezeigt (z. B. Disner et al., 2011) und sorgen hierbei für erhöhten Stress (Engert, Smallwood & Singer, 2014). Bisher ist jedoch noch nicht klar, wie sich kognitive und psychosoziale Faktoren bei Jugendlichen im Verlauf der durch die Pandemie hervorgerufenen Lockdown-Phasen hinweg verändern, ob diese den Alkoholkonsum in diesen Phasen mitbestimmen und welche Resilienzfaktoren hierbei eine Rolle spielen könnten.

Die aktuelle Studie fokussierte auf negative Gedanken und deren Einfluss auf Veränderungen im Alkoholkonsum über die erste Lockdown-Phase der Pandemie. Hierbei gehen wir von einem positiven Zusammenhang zwischen der Stärke negativer Gedanken und dem Konsum von Alkohol aus. Des Weiteren möchten wir untersuchen, ob dieser mögliche positive Zusammenhang durch Trait-Achtsamkeit, welche als Resilienzfaktor wirken könnte, moderiert wird.

Methodik

Stichprobe und Durchführung

Die Rekrutierung der Teilnehmenden erfolgte über Werbung an Schulen der Metropolregion Rhein-Neckar und in sozialen Netzwerken, sowie über das Einwohnermeldeamt der Stadt Mannheim. Für die Teilnahme an der in TP2 übergeordneten MRT-Untersuchung war es erforderlich, dass die Teilnehmer keine Probleme mit der deutschen Sprache hatten, Rechtshänder waren, keine psychischen oder akuten/ chronischen körperlichen Erkrankungen angaben und keine Medikamente einnahmen. Von den in TP2 erhobenen 72 Jugendlichen (48 % weiblich, Durchschnittsalter 15.11 ± 1.0 Jahre) nahmen 21 Teilnehmende (14 weiblich, Durchschnittsalter 15.14 ± 1.014 Jahre) vollständig an der mehrwelligen Online-Befragung zu COVID-19 teil. Eine Übersicht über die Gesamt- und die COVID-19-Stichprobe findet sich in Tabelle 1. Die Teilstichprobe, die an der COVID 19-Befragung teilnahm, unterschied sich weder im Alter (t(69) = .087, p > .05), der Geschlechterverteilung (t(69) =1.757, p > .05), dem allgemeinen Alkoholkonsum (t(72) = -.837, p > .05) noch der Trait-Achtsamkeit (t(72) = .423, p > .05) von der Teilstichprobe, die nicht an der COVID-19-Befragung teilnahm.

		Gesam	itstichprobe	COVID-	19-Stichprobe
		N (%)	M (SD)	N (%)	M (SD)
Teilnehmer		72		21	
Alter			15.11 (1.0)		15.14 (1.014)
	14 Jahre	32 (42.7)		9 (42.9)	
	16 Jahre	40 (53.3)		12 (57.1)	
Geschlecht	männlich	36 (48.0)		7 (33.3)	
	weiblich	36 (48.0)		14 (66.7)	
AUDIT Gesamtwert			3.47 (4.282)		2.81 (4.203)
MAAS-A Mittelwert			4.141 (.734)		4.198 (.691)

Tabelle 1. Übersicht über Verteilung und Mittelwerte der Gesamtstichprobe in TP2 und der Teilstichprobe der COVID-19-Befragung.

Die Daten wurden in der Rhein-Neckar Metropolregion vom 16.04.2020 bis 19.11.2020 erhoben. Die erste harte Lockdown-Phase in Deutschland begann am 22.03.2020 und endete am 04.05.2020 mit ersten Lockerungen (Bundesregierung Deutschland, 2021). Die ersten vier Messzeitpunkte lagen somit innerhalb der ersten COVID- 19-Welle, die laut Robert-Koch Institut (2021) von Januar bis Mitte Juni 2020 andauerte. Der fünfte Messzeitpunkt wurde im Abstand von vier Monaten erhoben, als die Inzidenzzahlen in Deutschland im Rahmen der zweiten COVID- 19-Welle wieder anstiegen (November 2020 bis Februar 2021; Robert-Koch Institut, 2021) und der "Lockdown light" mit Beginn zum 02.11.2020 von der Bundesregierung beschlossen wurde (Bundesregierung Deutschland, 2021). Zum Zeitpunkt des ersten Lockdowns wurde in der Rhein-Neckar Metropolregion unter anderem ein Kontaktverbot erlassen. Hierzu zählten das Einhalten eines Mindestabstandes zur nächsten Person von mindestens 1,5 Metern und die Begrenzung der Personenzahl, die sich im öffentlichen oder privaten Raum treffen durfte. Des Weiteren wurden Groß- und Privatveranstaltungen untersagt und eine Maskenpflicht für das Betreten von Geschäften und dem Öffentlichen Personennahverkehr erlassen. Außerdem wurden Schulen und Kindertagesstätten geschlossen (Bundesregierung Deutschland, 2021).

Die längsschnittliche Befragung wurde anonym als Onlinebefragung durchgeführt und durch die Ethikkommission der Medizinischen Fakultät Mannheim der Universität Heidelberg genehmigt. Für die Erhebung der COVID-19-Daten wurden die Teilnehmenden der Studie in TP2 zum Beginn des ersten Lockdowns in Deutschland per Mail kontaktiert, ausführlich über den Zweck der Untersuchung aufgeklärt und um Mitwirkung an der COVID- 19-Befragung gebeten. Nach schriftlicher Einwilligung der Sorgeberechtigten und der Jugendlichen, erhielten die Teilnehmenden via Mail einen Link zu der Online-Erhebungsplattform SoSci Survey (Leiner, 2019), wo sie mit einem persönlichen Teilnehmercode die Befragung am heimischen Computer starten konnten.

Instrumente

Die Auswirkungen der COVID-19-Pandemie wurden über das Coronavirus Health Impact Survey (CRISIS) V0.1 (Nikolaidis et al., 2021) in deutschsprachiger Form erfasst. Der CRISIS umfasst Fragen zu depressionsbezogenen (z. B. Konzentration, Sorge, Unruhe) und sozialen Faktoren (z. B. Einsamkeit), sowie zu verschiedenen psychischen Störungen und durch COVID-19 ausgelöste Veränderungen im alltäglichen Erleben. Für die aktuelle Studie haben wir die Fragen zu negativen Gedanken sowie die Angaben zum Alkoholkonsum ("Während der letzten 14 Tage: Wie viel und häufig hast du Alkohol konsumiert?"; 5-stufige Antwortskala von 1 = "überhaupt nicht" bis 5 = "regulär – Wie viele Einheiten pro Woche?") herangezogen. Die Erfassung negativer Gedanken erfolgte mittels eines einpoligen Items ("Während der letzten 14 Tage: inwieweit hattest du negative Gedanken und hast über unangenehme Erfahrungen oder Dinge nachgedacht, die dir ein schlechtes Gefühl geben?"; 5-stufige Antwortskala: 0 ="überhaupt nicht" bis 4 = "die meiste Zeit"). Weitere Beispielitems des CRISIS-Fragebogens finden sich im Elektronischen Supplement (ESM) 1.

Der allgemeine Alkoholkonsum vor der Pandemie wurde mit dem Alcohol Use Disorder Identification Test (AUDIT) von Babor und Grant (1989) erfasst. Der AUDIT umfasst 10 Items, die auf einer 5-stufigen Skala beantwortet werden (z. B. "Wie oft haben Sie an einem Tag mehr als 6 alkoholische Getränke getrunken?").

Achtsamkeit wurde mit der Mindful Attention Awareness Scale - Adolescents (MAAS-A; Brown, West, Loverich & Biegel, 2011) in deutscher Fassung erhoben. Der Fragebogen erfasst Achtsamkeit unidimensional über 14 Items, die auf einer sechsstufigen Likert-Skala von 1 = ,,fast immer" bis 6 = ,,fast nie" bewertet werden (Beispiel- Item: ,,Ich hetze durch Aktivitäten, ohne wirklich aufmerksam für sie zu sein").

Statistische Auswertung

Zur Analyse der Unterschiede im Alkoholkonsum sowie der negativen Gedanken über die erste Lockdown-Phase wurden Messwiederholungsmodelle berechnet. Mittels Korrelationsanalyse wurden die Zusammenhänge zwischen negativen Gedanken während der ersten Lockdown- Phase (Messzeitpunkte 1-4) und dem Alkoholkonsum zu Beginn der zweiten Welle (Messzeitpunkt 5) ermittelt. Schließlich wurde die Rolle von Achtsamkeit auch bezüglich einer möglichen prädiktiven Eigenschaft negativer Gedanken während der Lockdown-Phase (Messzeitpunkt 4 /Follow Up 3 (FU3)) auf den Alkoholkonsum zu Beginn der 2. Welle (Messzeitpunkt 5 (FU4)) mittels eines Regressionsmodells untersucht (Prädiktor: Negative Gedanken zu FU3, Kriterium: Alkoholkonsum zu FU4, Moderator: Achtsamkeit). Neben Alter und Geschlecht wurde auch für Alkoholkonsum und Negative Gedanken vor COVID-19 kontrolliert, um präpandemische Unterschiede in Alkoholkonsum und negativen Gedanken herauszurechnen.

Alle Analysen wurden mittels SPSS für Windows, Version 25.0 (IBM Corporation, 2017) und des SPSS Ergänzung- Werkzeug PROCESS macro Version 3.4 (Hayes, 2017) durchgeführt und mit einem Signifikanzniveau von p < .05 berechnet.

Ergebnisse

Die Messwiederholungsmodelle für Alkoholkonsum ($F_{5.85} = 1.296$, p = .273, $\eta_2 = .071$) und negative Gedanken ($F_{5.85} = 1.997$, p = .087, $\eta_2 = .105$) wurden nicht signifikant (beide p >.05). Die Verläufe von Alkoholkonsum und negativen Gedanken sind in Abbildung 1 dargestellt. Die Verläufe weiterer psychosozialer Faktoren, die mit dem CRISIS Fragebogen erfasst wurden, finden sich zur Information in ESM 2 und 3. **Abbildung 1.** Zeitlicher Verlauf für den Alkoholkonsum (1 = "überhaupt nicht" bis 5 = "regulär") und negative Gedanken (0 = "überhaupt nicht" bis 4 = "die meiste Zeit") während der COVID-19-Befragung über alle Befragungszeitpunkte hinweg, dargestellt für jeden der N = 21 Teilnehmenden. Regressionslinien bilden den allgemeinen Trend über alle Messzeitpunkte ab. Messwiederholungsmodelle wurden nicht signifikant (beide p > .05).



Es zeigten sich signifikante Korrelationen zwischen dem Alkoholkonsum zu FU4 und negativen Gedanken zu Baseline, FU1 und FU3 (siehe Tabelle 2). Die Korrelationen weiterer psychosozialer Faktoren, die mit dem CRISIS Fragebogen erfasst wurden, finden sich zur Information in ESM 4.

Tabelle 2. Partielle Korrelationen zwischen den Erhebungszeitpunkten negativer Gedanken der COVID-19-Befragung (Vor C-19 = vor COVID-19) kontrolliert für Alter, Geschlecht und AUDIT.

ľ	Negative Ged	lanken				
Alkohol Vor C-19	Vor C-19 .390	Baseline .656**	FU1 .414	FU2 .419	FU3 .516 [*]	FU4 041
Baseline FU1	.693 ^{**} .692 ^{**}	.852 ^{***} .815 ^{***}	.809 ^{***} .637 [*]	.605 [*] .596 [*]	.817 ^{***} .842 ^{***}	.337 .447†
FU2	.451†	.686**	.754**	.674**	.881***	$.600^{*}$
FU3	.544*	.763**	.545*	$.560^{*}$.795***	.370
FU4	$.448^{\dagger}$.692**	.631*	.461†	$.760^{**}$.243
Anmerkung	gen. Vor C-19	0 = vor COVID	-19; † <i>p</i> < .1; *	p < .05; ** p <	< .01; *** p < .0	01.

Zudem zeigte sich ein signifikanter Moderationseffekt von Achtsamkeit auf die Vorhersage des Alkoholkonsums zu FU4 durch negative Gedanken (Negative Gedanken FU3: b = 1.314, p < .01, Achtsamkeit: b = .523, p < .05, Alkohol vor COVID-19: b = .352, p < .001, Interaktionseffekt (Moderation) zwischen Negative Gedanken FU3 × Achtsamkeit: b = -.283, p < .01) (siehe Tabelle 3 und Abbildung 2). Die Zusammenfassung entsprechender Moderationsmodelle für die weiteren Faktoren des CRISIS Fragebogens findet sich zur vollständigen Information in ESM 5 und 6.

\mathbf{s}
SS
Ĕ
Ē
Ę
Ξ.
Σ
q
ш
õ
÷
Ċ.
E
\leq
R
$\tilde{}$
ů
·日
qn
õ
Js
0
q,
<u>o</u>
\mathbf{A}
5
Ę.
Ę
Š
ũ
.e
ut
ē
Ξ
Ē
8
\leq
a
Ē.
. <u>e</u> n
5

Modell		R^{2*}	F (df1,df2)	d	q	SE	95%	KI	d
							UG	0G	
Negative Gedanken		.915	15.273 (7,10)	.001					
1	Konstante				-2.263	1.641	-5.922	1.396	.198
	Neg. Gedanken				1.314	.305	.634	1.995	.002
	MAAS-A				.523	.205	.067	979.	.029
	Neg. Gedanken x MAAS-A	(.103)			283	.082	465	101	.006
	Alter				.018	.070	139	.175	.805
	Geschlecht				.241	.170	138	.619	.187
	Alkohol vor COVID-19				.352	090.	.218	.485	000.
	Neg. Gedanken vor COVID-19				103	.100	323	.118	.323
Anmerkungen. 95 % K	= 95 % Konfidenzintervall; $UG = Untervall$	ere Grenze;	OG = Obere Gren	ze; SE =	Standard	fehler; * =	= die durcl	n die Moe	leration

entstehenden Änderungen in R^2 werden in Klammern dargestellt.

SV VIV T ETIA 4 A 11-06-011 ET 12 -ζ • -. -Ń -. ľ Jo11 6:54 1.1 ¢ ^ollo Table 131

Abbildung 2. Moderationsmodell für negative Gedanken zu FU3 und Alkoholkonsum zu FU4 moderiert durch Achtsamkeit (MAAS-A). Höherer MAAS-A-Wert entspricht höherer Achtsamkeit. Regressionsgleichungen sind für jede MAAS-A-Gruppe abgetragen und bilden den allgemeinen Trend der Gruppe ab.



Diskussion

Ziel der aktuellen Studie war es, negative Gedanken im Verlauf der durch die Pandemie hervorgerufenen ersten Lockdown-Phase bei Jugendlichen zu charakterisieren und deren Auswirkungen auf den Alkoholkonsum zu Beginn der zweiten Welle, sowie die Rolle von Achtsamkeit als einen möglichen Resilienzfaktor zu untersuchen.

Über die Befragungszeitpunkte hinweg zeigte sich kein signifikanter Anstieg im Alkoholkonsum, sondern dieser blieb in der ersten Lockdown-Phase bei den untersuchten Jugendlichen eher stabil. Auch in negativen Gedanken zeigte sich kein signifikanter Anstieg über die erste Lock-down-Phase hinweg, jedoch zeigte sich ein genereller negativer Trend – auch bei psychosozialen Faktoren und im emotionalen Erleben (siehe elektronisches Supplement [ESM] 2–3), die sich alle im Verlauf verschlechterten.

Eine mögliche Erklärung für den relativ stabilen Verlauf des Alkoholkonsums könnte darin liegen, dass die Restriktionen durch die Ausgangssperre und das Kontaktverbot die Gelegenheiten zum Alkoholkonsum gerade in dieser ersten Lockdown-Phase doch deutlich minimierten. Gleichzeitig ist jedoch auch hervorzuheben, dass der Alkoholkonsum über diese Zeitspanne, trotz der Einschränkungen, nicht abnahm. Unter diesem Gesichtspunkt sind die zu beobachteten Veränderungen in negativen Gedanken (Abbildung 1) nochmals stärker hervorzuheben. Auch wenn sich in der aktuellen Studie nur ein Trend zeigte, könnten sie ein in der momentanen Pandemie-Phase noch verstecktes Risikopotential bergen, welches erst entscheidende negative Auswirkungen bei einer Normalisierung und/oder einem Rückgang der Pandemie hat. Dies trifft auch auf die weiteren erfassten psychosozialen Faktoren zu, die sich ebenso über die erste Lockdown-Phase hinweg teilweise stark verändern (siehe ESM 2–3). Diese Annahme eines erhöhten Risikopotentials wird auch dadurch untermauert, dass negative Gedanken zum Erhebungszeitpunkt FU3 (Ende Mai 2020) den Alkoholkonsum zu Beginn der zweiten COVID- 19-Welle signifikant vorhersagten. Diese Ergebnisse unterstützen außerdem vorhandene Studien, die bereits eine positive Assoziation zwischen wiederholtem Grübeln und negativen Emotionen und späterem Alkoholkonsum zeigen (Bravo, Pearson & Baumgardner, 2020; Memedovic et al., 2019), sowie Befunde, wonach Alkohol als Coping-Strategie gegen erlebten Stress und Depressivität eingesetzt wird (Windle, 2000; Bravo et al., 2018), was wiederum ebenfalls mit Rumination und dem Risiko zu Problemtrinken in Zusammenhang zu stehen scheint (Atkinson, Ortiz & Smith, 2020).

Geht man von einem solchen versteckten Risikopotential aus, dann ist die Identifikation möglicher Resilienzfaktoren, die solchen negativen Zusammenhängen entgegensteuern könnten, wichtig. Hierbei ist interessant zu sehen, dass Achtsamkeit solchen negativen Entwicklungen entgegenwirken könnte: Hoch achtsame Jugendliche tranken bei vermehrten negativen Gedanken weniger Alkohol, wohingegen wenig achtsame Jugendliche bei vermehrten negativen Gedanken einen erhöhten Alkoholkonsum aufwiesen (Abbildung 2). Achtsamkeit ist mit Rumination und negativen Gedanken assoziiert (z. B. Deyo, Wilson, Ong & Koopman, 2009) und die Ergebnisse stehen damit im Einklang mit früheren Studien zur Schutzfunktion von Achtsamkeit (z. B. Robinson, Ladd & Anderson, 2014; Broderick & Jennings, 2012). Ähnliche Wirkmechanismen von Achtsamkeit auf depressionsbezogene Emotionen und Alkoholkonsum konnten bereits gezeigt werden (Diehl et al., 2020; Garland, Gaylord, Boettiger & Howard, 2010).

Zusammenfassend zeigt die vorliegende Studie, dass negative Gedanken in der ersten COVID-19 Lockdown-Phase zu vermehrtem Alkoholkonsum bei Jugendlichen zu Beginn der zweiten Lockdown-Phase führen können und so sogar die Entwicklung in einen kritischen Alkoholkonsum nach dieser Phase mitbestimmen könnten. Es ist nicht auszuschließen, dass mit Andauern der Pandemie und in Ermangelung anderer Strategien zur Emotionsregulation der Alkoholkonsum bei Jugendlichen vermehrt als eine Bewältigungsstrategie eingesetzt wird. Die signifikante Rolle von Achtsamkeit legt zudem nahe, dass kognitive und psychosoziale Schnittstellen, wie sie etwa im Rahmen von TP2 des IMAC-Mind Verbundes evaluiert werden, sinnvoll in präventive Maßnahmen integriert werden könnten, um in starken Belastungssituationen einem erhöhten Alkoholkonsum frühzeitig entgegenzuwirken. Diese Maßnahmen könnten mit digitaler Technologie, beispielsweise über Smartphone Apps, implementiert und somit im Alltag einfacher einsetzbar gemacht werden. Dies ist auch eines der Hauptziele des TP2, unter Einbezug der neuropsychosozialen Mechanismen des Alkoholkonsums.

Einige Limitationen sollten bei der Interpretation der Ergebnisse Beachtung finden. Die Teilstichprobe der COVID-19-Befragung ist mit N = 21 relativ klein und weist eine niedrige Varianz im Alkoholkonsum auf. Zudem erfasst der CRISIS-Fragebogen Alkoholkonsum nur als einen Teilaspekt möglicher COVID-19-Folgen und lediglich durch ein Item, sodass präzisere Aussagen über Konsummuster der Jugendlichen (wie bspw. Binge drinking) nicht möglich sind. Zusätzliche Untersuchungen regelmäßig Alkohol konsumierender Jugendlicher mit detaillierteren Erfassungsinstrumenten für Alkoholkonsum könnten einen tieferen Einblick in den Verlauf des Alkoholkonsums und dessen Risikofaktoren über die COVID-19-Pandemie geben. Weiterhin wurden in der vorliegenden Arbeit zusätzliche mögliche Einflussgrößen, wie etwa eine mögliche restriktive Überwachung des Alkoholkonsums durch die Eltern oder andere entwicklungspsychosoziale Faktoren, wie etwa individuelle Trinkmotive (Kuntsche, Knibbe, Gmel & Engels, 2005; EMCDDA, 2011), das Netto-Einkommen des Haushalts (z. B. Goodman & Huang, 2002), oder das Alkoholkonsum- und Gesundheitsverhalten der Eltern (z. B. Yu, 2003) nicht konkret erfasst, welche in künftigen Arbeiten mit eingehen sollten. Berücksichtigt man den längsschnittlichen Verlauf, haben die Ergebnisse dennoch einen signifikanten Mehrwert, mangelt es doch gerade weiterhin noch an solchen längsschnittlichen Daten. In diesem Zusammenhang sollten vor allem zukünftige Ansätze versuchen, Daten zu Pandemieeffekten in bereits bestehenden längsschnittlichen Kohorten zu erheben. Dies würde auch wichtige Möglichkeiten im Hinblick auf weitere präpandemische Faktoren bieten und somit die Präzision in Richtung Prävention bei Alkoholkonsum bezogenen Risikoprofilen deutlich erhöhen. Dies verfolgen wir aktuell in TP1 des IMAC-Mind Verbundes. Hier integrieren wir unterschiedliche Längsschnittkohorten und analysieren die Daten im Hinblick auf neuropsychosoziale Mechanismen des Alkoholkonsums und deren Bezug zu Achtsamkeit, um schließlich solche prädiktiven Verlaufsmodelle näher zu bestimmen.

Schlussfolgerungen für die Praxis

• Während der 1. Welle der COVID-19 Pandemie zeigt sich der Alkoholkonsum bei 14- und 16-jährigen Jugendlichen relativ stabil

• Negative Gedanken zum Ende der 1. Welle sagen den Alkoholkonsum zu Beginn der zweiten COVID-19-Welle vorher

• Achtsamkeit wirkt moderierend auf diesen Zusammenhang

• Kognitive und psychosoziale Faktoren sollten daher als präventive Maßnahmen zur Verhinderung eines übersteigerten Alkoholkonsums bei Jugendlichen im weiteren Verlauf bzw. als Folge der Pandemie frühzeitig Berücksichtigung finden

Elektronisches Supplement

Das elektronische Supplement (ESM) ist mit der Onlineversion dieses Artikels verfügbar unter https://doi.org/10.1024/0939-5911/a000734

ESM 1. Beispielitems des CRISIS-Fragebogens

ESM 2. Verlauf zweipoliger Items getrennt für jeden Teilnehmenden über die Messzeitpunkte (Abbildung)

ESM 3. Verlauf einpoliger Items getrennt für jeden Teilnehmenden über die Messzeitpunkte (Abbildung)

ESM 4. Partielle Korrelationen der Faktoren mit Alkohol zu allen Erhebungszeitpunkten (Tabelle)

ESM 5. Moderationsmodelle für Prädiktor zu FU3 und Alkoholkonsum zu FU4 mit Moderator MAAS-A (Tabelle)

ESM 6. Signifikantes Moderationsmodell für Entspannung/Nervosität zu FU3 und Alkoholkonsum zu FU4 moderiert durch Achtsamkeit (MAAS-A) (Abbildung)

Literatur

- Appleyard, K., Egeland, B., van Dulmen, M. H. M. & Sroufe, L. A. (2005). When more is not better: the role of cumulative risk in child behavior outcomes. *Journal of child psychology and psychiatry, and allied disciplines, 46* (3), 235–245. https://doi. org/10.1111/j.1469-7610.2004.00351.x
- Atkinson, E. A., Ortiz, A. M. L. & Smith, G. T. (2020). Affective risk for problem drinking: reciprocal influences among negative urgency, affective lability, and rumination. *Current Drug Research Reviews, 12* (1), 42–51. https://doi.org/10.2174/25899775116661 91021105154
- Babor, T. F. & Grant, M. (1989). From clinical research to secondary prevention: International collaboration in the development of the Alcohol Disorders Identification Test (AUDIT). Alcohol Health and Research World, 13, 371–374.

- Bowen, S. & Enkema, M. C. (2014). Relationship between dispositional mindfulness and substance use: findings from a clinical sample. *Addictive Behaviors*, 39 (3), 532–537. https://doi.org/10.1016/j.addbeh.2013.10.026
- Bravo, A. J., Pearson, M. R. & Baumgardner, S. F. (2020). The relationship between negative affect and alcohol and marijuana use outcomes among dual users. *Substance Use & Misuse*, 55 (4), 658–665. https://doi.org/10.1080/10826084.2019.1696820
- Bravo, A. J., Pilatti, A., Pearson, M. R., Mezquita, L., Ibáñez, M. I. & Ortet, G. (2018).
 Depressive symptoms, ruminative thinking, drinking motives, and alcohol outcomes: A multiple mediation model among college students in three countries. *Addictive Behaviors*, 76, 319–327. https://doi.org/10.1016/j.addbeh.2017.08.028
- Broderick, P. C. & Jennings, P. A. (2012). Mindfulness for adolescents: a promising approach to supporting emotion regulation and preventing risky behavior. *New directions for youth development, 2012* (136),111–126. https://doi.org/10.1002/yd.20042
- Brown, K. W., West, A. M., Loverich, T. M. & Biegel, G. M. (2011). Assessing adolescent mindfulness: validation of an adapted Mindful Attention Awareness Scale in adolescent normative and psychiatric populations. *Psychological assessment, 23* (4),1023–1033. https://doi.org/10.1037/a0021338
- Brown, S. A., McGue, M., Maggs, J., Schulenberg, J., Hingson, R., Swartzwelder, S. et al. (2008). A developmental perspective on alcohol and youths 16 to 20 years of age. *PEDIATRICS*, 121 Suppl 4, 290–310. https://doi.org/10.1542/peds.2007-2243D
- Bundesregierung Deutschland. (2021). Coronavirus in Deutschland. Verfügbar unter https://www.bundesregierung.de/breg-de
- Cavicchioli, M., Movalli, M. & Maffei, C. (2018). The clinical efficacy of mindfulness-based treatments for alcohol and drugs use disorders: A meta-analytic review of randomized and nonrandomized controlled trials. *European Addiction Research*, 24 (3), 137–162. https://doi.org/10.1159/000490762
- Christopher, M., Ramsey, M. & Antick, J. (2013). The role of dispositional mindfulness in mitigating the impact of stress and impulsivity on alcohol-related problems. *Addiction Research & Theory, 21* (5), 429–434. https://doi.org/10.3109/16066359.2012.737873
- Conrod, P. J. & Nikolaou, K. (2016). Annual Research Review: On the developmental neuropsychology of substance use disorders. *Journal of Child Psychology and Psychiatry*, 57 (3), 371–394. https://doi.org/10.1111/jcpp.12516

- Deyo, M., Wilson, K. A., Ong, J. & Koopman, C. (2009). Mindfulness and rumination: does mindfulness training lead to reductions in the ruminative thinking associated with depression? *Explore*, 5 (5), 265–271. https://doi.org/10.1016/j.explore.2009.06.005
- Diehl, J. M., McGonigal, P. T., Morgan, T. A., Dalrymple, K., Harris, L. M., Chelminski, I. et al. (2020). Emotion regulation accounts for associations between mindfulness and depression across and within diagnostic categories. *Annals of clinical psychiatry*, 32 (2), 97–106.
- Disner, S. G., Beevers, C. G., Haigh, E. A. P. & Beck, A. T. (2011). Neural mechanisms of the cognitive model of depression. *Nature Reviews Neuroscience*, 12 (8), 467–477. https://doi.org/10.1038/nrn3027
- Dumas, T. M., Ellis, W. & Litt, D. M. (2020). What does adolescent substance use look like during the COVID-19 pandemic? Examining changes in frequency, social contexts, and pandemic-related predictors. *The Journal of adolescent health*, 67 (3), 354–361. https://doi.org/10.1016/j.jadohealth.2020.06.018
- Dunning, D. L., Griffiths, K., Kuyken, W., Crane, C., Foulkes, L., Parker, J. et al. (2019). Research Review: The effects of mindfulness- based interventions on cognition and mental health in children and adolescents - a meta-analysis of randomized controlled trials. *Journal of Child Psychology and Psychiatry*, 60 (3), 244–258. https://doi.org/10.1111/jcpp.12980
- Ellis, W. E., Dumas, T. M. & Forbes, L. M. (2020). Physically isolated but socially connected: Psychological adjustment and stress among adolescents during the initial COVID-19 crisis. *Canadian Journal of Behavioural Science*, 52 (3), 177–187. https://doi. org/10.1037/cbs0000215
- European Monitoring Centre for Drugs and Drug Addiction (EMCDDA). (2011). Annual Report 2011: The State of the Drugs Problem in Europe. Luxembourg: Publications Office of the European Union. https://doi.org/10.2810/44330
- Engert, V., Smallwood, J. & Singer, T. (2014). Mind your thoughts: associations between selfgenerated thoughts and stress-induced and baseline levels of cortisol and alpha-amylase. *Biological psychology*, 103, 283–291. https://doi.org/10.1016/j. biopsycho.2014.10.004
- Ensel, W. M. & Lin, N. (1991). The life stress paradigm and psychological distress. *Journal of Health and Social Behavior*, 32 (4), 321. https://doi.org/10.2307/2137101
- Figueiredo, C. S. de, Sandre, P. C., Portugal, L. C. L., Mázala-de-Oliveira, T., Da Silva Chagas,
 L., Raony, Í. et al. (2021). COVID-19 pandemic impact on children and adolescents'
 mental health: Biological, environmental, and social factors. *Progress in*

neuropsychopharmacology & biological psychiatry, 106, 110171. https://doi.org/10.1016/j.pnpbp.2020.110171

- Galea, S., Merchant, R. M. & Lurie, N. (2020). The mental health consequences of COVID-19 and physical distancing: The need for prevention and early intervention. *JAMA internal medicine*, 180 (6), 817–818. https://doi.org/10.1001/jamainternmed.2020.1562
- Garland, E. L., Gaylord, S. A., Boettiger, C. A. & Howard, M. O. (2010). Mindfulness training modifies cognitive, affective, and physiological mechanisms implicated in alcohol dependence: results of a randomized controlled pilot trial. *Journal of psychoactive drugs*, 42 (2), 177–192. https://doi.org/10.1080/02791072.2010.10400690
- Goldberg, S. B., Riordan, K. M., Sun, S. & Davidson, R. J. (2021). The empirical status of mindfulness-based interventions: A systematic review of 44 meta-analyses of randomized controlled trials. *Perspectives on psychological science* [advance online publication]. https://doi.org/10.1177/1745691620968771
- Goodman, E. & Huang, B. (2002). Socioeconomic status, depressive symptoms, and adolescent substance use. Archives of Pediatrics & Adolescent Medicine, 156 (5), 448–453. https://doi.org/10.1001/archpedi.156.5.448
- Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York: Guilford Publications.
- Heinrich, A., Schumann, G., Flor, H. & Nees, F. (2016). Identification of key items regarding personality, environment, and life events to assess risk and resilience factors for harmful alcohol drinking in adolescents. *Alcohol and alcoholism*, 51 (6), 710–715. https://doi.org/10.1093/alcalc/agw012
- IBM Corporation. (2017). *IBM SPSS Statistics for Windows* (Version 25.0) [Computer software]. Armonk, NY: IBM Corporation.
- Karyadi, K. A., VanderVeen, J. D. & Cyders, M. A. (2014). A meta-analysis of the relationship between trait mindfulness and substance use behaviors. *Drug and Alcohol Dependence*, 143, 1–10. https://doi.org/10.1016/j.drugalcdep.2014.07.014
- Kuntsche, E., Knibbe, R., Gmel, G. & Engels, R. (2005). Why do young people drink? A review of drinking motives. *Clinical Psychology Review*, 25 (7), 841–861.
- Le, T. M., Wang, W., Zhornitsky, S., Dhingra, I., Chen, Y., Zhang, S. et al. (2021). The neural processes interlinking social isolation, social support, and problem alcohol use. *International Journal of Neuropsychopharmacology*, 24 (4), 333–343. https://doi.org/10.1093/ijnp/pyaa086

- Leiner, D. J. (2019). SoSci Survey (Version 3.2.32) [Computer software]. München: SoSci Survey GmbH. https://www.soscisurvey. de
- Liang, L., Ren, H., Cao, R., Hu, Y., Qin, Z., Li, C. et al. (2020). The effect of COVID-19 on youth mental health. *The Psychiatric quarterly*, *91* (3), 841–852. https://doi.org/10.1007/s11126-020-09744-3
- Lyvers, M., Makin, C., Toms, E., Thorberg, F. A. & Samios, C. (2014). Trait mindfulness in relation to emotional self-regulation and executive function. *Mindfulness*, 5 (6), 619– 625. https://doi.org/10.1007/s12671-013-0213-y
- Memedovic, S., Slade, T., Ross, J., Darke, S., Mills, K. L., Marel, C. et al. (2019). Rumination and problematic substance use among individuals with a long-term history of illicit drug use. *Drug and Alcohol Dependence, 203*, 44–50. https://doi.org/10.1016/j.drugalcdep.2019.05.028
- Nees, F., Tzschoppe, J., Patrick, C. J., Vollstädt-Klein, S., Steiner, S., Poustka, L. et al. (2012).
 Determinants of early alcohol use in healthy adolescents: the differential contribution of neuroimaging and psychological factors. *Neuropsychopharmacology*, *37* (4), 986–995. https://doi.org/10.1038/npp.2011.282
- Nikolaidis, A., Paksarian, D., Alexander, L., Derosa, J., Dunn, J., Nielson, D. M. et al. (2021). The Coronavirus Health and Impact Survey (CRISIS) reveals reproducible correlates of pandemic-related mood states across the Atlantic. *Scientific Reports, 11* (1), 8139. https://doi.org/10.1038/s41598-021-87270-3
- Oberle, E., Schonert-Reichl, K. A., Lawlor, M. S. & Thomson, K. C. (2012). Mindfulness and inhibitory control in early adolescence. *The Journal of Early Adolescence, 32* (4), 565–588. https://doi.org/10.1177/0272431611403741
- Robert-Koch Institut. (2021). COVID-19-Dashboard. Zugriff am 16. Juni 2021 unter https://experience.arcgis.com/experience/ 478220a4c454480e823b17327b2bf1d4/page/page 0/
- Robinson, J. M., Ladd, B. O. & Anderson, K. G. (2014). When you see it, let it be: Urgency, mindfulness and adolescent substance use. *Addictive Behaviors*, 39 (6), 1038–1041. https://doi.org/10.1016/j.addbeh.2014.02.011
- Saltzman, L. Y., Hansel, T. C. & Bordnick, P. S. (2020). Loneliness, isolation, and social support factors in post-COVID-19 mental health. *Psychological trauma: theory, research, practice and policy, 12* (S1), 55–57. https://doi.org/10.1037/tra0000703
- Shanahan, L., Steinhoff, A., Bechtiger, L., Murray, A. L., Nivette, A., Hepp, U. et al. (2020). Emotional distress in young adults during the COVID-19 pandemic: evidence of risk

and resilience from a longitudinal cohort study. *Psychological medicine*, 1–10. https://doi.org/10.1017/S003329172000241X

- Swendsen, J., Burstein, M., Case, B., Conway, K. P., Dierker, L., He, J. et al. (2012). Use and abuse of alcohol and illicit drugs in US adolescents: results of the National Comorbidity Survey-Adolescent Supplement. *Archives of General Psychiatry*, 69 (4), 390–398. https://doi.org/10.1001/archgenpsychiatry.2011.1503
- Whelan, R., Watts, R., Orr, C. A., Althoff, R. R., Artiges, E., Banaschewski, T. et al. (2014). Neuropsychosocial profiles of current and future adolescent alcohol misusers. *Nature*, 512 (7513), 185–189. https://doi.org/10.1038/nature13402
- White, H. R., Xie, M., Thompson, W., Loeber, R. & Stouthamer-Loeber, M. (2001). Psychopathology as a predictor of adolescent drug use trajectories. *Psychology of Addictive Behaviors*, 15 (3), 210–218. https://doi.org/10.1037/0893-164X.15.3.210
- Windle, M. (2000). Parental, Sibling, and Peer Influences on Adolescent Substance Use and Alcohol Problems. *Applied Developmental Science*, 4, 98–110. https://doi.org/10.1207/S1532480
- XADS0402_5 Wittchen, H.-U., Behrendt, S., Höfl er, M., Perkonigg, A., Lieb, R., Bühringer, G. et al. (2008). What are the high risk periods for incident substance use and transitions to abuse and dependence? Implications for early intervention and prevention. *International journal of methods in psychiatric research*, *17 Suppl* 1, S16–29. https://doi.org/10.1002/mpr.254
- Yu, J. (2003). The association between parental alcohol-related behaviors and children's drinking. *Drug and Alcohol Dependence*, 69 (3), 253–262. https://doi.org/10.1016/S0376-8716 (02)00324-1

Deklaration konkurrierender Interessen

Keine.

Finanzierung

Die Studie wird im Rahmen des Teilprojektes 2 im IMAC-Mind Verbund aus Mitteln des Bundesministeriums für Bildung und Forschung (BMBF, Förderkennzeichen: 01GL1745B) finanziert. Mit der Förderung des Forschungsverbundes "IMAC-Mind: Verbesserung der psychischen Gesundheit und Verringerung von Suchtgefahr im Kindes- und Jugendalter durch Achtsamkeit: Mechanismen, Prävention und Behandlung" (2017–2021) leistet das Bundesministerium für Bildung und Forschung einen Beitrag, die Prävention und therapeutische Versorgung von Kindern und Jugendlichen mit Suchtstörungen und komorbiden psychischen Störungen zu verbessern. Die Projektkoordination erfolgt durch das Deutsche Zentrum für Suchtfragen des Kindes- und Jugendalters am Universitätsklinikum Hamburg-Eppendorf.

Projektleiter_innen in den Teilprojekten sind: Rainer Thomasius (Koordinator und Sprecher des Verbundes, Universitätsklinikum Hamburg-Eppendorf), Nicolas Arnaud (Universitätsklinikum Hamburg-Eppendorf), Tobias Banaschewski, Herta Flor (Zentralinstitut für Seelische Gesundheit Mannheim), Frauke Nees (Zentralinstitut für Seelische Gesundheit Mannheim und Universitätsklinikum Schleswig-Holstein, Christian-Albrechts-Universität zu Kiel), Johannes Kornhuber (Friedrich-Alexander-Universität Erlangen-Nürnberg), Michael Klein (Katholische Hochschule Nordrhein Westfalen Köln), Olaf Reis (Universitätsmedizin Rostock), Tanja Legenbauer (Ruhr-Universität Bochum, LWL Universitätsklinik Hamm für Kinder- und Jugendpsychiatrie), Antonia Zapf (Universitätsklinikum Hamburg-Eppendorf). Für ausführliche Informationen siehe www.IMAC-Mind.de

Förderung

Open-Access-Veröffentlichung ermöglicht durch Zentralinstitut für Seelische Gesundheit (ZI).

Jugendliches Alkoholkonsumverhalten während der COVID-19-Pandemie und die Bedeutung von Achtsamkeit

Elektronisches Supplement

Das elektronische Supplement (ESM) ist mit der Onlineversion dieses Artikels verfügbar unter https://doi.org/10.1024/0939-5911/a000734

ESM 1. Beispielitems des CRISIS-Fragebogens

Emotionen und soziales Erleben werden im CRISIS Fragebogen durch einpolige und zweipolige Items erfasst.

Beispiel für einpoliges Item:

"Während der letzten 14 Tage: Wie besorgt warst du im Allgemeinen?"

5-stufige Antwortskala: 0 = "überhaupt nicht besorgt" bis 4 = "sehr besorgt"

Beispiel für zweipoliges Item:

"Während der letzten 14 Tage: Wie glücklich oder traurig warst du?"

5-stufige Antwortskala: -2 = ,,sehr traurig", -1 = ,,mäßig traurig", 0 = ,,neutral",

1 = "mäßig glücklich", 2 = "sehr glücklich"



ESM 2. Verlauf zweipoliger Items getrennt für jeden Teilnehmenden über die Messzeitpunkte

Anmerkung. Die gestrichelte, graue Linie entspricht der Kategorie "neutral" und dient der besseren Übersicht innerhalb der Grafik. Negative Ausprägung der Emotion (z.B. Nervosität) ist am negativen Pol, positive Ausprägung der Emotion (z.B. Entspannung) ist am positiven Pol abgetragen. Regressionslinien bilden den allgemeinen Trend über alle Messzeitpunkte ab. Messwiederholungsmodelle wurden nicht signifikant (alle p > .05).



ESM 3. Verlauf einpoliger Items getrennt für jeden Teilnehmenden über die Messzeitpunkte

Anmerkung. Regressionslinien bilden den allgemeinen Trend über alle Messzeitpunkte ab. Messwiederholungsmodelle wurden nicht signifikant (alle p > .05).
		Ersc	höpfung			
Alkohol	Vor C-19	Baseline	FU1	FU2	FU3	FU4
Vor C-19	.474†	.107	.139	.481†	.454†	.019
Baseline	.659**	.290	.336	.655**	.615*	.362
FU1	.530*	.220	.432	.645**	.591*	.524*
FU2	.595*	.569*	.469†	.635*	.635*	.369
FU3	.396	.169	.478†	.561*	.477†	.476†
FU4	$.708^{**}$.481†	.549*	.810***	.716**	.290
		Ur	nruhe			
Vor C-19	.314	.175	.315	.166	.277	.247
Baseline	.131	.072	.558*	.245	.362	.352
FU1	.133	.229	.855***	.551*	.440	.302
FU2	103	270	.414	.226	.131	105
FU3	.277	.390	.823***	.537*	.178	.211
FU4	.009	038	.387	.099	.076	.037
		Eins	amkeit			
Vor C-19	$.607^{*}$.592*	.071	.094	.490*	.192
Baseline	.660**	.760**	.505†	.427	.843***	.557*
FU1	.554*	.799***	.422	.602*	.469†	.556*
FU2	.613*	.733**	$.708^{**}$.740**	.686**	.660**
FU3	.477†	.740**	.458†	.554*	.390	.474†
FU4	.476†	.574*	.487†	.394	.737**	.487†
		S	orge			
Vor C-19	.237	.157	.410	.387	.498†	.204
Baseline	.340	.406	.606*	.652**	.812***	.501*
FU1	.149	.691**	.638**	.701**	.896***	.636*
FU2	.138	.378	.360	.432	.773**	.425
FU3	.164	$.588^{*}$.422	.544*	.824***	.461†
FU4	.176	.167	.255	.421	$.709^{**}$.272
		Glück	k/Trauer			
Vor C-19	479 [†]	619*	251	209	234	.012
Baseline	573*	786**	685**	417	563*	459†
FU1	258	615*	499†	499†	332	522*
FU2	330	635*	581*	528*	615*	541*
FU3	376	560*	469†	451†	347	421
FU4	462†	594*	457†	188	473†	279
		Entspannu	ng/ Nervosität			
Vor C-19	025	135	301	395	404	.175
Baseline	138	243	383	681**	586*	263
FU1	069	614*	533*	626*	574*	406
FU2	.017	163	407	762**	649**	283
FU3	174	548*	459 [†]	579*	400	319
FU4	.107	092	387	692**	354	.050
		Konzentratio	n/ Ablenkbark	eit		
Vor C-19	416	161	231	449 [†]	475	.083
Baseline	446 [†]	161	468 [†]	667	450 [*]	246
FU1	141	074	420	687	280	136
FU2	286	191	332	634	633	.019
FU3	362	110	622	731	398	109
FU4	314	084	407/	608	598	.005

ESM 4. Partielle Korrelationen der Faktoren mit Alkohol zu allen Erhebungszeitpunkt

Anmerkung. Partielle Korrelationen wurden kontrolliert für Alter, Geschlecht und AUDIT; Vor C-19 = vor COVID-19; [†] p < .1, ^{*} p < .05, ^{**} p < .01, ^{***} p < .001.

Original Contributions – Study 3: Alcohol Use during COVID-19 and Mindfulness

Modell		R^{2*}	F(dfl,df2)	d	q	SE	95%	KI	d
							UG	0G	
Erschöpfung		.852	8.25 (7,10)	.002					
	Konstante				-2.059	2.531	-7.699	3.581	.435
	Erschöpfung				.634	.530	547	1.816	.259
	MAAS-A				.299	.440	682	1.281	.512
	$Erschöpfung \times MAAS-A$	(.010)			109	.132	403	.184	.425
	Alter				.057	.101	169	.283	.588
	Geschlecht				-000	.244	553	.536	.972
	Alkohol vor COVID-19				.347	.091	.143	.550	.004
	Erschöpfung vor COVID-19				.095	.100	127	.317	.362
Unruhe		069.	3.179 (7,10)	.048					
	Konstante				1.150	3.039	-5.623	7.922	.713
	Unruhe				066	1.226	-2.798	2.666	.958
	MAAS-A				180	.559	-1.425	1.065	.753
	Unruhe \times MAAS-A	(000)			001	.314	702	.700	998.
	Alter				.029	.131	264	.321	.830
	Geschlecht				020	.341	780	.740	.955
	Alkohol vor COVID-19				.453	.124	.178	.729	.004
	Unruhe vor COVID-19				061	.121	331	.210	.627
pannung/Nervosität		.815	6.291 (7,10)	.005					
1	Konstante				281	1.961	-4.651	4.089	.889
	Entspannung/Nerv.				-2.141	.799	-3.921	361	.023
	MAAS-A				476	.181	879	073	.025
	Entspannung/Nerv. × MAAS-A	(.122)			.531	.207	.070	.993	.028
	Alter				.157	.110	088	.402	.184
	Geschlecht				.291	.259	286	.868	.287
	Alkohol vor COVID-19				.300	.094	.092	.508	600.
	Entspannung vor COVID-19				.050	.092	156	.255	.603

ESM 5. Moderationsmodelle für Prädiktor zu FU3 und Alkoholkonsum zu FU4 mit Moderator MAAS-A

G = Obere Grenze, SE= Standardfehler, * = die durch die Moderation entstehenden Änderungen in R^2 werden in Klammern dargestellt. Modelle wurden aufgrund der kleinen Stichprobe nicht für multiples Testen korrigiert. **ESM 6.** Signifikantes Moderationsmodell für Entspannung/Nervosität zu FU3 und Alkoholkonsum zu FU4 moderiert durch Achtsamkeit (MAAS-A)



Anmerkung. Höherer MAAS-A-Wert entspricht höherer Achtsamkeit. Regressionsgleichungen sind für jede MAAS-A-Gruppe abgetragen und bilden den allgemeinen Trend der Gruppe ab. Positiver Pol der X-Achse entspricht der Ausprägung "Entspannung", negativer Pol entspricht der Ausprägung "Nervosität".

3 GENERAL DISCUSSION

Adolescence, the transitional period between childhood and adulthood, is characterized by extensive developmental tasks along the path to a successful integration into the adult world. At the same time, adolescence is prone to a range of maladaptive behaviors, such as alcohol use, which are referred to as problem behavior in the framework of Problem Behavior Theory. In accordance with this framework, there are several risk factors that may influence these problem behaviors. In this context, this dissertation focused on the problem behavior of alcohol use and examined the question of how different risk factors interact in their influence on adolescent alcohol use. The focus was on the systems "social context", "behavior" and "problem behavior". Study 1 used self-report measures of bullying, empathy and alcohol use from a longitudinal, multi-center study and examined the relation between the socially relevant emotion of empathy and the problem behavior of bullying in relation to alcohol use among adolescents at two time points. It was hypothesized that active and passive bullying would be associated with increased alcohol use (Hypothesis 1.1) and that affective empathy would have a moderating (namely, a strengthening) effect on this relation (Hypothesis 1.2). Study 2 revisited the concept of empathy and examined it in relation to emotion regulation and interoception. In a cross-sectional design, behavioral measures of empathy (EmpaToM task), emotion regulation and interoception (Heartbeat Counting Task) and a self-report of interoception and alcohol use were used. It was hypothesized that difficulties in emotion regulation, higher interoception and higher affective empathy would be associated with higher alcohol use (Hypothesis 2.1) and that interoception and affective empathy further increase the relation between emotion regulation and alcohol use (Hypotheses 2.2). Study 3 investigated the social context of adolescent alcohol use and examined how the macrosocial crisis of the COVID-19 pandemic affected alcohol use and negative thoughts over the course of the first wave of the pandemic. For this purpose, a longitudinal online survey was conducted with a subsample of the participants used in Study 2. It was assumed that the COVID-19 pandemic would have an effect leading to an increase in alcohol use and negative thoughts among adolescents (Hypothesis 3). The different methods used in the different studies allowed not only for a longitudinal comparison and thus the test of causal relationship (Study 1 and Study 3), but also for a comparison of behavioral measures with self-report results (Study 1 and Study 2) and thus for an analysis of different levels of each factor.

The following sections summarize the results in relation to the hypotheses, before integrating them in the context of the current state of research and PBT. Furthermore, some general limitations of the presented studies are discussed, and an outline for future research is given.

3.1 Summary of findings

The main empirical finding of Study 1 was only partially in line with the predictions made by hypothesis 1.1. At both time points, perpetrators of bullying were found to use more alcohol than those participants noninvolved in bullying and victims of bullying. This effect was particularly true for male participants. However, contrary to hypothesis 1.1, there was no difference between victims and noninvolved participants. Hypothesis 1.2 was only partially supported by the results of Study 1. A moderating positive effect of the empathy aspect of fantasy on alcohol use at time one, as well as a moderating negative effect of the empathy aspect of personal distress at time two, were found for perpetrators, particularly for male participants.

Study 2 replicated previous findings which had shown that difficulties in emotion regulation are commonly associated with increased alcohol use (Nawi et al., 2021; Khosravani et al., 2017). In Study 2, lower emotion regulation was associated with more alcohol use and more frequent binge drinking. It was also shown that higher interoception was associated with more frequent drinking. However, hypothesis 2.1 was only partially supported by our analyses, as no direct influence of empathy on adolescents' drinking behavior could be shown in Study 2. Similarly, hypothesis 2.2 was only partially supported by the results of Study 2. Empathy showed a moderating negative effect on the relation between emotion regulation and the amount of alcohol use in 16-year-old participants, but not in 14-year-old participants. In addition, Study 2 only showed a moderating effect of self-reported interoception (in the form of attention regulation) on the relation between emotion regulation on the one hand and alcohol quantity and binge drinking on the other hand in 16-year-olds, but in the opposite direction as expected. Behavioral interoception, as measured by the Heartbeat Counting Task, did not moderate the association between emotion regulation and alcohol use in Study 2.

Hypothesis 3 did not find empirical support, based on the results of study 3. The study showed no direct influence of the COVID-19 pandemic on adolescent alcohol use, which remained relatively stable during the study period. Similarly, there was no direct effect of the COVID-19 pandemic on negative thoughts. Only a trend towards significance for negative

thoughts was observed. Nevertheless, negative thoughts were clearly positively correlated with alcohol use over the course of the study. In addition, mindfulness was found to moderate the relation between negative thoughts and alcohol use: highly mindful adolescents showed a decrease in alcohol use when negative thoughts increased. In contrast, adolescents who were less mindful showed increased alcohol use when negative thoughts increased.

3.2 Integration of the findings

There are many studies that examine risk factors and their interactions for adolescent alcohol use. These studies mainly focued on risk factors associated with brain maturation (Conrod & Nikolaou, 2016), such as reward sensitivity and impulsivity, as well as other risk behaviors and personality factors (Nees et al., 2012). The results of this dissertation extend these findings by including additional factors from other PBT systems, investigating their interaction and partially confirming their effect on adolescent alcohol use.

3.2.1 Bullying

Study 1 shows that active bullying can be considered a risk factor for increased alcohol use in adolescence, reflecting the fact that, in line with the assumptions of PBT, different problem behaviors can co-occur (Weichold & Blumenthal, 2018). Similar findings have been reported in other studies, according to which bullying behavior is not only associated with heightened alcohol use, but also with heightened probability of crime (Ttofi et al., 2011), aggression and antisocial behavior (Solberg & Olweus, 2003), more smoking (Carvalho et al., 2017) and use of illicit drugs (Valdebenito et al., 2015). Contrary to expectations and previous research (Topper et al., 2011; Radliff et al., 2012; Tharp-Taylor et al., 2009), victims did not show increased alcohol use in our study. In a broader sense, victims are more likely to be "involuntary recipients" of the problem behavior of bullying, and therefore bullying should rather be categorized in the system of "social context" or "perceived environment" for victims within the PBT framework. In contrast to perpetrators, there was no direct association between the two types of problem behaviors for victims. The results of Study 1 also suggest that victims of bullying are more likely to show internalizing problem behavior. This is consistent with other studies reporting higher levels of depression and anxiety (Hong et al., 2014; Kretschmer, 2016), but also low self-esteem (Olweus, 2013) and feelings of isolation (Carvalho et al., 2017) in victims, factors that are commonly associated with increased alcohol use (Brière et al., 2014; M. d. A. Costa et al., 2013; Bartsch et al., 2017; Le et al., 2021). Given the importance of popularity and belonging to a group in adolescence (Vierhaus & Wendt, 2018), this may be particularly relevant to the development of problem behaviors in victims.

In the terminology of PBT, bullying can therefore also be seen as a risk factor for problem behaviors in victims. However, given the differences between perpetrators and victims, it might be useful to differentiate the problem behavior summarized in PBT into internalizing and externalizing problem behavior, as already suggested by the taxonomy of Achenbach (1966). This distinction may also be relevant for differences in experiences with bullying between males and females and with respect to the type of bullying. For example, males are more likely to experience direct bullying, while females are more likely to experience indirect bullying (Carbone-Lopez et al., 2010; Salmon et al., 2018). Similarly, males are more likely to show externalizing problem behaviors (Carbone-Lopez et al., 2010).

3.2.2 Empathy

In Study 1, lower affective empathy was correlated with higher alcohol use in perpetrators, with a similar effect of higher cognitive empathy. This highlights the need to distinguish between affective and cognitive empathy (Weisz & Cikara, 2021; Stietz et al., 2019), as these two mechanisms may affect associations in contrary directions. Study 2 added to these findings of Study 1. Again, affective empathy was found to moderate the relation between lower emotion regulation and higher alcohol use, increasing this correlation for lower affective empathy levels. Contrary to the prior assumption, this finding suggests that it is not increased affective empathy but rather the lack of it that can be considered a risk factor of alcohol use in the sense of PBT. Therefore, this dissertation builds on previous findings and shows that empathic abilities are not only impaired in the presence of alcohol problems (Nachane et al., 2021; Le Berre, 2019), but can also be considered a relevant factor in the development of alcohol use in adolescence.

As the findings of Study 1 and Study 2 show, empathy has primarily an indirect effect on the relation between risk factors. Thus, the results may be indicative of another underlying factor that was not explicitly measured. For example, the lack of affective empathy may indicate a lack of general social skills (Ishak et al., 2014). As the latter are central to peer popularity and thus to group membership (Bukowski et al., 2011; Meijs et al., 2010), this could explain the indirect influences found in our studies. Consistently with this assumption, previous research showed that low empathy is associated with aggressive behavior (Giancola, 2003) and with belonging to deviant peer groups (Lenzi et al., 2015), which are more likely to engage in active bullying (Nickerson & Mele-Taylor, 2014). This not only leads to an increased risk for alcohol use in the PBT "problem behavior" system. In addition, the surrounding deviant peers themselves are also more likely to use alcohol (Samek et al., 2013), thus providing the individual with a corresponding model for problem behavior in the "perceived environment system".

In a more pathological sense, the lack of affective empathy might also relate the underlying trait of psychopathology, which, according to PBT, belongs to the "personality system" and is associated with lower empathy (Dadds et al., 2009), higher antisocial behavior (Fanti et al., 2009) and also higher alcohol use (Anderson et al., 2018). Psychopathology may therefore also be a risk factor for alcohol use among adolescents.

Taking all of this together, it can be assumed that higher affective empathy may not only be beneficial for social interaction as a form of prosocial behavior and social competencies (Bach et al., 2017; Saarni, 1999; Portt et al., 2020), but may thus also be considered a protective factor in the sense of the PBT.

3.2.3 Interoception

Increased interoceptive accuracy was found to be a risk factor of adolescent alcohol use in terms of PBT in our studies, as expected and in line with the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984). The additional value of this finding is that the effect of interoception on alcohol use was analyzed in healthy adolescents, providing initial evidence that the perception of bodily signals plays a relevant role in this early stage of alcohol use. At the same time, the results on the interaction with emotion regulation also show that interoception has to be considered in a differentiated way with respect to its sub-components (Garfinkel et al., 2015) and therefore interoception as a whole should not be seen as risk factor in the sense of PBT. Current research shows that alcohol-dependent patients report higher interoceptive sensibility and lower interoceptive accuracy compared to healthy individuals (Jakubczyk et al., 2019), and greater problems in controlling their behavior in response to negative emotions when they show higher interoceptive sensibility (Jakubczyk et al., 2020). Moreover, interoceptive awareness appears to be negatively correlated with craving in alcohol dependence (Ateş Çöl et al., 2016). In addition, adolescents with alcohol use disorder respond to aversive internal signals with higher metabolic activation in brain regions associated with interoception and show lower activation for positive internal signals (Berk et al., 2015).

In contrast, in the present dissertation, interoceptive sensibility, as measured by the selfreport questionnaire in Study 2, appeared to be a protective factor in reducing the relation between emotion regulation and adolescent alcohol use. This may be mainly due to the fact that the Multidimensional Assessment of Interoceptive Awareness (Mehling et al., 2012) is highly associated with the concept of mindfulness (Machorrinho et al., 2019). Mindfulness is defined as the ability to be aware and focused in the present moment without judging or reacting to external or internal stimuli (Kabat-Zinn, 1990) and has a very strong link to interoceptive perception (Fletcher et al., 2010). Increased mindfulness is also associated with attentional and cognitive control processes (K. W. Brown & Ryan, 2003), as well as improved impulse inhibition (Lyvers et al., 2014), emotion regulation (K. W. Brown & Ryan, 2003) and attentional control (Baer et al., 2006). Mindfulness also appears to have a direct positive effect on alcohol use (Charles, 2010; Fernandez et al., 2010; Karyadi et al., 2014) and through training also improves attention (Jha et al., 2007). In terms of the PBT, therefore, mindfulness appears to be a protective factor that has an indirect effect on the problem behavior alcohol use via moderation of the influences of risk factors, as well as a direct effect. In this context, the selfreport findings from Study 2 can also be interpreted as hinting at a protective factor in terms of mindfulness, which weakens the relation between emotion regulation and alcohol use.

3.2.4 Emotion regulation

The results of Study 2 support previous research in that a lack of emotion regulation appears to be a risk factor for increased alcohol use in adolescence (Nawi et al., 2021; Estévez et al., 2017; King et al., 2023). The literature mainly discusses response-focused emotion regulation strategies, such as suppression and rumination (Gross, 1998; Brandstätter et al., 2018b; Nolen-Hoeksema, 2012), as risk factors for increased alcohol use (Norberg et al., 2016; Devynck et al., 2019). On the other hand, the use of antecedent-focused strategies like reappraisal appear to have a protective effect on the use of alcohol and other drugs (Norberg et al., 2016; Fucito et al., 2010; Laghi et al., 2021). In addition to findings that adolescents have more difficulties in successfully using reappraisal (Silvers et al., 2012), the results of Study 2 showed that a lack of reappraisal strategies was associated with increased alcohol use. Emotion regulation seems to have an effect mainly on the amount of alcohol used and the frequency of binge drinking, although the two alcohol measures are undoubtedly related, as more frequent binge drinking goes along with a generally higher amount of alcohol. Interestingly, compared to alcohol frequency, a different underlying mechanism seems to be at work here, and alcohol may be used primarily as a coping strategy to deal with negative emotions (Lazarus & Folkman,

1984). Thus, this dissertation builds on work that has focused primarily on the relation between alcohol misuse, for example in the form of binge drinking, and emotion regulation, and shows that emotion regulation difficulties are associated with increased binge drinking (Benzerouk et al., 2022; Laghi, Liga, & Pompili, 2018; Lannoy et al., 2021). Thus, a lack in emotion regulation can certainly be seen as a risk factor for the problem behavior of alcohol use in the sense of PBT.

In Study 2, lower emotion regulation also interacted with lower empathy in their effect on alcohol use. This may indicate a relation that has been found in previous research, but was not explicitly investigated here: reappraisal is associated with higher affective empathy and increased prosocial behavior (Laghi, Lonigro, et al., 2018). This may illustrate a part of social skills, namely emotional competence, that comprise both mechanisms (Saarni, 1999) and has already been discussed in section 3.2.2. It should also be noted that children and adolescents with maladaptive emotion regulation strategies also tend to have poorer social outcomes, such as less emotion-sharing, less social support and less closeness to peers (Gross & John, 2003; Srivastava et al., 2009; Laghi, Lonigro, et al., 2018). Thus, emotion regulation could not only be a risk factor for the problem behavior of alcohol use, but could also affect the PBT systems of "social context" and "perceived environment".

3.2.5 Macrosocial factors: the COVID-19 pandemic

Macrosocial changes, such as economic crises or pandemics, can occur rather unexpectedly and can be seen as stressful societal experiences. These experiences often have negative consequences for mental health, such as triggering problem behavior (see section 1.4.2). The recent COVID-19 pandemic can also be classified as such an unexpected and stressful societal experience.

The results of Study 3 did not replicate previous research which had shown that the COVID-19 pandemic led to increased feelings of isolation (Ellis et al., 2020; Liang et al., 2020), more depressive symptoms (Bignardi et al., 2020; Loades et al., 2020) and more stress (Twenge & Joiner, 2020; Qiu et al., 2020), factors commonly associated with increased risk of alcohol use (Dumas et al., 2020; Pelham et al., 2021). In Study 3, only a general negative trend was observed for psychosocial factors and emotional experiences like negative thoughts.

In addition, studies show mixed results on the impact of the COVID-19 pandemic on alcohol use, depending on the country and the alcohol measure examined, for example general drinking frequency versus frequency of heavy episodic drinking (Sohi et al., 2022). For instance, during the COVID-19 pandemic, there was a general decline in alcohol use (Sohi et al., 2011) and the country and the country and the alcohol use a general decline in alcohol use (Sohi et al., 2011).

al., 2022; Patrick et al., 2022; Kilian et al., 2022), and adolescents' alcohol use habits remained unchanged (Kapetanovic et al., 2022), which is further corroborated by the results of Study 3. However, for individuals who had expressed problematic patterns of alcohol use already prior to the pandemic, there was an increase in alcohol use during the COVID-19 pandemic (Kilian et al., 2022; Patrick et al., 2022).

Other studies have shown that the increase of alcohol use during the COVID-19 pandemic is certainly related to other (risk) factors, such as changes in context (e.g., loss of income), individual variables (e.g., younger age) and the presence of depressive symptoms (Acuff et al., 2022; Baptist Mohseni et al., 2022). The findings of Study 3 point in a similar direction, as negative thoughts, but not the COVID-19 experience itself, were positively correlated with and partly predicted increased alcohol use. Here, negative thoughts can be interpreted as a sign of depressive symptoms, which are linked to alcohol use (Dixit & Crum, 2000), and rumination, which is a maladaptive emotion regulation strategy (see section 3.2.4).

The results considered suggest that the effects of the COVID-19 pandemic do not only directly affect adolescent alcohol use, but should always be considered in interaction with other risk factors from other PBT systems (Bountress et al., 2022) and may only become apparent in the longer term. This also reflects what studies have found in previous crises and pandemics, which have commonly found that such stressful societal experiences are primarily associated with risk factors of alcohol use. These include increased stress and the occurrence of post-traumatic stress disorder symptoms (Chua et al., 2004; T. M. C. Lee et al., 2006; Reynolds et al., 2008), and depression and anxiety symptoms (Sargent-Cox et al., 2011). In general, therefore, stressful societal experiences such as the COVID-19 pandemic can be considered as risk factor for the development of problem behaviors in the sense of PBT. In this context, as the findings of Study 3 also show, mindfulness may be a relevant protective factor in such unexpectedly stressful situations, as it not only shows moderating effects between negative thoughts and alcohol use, but also between emotion regulation and alcohol use in Study 2, as already discussed in section 3.2.3.

3.3 Limitations and implications

In addition to the limitations already discussed in the individual studies, some general limitations of the dissertation project should be noted. First, the primary focus was on a limited number of risk factors for the development of alcohol use. However, for a broader picture of adolescent development, there are also other key problem behaviors that should be taken into

account, besides alcohol use in its already complex and multifactorial etiological structure (Appleyard et al., 2005). These other key behaviors include the development of internalizing behaviors such as anxiety and depression, that often occur in adolescence (Ravens-Sieberer et al., 2008). In addition, some of the risk factors analyzed here were not related to each other in their influence on alcohol use, so other additional factors may be more important. For example, emotion regulation is highly associated with reward sensitivity (Aghajani et al., 2021; Kelley et al., 2019) and behavioral inhibition (Leen-Feldner et al., 2004). In turn, these factors are highly associated with alcohol use (Simons et al., 2017; Urošević et al., 2015; van Hemel-Ruiter et al., 2015; Peeters et al., 2017). Moreover, as the results on mindfulness show, protective factors also play a crucial role in the model of PBT, so future research should not only examine the interaction of risk factors, but also include more protective factors. Furthermore, these results might then be used to derive preventive steps, such as the promotion of social-emotional competence (Domitrovich et al., 2017; Malik & Furman, 1993). At the same time, future research should also take into account the personal and social functions of problem behavior, as it might serve as a solution to some developmental tasks, like PBT already postulates (Jessor, 1991). For example, in the case of alcohol use, it has been shown that adolescents perceive alcohol use as a social catalyst (Goldman, 2002; Kuntsche et al., 2005), as a way of enhancing their popularity (Dumas et al., 2020) or supporting their peer relationships and bonding to their peer group (S. A. Brown et al., 2009). Future research could also focus on analyzing such shortterm functions of alcohol use, adding yet another aspect to the complex interplay of influences on adolescent problem behaviors. On the way towards such a multifaceted picture, this dissertation provides an extension of previous findings on risk factors for adolescent alcohol use by not only analyzing factors that have received little attention, but also their relation to each other. This adds to the rather complex picture of factors influencing adolescent alcohol use and additionally provides information on a protective factor. Now, these factors and their associations can also be examined in the context of other problem behaviors such as depression.

Furthermore, the present dissertation primarily used questionnaire data and behavioral measures under experimental conditions, both of which required conscious ratings by the participants. Future research could combine the methods used here with functional magnetic resonance imaging or peripheral physiological measures such as skin conductance responses or heart rate variability to understand whether ratings can also be mapped to processes at a physiological level. It also provides an opportunity to take into account the neurobiological changes in the brain that are very important during adolescence (see section 1.2) and to study the mechanisms mentioned at a functional level.

In addition, the methods used restrict the ecological validity of the findings. The dissertation aimed to understand the underlying mechanisms of alcohol use. For this purpose the used methods were appropriate, but could be complemented in future research by novel methods that better reflect the reality of everyday life. For example, ecological momentary assessment could help to examine the association between risk factors in adolescents' everyday lives (Wray et al., 2014), as has already been shown for emotions (Silk et al., 2003; Maciejewski et al., 2015) and their direct influence on alcohol use (Kashdan et al., 2010; Dvorak et al., 2014). Empathy is also an emotion that arises primarily through direct contact and interaction with other people (Roth et al., 2016) and therefore was only measured indirectly but on a behavioral level in this dissertation. Here the dissertation extends previous research mainly using questionnaires to assess affective empathy (e.g., Nachane et al., 2021; Ainley et al., 2015; Ardenghi et al., 2023). Methods such as virtual reality could complete this approach and measure empathy in direct interaction with an avatar or another person in a standardized virtual environment. Virtual reality might also be considered in the context of bullying surveys, as bullying assessment methods have been limited to self-report or very large survey methods (e.g., Rivers et al., 2009; Espelage et al., 2003).

As Jessor (2001) describes, "all behavior is the result of person-environment interaction" (p. 65). Emotions, which motivate or are a consequence of behavior (Kleinginna & Kleinginna, 1981), and which are triggered by environmental situations and stimuli (Brandstätter et al., 2018a), appear to be particularly relevant in the context of problem behavior. However, the "behavior system" of PBT refers primarily to volitional behavior (F. M. Costa et al., 2007), and emotions are clearly underrepresented in the model. This may be due to the social-psychological orientation of the model (Jessor, 2001), but also to the fact that emotions change relatively quickly, whereas the PBT primarily includes stable, enduring factors. It can therefore be assumed that changes in the PBT systems only occur very slowly, if at all, whereas emotions can sometimes change in a matter of seconds, as the physiological component of emotions shows (LeDoux, 1996). Nevertheless, the results of this dissertation and earlier research on the motives for alcohol use (enhancing positive emotions and coping with negative emotions, Cooper et al., 1995; Arbeau et al., 2011) show that emotions and their regulation may be relevant factors in the development of problem behavior. Therefore, it seems reasonable to include emotions in the PBT model. However, one difficulty seems to be that emotions cannot be clearly assigned to one of the systems. Emotions can be part of a stable personality trait, as for example, in the form of neuroticism within the Big Five model (Goldberg, 1990; Zimmermann et al., 2018) (personality system), but they can also be seen as

a subsystem of behavioral characteristics (Singh, 2022), and can also play a central role in the social context (perceived environment system) (Brandstätter et al., 2018b). For this reason, an extension of the PBT could also include emotions as a further system that interacts with all the systems mentioned and thus allows a clearer differentiation of the systems (see Figure 8). Building on the results of this dissertation, future research could examine other components of emotions and analyze them in the context of the PBT. For example, the evaluation of emotions and stimuli (i.e., the cognitive component) has an impact not only on the development of emotions (Brandstätter et al., 2018c) but also on problem behavior, as studies on emotion in depression indicate (Vanderlind et al., 2020; Rottenberg, 2005; Mennin et al., 2007).

Figure 8

Scheme of Problem Behavior Theory domains of risk and protective factors extended by the system "Emotion"



Note. The parts marked in red correspond to the proposed extensions of the Problem Behavior Theory.

4 CONCLUSION

Adolescence is a period characterized by developmental tasks and a range of maladaptive behaviors, such as alcohol use. The factors that influence adolescent alcohol use are manifold and complex. Within the framework PBT, the studies in this dissertation provided relevant findings on risk factors and their interaction on alcohol use among adolescents. However, this also raises further questions.

Study 1 provided evidence that involvement in bullying, combined with lower affective empathy, is a risk factor for increased alcohol use. In addition, Study 2 showed that emotion regulation and interoceptive accuracy have a direct effect on adolescent drinking and that empathy only has a partial moderating role. Study 3 showed no direct effect of the COVID-19 pandemic on alcohol use and negative thoughts, but increased negative thoughts were associated with increased alcohol use. This effect was attenuated by mindfulness. In summary, the studies presented were not only able to demonstrate direct effects on alcohol use among adolescents. The interactions assumed in the PBT were also partially supported by the studies. In addition, Study 2 and 3 also showed the effect of a protective factor, namely mindfulness.

The presented results indicate that other risk factors and protective factors may also have a relevant influence on alcohol use in adolescence. It appears to be necessary to examine these relevant factors together in order to understand their mode of action and to obtain a comprehensive picture of adolescent alcohol use in the context of this sensible developmental phase. Furthermore, it also seems necessary to look at different problem behaviors in combination, in order to assess common risk factors, so that the results can be used to develop more specified interventions and prevention approaches.

5 SUMMARY

5.1 Summary

Risk factors for adolescent alcohol use are multifactorial and complex. In line with Problem Behavior Theory (PBT), this dissertation investigated the impact and interaction of the risk factors bullying, empathy, emotion regulation, interoception and the COVID-19 pandemic on adolescent alcohol use.

In Study 1, 2,165 adolescents in a longitudinal study completed self-report questionnaires about their involvement in bullying (active and passive), their empathy and alcohol use at two time points. Active bullying, especially among male participants, showed a positive association with increased alcohol use at both time points. This effect was stronger in participants with higher cognitive empathy levels at time 1, and it was reduced for higher affective empathy levels at time 2. The results suggest that psychopathology may be an underlying factor associated not only with reduced affective empathy, but also with increased alcohol use.

Study 2 revisited the concept of empathy and examined it in relation to emotion regulation and interoception. For this purpose, 72 adolescents completed three different tasks in the laboratory. Emotion regulation was measured using an emotion regulation task, empathy was measured using the EmpaToM task and the Heartbeat Counting Task (HCT), and a questionnaire was used to assess interoception. Alcohol use was assessed using the Time Line Follow Back Interview. The results of the study replicated previous research showing that deficits in emotion regulation are associated with increased alcohol use. Emotion regulation was primarily associated with the amount of alcohol used and the frequency of binge drinking. A lack of affective empathy strengthened the relationship between emotion regulation and the amount of alcohol used. In addition, higher interoception, as measured by questionnaire, had a protective effect on the relationship between emotion regulation and the amount of alcohol used and binge drinking. These relations were particularly relevant for the 16-year-old participants. Increased interoception, measured by the HCT, was also positively associated with increased alcohol frequency. The results of Study 2 suggest that emotion regulation and interoception have different effects on different mechanisms of alcohol use, and that empathy is more indirectly related to alcohol use. In addition, self-report interoception seems to have a protective influence. Here, increased interoception seem to be associated with the concept of mindfulness.

Study 3 focused on a recent macrosocial stressful experience, the COVID-19 pandemic, and its influence on negative thoughts and alcohol use among adolescents. For this purpose, 21 adolescents from Study 2 were surveyed online over a period of six weeks during the first wave of the COVID-19 pandemic in Germany. Among other questions, they were asked about the occurrence of negative thoughts and their alcohol use. The results of Study 3 show no direct effect of the COVID-19 pandemic on negative thoughts or alcohol use, but a general negative trend in negative thoughts was observed. Negative thoughts were positively correlated with alcohol use over the study period. Negative thoughts at the end of the first COVID-19 wave predicted alcohol use at the beginning of the second COVID-19 wave in Germany. In addition, mindfulness moderated this relation, with highly mindful adolescents using less alcohol use as negative thoughts increased. Even if the COVID-19 pandemic did not have an immediate effect on alcohol use, the consequences may only become apparent in the long term, as the COVID-19 pandemic could affect risk factors of alcohol use, as was the case with other stressful societal experiences. Here, mindfulness seems to have a significant protective effect.

The results of the three studies were discussed in detail in relation to current research on each risk factor and their interaction and in accordance with the PBT framework. It is also suggested that the risk factors identified in the present dissertation should be considered more comprehensively in terms of their interaction with protective factors and examined in relation to other problem behaviors.

5.2 Zusammenfassung

Die Risikofaktoren für jugendlichen Alkoholkonsum sind multifaktoriell und komplex. Entlang der Problem Behavior Theory (PBT) wurden in der vorliegenden Arbeit die Wirkweise und Interaktion der Risikofaktoren Mobbing, Empathie, Emotionsregulation, Interozeption und der COVID-19 Pandemie auf den Alkoholkonsum Jugendlicher untersucht.

In Studie 1 gaben in einem längsschnittlichen Verlauf 2.165 Jugendliche zu zwei Zeitpunkten über Selbstberichtsfragebögen Auskunft über ihre Beteiligung an Mobbing (aktiv und passiv), ihre empathischen Fähigkeiten und ihren Alkoholkonsum. Dabei zeigte vor allem aktives Mobbing unter männlichen Teilnehmern einen positiven Zusammenhang mit vermehrtem Alkoholkonsum zu beiden Zeitpunkten. Dieser Effekt wurde durch erhöhte kognitive Empathie zu Zeitpunkt 1 und eine reduzierte affektive Empathie zu Zeitpunkt 2 verstärkt. Die Ergebnisse deuten auf Psychopathologie als einen zugrundeliegenden Faktor hin,

der nicht nur mit reduzierter Empathie, sondern auch mit vermehrtem antisozialen Verhalten und erhöhtem Alkoholkonsum assoziiert ist.

In Studie 2 wurde das Konzept der Empathie noch einmal aufgegriffen und im Zusammenhang mit Emotionsregulation und Interozeption untersucht. Hierfür durchliefen 72 Jugendliche drei verschiedene Aufgaben im Labor. Emotionsregulation wurde mittels einer Emotionsregulationsaufgabe erfasst, Empathie anhand der EmpaToM Task gemessen und die Heartbeat Counting Task (HCT) sowie ein Fragebogen zur Einschätzung von Interozeption herangezogen. Alkoholkonsum wurde mittels des Time Line Follow Back Interviews erfasst. Die Studienergebnisse replizieren frühere Forschung, wonach Defizite in der Emotionsregulation mit einem erhöhten Alkoholkonsum assoziiert sind. Hierbei war Emotionsregulation vornehmlich mit der Menge des konsumierten Alkohols und der Häufigkeit des Binge Drinkings assoziiert. Ein Mangel an affektiver Empathie wirkte sich verstärkend auf den Zusammenhang von Emotionsregulation und der Alkoholmenge aus. Außerdem wirkte höhere Interozeption, gemessen anhand des Fragebogens, protektiv auf den Zusammenhang zwischen Emotionsregulation und Alkoholmenge sowie Binge Drinking. Diese Zusammenhänge zeigten sich vor allem bei 16-jährigen Teilnehmern als besonders relevant. Erhöhte Interozeption, gemessen mit der HCT, war zudem positiv mit vermehrter Trinkhäufigkeit assoziiert. Die Ergebnisse von Studie 2 deuten darauf hin, dass Emotionsregulation und Interozeption auf verschiedene Mechanismen des Alkoholkonsums unterschiedlich wirken und Empathie eher indirekt mit dem Alkoholkonsum assoziiert ist. Außerdem scheint Interozeption in Form des Fragebogenmaßes einen protektiven Einfluss zu haben. Hier scheitn die erhöhte Interozeption mit dem Konzept der Achtsamkeit in Verbindung zu stehen.

Studie 3 beschäftigte sich mit dem Einfluss einer kürzlich aufgetretenen makrosozialen Stresserfahrung, der COVID-19 Pandemie, auf negative Gedanken und den Alkoholkonsum Jugendlicher. Hierfür wurden 21 Jugendliche der Studie 2 mittels einer Onlineerhebung über einen Zeitraum von sechs Wochen innerhalb der ersten COVID-19-Pandemie-Welle in Deutschland befragt. Unter anderem wurden sie zum Auftreten negativer Gedanken und ihrem Alkoholkonsum befragt. Die Ergebnisse von Studie 3 zeigen keinen direkten Einfluss der COVID-19-Pandemie auf negative Gedanken oder den Alkoholkonsum, jedoch war ein genereller negativer Trend in negativen Gedanken zu beobachten. Negative Gedanken waren über den Erhebungszeitraum positiv mit dem Alkoholkonsum korreliert. Hierbei sagten negative Gedanken zum Ende der ersten COVID-19 Welle den Alkoholkonsum zu Beginn der zweiten COVID-19 Welle in Deutschland voraus. Außerdem moderierte Achtsamkeit diesen

162

Zusammenhang, wobei hoch achtsame Jugendliche bei vermehrten negativen Gedanken weniger Alkohol konsumierten, wohingegen wenig achtsame Jugendliche einen erhöhten Alkoholkonsum bei negativen Gedanken berichteten. Auch wenn die COVID-19 Pandemie keinen direkten Einfluss auf den Alkoholkonsum zeigte, können die Folgen erst auf lange Sicht deutlich werden, da die COVID-19 Pandemie Risikofaktoren für den Alkoholkonsum beeinflussen könnte, wie es bei anderen makrosozialen Stresserfahrungen der Fall war. Achtsamkeit scheint hier einen wesentlichen protektiven Einfluss zu haben.

Die Ergebnisse der drei Studien werden im Hinblick auf aktuelle Forschung der einzelnen Facetten ausführlich und in Übereinstimmung mit der PBT diskutiert. Zudem wird vorgeschlagen, die in der vorliegenden Arbeit identifizierten Risikofaktoren im Hinblick auf ihre Interaktion mit protektiven Faktoren umfassender zu betrachten und im Hinblick auf andere Problemverhaltensweisen zu untersuchen.

6 REFERENCES

- Achenbach, T. M. (1966). The classification of children's psychiatric symptoms: A factor-analytic study. *Psychological Monographs*, 80(7), 1–37. https://doi.org/10.1037/h0093906
- Acuff, S. F., Strickland, J. C., Tucker, J. A., & Murphy, J. G. (2022). Changes in alcohol use during COVID-19 and associations with contextual and individual difference variables: A systematic review and meta-analysis. *Psychology of Addictive Behaviors : Journal of the Society of Psychologists in Addictive Behaviors*, 36(1), 1–19. https://doi.org/10.1037/adb0000796
- Adan, A., Forero, D. A., & Navarro, J. F. (2017). Personality traits related to binge drinking: A systematic review. *Frontiers in Psychiatry*, *8*, 134. https://doi.org/10.3389/fpsyt.2017.00134
- Aghajani, M., Izadi, M., Farrokhi, N., & Hassani, F. (2021). Emotional dysregulation symptoms based on sensitivity to punishment and reward and intensity mediated by emotion regulation. *Practice in Clinical Psychology*, 9(2), 153–164. https://doi.org/10.32598/jpcp.9.2.771.1
- Ainley, V., Maister, L., & Tsakiris, M. (2015). Heartfelt empathy? No association between interoceptive awareness, questionnaire measures of empathy, reading the mind in the eyes task or the director task. *Frontiers in Psychology*, *6*, 554. https://doi.org/10.3389/fpsyg.2015.00554
- Albert, D., Chein, J., & Steinberg, L. D. (2013). Peer influences on adolescent decision making. *Current Directions in Psychological Science*, 22(2), 114–120. https://doi.org/10.1177/0963721412471347
- Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review*, 30(2), 217–237. https://doi.org/10.1016/j.cpr.2009.11.004
- Anderson, S. L., Zheng, Y., & McMahon, R. J. (2018). Do callous-unemotional traits and conduct disorder symptoms predict the onset and development of adolescent substance use? *Child Psychiatry and Human Development*, 49(5), 688–698. https://doi.org/10.1007/s10578-018-0789-5

- Appleyard, K., Egeland, B., van Dulmen, M. H. M., & Sroufe, L. A. (2005). When more is not better: The role of cumulative risk in child behavior outcomes. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, 46(3), 235–245. https://doi.org/10.1111/j.1469-7610.2004.00351.x
- Arbeau, K. J., Kuiken, D., & Wild, T. C. (2011). Drinking to enhance and to cope: A daily process study of motive specificity. *Addictive Behaviors*, *36*(12), 1174–1183. https://doi.org/10.1016/j.addbeh.2011.07.020
- Ardenghi, S., Russo, S., Bani, M., Rampoldi, G., & Strepparava, M. G. (2023). The role of difficulties in emotion regulation in predicting empathy and patient-centeredness in preclinical medical students: A cross-sectional study. *Psychology, Health & Medicine*, 28(5), 1215–1229. https://doi.org/10.1080/13548506.2021.2001549
- Arnett, J. J. (2015). *Emerging adulthood: The winding road from the late teens through the twenties* (2. ed.). Oxford Univ. Press.
- Ateş Çöl, I., Sönmez, M. B., & Vardar, M. E. (2016). Evaluation of interoceptive awareness in alcohol-addicted patients. *Noro Psikiyatri Arsivi*, 53(1), 17–22. https://doi.org/10.5152/npa.2015.9898
- Babicka-Wirkus, A., Kozłowski, P., Wirkus, Ł., & Stasiak, K. (2023). Internalizing and externalizing disorder levels among adolescents: Data from Poland. *International Journal of Environmental Research and Public Health*, 20(3). https://doi.org/10.3390/ijerph20032752
- Bach, R. A., Defever, A. M., Chopik, W. J., & Konrath, S. H. (2017). Geographic variation in empathy: A state-level analysis. *Journal of Research in Personality*, 68, 124–130. https://doi.org/10.1016/j.jrp.2016.12.007
- Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment*, 13(1), 27–45. https://doi.org/10.1177/1073191105283504
- Baptist Mohseni, N., Morris, V., Vedelago, L., Kempe, T., Rapinda, K., Mesmer, E., Bilevicius, E., Wardell, J. D., MacKillop, J., & Keough, M. T. (2022). A longitudinal approach to understanding risk factors for problem alcohol use during the COVID-19 pandemic. *Alcoholism: Clinical and Experimental Research*, *46*(3), 434–446. https://doi.org/10.1111/acer.14774
- Barnes, J. (2012, April 13). Le Grand Meaulnes revisited. *The Guardian*. https://www.theguardian.com/books/2012/apr/13/grand-meaulnes-wanderer-julian-barnes

- Bartsch, L. A., King, K. A., Vidourek, R. A., & Merianos, A. L. (2017). Self-esteem and alcohol use among youths. *Journal of Child & Adolescent Substance Abuse*, 26(5), 414–424. https://doi.org/10.1080/1067828X.2017.1322018
- Batson, C. D. (2011). These things called empathy: Eight related but distinct phenomena. In J.
 Decety & W. J. Ickes (Eds.), *A Bradford book. The social neuroscience of empathy* (pp. 3–15). MIT Press.
- Bengel, J., & Jerusalem, M. (2009). *Handbuch der Gesundheitspsychologie und medizinischen Psychologie*. Hogrefe.
- Benzerouk, F., Djerada, Z., Naassila, M., Barrière, S., Kaladjian, A., & Gierski, F. (2022).
 Role of impulsivity and emotion dysregulation dimensions on core characteristics of binge drinking among university students. *Psychologica Belgica*, 62(1), 286–296.
 https://doi.org/10.5334/pb.1167
- Berk, L., Stewart, J. L., May, A. C., Wiers, R. W., Davenport, P. W., Paulus, M. P., & Tapert, S. F. (2015). Under pressure: Adolescent substance users show exaggerated neural processing of aversive interoceptive stimuli. *Addiction (Abingdon, England)*, 110(12), 2025–2036. https://doi.org/10.1111/add.13090
- Bignardi, G., Dalmaijer, E. S., Anwyl-Irvine, A. L., Smith, T. A., Siugzdaite, R., Uh, S., & Astle, D. E. (2020). Longitudinal increases in childhood depression symptoms during the COVID-19 lockdown. *Archives of Disease in Childhood*, *106*(8), 791–797. https://doi.org/10.1136/archdischild-2020-320372
- Block-Lerner, J., Adair, C., Plumb, J. C., Rhatigan, D. L., & Orsillo, S. M. (2007). The case for mindfulness-based approaches in the cultivation of empathy: Does nonjudgmental, present-moment awareness increase capacity for perspective-taking and empathic concern? *Journal of Marital and Family Therapy*, 33(4), 501–516. https://doi.org/10.1111/j.1752-
- BMFSFJ. (2017). 15. Kinder- und Jugendbericht. Bericht über die Lebenssituation junger Menschen und die Leistungen der Kinder- und Jugendhilfe in Deutschland. BMFSFJ.
- Bountress, K. E., Cusack, S. E., Conley, A. H., Aggen, S. H., The, S. F. S. W. G., Vassileva, J., Dick, D. M., & Amstadter, A. B. (2022). The COVID-19 pandemic impacts psychiatric outcomes and alcohol use among college students. *European Journal of Psychotraumatology*, 13(1), 2022279. https://doi.org/10.1080/20008198.2021.2022279

- Bowker, J. C., Rubin, K. H., Buskirk-Cohen, A., Rose-Krasnor, L., & Booth-Laforce, C. (2010). Behavioral changes predicting temporal changes in perceived popular status. *Journal of Applied Developmental Psychology*, *31*(2), 126–133. https://doi.org/10.1016/j.appdev.2009.10.002
- Brandstätter, V., Schüler, J., Puca, R. M., & Lozo, L. (2018a). Emotion als psychologisches Konzept. In V. Brandstätter, J. Schüler, R. M. Puca, & L. Lozo (Eds.), *Motivation und Emotion* (2nd ed., pp. 163–182). Springer Berlin Heidelberg.
- Brandstätter, V., Schüler, J., Puca, R. M., & Lozo, L. (2018b). Emotionspsychologische Forschungsmethoden. In V. Brandstätter, J. Schüler, R. M. Puca, & L. Lozo (Eds.), *Motivation und Emotion* (2nd ed., pp. 183–200). Springer Berlin Heidelberg.
- Brandstätter, V., Schüler, J., Puca, R. M., & Lozo, L. (2018c). Emotionsregulation. In V.
 Brandstätter, J. Schüler, R. M. Puca, & L. Lozo (Eds.), *Motivation und Emotion* (2nd ed., 221-238). Springer Berlin Heidelberg.
- Brandstätter, V., Schüler, J., Puca, R. M., & Lozo, L. (2018d). Forschungsansätze und Emotionstheorien. In V. Brandstätter, J. Schüler, R. M. Puca, & L. Lozo (Eds.), *Motivation und Emotion* (2nd ed., pp. 201–219). Springer Berlin Heidelberg.
- Breehl, L., & Caban, O. (2023). StatPearls: Physiology, Puberty.
- Brewer, R., Murphy, J., & Bird, G. (2021). Atypical interoception as a common risk factor for psychopathology: A review. *Neuroscience and Biobehavioral Reviews*, 130, 470–508. https://doi.org/10.1016/j.neubiorev.2021.07.036
- Brière, F. N., Rohde, P., Seeley, J. R., Klein, D., & Lewinsohn, P. M. (2014). Comorbidity between major depression and alcohol use disorder from adolescence to adulthood. *Comprehensive Psychiatry*, 55(3), 526–533. https://doi.org/10.1016/j.comppsych.2013.10.007
- Bronfenbrenner, U. (1979). Contexts of child rearing: Problems and prospects. *American Psychologist*, *34*(10), 844–850. https://doi.org/10.1037/0003-066X.34.10.844
- Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, *84*(4), 822–848. https://doi.org/10.1037/0022-3514.84.4.822
- Brown, S. A., McGue, M [Matthew], Maggs, J., Schulenberg, J., Hingson, R., Swartzwelder, S., Martin, C., Chung, T., Tapert, S. F., Sher, K., Winters, K. C., Lowman, C., & Murphy, S. (2009). Underage alcohol use: Summary of developmental processes and mechanisms: Ages 16–20. *Alcohol Research & Health*, 1(32), 41–52.

- Buhrmester, D. (1990). Intimacy of friendship, interpersonal competence, and adjustment during preadolescence and adolescence. *Child Development*, *61*(4), 1101. https://doi.org/10.2307/1130878
- Bukowski, W. M., Buhrmester, D., & Underwood, M. K. (2011). Peer relations as a developmental context. In M. K. Underwood & L. H. Rosen (Eds.), *Social development: Relationships in infancy, childhood, and adolescence* (pp. 153–179). Guilford Press.
- Bukowski, W. M., Sippola, L. K., & Newcomb, A. F. (2000). Variations in patterns of attraction of same- and other-sex peers during early adolescence. *Developmental Psychology*, 36(2), 147–154. https://doi.org/10.1037/0012-1649.36.2.147
- Cameron, O. G. (2001). Interoception: The inside story a model for psychosomatic processes. *Psychosomatic Medicine*, *63*(5), 697–710. https://doi.org/10.1097/00006842-200109000-00001.
- Cameron, O. G. (2002). *Visceral sensory neuroscience: Interoception*. Oxford University Press.
- Canham, S. L., Mauro, P. M., Kaufmann, C. N., & Sixsmith, A. (2016). Association of alcohol use and loneliness frequency among middle-aged and older adult drinkers. *Journal of Aging and Health*, 28(2), 267–284. https://doi.org/10.1177/0898264315589579
- Carbone-Lopez, K., Esbensen, F.-A., & Brick, B. T. (2010). Correlates and consequences of peer victimization: Gender differences in direct and indirect forms of bullying. *Youth Violence and Juvenile Justice*, 8(4), 332–350. https://doi.org/10.1177/1541204010362954
- Carvalho, M., Branquinho, C., & Matos, M. G. de (2017). Bullies, victims and provocative victims in context: Discriminant factors in a Portuguese adolescent sample. *European Scientific Journal* (13 (20)), 23–36. https://doi.org/10.19044/esj.2017.v13n20p23
- Charles, D. (2010). *The role of mindfulness and acculturation in binge drinking behavior among Asian-American college students* [Doctoral dissertation]. Pacific University. http://commons.pacificu.edu/spp/143
- Chein, J., Albert, D., O'Brien, L., Uckert, K., & Steinberg, L. D. (2011). Peers increase adolescent risk taking by enhancing activity in the brain's reward circuitry. *Developmental Science*, 14(2), F1-10. https://doi.org/10.1111/j.1467-7687.2010.01035.x
- Chua, S. E., Cheung, V., Cheung, C., McAlonan, G. M., Wong, J. W. S., Cheung, E. P. T., Chan, M. T. Y., Wong, M. M. C., Tang, S. W., Choy, K. M., Wong, M. K., Chu, C. M., & Tsang, K. W. T. (2004). Psychological effects of the SARS outbreak in Hong Kong on

high-risk health care workers. *Canadian Journal of Psychiatry. Revue Canadienne De Psychiatrie*, 49(6), 391–393. https://doi.org/10.1177/070674370404900609

- Conrod, P. J., & Nikolaou, K. (2016). Annual research review: On the developmental neuropsychology of substance use disorders. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, 57(3), 371–394. https://doi.org/10.1111/jcpp.12516
- Coombes, S. A., Higgins, T., Gamble, K. M., Cauraugh, J. H., & Janelle, C. M. (2009). Attentional control theory: Anxiety, emotion, and motor planning. *Journal of Anxiety Disorders*, 23(8), 1072–1079. https://doi.org/10.1016/j.janxdis.2009.07.009
- Cooper, M. L., Frone, M. R., Russell, M., & Mudar, P. (1995). Drinking to regulate positive and negative emotions: A motivational model of alcohol use. *Journal of Personality and Social Psychology*, 69(5), 990–1005. https://doi.org/10.1037//0022-3514.69.5.990
- Costa, F. M., Jessor, R., & Turbin, M. S. (2007). College student involvement in cigarette smoking: The role of psychosocial and behavioral protection and risk. *Nicotine & Tobacco Research: Official Journal of the Society for Research on Nicotine and Tobacco*, 9(2), 213– 224. https://doi.org/10.1080/14622200601078558
- Costa, M. d. A., Salum Junior, G. A., Isolan, L. R., Acosta, J. R., Jarros, R. B., Blaya, C., Diemen, L. von, & Manfro, G. G. (2013). Association between anxiety symptoms and problematic alcohol use in adolescents. *Trends in Psychiatry and Psychotherapy*, 35(2), 106– 110. https://doi.org/10.1590/S2237-60892013000200003
- Craig, A. D. (2003). Interoception: The sense of the physiological condition of the body. *Current Opinion in Neurobiology*, *13*(4), 500–505. https://doi.org/10.1016/s0959-4388(03)00090-4
- Dadds, M. R., Hawes, D. J., Frost, A. D. J., Vassallo, S., Bunn, P., Hunter, K., & Merz, S. (2009). Learning to 'talk the talk': The relationship of psychopathic traits to deficits in empathy across childhood. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, 50(5), 599–606. https://doi.org/10.1111/j.1469-7610.2008.02058.x
- Darwin, C. (1872). The expression of emotions in man and animals. Oxford University Press.
- Davis, M. H. (1980). A multidimensional approach to individual differences in empathy. *JSAS Catalog of Selected Documents in Psychology*, *10*, 85.
- Decety, J., & Moriguchi, Y. (2007). The empathic brain and its dysfunction in psychiatric populations: Implications for intervention across different clinical conditions. *BioPsychoSocial Medicine*, 1, 22. https://doi.org/10.1186/1751-0759-1-22

- Del Piero, L. B., Saxbe, D. E., & Margolin, G. (2016). Basic emotion processing and the adolescent brain: Task demands, analytic approaches, and trajectories of changes. *Developmental Cognitive Neuroscience*, 19, 174–189. https://doi.org/10.1016/j.dcn.2016.03.005
- Devynck, F., Rousseau, A., & Romo, L. (2019). Does repetitive negative thinking influence alcohol use? A systematic review of the literature. *Frontiers in Psychology*, 10, 1482. https://doi.org/10.3389/fpsyg.2019.01482
- Diego, M. A., Field, T. M., & Sanders, C. E. (2003). Academic performance, popularity, and depression predict adolescent substance abuse. *Adolescence* (38), 35–42.
- Dixit, A. R., & Crum, R. M. (2000). Prospective study of depression and the risk of heavy alcohol use in women. *The American Journal of Psychiatry*, 157(5), 751–758. https://doi.org/10.1176/appi.ajp.157.5.751
- Domitrovich, C. E., Durlak, J. A., Staley, K. C., & Weissberg, R. P. (2017). Social-emotional competence: An essential factor for promoting positive adjustment and reducing risk in school children. *Child Development*, 88(2), 408–416. https://doi.org/10.1111/cdev.12739
- Dreher, E., & Dreher, M. (1985). Entwicklungsaufgaben im Jugendalter: Bedeutsamkeit und Bewältigungskonzepte. In D. Liepmann & A. Stiksrud (Eds.), *Entwicklungsaufgaben und Bewältigungsprobleme in der Adoleszenz* (pp. 56–70). Hogrefe.
- Dumas, T. M., Ellis, W., & Litt, D. M. (2020). What does adolescent substance use look like during the COVID-19 pandemic? Examining changes in frequency, social contexts, and pandemic-related predictors. *The Journal of Adolescent Health : Official Publication of the Society for Adolescent Medicine*, 67(3), 354–361. https://doi.org/10.1016/j.jadohealth.2020.06.018
- Dvorak, R. D., Pearson, M. R., & Day, A. M. (2014). Ecological momentary assessment of acute alcohol use disorder symptoms: Associations with mood, motives, and use on planned drinking days. *Experimental and Clinical Psychopharmacology*, 22(4), 285–297. https://doi.org/10.1037/a0037157
- Egondi, T., Kabiru, C., Beguy, D., Kanyiva, M., & Jessor, R. (2013). Adolescent home-leaving and the transition to adulthood: A psychosocial and behavioural study in the slums of Nairobi. *International Journal of Behavioral Development*, *37*(4), 298–308. https://doi.org/10.1177/0165025413479299
- Ellis, W. E., Dumas, T. M., & Forbes, L. M. (2020). Physically isolated but socially connected: Psychological adjustment and stress among adolescents during the initial COVID-

19 crisis. *Canadian Journal of Behavioural Science / Revue Canadienne Des Sciences Du Comportement*, *52*(3), 177–187. https://doi.org/10.1037/cbs0000215

EMCDDA. (2011). *Statistical Bulletin 2011: Treatment Demand Indicator*. Publications Office of the European Union. https://doi.org/10.2810/44330

Erikson, E. H. (1973). Identität und Lebenszyklus. Suhrkamp.

- Ernst, J., Northoff, G., Böker, H., Seifritz, E., & Grimm, S. (2013). Interoceptive awareness enhances neural activity during empathy. *Human Brain Mapping*, *34*(7), 1615–1624. https://doi.org/10.1002/hbm.22014
- Ernst, M. (2014). The triadic model perspective for the study of adolescent motivated behavior. *Brain and Cognition*, *89*, 104–111. https://doi.org/10.1016/j.bandc.2014.01.006
- Ernst, M., & Fudge, J. L. (2009). A developmental neurobiological model of motivated behavior: Anatomy, connectivity and ontogeny of the triadic nodes. *Neuroscience and Biobehavioral Reviews*, 33(3), 367–382. https://doi.org/10.1016/j.neubiorev.2008.10.009
- Ernst, M., Pine, D. S., & Hardin, M. (2006). Triadic model of the neurobiology of motivated behavior in adolescence. *Psychological Medicine*, *36*(3), 299–312. https://doi.org/10.1017/S0033291705005891
- Ernst, M., Romeo, R. D., & Andersen, S. L. (2009). Neurobiology of the development of motivated behaviors in adolescence: A window into a neural systems model. *Pharmacology, Biochemistry, and Behavior*, 93(3), 199–211. https://doi.org/10.1016/j.pbb.2008.12.013
- Espelage, D. L., Holt, M. K., & Henkel, R. R. (2003). Examination of peer-group contextual effects on aggression during early adolescence. *Child Development*, *74*(1), 205–220. https://doi.org/10.1111/1467-8624.00531
- Estévez, A., Jáuregui, P., Sánchez-Marcos, I., López-González, H., & Griffiths, M. D. (2017).
 Attachment and emotion regulation in substance addictions and behavioral addictions. *Journal of Behavioral Addictions*, 6(4), 534–544. https://doi.org/10.1556/2006.6.2017.086
- Faller, H., & Schowalter, M. (2019). Theoretische Grundlagen. In H. Faller & H. Lang (Eds.), Medizinische Psychologie und Soziologie (5th ed., pp. 109–220). Springer Berlin Heidelberg.
- Fanti, K. A., Frick, P. J., & Georgiou, S. (2009). Linking callous-unemotional traits to instrumental and non-instrumental forms of aggression. *Journal of Psychopathology and Behavioral Assessment*, 31(4), 285–298. https://doi.org/10.1007/s10862-008-9111-3

- Fernandez, A. C., Wood, M. D., Stein, L. A. R., & Rossi, J. S. (2010). Measuring mindfulness and examining its relationship with alcohol use and negative consequences. *Psychology of Addictive Behaviors: Journal of the Society of Psychologists in Addictive Behaviors*, 24(4), 608–616. https://doi.org/10.1037/a0021742
- Fischer, A. H., Manstead, A. S. R., Evers, C., Timmers, M., & Valk, G. (2004). Motives and norms underlying emotion regulation. In P. Philippot & R. S. Feldman (Eds.), *The regulation of emotion* (pp. 189–210). Mahwah, NJ.
- Fletcher, L. B., Schoendorff, B., & Hayes, S. C. (2010). Searching for mindfulness in the brain: A process-oriented approach to examining the neural correlates of mindfulness. *Mindfulness*, 1(1), 41–63. https://doi.org/10.1007/s12671-010-0006-5
- Fucito, L. M., Juliano, L. M., & Toll, B. A. (2010). Cognitive reappraisal and expressive suppression emotion regulation strategies in cigarette smokers. *Nicotine & Tobacco Research: Official Journal of the Society for Research on Nicotine and Tobacco*, 12(11), 1156–1161. https://doi.org/10.1093/ntr/ntq146
- Garfinkel, S. N., Manassei, M. F., Hamilton-Fletcher, G., den Bosch, Y. in, Critchley, H. D., & Engels, M. (2016). Interoceptive dimensions across cardiac and respiratory axes. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 371(1708). https://doi.org/10.1098/rstb.2016.0014
- Garfinkel, S. N., Seth, A. K., Barrett, A. B., Suzuki, K., & Critchley, H. D. (2015). Knowing your own heart: Distinguishing interoceptive accuracy from interoceptive awareness. *Biological Psychology*, 104, 65–74. https://doi.org/10.1016/j.biopsycho.2014.11.004
- Giancola, P. R. (2003). The moderating effects of dispositional empathy on alcohol-related aggression in men and women. *Journal of Abnormal Psychology*, *112*(2), 275–281. https://doi.org/10.1037/0021-843X.112.2.275
- Goede, I. H. A. de, Branje, S. J. T., & Meeus, W. H. J. (2009). Developmental changes in adolescents' perceptions of relationships with their parents. *Journal of Youth and Adolescence*, *38*(1), 75–88. https://doi.org/10.1007/s10964-008-9286-7
- Gogtay, N., Giedd, J. N., Lusk, L., Hayashi, K. M., Greenstein, D., Vaituzis, A. C., Nugent, T. F., Herman, D. H., Clasen, L. S., Toga, A. W., Rapoport, J. L., & Thompson, P. M. (2004). Dynamic mapping of human cortical development during childhood through early adulthood. *Proceedings of the National Academy of Sciences of the United States of America*, *101*(21), 8174–8179. https://doi.org/10.1073/pnas.0402680101

- Goldberg, L. R. (1990). An alternative "description of personality": The big-five factor structure. *Journal of Personality and Social Psychology*, 59(6), 1216–1229. https://doi.org/10.1037/0022-3514.59.6.1216
- Goldman, M. S. (2002). Expectancy and risk for alcoholism: The unfortunate exploitation of a fundamental characteristic of neurobehavioral adaptation. *Alcoholism: Clinical and Experimental Research*, 26(5), 737–746. https://doi.org/10.1111/j.1530-0277.2002.tb02599.x
- Gross, J. J. (1998). Antecedent- and response-focused emotion regulation: Divergent consequences for experience, expression, and physiology. *Journal of Personality and Social Psychology*, 74(1), 224–237. https://doi.org/10.1037//0022-3514.74.1.224
- Gross, J. J. (2002). Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology*, *39*(3), 281–291. https://doi.org/10.1017/s0048577201393198
- Gross, J. J. (Ed.). (2007). Handbook of emotion regulation. Guilford Press.
- Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes:
 Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology*, 85(2), 348–362. https://doi.org/10.1037/0022-3514.85.2.348
- Gross, J. J., & Thompson, R. A. (2007). Emotion regulation: Conceptual foundations. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 3–24). Guilford Press.
- Grotevant, H. D., & Cooper, C. R. (1986). Individuation in family relationships. *Human De*velopment, 29(2), 82–100. https://doi.org/10.1159/000273025
- Grynberg, D., & Pollatos, O. (2015). Perceiving one's body shapes empathy. *Physiology & Behavior*, *140*, 54–60. https://doi.org/10.1016/j.physbeh.2014.12.026
- Guthrie Yarwood, M. (2022). *Psychology of human emotion: An open access textbook*. https://psu.pb.unizin.org/psych425/
- Harver, A., Katkin, E. S., & Bloch, E. (1993). Signal-detection outcomes on heartbeat and respiratory resistance detection tasks in male and female subjects. *Psychophysiology*, *30*(3), 223–230. https://doi.org/10.1111/j.1469-8986.1993.tb03347.x
- Hatfield, E., Cacioppo, J. T., & Rapson, R. L. (1994). *Emotional Contagion*. Cambridge University Press.
- Havighurst, R. J. (1948). Developmental tasks and education. David McKay.
- Herbert, B. M., Muth, E. R., Pollatos, O., & Herbert, C. (2012). Interoception across modalities: On the relationship between cardiac awareness and the sensitivity for gastric functions. *PloS One*, 7(5), e36646. https://doi.org/10.1371/journal.pone.0036646

- Herbert, B. M., & Pollatos, O. (2008). Interozeptive Sensitivität, Gefühle und Verhaltensregulation. *Zeitschrift Für Neuropsychologie*, 19(3), 125–137. https://doi.org/10.1024/1016-264X.19.3.125
- Herd, T., & Kim-Spoon, J. (2021). A systematic review of associations between adverse peer experiences and emotion regulation in adolescence. *Clinical Child and Family Psychology Review*, 24(1), 141–163. https://doi.org/10.1007/s10567-020-00337-x
- Hong, J. S., Davis, J. P., Sterzing, P. R., Yoon, J., Choi, S., & Smith, D. C. (2014). A conceptual framework for understanding the association between school bullying victimization and substance misuse. *Am J Orthopsychiatry*, 84(6), 696–710. https://doi.org/10.1037/ort0000036.
- Ishak, N. M., Abidin, M. H. Z., & Bakar, A. Y. A. (2014). Dimensions of social skills and their relationship with empathy among gifted and talented students in Malaysia. *Procedia -Social and Behavioral Sciences*, *116*, 750–753. https://doi.org/10.1016/j.sbspro.2014.01.292
- Jakubczyk, A., Skrzeszewski, J., Trucco, E. M., Suszek, H., Zaorska, J., Nowakowska, M., Michalska, A., Wojnar, M., & Kopera, M. (2019). Interoceptive accuracy and interoceptive sensibility in individuals with alcohol use disorder-different phenomena with different clinical correlations? *Drug and Alcohol Dependence*, 198, 34–38. https://doi.org/10.1016/j.drugalcdep.2019.01.036
- Jakubczyk, A., Trucco, E. M., Klimkiewicz, A., Skrzeszewski, J., Suszek, H., Zaorska, J., Nowakowska, M., Michalska, A., Wojnar, M., & Kopera, M. (2020). Association between interoception and emotion regulation in individuals with alcohol use disorder. *Frontiers in Psychiatry*, 10, 1028. https://doi.org/10.3389/fpsyt.2019.01028
- James, W. (1884). What is emotion? Mind, 9, 188–205.
- Jenni, O. (2020). Wachstum und Entwicklung im Schulalter und in der Adoleszenz. In G. F. Hoffmann, M. J. Lentze, J. W. Spranger, F. Zepp, R. Berner, J. Schaub, & F.-J. Schulte (Eds.), Springer Reference Medizin. Pädiatrie: Grundlagen und Praxis (5th ed., pp. 91– 101). Springer.
- Jessor, R. (1987). Problem-behavior theory, psychosocial development, and adolescent problem drinking. *British Journal of Addiction*, 82(4), 331–342. https://doi.org/10.1111/j.1360-0443.1987.tb01490.x

- Jessor, R. (1991). Risk behavior in adolescence: A psychosocial framework for understanding and action. *The Journal of Adolescent Health: Official Publication of the Society for Adolescent Medicine*, *12*(8), 597–605. https://doi.org/10.1016/1054-139X(91)90007-K
- Jessor, R. (2001). Problem-Behavior Theory. In J. Raithel (Ed.), *Risikoverhaltensweisen Jugendlicher: Formen, Erklärungen und Prävention* (pp. 61–78). Leske + Budrich.
- Jessor, R. (2014). Problem behavior theory: A half-century of research on adolescent behavior and development. In R. M. Lerner, A. C. Petersen, R. K. Silbereisen, & J. Brooks-Gunn (Eds.), *The developmental science of adolescence: History through autobiography* (pp. 239–256). Psychology Press.
- Jessor, R. (2016). *The Origins and Development of Problem Behavior Theory: The Collected Works of Richard Jessor. Advancing Responsible Adolescent Development Ser.* Springer International Publishing.
- Jessor, R., & Jessor, S. L. (1977). *Problem Behavior and Psychological Development: A Longitudinal Study of Youth*. Academic Press.
- Jha, A. P., Krompinger, J., & Baime, M. J. (2007). Mindfulness training modifies subsystems of attention. *Cognitive, Affective & Behavioral Neuroscience*, 7(2), 109–119. https://doi.org/10.3758/CABN.7.2.109
- Jiang, L. C., Yang, I. M., & Wang, C. (2017). Self-disclosure to parents in emerging adulthood. *Journal of Social and Personal Relationships*, 34(4), 425–445. https://doi.org/10.1177/0265407516640603
- Johnston, L. D., O'Malley, P. M., & Bachman, J. G. (2003). Monitoring the future: National results on adolescent drug use: Overview of key findings. *FOCUS*, 1(2), 213–234. https://doi.org/10.1176/foc.1.2.213
- Jones, E. A. K., Mitra, A. K., & Bhuiyan, A. R. (2021). Impact of COVID-19 on mental health in adolescents: A systematic review. *International Journal of Environmental Research and Public Health*, 18(5). https://doi.org/10.3390/ijerph18052470
- Juvonen, J., & Cardigan, J. (2002). Social determinants of public behavior of middle school youth: Perceived peer norms and need to be accepted. In T. Urdan (Ed.), *Adolescence and education vol. 2: Academic motivation of adolescents* (pp. 277–297). Information Age Publishing.
- Kabat-Zinn, J. (1990). Full catastrophe living: How to cope with stress, pain, and illness using mindfulness meditation. Doubleday.

- Kapetanovic, S., Ander, B., Gurdal, S., & Sorbring, E. (2022). Adolescent smoking, alcohol use, inebriation, and use of narcotics during the COVID-19 pandemic. *BMC Psychology*, *10*(1), 44. https://doi.org/10.1186/s40359-022-00756-1
- Karyadi, K. A., VanderVeen, J. D., & Cyders, M. A. (2014). A meta-analysis of the relationship between trait mindfulness and substance use behaviors. *Drug and Alcohol Dependence*, 143, 1–10. https://doi.org/10.1016/j.drugalcdep.2014.07.014
- Kashdan, T. B., Ferssizidis, P., Collins, R. L., & Muraven, M. (2010). Emotion differentiation as resilience against excessive alcohol use: An ecological momentary assessment in underage social drinkers. *Psychological Science*, *21*(9), 1341–1347. https://doi.org/10.1177/0956797610379863
- Kelley, N. J., Glazer, J. E., Pornpattananangkul, N., & Nusslock, R. (2019). Reappraisal and suppression emotion-regulation tendencies differentially predict reward-responsivity and psychological well-being. *Biological Psychology*, 140, 35–47. https://doi.org/10.1016/j.biopsycho.2018.11.005
- Kelly, E. V., Newton, N. C., Stapinski, L. A., Slade, T., Barrett, E. L., Conrod, P. J., & Teesson, M. (2015). Concurrent and prospective associations between bullying victimization and substance use among Australian adolescents. *Drug and Alcohol Dependence*, 154, 63– 68. https://doi.org/10.1016/j.drugalcdep.2015.06.012
- Khalsa, S. S., Rudrauf, D., & Tranel, D. (2009). Interoceptive awareness declines with age. *Psychophysiology*, *46*(6), 1130–1136. https://doi.org/10.1111/j.1469-8986.2009.00859.x
- Khosravani, V., Sharifi Bastan, F., Ghorbani, F., & Kamali, Z. (2017). Difficulties in emotion regulation mediate negative and positive affects and craving in alcoholic patients. *Addictive Behaviors*, 71, 75–81. https://doi.org/10.1016/j.addbeh.2017.02.029
- Kilian, C., O'Donnell, A., Potapova, N., López-Pelayo, H., Schulte, B., Miquel, L., Paniello Castillo, B., Schmidt, C. S., Gual, A., Rehm, J., & Manthey, J. (2022). Changes in alcohol use during the Covid-19 pandemic in Europe: A meta-analysis of observational studies. *Drug and Alcohol Review*, 41(4), 918–931. https://doi.org/10.1111/dar.13446
- King, S. A., Hubbard, S. M., Teeters, J. B., & Brausch, A. M. (2023). A longitudinal examination of alcohol use and emotion dysregulation in adolescence. *Experimental and Clinical Psychopharmacology*, *31*(2), 414–422. https://doi.org/10.1037/pha0000624

- Kleinginna, P. R., & Kleinginna, A. M. (1981). A categorized list of emotion definitions, with suggestions for a consensual definition. *Motivation and Emotion*, 5(4), 345–379. https://doi.org/10.1007/BF00992553
- Klinkhammer, J., Voltmer, K., & Salisch, M. von. (2022). *Emotionale Kompetenz bei Kindern und Jugendlichen: Entwicklung und Folgen* (2., erweiterte und überarbeitete Auflage). Verlag W. Kohlhammer.
- Koepke, S., & Denissen, J. J. (2012). Dynamics of identity development and separation–individuation in parent–child relationships during adolescence and emerging adulthood – a conceptual integration. *Developmental Review: DR*, 32(1), 67–88. https://doi.org/10.1016/j.dr.2012.01.001
- Konrad, K., & König, J. (2018). Biopsychologische Veränderungen. In A. Lohaus (Ed.), *Entwicklungspsychologie des Jugendalters* (pp. 1–22). Springer Berlin Heidelberg.
- Kretschmer, T. (2016). What explains correlates of peer victimization? A systematic review of mediating factors. *Adolescent Research Review*, 1(4), 341–356. https://doi.org/10.1007/s40894-016-0035-y
- Kuntsche, E., Knibbe, R., Gmel, G., & Engels, R. (2005). Why do young people drink? A review of drinking motives. *Clinical Psychology Review*, 25(25 // 7), 841–861. https://doi.org/10.1016/j.cpr.2005.06.002
- Kupersmidt, J. B., & Coie, J. D. (1990). Preadolescent peer status, aggression, and school adjustment as predictors of externalizing problems in adolescence. *Child Development*, 61(5), 1350. https://doi.org/10.2307/1130747
- LaFontana, K. M., & Cillessen, A. H. N. (2010). Developmental changes in the priority of perceived status in childhood and adolescence. *Social Development*, 19(1), 130–147. https://doi.org/10.1111/j.1467-9507.2008.00522.x
- Laghi, F., Bianchi, D., Lonigro, A., Pompili, S., & Baiocco, R. (2021). Emotion regulation and alcohol abuse in second-generation immigrant adolescents: The protective role of cognitive reappraisal. *Journal of Health Psychology*, 26(4), 513–524. https://doi.org/10.1177/1359105318820715
- Laghi, F., Liga, F., & Pompili, S. (2018). Adolescents who binge eat and drink: The role of emotion regulation. *Journal of Addictive Diseases*, 37(1-2), 77–86. https://doi.org/10.1080/10550887.2018.1553458

Laghi, F., Lonigro, A., Pallini, S., & Baiocco, R. (2018). Emotion regulation and empathy: Which relation with social conduct? *The Journal of Genetic Psychology*, *179*(2), 62–70. https://doi.org/10.1080/00221325.2018.1424705

Lange, C. G. (1887). Über Gemütsbewegungen. Theodor Thomas.

- Lannoy, S., Duka, T., Carbia, C., Billieux, J., Fontesse, S., Dormal, V., Gierski, F., López-Caneda, E., Sullivan, E. V., & Maurage, P. (2021). Emotional processes in binge drinking: A systematic review and perspective. *Clinical Psychology Review*, 84, 101971. https://doi.org/10.1016/j.cpr.2021.101971
- Larson, R. W., Richards, M. H., Moneta, G., Holmbeck, G., & Duckett, E. (1996). Changes in adolescents' daily interactions with their families from ages 10 to 18: Disengagement and transformation. *Developmental Psychology*, 32, 744–754.
- Laursen, B., & Collins, W. A. (1994). Interpersonal conflict during adolescence. *Psychological Bulletin*, *115*(2), 197–209. https://doi.org/10.1037/0033-2909.115.2.197
- Laursen, B., Coy, K. C., & Collins, W. A. (1998). Reconsidering changes in parent-child conflict across adolescence: A meta-analysis. *Child Development*, *69*(3), 817–832.
- Lazarus, R. S., & Folkman, S. (1984). Stress, appraisal, and coping. Springer.
- Le, T. M., Wang, W., Zhornitsky, S., Dhingra, I., Chen, Y., Zhang, S., & Li, C.-S. R. (2021). The neural processes interlinking social isolation, social support, and problem alcohol use. *International Journal of Neuropsychopharmacology*, *24*(4), 333–343. https://doi.org/10.1093/ijnp/pyaa086
- Le Berre, A.-P. (2019). Emotional processing and social cognition in alcohol use disorder. *Neuropsychology*, *33*(6), 808–821. https://doi.org/10.1037/neu0000572
- LeDoux, J. E. (1996). *The emotional brain: the mysterious underpinnings of emotional life*. Simon & Schuster.
- LeDoux, J. E. (2001). Das Netz der Gefühle. dtv.
- Lee, S., Guo, W.-J., Tsang, A., Mak, A. D. P., Wu, J., Ng, K. L., & Kwok, K. (2010). Evidence for the 2008 economic crisis exacerbating depression in Hong Kong. *Journal of Affective Disorders*, *126*(1-2), 125–133. https://doi.org/10.1016/j.jad.2010.03.007
- Lee, T. M. C., Chi, I., Chung, L. W. M., & Chou, K.-L. (2006). Ageing and psychological response during the post-SARS period. *Aging & Mental Health*, 10(3), 303–311. https://doi.org/10.1080/13607860600638545

- Leen-Feldner, E. W., Zvolensky, M. J., Feldner, M. T., & Lejuez, C. (2004). Behavioral inhibition: Relation to negative emotion regulation and reactivity. *Personality and Individual Differences*, 36(6), 1235–1247. https://doi.org/10.1016/S0191-8869(02)00113-7
- Lenzi, M., Sharkey, J., Vieno, A., Mayworm, A., Dougherty, D., & Nylund-Gibson, K.
 (2015). Adolescent gang involvement: The role of individual, family, peer, and school factors in a multilevel perspective. *Aggressive Behavior*, 41(4), 386–397. https://doi.org/10.1002/ab.21562
- Lerner, J. S., Li, Y., Valdesolo, P., & Kassam, K. S. (2015). Emotion and decision making. Annual Review of Psychology, 66, 799–823. https://doi.org/10.1146/annurev-psych-010213-115043
- Leven, I., Quenzel, G., & Hurrelmann, K. (2015). Familie, Bildung, Beruf, Zukunft: Am liebsten alles. In S. D. Holding (Ed.), *Jugend 2015. Eine pragmatische Generation im Aufbruch* (pp. 47–110). Fischer.
- Levine, L. J., & Pizarro, D. A. (2004). Emotion and memory research: A grumpy overview. *Social Cognition*, 22(5), 530–554. https://doi.org/10.1521/soco.22.5.530.50767
- Li, D., Zucker, N. L., Kragel, P. A., Covington, V. E., & LaBar, K. S. (2017). Adolescent development of insula-dependent interoceptive regulation. *Developmental Science*, 20(5). https://doi.org/10.1111/desc.12438
- Liang, L., Ren, H., Cao, R., Hu, Y., Qin, Z., Li, C., & Mei, S. (2020). The effect of COVID-19 on youth mental health. *The Psychiatric Quarterly*, 91(3), 841–852. https://doi.org/10.1007/s11126-020-09744-3
- Lindström, M., & Giordano, G. N. (2016). The 2008 financial crisis: Changes in social capital and its association with psychological wellbeing in the United Kingdom a panel study. *Social Science & Medicine (1982)*, *153*, 71–80. https://doi.org/10.1016/j.socscimed.2016.02.008
- Linn, B. K., Zhao, J., Bradizza, C. M., Lucke, J. F., Ruszczyk, M. U., & Stasiewicz, P. R. (2021). Alexithymia disrupts emotion regulation processes and is associated with greater negative affect and alcohol problems. *Journal of Clinical Psychology*, 77(12), 2915–2928. https://doi.org/10.1002/jclp.23279
- Loades, M. E., Chatburn, E., Higson-Sweeney, N., Reynolds, S., Shafran, R., Brigden, A., Linney, C., McManus, M. N., Borwick, C., & Crawley, E. (2020). Rapid systematic re-

view: The impact of social isolation and loneliness on the mental health of children and adolescents in the context of COVID-19. *Journal of the American Academy of Child and Adolescent Psychiatry*, *59*(11), 1218-1239.e3. https://doi.org/10.1016/j.jaac.2020.05.009

- Lucien, J. N., Ortega, M. T., & Shaw, N. D. (2021). Sleep and puberty. *Current Opinion in Endocrine and Metabolic Research*, 17, 1–7. https://doi.org/10.1016/j.coemr.2020.09.009
- Lyvers, M., Makin, C., Toms, E., Thorberg, F. A., & Samios, C. (2014). Trait mindfulness in relation to emotional self-regulation and executive function. *Mindfulness*, 5(6), 619–625. https://doi.org/10.1007/s12671-013-0213-y
- Machorrinho, J., Veiga, G., Fernandes, J., Mehling, W., & Marmeleira, J. (2019). Multidimensional assessment of interoceptive awareness: Psychometric properties of the Portuguese version. *Perceptual and Motor Skills*, 126(1), 87–105. https://doi.org/10.1177/0031512518813231
- Maciejewski, D. F., van Lier, P. A. C., Branje, S. J. T., Meeus, W. H. J., & Koot, H. M. (2015).
 A 5-year longitudinal study on mood variability across adolescence using daily diaries. *Child Development*, 86(6), 1908–1921. https://doi.org/10.1111/cdev.12420
- Mahalik, J. R., Levine Coley, R., McPherran Lombardi, C., Doyle Lynch, A., Markowitz, A. J., & Jaffee, S. R. (2013). Changes in health risk behaviors for males and females from early adolescence through early adulthood. *Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association*, 32(6), 685–694. https://doi.org/10.1037/a0031658
- Malik, N. M., & Furman, W. (1993). Practitioner review: Problems in children's peer relations: What can the clinician do? *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, 34(8), 1303–1326. https://doi.org/10.1111/j.1469-7610.1993.tb02093.x
- Marshall, E. J. (2014). Adolescent alcohol use: Risks and consequences. Alcohol and Alcoholism (Oxford, Oxfordshire), 49(2), 160–164. https://doi.org/10.1093/alcalc/agt180
- Mavroveli, S., Petrides, K. V., Rieffe, C., & Bakker, F. (2007). Trait emotional intelligence, psychological well-being and peer-rated social competence in adolescence. *British Journal* of Developmental Psychology, 25(2), 263–275. https://doi.org/10.1348/026151006X118577
- McCambridge, J., McAlaney, J., & Rowe, R. (2011). Adult consequences of late adolescent alcohol consumption: A systematic review of cohort studies. *PLoS Medicine*, 8(2), e1000413. https://doi.org/10.1371/journal.pmed.1000413
- Mehling, W. E., Price, C., Daubenmier, J. J., Acree, M., Bartmess, E., & Stewart, A. (2012). The multidimensional assessment of interoceptive awareness (MAIA). *PloS One*, 7(11), e48230. https://doi.org/10.1371/journal.pone.0048230
- Meijs, N., Cillessen, A. H. N., Scholte, R. H. J., Segers, E., & Spijkerman, R. (2010). Social intelligence and academic achievement as predictors of adolescent popularity. *Journal of Youth and Adolescence*, 39(1), 62–72. https://doi.org/10.1007/s10964-008-9373-9
- Mennin, D. S., Holaway, R. M., Fresco, D. M., Moore, M. T., & Heimberg, R. G. (2007). Delineating components of emotion and its dysregulation in anxiety and mood psychopathology. *Behavior Therapy*, 38(3), 284–302. https://doi.org/10.1016/j.beth.2006.09.001
- Migliorini, R., Stewart, J. L., May, A. C., Tapert, S. F., & Paulus, M. P. (2013). What do you feel? Adolescent drug and alcohol users show altered brain response to pleasant interoceptive stimuli. *Drug and Alcohol Dependence*, *133*(2), 661–668. https://doi.org/10.1016/j.drugalcdep.2013.08.015
- Montgomery, W. A., & Jones, G. E. (1984). Laterality, emotionality, and heartbeat perception. *Psychophysiology*, *21*(4), 459–465. https://doi.org/10.1111/j.1469-8986.1984.tb00227.x
- Murphy, J., Brewer, R., Catmur, C., & Bird, G. (2017). Interoception and psychopathology: A developmental neuroscience perspective. *Developmental Cognitive Neuroscience*, 23, 45– 56. https://doi.org/10.1016/j.dcn.2016.12.006
- Nachane, H. B., Nadadgalli, G. V., & Umate, M. S. (2021). Cognitive and affective empathy in men with alcohol dependence: Relation with clinical profile, abstinence, and motivation. *Indian Journal of Psychiatry*, 63(5), 418–423. https://doi.org/10.4103/indianjpsychiatry.indianjpsychiatry_1101_20
- Nansel, T. R., Craig, W., Overpeck, M. D., Saluja, G., Ruan, W. J., & and the Health Behavior in School-aged Children Bullying Analyses Working Group (2004). Cross-national consistency in the relationship between bullying behaviors and psychosocial adjustment. *Arch Pediatr Adolesc Med*, 158(8), 730–736. https://doi.org/10.1001/archpedi.158.8.730
- Nawi, A. M., Ismail, R., Ibrahim, F., Hassan, M. R., Manaf, M. R. A., Amit, N., Ibrahim, N., & Shafurdin, N. S. (2021). Risk and protective factors of drug abuse among adolescents: A systematic review. *BMC Public Health*, 21(1), 2088. https://doi.org/10.1186/s12889-021-11906-2

- Nees, F., Tzschoppe, J., Patrick, C. J., Vollstädt-Klein, S., Steiner, S., Poustka, L., Banaschewski, T., Barker, G. J., Büchel, C., Conrod, P. J., Garavan, H., Heinz, A., Gallinat, J., Lathrop, M., Mann, K., Artiges, E., Paus, T., Poline, J.-B., Robbins, T. W. . . . Flor, H. (2012). Determinants of early alcohol use in healthy adolescents: The differential contribution of neuroimaging and psychological factors. *Neuropsychopharmacology: Official Publication of the American College of Neuropsychopharmacology*, *37*(4), 986–995. https://doi.org/10.1038/npp.2011.282
- Nickerson, A. B., & Mele-Taylor, D. (2014). Empathetic responsiveness, group norms, and prosocial affiliations in bullying roles. *School Psychology Quarterly: The Official Journal of the Division of School Psychology, American Psychological Association*, 29(1), 99–109. https://doi.org/10.1037/spq0000052
- Nolen-Hoeksema, S. (2012). Emotion regulation and psychopathology: The role of gender. *Annual Review of Clinical Psychology*, 8, 161–187. https://doi.org/10.1146/annurevclinpsy-032511-143109
- Norberg, M. M., Ham, L. S., Olivier, J., Zamboanga, B. L., Melkonian, A., & Fugitt, J. L. (2016). Pregaming and emotion regulation's relationship to alcohol problems in college students: A cross-sectional study. *Substance Use & Misuse*, *51*(8), 1024–1033. https://doi.org/10.3109/10826084.2016.1152498
- Oerter, R., & Dreher, E. (2002). Jugendalter. In R. Oerter & L. Montada (Eds.), *Entwicklungspsychologie* (5th ed., pp. 258–318). Beltz Verlage.
- Olweus, D. (2013). School bullying: Development and some important challenges. Annual Review of Clinical Psychology, 9, 751–780. https://doi.org/10.1146/annurev-clinpsy-050212-185516
- Patrick, M. E., Terry-McElrath, Y. M., Miech, R. A., Keyes, K. M., Jager, J., & Schulenberg, J. E. (2022). Alcohol use and the COVID-19 pandemic: Historical trends in drinking, contexts, and reasons for use among U.S. adults. *Social Science & Medicine (1982)*, 301, 114887. https://doi.org/10.1016/j.socscimed.2022.114887
- Paus, T. (2005). Mapping brain maturation and cognitive development during adolescence. *Trends in Cognitive Sciences*, 9(2), 60–68. https://doi.org/10.1016/j.tics.2004.12.008
- Peeters, M., Oldehinkel, T., & Vollebergh, W. (2017). Behavioral control and reward sensitivity in adolescents' risk taking behavior: A longitudinal trails study. *Frontiers in Psychol*ogy, 8, 231. https://doi.org/10.3389/fpsyg.2017.00231

- Pelham, W. E., Tapert, S. F., Gonzalez, M. R., McCabe, C. J., Lisdahl, K. M., Alzueta, E., Baker, F. C., Breslin, F. J., Dick, A. S., Dowling, G. J., Guillaume, M., Hoffman, E. A., Marshall, A. T., McCandliss, B. D., Sheth, C. S., Sowell, E. R., Thompson, W. K., van Rinsveld, A. M., Wade, N. E., & Brown, S. A. (2021). Early adolescent substance use before and during the COVID-19 pandemic: A longitudinal survey in the ABCD study cohort. *The Journal of Adolescent Health: Official Publication of the Society for Adolescent Medicine*, *69*(3), 390–397. https://doi.org/10.1016/j.jadohealth.2021.06.015
- Peralta-Palmezano, F. J., Escobar-Serna, D. P., & Peralta-Palmezano, J. J. (2021). Reference values for the water load test in healthy school children and adolescents. *Acta Gastro-Enterologica Belgica*, 84(2), 299–303. https://doi.org/10.51821/84.2.299
- Pinquart, M., & Silbereisen, R. K. (2002). Changes in adolescents' and mothers' autonomy and connectedness in conflict discussions: An observation study. *Journal of Adolescence*, 25(5), 509–522. https://doi.org/10.1006/jado.2002.0491
- Platt, B., Cohen Kadosh, K., & Lau, J. Y. F. (2013). The role of peer rejection in adolescent depression. *Depression and Anxiety*, *30*(9), 809–821. https://doi.org/10.1002/da.22120
- Portt, E., Person, S., Person, B., Rawana, E., & Brownlee, K. (2020). Empathy and positive aspects of adolescent peer relationships: A scoping review. *Journal of Child and Family Studies*, 29(9), 2416–2433. https://doi.org/10.1007/s10826-020-01753-x
- Powers, A., & Casey, B. J. (2015). The adolescent brain and the emergence and peak of psychopathology. *Journal of Infant, Child, and Adolescent Psychotherapy*, 14(1), 3–15. https://doi.org/10.1080/15289168.2015.1004889
- Powers, R. J., & Kutash, I. L. (1985). Stress and alcohol. *The International Journal of the Addictions*, 20(3), 461–482. https://doi.org/10.3109/10826088509044926
- Preston, S. D., & Waal, F. B. M. de (2002). Empathy: Its ultimate and proximate bases. *The Behavioral and Brain Sciences*, 25(1), 1-20; discussion 20-71. https://doi.org/10.1017/s0140525x02000018.
- Qiu, J., Shen, B., Zhao, M., Wang, Z., Xie, B., & Xu, Y. (2020). A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: Implications and policy recommendations. *General Psychiatry*, 33(2), e100213. https://doi.org/10.1136/gpsych-2020-100213

- Radliff, K. M., Wheaton, J. E., Robinson, K., & Morris, J. (2012). Illuminating the relationship between bullying and substance use among middle and high school youth. *Addictive Behaviors*, 37(4), 569–572. https://doi.org/10.1016/j.addbeh.2012.01.001
- Ravens-Sieberer, U., Wille, N., Erhart, M., Bettge, S., Wittchen, H.-U., Rothenberger, A., Herpertz-Dahlmann, B., Resch, F., Hölling, H., Bullinger, M., Barkmann, C., Schulte-Markwort, M., & Döpfner, M. (2008). Prevalence of mental health problems among children and adolescents in Germany: Results of the BELLA study within the national health interview and examination survey. *European Child & Adolescent Psychiatry*, *17 Suppl 1*, 22–33. https://doi.org/10.1007/s00787-008-1003-2
- Reynolds, D. L., Garay, J. R., Deamond, S. L., Moran, M. K., Gold, W., & Styra, R. (2008).
 Understanding, compliance and psychological impact of the SARS quarantine experience. *Epidemiology and Infection*, 136(7), 997–1007.
 https://doi.org/10.1017/S0950268807009156
- Rivers, I., Poteat, V. P., Noret, N., & Ashurst, N. (2009). Observing bullying at school: The mental health implications of witness status. *School Psychology Quarterly*(24 (4)), 211– 223. https://doi.org/10.1037/a0018164
- Roggenhofer, C. (2017). Neuronale Korrelate der Interozeption bei Patienten mit Panikstörung – eine funktionelle Bildgebungsstudie [Dissertation]. Ruprecht-Karls-Universität, Heidelberg. http://archiv.ub.uni-heidelberg.de/volltextserver/25196/1/Dissertation_Roggenhofer_FINAL_Juni2018.pdf
- Rose-Krasnor, L. (1997). The nature of social competence: A theoretical review. *Social Development*, *6*(1), 111–135. https://doi.org/10.1111/j.1467-9507.1997.tb00097.x
- Roth, M., Altmann, T., & Schönefeld, V. (2016). Einleitung: Definitionen, Modelle und Trainierbarkeit von Empathie. In M. Roth, V. Schönefeld, & T. Altmann (Eds.), *Trainings- und Interventionsprogramme zur Förderung von Empathie: Ein praxisorientiertes Kompendium* (pp. 1–10). Springer Berlin Heidelberg.
- Rottenberg, J. (2005). Mood and emotion in major depression. *Current Directions in Psychological Science*, *14*(3), 167–170. https://doi.org/10.1111/j.0963-7214.2005.00354.x
- Saarni, C. (1999). The development of emotional competence. Guilford Press.

- Salmon, S., Turner, S., Taillieu, T., Fortier, J., & Afifi, T. O. (2018). Bullying victimization experiences among middle and high school adolescents: Traditional bullying, discriminatory harassment, and cybervictimization. *Journal of Adolescence*(63), 29–40. https://doi.org/10.1016/j.adolescence.2017.12.005
- Salovey, P., & Mayer, J. D. (1990). Emotional intelligence. *Imagination, Cognition and Personality*, *9*(3), 185–211. https://doi.org/10.2190/DUGG-P24E-52WK-6CDG
- Samek, D. R., Keyes, M. A., Iacono, W. G., & McGue, M [Matt] (2013). Peer deviance, alcohol expectancies, and adolescent alcohol use: Explaining shared and nonshared environmental effects using an adoptive sibling pair design. *Behavior Genetics*, 43(4), 286–296. https://doi.org/10.1007/s10519-013-9595-9
- Sargent-Cox, K., Butterworth, P., & Anstey, K. J. (2011). The global financial crisis and psychological health in a sample of Australian older adults: A longitudinal study. *Social Science & Medicine (1982)*, 73(7), 1105–1112. https://doi.org/10.1016/j.socscimed.2011.06.063
- Schachter, S., & Singer, J. E. (1962). Cognitive, social, and physiological determinants of emotional state. *Psychological Review*, *69*, 379–399. https://doi.org/10.1037/h0046234
- Schandry, R. (1998). Lehrbuch der Psychophysiologie: Körperliche Indikatoren psychischen Geschehens (3rd ed.). Beltz Psychologie Verlags Union.
- Schandry, R. (2003). Vom Herz zum Hirn [From the heart to the brain]. *Deutsche medizini-sche Wochenschrift (1946)*, *128*(51-52), 2707–2711. https://doi.org/10.1055/s-2003-812550
- Scherer, K. R. (1984). Emotions as a multicomponent process: A model and some cross-cultural data. In P. Shaver (Ed.), *Review of personality and social psychology: Vol. 5 emotions*, *relationships and health* (pp. 37–63). Sage.
- Scherer, K. R. (1999). Appraisal theory. In T. Dalgleish & M. Power (Eds.), *Handbook of cognition and emotion* (pp. 637–663). Wiley.
- Scherer, K. R. (2009). The dynamic architecture of emotion: Evidence for the component process model. *Cognition & Emotion*, 23(7), 1307–1351. https://doi.org/10.1080/02699930902928969
- Scherer, K. R., & Wallboot, H. G. (1990). Ausdruck von Emotionen. In K. R. Scherer (Ed.), *Enzyklopädie der Psychologie (C, IV, 3), Psychologie der Emotion* (pp. 345–422). Hogrefe.

- Schubert, K. O., Clark, S. R., Van, L. K., Collinson, J. L., & Baune, B. T. (2017). Depressive symptom trajectories in late adolescence and early adulthood: A systematic review. *Australian & New Zealand Journal of Psychiatry*, 51(5), 477–499. https://doi.org/10.1177/00048674177002
- Selman, R. L. (1980). The growth of interpersonal understanding: Developmental and clinical analyses. Developmental psychology series. Acad. Press.
- Silbereisen, R. K., & Schmitt-Rodermund, E. (1998). Entwicklung im Jugendalter: Prozesse, Kontexte und Ergebnisse. In H. Keller (Ed.), *Entwicklungspsychologie* (pp. 377–397). Huber.
- Silk, J. S., Steinberg, L. D., & Morris, A. S. (2003). Adolescents' emotion regulation in daily life: Links to depressive symptoms and problem behavior. *Child Development*, 74(6), 1869–1880. https://doi.org/10.1046/j.1467-8624.2003.00643.x
- Silvers, J. A., McRae, K., Gabrieli, J. D. E., Gross, J. J., Remy, K. A., & Ochsner, K. N. (2012). Age-related differences in emotional reactivity, regulation, and rejection sensitivity in adolescence. *Emotion (Washington, D.C.)*, *12*(6), 1235–1247. https://doi.org/10.1037/a0028297
- Simons, R. M., Hahn, A. M., Simons, J. S., & Murase, H. (2017). Emotion dysregulation and peer drinking norms uniquely predict alcohol-related problems via motives. *Drug and Alcohol Dependence*, 177, 54–58. https://doi.org/10.1016/j.drugalcdep.2017.03.019
- Singh, P. (2022). Emotion regulation difficulties, perceived parenting and personality as predictors of health-risk behaviours among adolescents. *Current Psychology*, 1–16. https://doi.org/10.1007/s12144-021-02536-3
- Sisk, C. L., & Foster, D. L. (2004). The neural basis of puberty and adolescence. *Nature Neuroscience*, 7(10), 1040–1047. https://doi.org/10.1038/nn1326
- Smith, N. D. L., & Cottler, L. B. (2018). The epidemiology of post-traumatic stress disorder and alcohol use disorder. *Alcohol Research: Current Reviews*, *39*(2), 113–120.
- Sohi, I., Chrystoja, B. R., Rehm, J., Wells, S., Monteiro, M., Ali, S., & Shield, K. D. (2022). Changes in alcohol use during the COVID-19 pandemic and previous pandemics: A systematic review. *Alcoholism: Clinical and Experimental Research*, 46(4), 498–513. https://doi.org/10.1111/acer.14792

- Solberg, M. E., & Olweus, D. (2003). Prevalence estimation of school bullying with the olweus bully/victim questionnaire. *Aggressive Behavior*, 29, 239–268. https://doi.org/10.1002/ab.10047
- Squeglia, L. M., Tapert, S. F., Sullivan, E. V., Jacobus, J., Meloy, M. J., Rohlfing, T., & Pfefferbaum, A. (2015). Brain development in heavy-drinking adolescents. *The American Journal of Psychiatry*, 172(6), 531–542. https://doi.org/10.1176/appi.ajp.2015.14101249
- Srivastava, S., Tamir, M., McGonigal, K. M., John, O. P., & Gross, J. J. (2009). The social costs of emotional suppression: A prospective study of the transition to college. *Journal of Personality and Social Psychology*, 96(4), 883–897. https://doi.org/10.1037/a0014755
- Stautz, K., & Cooper, A. (2013). Impulsivity-related personality traits and adolescent alcohol use: A meta-analytic review. *Clinical Psychology Review*, 33(4), 574–592. https://doi.org/10.1016/j.cpr.2013.03.003
- Steinberg, L. D. (2005). Adolescence (7. ed.). McGraw-Hill Higher Education.
- Steinberg, L. D., Dahl, R. E., Keating, D., Kupfer, D. J., Masten, A. S., & Pine, D. S. (2006). The study of developmental psychopathology in adolescence: Integrating affective neuroscience with the study of context. In D. Cicchetti & D. J. Cohen (Eds.), *Developmental psychopathology, vol. 2: Developmental neuroscience* (pp. 710–741). Wiley.
- Stietz, J., Jauk, E., Krach, S., & Kanske, P. (2019). Dissociating empathy from perspectivetaking: Evidence from intra- and inter-individual differences research. *Frontiers in Psychiatry*, 10, 126. https://doi.org/10.3389/fpsyt.2019.00126
- Suksasilp, C., & Garfinkel, S. N. (2022). Towards a comprehensive assessment of interoception in a multi-dimensional framework. *Biological Psychology*, 168, 108262. https://doi.org/10.1016/j.biopsycho.2022.108262
- Tharp-Taylor, S., Haviland, A., & D'Amico, E. J. (2009). Victimization from mental and physical bullying and substance use in early adolescence. *Addictive Behaviors*, 34, 561– 567. https://doi.org/10.1016/j.addbeh.2009.03.012
- Thomas, H. J., Chan, G. C. K., Scott, J. G., Connor, J. P., Kelly, A. B., & Williams, J. (2016). Association of different forms of bullying victimisation with adolescents' psychological distress and reduced emotional wellbeing. *The Australian and New Zealand Journal of Psychiatry*, 50(4), 371–379. https://doi.org/10.1177/0004867415600076
- Topper, L. R., Castellanos-Ryan, N., Mackie, C., & Conrod, P. J. (2011). Adolescent bullying victimisation and alcohol-related problem behaviour mediated by coping drinking motives

over a 12month period. *Addictive Behaviors*, *36*, 6–13. https://doi.org/10.1016/j.addbeh.2010.08.016

- Ttofi, M. M., Farrington, D. P., Lösel, F., & Loeber, R. (2011). The predictive efficiency of school bullying versus later offending: A systematic/meta-analytic review of longitudinal studies. *Criminal Behaviour and Mental Health : CBMH*, 21(2), 80–89. https://doi.org/10.1002/cbm.808
- Twenge, J. M., & Joiner, T. E. (2020). Mental distress among U.S. Adults during the COVID-19 pandemic. *Journal of Clinical Psychology*, 76(12), 2170–2182. https://doi.org/10.1002/jclp.23064
- Urošević, S., Collins, P., Muetzel, R., Schissel, A., Lim, K. O., & Luciana, M. (2015). Effects of reward sensitivity and regional brain volumes on substance use initiation in adolescence. *Social Cognitive and Affective Neuroscience*, 10(1), 106–113. https://doi.org/10.1093/scan/nsu022
- Vaitl, D. (1996). Interoception. *Biological Psychology*, *42*(1-2), 1–27. https://doi.org/10.1016/0301-0511(95)05144-9
- Vaitl, D. (2000). Psychophysiologie der Interozeption. In D. Vaitl & F. Petermann (Eds.), Handbuch der Entspannungsverfahren (2nd ed., pp. 101–132). Beltz Psychologie Verlags Union.
- Valdebenito, S., Ttofi, M., & Eisner, M. (2015). Prevalence rates of drug use among school bullies and victims: A systematic review and meta-analysis of cross-sectional studies. *Aggression and Violent Behavior*, 23, 137–146. https://doi.org/10.1016/j.avb.2015.05.004
- van den Houte, M., Vlemincx, E., Franssen, M., van Diest, I., van Oudenhove, L., & Luminet, O. (2021). The respiratory occlusion discrimination task: A new paradigm to measure respiratory interoceptive accuracy. *Psychophysiology*, 58(4), e13760. https://doi.org/10.1111/psyp.13760
- van Hemel-Ruiter, M. E., Jong, P. J. de, Ostafin, B. D., & Wiers, R. W. (2015). Reward sensitivity, attentional bias, and executive control in early adolescent alcohol use. *Addictive Behaviors*, 40, 84–90. https://doi.org/10.1016/j.addbeh.2014.09.004
- Vanderlind, W. M., Millgram, Y., Baskin-Sommers, A. R., Clark, M. S., & Joormann, J. (2020). Understanding positive emotion deficits in depression: From emotion preferences to emotion regulation. *Clinical Psychology Review*, 76, 101826. https://doi.org/10.1016/j.cpr.2020.101826

- Veenstra, M. Y., Lemmens, P. H. H. M., Friesema, I. H. M., Tan, F. E. S., Garretsen, H. F. L., Knottnerus, J. A., & Zwietering, P. J. (2007). Coping style mediates impact of stress on alcohol use: A prospective population-based study. *Addiction (Abingdon, England)*, 102(12), 1890–1898. https://doi.org/10.1111/j.1360-0443.2007.02026.x
- Vieno, A., Gini, G., & Santinello, M. (2011). Different forms of bullying and their association to smoking and drinking behavior in Italian adolescents. *Journal of School Health*, 81(7), 393–399. https://doi.org/10.1111/j.1746-1561.2011.00607.x
- Vierhaus, M., & Wendt, E.-V. (2018). Sozialbeziehungen zu Gleichaltrigen. In A. Lohaus (Ed.), *Entwicklungspsychologie des Jugendalters* (pp. 139–167). Springer Berlin Heidelberg.
- Walper, S. (2008). Eltern-Kind-Beziehungen im Jugendalter. In R. K. Silbereisen & M. Hasselhorn (Eds.), *Enzyklopädie der Psychologie, Serie V Entwicklung: Vol. 5. Psychologie des Jugend- und frühen Erwachsenenalters* (pp. 135–188). Hogrefe.
- Walper, S., Lux, U., & Witte, S. (2018). Sozialbeziehungen zur Herkunftsfamilie. In A. Lohaus (Ed.), *Entwicklungspsychologie des Jugendalters* (pp. 113–137). Springer Berlin Heidelberg.
- Weichold, K., & Blumenthal, A. (2018). Problemverhalten. In A. Lohaus (Ed.), *Entwicklungs-psychologie des Jugendalters* (pp. 169–196). Springer Berlin Heidelberg.
- Weisz, E., & Cikara, M. (2021). Strategic regulation of empathy. *Trends in Cognitive Sciences*, 25(3), 213–227. https://doi.org/10.1016/j.tics.2020.12.002
- Westenberg, P. M., Drewes, M. J., Goedhart, A. W., Siebelink, B. M., & Treffers, P. D. A. (2004). A developmental analysis of self-reported fears in late childhood through mid-adolescence: Social-evaluative fears on the rise? *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, 45(3), 481–495. https://doi.org/10.1111/j.1469-7610.2004.00239.x
- Westenberg, P. M., Gullone, E., Bokhorst, C. L., Heyne, D. A., & King, N. J. (2007). Social evaluation fear in childhood and adolescence: Normative developmental course and continuity of individual differences. *British Journal of Developmental Psychology*, 25(3), 471– 483. https://doi.org/10.1348/026151006X173099
- Wiśniewski, P., Maurage, P., Jakubczyk, A., Trucco, E. M., Suszek, H., & Kopera, M. (2021). Alcohol use and interoception - a narrative review. *Progress in Neuro-Psychopharmacol*ogy & Biological Psychiatry, 111, 110397. https://doi.org/10.1016/j.pnpbp.2021.110397

- Wittchen, H.-U., Behrendt, S., Höfler, M., Perkonigg, A., Lieb, R., Bühringer, G., & Beesdo, K. (2008). What are the high risk periods for incident substance use and transitions to abuse and dependence? Implications for early intervention and prevention. *International Journal of Methods in Psychiatric Research*, *17 Suppl 1*, S16-29. https://doi.org/10.1002/mpr.254
- Wolke, D., & Skew, A. J. (2012). Bullying among siblings. *International Journal of Adoles*cent Medicine and Health, 24(1), 17–25. https://doi.org/10.1515/ijamh.2012.004
- Wray, T. B., Merrill, J. E., & Monti, P. M. (2014). Using ecological momentary assessment (EMA) to assess situation-level predictors of alcohol use and alcohol-related consequences. *Alcohol Research : Current Reviews*, 36(1), 19–27.
- Wysocka, E., & Ostafińska-Molik, B. (2014). Internalizing and externalizing disorders and type of family of origin – theoretical analysis and findings. *Polish Journal of Social Rehabilitation*, 8, 131–155.
- Zeiher, J., Lange, C., Starker, A., Lampert, T., & Kuntz, B. (2018). Tabak- und Alkoholkonsum bei 11- bis 17-Jährigen in Deutschland – Querschnittergebnisse aus KIGGS Welle 2 und Trends. *Journal of Health Monitoring*, 3(2), 23–44. https://doi.org/10.17886/RKI-GBE-2018-066
- Zimmermann, P., & Iwanski, A. (2014). Emotion regulation from early adolescence to emerging adulthood and middle adulthood. *International Journal of Behavioral Development*, 38(2), 182–194. https://doi.org/10.1177/0165025413515405
- Zimmermann, P., Podewski, F., Çelik, F., & Iwanski, A. (2018). Emotionale Entwicklung. In A. Lohaus (Ed.), *Entwicklungspsychologie des Jugendalters* (pp. 75–90). Springer Berlin Heidelberg.
- Zimmermann, P., & Thompson, R. A. (2014). New directions in developmental emotion regulation research across the life span. *International Journal of Behavioral Development*, 38(2), 139–141. https://doi.org/10.1177/0165025413519015

7 CURRICULUM VITAE

PERSONAL INFORMATION

Name and first name	Prignitz, Maren				
Date of birth:	14.01.1991				
Place of birth:	Freital				
EDUCATION					
2001-2009	Weißeritzgymnasium in Freital				
27.06.2009	Abitur				

ACADEMIC BACKGROUND

WS 2009	Start of the psychology degree programme at Technischen Universität Chemnitz
18.09.2012	Bachelor of Science (B. Sc.)
11.02.2016	Master of Science (M. Sc.)
March 2018 - today	Doctoral thesis at Institute of Cognitive and Clinical Neuroscience at Central Institute of Mental Health Mannheim

PROFESSIONAL BACKGROUND

05/2016 - 01/2017	Educational Frankenthal	specialist	at	Zentrum	für	Arbeit	und	Bildung
02/2017 - 01/2018	Educational s							

PUBLICATIONS IN PEER REVIEWED JOURNALS

Prignitz, M., Banaschewski, T., Bokde, A. L. W., Desrivières, S., Grigis, A., Garavan, H., Gowland, P., Heinz, A., Martinot, J.-L., Paillère Martinot, M.-L., Artiges, E., Papadopoulos Orfanos, D., Poustka, L., Hohmann, S., Fröhner, J. H., Robinson, L., Smolka, M. N., Walter, H., ... Winterer, J. M. (2023). The Role of Empathy in Alcohol Use of Bullying Perpetrators and Victims: Lower Personal Empathic Distress Makes Male Perpetrators of Bullying More Vulnerable to Alcohol Use. *International Journal of Environmental Research and Public Health*, *20*(13), 6286. https://doi.org/10.3390/ijerph20136286

Lenz, B., Gerhardt, S., Boroumand-Jazi, R., Eichler, A., Buchholz, V. N., Fasching, P. A., Kornhuber, J., Banaschewski, T., Flor, H., Guldner, S., **Prignitz, M.**, Nees, F. & IMAC-Mind Consortium (2023). Sex-specific association between prenatal androgenization (second-to-fourth digit length ratio) and frontal brain volumes in adolescents. *Eur Arch Psychiatry Clin Neurosci*, 273, 1243–1254. https://doi.org/10.1007/s00406-022-01515-4

Prignitz, M., Guldner, S., & Nees, F. (2021). Jugendliches Alkoholkonsumverhalten während der COVID-19-Pandemie und die Bedeutung von Achtsamkeit. *Sucht, 67*(6), 287-297. https://doi.org/10.1024/0939-5911/a000734

8 ACKNOWLEDGEMENTS

An erster Stelle möchte ich Frau Prof. Dr. Herta Flor danken, die die Betreuung meiner Dissertation in der Endphase übernommen hat. Ihrem Blick für Details und ihrem fachlichen Input sowie ihrem Verständnis und ihrer steten Unterstützung verdanke ich die Fertigstellung dieser Arbeit.

Mein besonderer Dank gilt meiner ersten Betreuerin Frau Prof. Dr. Frauke Nees, die meine Begeisterung bei der Entwicklung der Fragestellung geteilt hat, mit ihrem sachlichen Hinweisen und wertvollen Rückmeldungen zum Feinschliff des Themas und der Publikationen beigetragen hat und stets ein offenes Ohr für Probleme, Fragen und Anliegen hatte. Durch die enge und produktive Zusammenarbeit habe ich viel gelernt.

Dr. Stella Guldner danke ich für die gemeinsame Projektarbeit, das wertvolle Feedback, die vielen lehrreichen Gespräche, die unermüdliche Hilfsbereitschaft, ihren Zuspruch und viel gemeinsames Lachen. Ich konnte mich immer auf sie verlassen und bin voller Dankbarkeit für die Unterstützung und das Verständnis, ohne die ich heute nicht da wäre, wo ich bin. Stella, du bist eine einmalige Kollegin und eine wertvolle Freundin.

Dr. Kornelius Kammler-Sücker danke ich für seine Unterstützung bei der sprachlichen Überarbeitung der Dissertation, seine Flexibilität und Zuverlässigkeit. Ihm und allen anderen Kollegen am Institut, die sich auf einem ähnlichen Weg befinden oder bereits am Ziel angekommen sind, möchte ich für die gemeinsame Zeit danken. Ich habe viel von euch gelernt, mit euch gelacht und schätze die unzähligen gemeinsamen Momente sehr.

Meinen wissenschaftlichen Hilfskräften Elena Textor und Ina Miola möchte ich dafür danken, dass sie mir in den letzten Monaten den Rücken freigehalten haben. Durch ihre harte und unermüdliche Arbeit sind sie eine Bereicherung. Elena, Ina, ihr seid die besten Hiwis, die ich mir vorstellen kann!

Ich danke allen Probanden für ihre Bereitschaft, an den zum Teil sehr anstrengenden Studien teilzunehmen und damit wissenschaftliche Erkenntnisse zu erlangen.

Meiner Schwiegermutter Christiane Knoll danke ich für ihr Einfühlungsvermögen, ihr Vertrauen in mich und ihr aufrichtiges Interesse an meiner Arbeit.

Zum Schluss, Linda. Danke für deine Unterstützung meiner Träume und Bestrebungen, danke für deine Geduld und die Entbehrungen, die du ausgehalten hast. Danke für deine liebevolle Aufmerksamkeit, dein Einfühlungsvermögen und für die Stabilität, die du mir gibst. Ohne dich, wäre das hier kaum vorstellbar gewesen.

EIDESSTATTLICHE VERSICHERUNG

- Bei der von mir eingereichten kumulativen Dissertation zu dem Thema "*The Relation Between Risk Factors for Adolescent Alcohol Use in the Context of Problem Behavior Theory*" handelt es sich um meine eigenständig erbrachte Leistung. Daten, Abbildungen und Tabellen, die auf der Forschungsarbeit anderer beruhen und in die Dissertation integriert wurden, werden im Text der Dissertation deutlich kenntlich gemacht.
- Ich habe nur die angegebenen Quellen und Hilfsmittel benutzt und mich keiner unzulässigen Hilfe Dritter bedient. Insbesondere habe ich wörtlich oder sinngemäß aus anderen Werken übernommene Inhalte als solche kenntlich gemacht.
- 4. Die Richtigkeit der vorstehenden Erklärungen bestätige ich.
- 5. Die Bedeutung der eidesstattlichen Versicherung und die strafrechtlichen Folgen einer unrichtigen oder unvollständigen eidesstattlichen Versicherung sind mir bekannt.

Ich versichere an Eides statt, dass ich nach bestem Wissen die reine Wahrheit erklärt und nichts verschwiegen habe.

Ort und Datum

Unterschrift



Supplement

References to the publication of the studies related to the dissertation 'The Relation Between Risk Factors for Adolescent Alcohol Use in the Context of Problem Behavior Theory' by Maren Prignitz

Three references are missing in the passage entitled 'Implications for clinical work' on pages 96 and 97 of my thesis.

The passage is reproduced here with the reference to the findings of the respective statements:

"The results of this study imply that it might be useful to strengthen adolescent' emotion regulation ability, as social stimuli are particularly relevant during adolescence (Foulkes & Blakemore, 2016) and adolescent face increased difficulties with emotion regulation due to protracted development of frontal brain networks involved in self-regulation (Shadur & Lejuez, 2015). However, emotion regulation becomes particularly relevant as adolescents are more aware of their emotions and less able to empathize with others. Mindfulness, as a factor that has already been shown to strengthen self-regulation and emotion regulation skills (Hölzel et al., 2011), may be a useful starting point. Our results support this with the findings on attention regulation."

References

- Foulkes, L., & Blakemore, S.-J. (2016). Is there heightened sensitivity to social reward in adolescence? *Current Opinion in Neurobiology*, 40, 81–85. https://doi.org/10.1016/j.conb.2016.06.016
- Hölzel, B. K., Lazar, S. W., Gard, T., Schuman-Olivier, Z., Vago, D. R., & Ott, U. (2011). How does mindfulness meditation work? Proposing mechanisms of action from a conceptual and neural perspective. *Perspectives* on *Psychological Science: A Journal of the Association for Psychological Science*, 6(6), 537–559. https://doi.org/10.1177/1745691611419671
- Shadur, J. M., & Lejuez, C. W. (2015). Adolescent substance use and comorbid psychopathology: Emotion regulation deficits as a transdiagnostic risk factor. *Current Addiction Reports*, 2(4), 354–363. https://doi.org/10.1007/s40429-015-0070-y

Haven Bjul

Maren Prignitz