

**Becoming cruel in the face of war -  
Sex-specific, individual, and social aspects affecting the  
relation between exposure to traumatic stress and aggression**

**Dissertation**

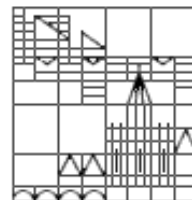
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## Abbreviations

<b>AA</b>	Appetitive aggression	<b>KERF</b>	Skala belastende Kindheits- erfahrungen [Scale adverse childhood experiences]
<b>AAS</b>	Appetitive aggression scale		
<b>adjBIC</b>	Adjusted Bayesian information criterion	<b>LRA</b>	Lord's Resistance Army
<b>AFAS</b>	Appetitive and facilitative aggression scale	<b>MACE</b>	Modified adverse childhood experiences scale
<b>ANOVA</b>	Analysis of variance	<b>MANOVA</b>	Multivariate analysis of variance
<b>APA</b>	American Psychiatric Association	<b>M</b>	Mean
<b>BAMF</b>	Bundesamt für Migration und Flüchtlinge [Federal Office for Migration and Refugees]	<b>NET</b>	Narrative Exposure Therapy
<b>BART</b>	Balloon analogue risk task	<b>PDS</b>	Posttraumatic diagnostic scale
<b>BIF</b>	Burundian franc	<b>PHQ-9</b>	Patient health questionnaire
<b>CI</b>	Confidence interval	<b>PSS-I</b>	Posttraumatic stress scale interview version
<b>CM</b>	Childhood maltreatment	<b>PTSD</b>	Posttraumatic stress disorder
<b>CFI</b>	Comparative fit index	<b>RMSE</b>	Root mean squared error
<b>corrAIC</b>	Corrected Akaike information criterion	<b>RMSEA</b>	Root mean square error of approximation
<b>DDR</b>	Demobilization, disarmament, and reintegration program	<b>SAQ</b>	Social acknowledgement questionnaire
<b>DSM-IV</b>	Fourth version of the diagnostic and statistical manual	<b>SD</b>	Standard difference
<b>DSM-5</b>	Fifth version of the diagnostic and statistical manual	<b>SE</b>	Standard error
<b>DVCV</b>	Domestic and community violence checklist	<b>SEL</b>	Self-experienced event types
<b>FORNET</b>	Narrative Exposure Therapy For Forensic Offenders	<b>SEM</b>	Structural equation model
<b>GBM</b>	Gradient boosting machines	<b>SRMR</b>	Standardized root mean square residual
<b>ISIS/IS</b>	Islamic State (of Iraq and Syria)	<b>TLI</b>	Tucker-Lewis index
<b>I8</b>	Impulsivity questionnaire	<b>UN</b>	United Nations
		<b>UNHCR</b>	United Nations Refugee Agency
		<b>UPPS</b>	urgency, premeditation, perseverance, and sensation seeking model
		<b>WHO</b>	World Health Organization
		<b>WIT</b>	Witnessed event types
		<b>ZAR</b>	South African rand

## Summary

The year 2014 saw the largest number of civilian fatalities due to organized violence registered since the end of the Cold War with the exception of the Rwandan genocide (Melander, 2015; Pettersson & Wallensteen, 2015). These armed conflicts worldwide have resulted in a tremendous increase of expulsion and migration, having culminated in 2015 in the highest number of displaced individuals ever recorded (United Nations Refugee Agency [UNHCR], 2016). From a scientific point of view, it raises the question of psychological factors maintaining violence. Several studies have shown that experiences of violence provoke a downward cycle of further violence (Widom, 1989). Maltreated children are especially vulnerable to becoming future perpetrators (e.g., Rasche et al., 2016; Wilson, Stover, & Berkowitz, 2009). Also, victims of violence during adulthood, having developed posttraumatic stress disorder (PTSD), present a high risk for increased aggression (e.g., Orth & Wieland, 2006; Rasche et al., 2016). With respect to this relation, previous researchers have focused on reactive aggression, which is defined as defense reactions in response to a perceived provocation, threat or danger (McEllistrem, 2004; Ramírez, 2009). Besides this, another type of aggression plays a significant role in the maintenance of violence in conflict regions: Appetitive aggression (Elbert, Moran, & Schauer, 2017; Elbert, Weierstall, & Schauer, 2010). Derived primarily from reports of former members of armed groups, studies from different cultural contexts indicate that a positive perception of violence can develop following active participation in atrocities and massacres, culminating in a addiction-like craving for further perpetration (e.g., Hecker, Hermenau, Maedl, Elbert, & Schauer, 2012; Köbach, Schaal, & Elbert, 2015; Weierstall, Bueno-Castellanos, Neuner, & Elbert, 2013). So far, appetitive aggression has been conceptualized as a male-driven phenomenon (Elbert et al., 2010; Nell, 2006), but a pilot investigation has indicated that females can also perceive a thrill and desire for the perpetration of violence (Meyer-Parlapanis et al., 2016).

A concept which might explain associations between traumatic stress and the development of reactive and appetitive aggression is impulsivity. Increased impulsive behavior can arise as a reaction towards traumatic experiences (e.g., Braquehais, Oquendo, Baca-Garcia, & Sher, 2010; Evren et al., 2013; Kotler, Iancu, Efroni, & Amir, 2001; Weiss, Tull, Viana, Anestis, & Gratz, 2012). Likewise, impulsivity has been associated with aggressive acts (e.g., DeWall, Baumeister, Stillman, & Gailliot, 2007; Moffitt et al., 2011; Rasche et al., 2016). Newer models classify impulsivity as a heterogeneous construct with different facets, such as the

UPPS model with its four facets *urgency*, *premeditation*, *perseverance*, and *sensation seeking* (Whiteside & Lynam, 2001; Whiteside, Lynam, Miller, & Reynolds, 2005). Thus far, this model has not been investigated with respect to appetitive aggression. Moreover, the interaction between the various factors, including experiences of trauma and aggression via impulsivity in high-risk populations for trauma, is not clear.

Another phenomenon that has been investigated within this context is an increase of risk behavior, for example, a potential health risk like excessive speed while driving, or substance misuse. It has been suggested that these behaviors occur as a coping strategy in order to reduce negative affect (Ben-Zur & Zeidner, 2009; Rheingold, Acierno, & Resnick, 2004; Tull, Weiss, & McDermott, 2016). However, there are also contradictory results, in particular when risk behavior has been assessed by means of the *balloon analogue risk task* (BART), a computer-based task in order to measure risk propensity across domains (e.g., Sujan, Humphreys, Ray, & Lee, 2014; Tull et al., 2009). This indicates that types of traumatic experiences might play an important role.

Whilst PTSD severity can be verifiably reduced by means of *Narrative Exposure Therapy for Traumatized Offenders* (FORNET; Hermenau, Hecker, Schaal, Maedl, & Elbert, 2013; Hinsberger, Holtzhausen, et al., 2016; Köbach, Schaal, Hecker, & Elbert, 2015), the intervention could not effect a reduction of the attraction towards violence. A potential explanation is the impact of social acknowledgment, which has an important influence in the development of PTSD (Maercker, Povilonyte, Lianova, & Pöhlmann, 2009), and is associated with aggressive behavior (Sommer et al., 2016; Twenge, Baumeister, Tice, & Stucke, 2001). This assumption has not been tested so far regarding FORNET.

With the current dissertation, the following research questions were investigated: 1) What impact does exposure to violence have for mental health and appetitive aggression in former female members of armed groups? Can recent aggressive behavior be predicted? 2) Are there sex-specific factors in the development of appetitive aggression? What specific types of perpetrated acts can predict appetitive aggression in females? 3) How do facets of impulsivity affect the relation between exposure to violence and aggression in a highly affected sample of individuals with refugee status? 4) How does risk behavior change depending on the type of trauma in the above-mentioned sample? 5) What role does social acknowledgment play in the treatment of appetitive aggression and PTSD by means of FORNET in adolescent offenders from South Africa?

The results demonstrated that 1) females with active involvement in combat presented the highest trauma-related impairment and aggression scores compared to female members of armed groups without combat experience, and to civilians. For all three groups, adverse childhood experiences were crucial in the prediction of aggressive behavior besides appetitive aggression. Accordingly, women in war-torn regions are affected by exposure to different types of violence dependent on their active involvement. Likewise, they are also involved in the trans-generational maintenance of a spiral of violence. 2) The moderation effect of sex revealed the sex-specific development of appetitive aggression. Whilst traumatic experiences in males facilitated an attraction towards violence, the opposite effect emerged in females. Perpetrated violence had a high predictive value for appetitive aggression in both sexes, but was more positively associated for females. 3) There was no indication of an indirect effect of impulsivity in the relation between traumatization and reactive and appetitive aggression. Reactive aggression was best predicted by PTSD and adverse childhood experiences, whereas the latter also predicted appetitive aggression together with sensation seeking. The detrimental and long-lasting effect of child maltreatment on behavior during adulthood could be confirmed with this study. It is postulated, that biased information processing results in the evaluation of environmental cues as a threat and thus increased reactive aggression. The relation between appetitive aggression and sensation seeking implies that positive emotions emerge when violence is perpetrated. 4) Specific types of traumatic events had a differential effect on risk behavior – depending on the type either increasing or diminishing it. It is suggested that peri- and posttraumatic fear, varying in its intensity due to different trauma types, can account for the avoidance of risk. 5) The factor *societal disapproval* impeded the reduction of appetitive aggression and PTSD following treatment with FORNET in adolescent offenders. It could be demonstrated that social acknowledgment is an important factor for designing future interventions.

Further research should focus on gathering epidemiological data about active involvement of women in armed conflicts, in order to establish predictors and consequences for mental health, and to be able to target vulnerable groups. Additionally, we should test whether results concerning sex-specific development of appetitive aggression can be generalized across other contexts and which risk- and protective factors are involved. With respect to the relation between traumatization and aggression via impulsivity, the assumption of biased information processing should be tested. Moreover, we need to assess whether this alteration can also account for the impact of social acknowledgment on the reduction of appetitive

aggression. Lastly, future studies should investigate the association between domain specific risk behavior and general risk perception across domains as measured by the BART.

In order to break the cycle of violence, due to the participation of females in warfare and maintenance of violence, demobilization, disarmament, and reintegration (DDR) programs need to systematically integrate female combatants, instead of formally excluding them as has frequently happened in the past (McKay & Mazurana, 2004). In addition, this dissertation highlights the necessity of sex-specific approaches, not only concerning the reintegration of former male and female combatants, but also with respect to intervention programs targeting appetitive aggression. Furthermore, in light of the massive impact of child maltreatment, the importance of extending prevention programs is underlined, together with enabling access for individuals without proper residence status in Germany. Regarding increased risk behavior, this needs particular emphasis in interventions with victims of non-organized violence. The impact of societal acknowledgment with respect to experienced violence demonstrates its great value for the prevention of further violence. This is also relevant with a view to the current refugee situation in Germany, with high numbers of traumatized individuals. The potential for an exacerbation of the cycle of violence needs to be addressed.



## **Zusammenfassung**

Im Jahr 2014 wurde, ohne Berücksichtigung des Genozids in Ruanda, die höchste zivile Opferrate aufgrund organisierter Gewalt seit dem Ende des kalten Krieges registriert (Melander, 2015; Pettersson & Wallensteen, 2015). Weltweit haben bewaffnete Konflikte dabei zu einer massiven Zunahme von Vertreibung und Flucht geführt und gipfelten im Jahr 2015 in der höchsten Anzahl jemals registrierter Geflüchteter (UNHCR, 2016). Von wissenschaftlicher Seite stellt sich die Frage nach psychologischen Faktoren, die an der Aufrechterhaltung von Gewalt beteiligt sind.

Dass Gewalterfahrungen eine Abwärtsspirale weiterer Gewalt auslösen (Widom, 1989) konnte durch diverse Studien gezeigt werden. So besteht für misshandelte Kinder ein hohes Risiko später selber zum Täter zu werden (z.B. Rasche et al., 2016; Wilson et al., 2009). Auch Opfer von Gewalterfahrungen im Erwachsenenalter mit einer posttraumatischen Belastungsstörung (PTBS) zeigen ein erhöhtes Risiko für aggressiver Verhaltensweisen (z.B. Orth & Wieland, 2006; Rasche et al., 2016). In diesem Zusammenhang wurden vor allem reaktive Aggressionsformen untersucht, die als eine Verteidigungsreaktion auf eine wahrgenommene Provokation, Bedrohung oder Gefahr definiert sind (McEllistrem, 2004; Ramírez, 2009). Darüber hinaus ist noch eine weitere Aggressionsform von zentraler Bedeutung, um die Aufrechterhaltung von Gewalt in Krisenregionen zu erklären: Appetitive Aggression (Elbert et al., 2017; Elbert et al., 2010). Basierend auf den Berichten ehemaliger Mitglieder bewaffneter Gruppen zeigen Studien in diversen Regionen, dass sich durch Beteiligung an Gräueltaten und Massakern eine positive Einstellung gegenüber Gewalt entwickeln kann, die in einem suchartigen Verlangen nach der Ausübung weiterer Taten mündet (z.B. Hecker et al., 2012; Köbach, Schaal, & Elbert, 2015; Weierstall, Bueno-Castellanos, et al., 2013). Appetitive Aggression wurde dabei bisher als hauptsächlich männliches Phänomen betrachtet (Elbert et al., 2010; Nell, 2006) doch eine Pilotstudie zeigte, dass auch Frauen den Kitzel und die Lust an der Gewaltausübung erleben (Meyer-Parlapanis et al., 2016).

Ein Konzept mit hohem Potential, um den Zusammenhang zwischen traumatischem Stress und der Entwicklung reaktiver und appetitiver Aggression zu erklären, ist Impulsivität. Erhöhte impulsive Verhaltensweisen können als Reaktion auf traumatische Erfahrungen entstehen (z.B. Braquehais et al., 2010; Evren et al., 2013; Kotler et al., 2001; Weiss et al.,

2012). Gleichzeitig wurde Impulsivität in Zusammenhang mit aggressiven Verhaltensweisen gebracht (z.B. DeWall et al., 2007; Moffitt et al., 2011; Rasche et al., 2016). Neuere Modelle klassifizieren Impulsivität als heterogenes Konzept mit verschiedenen Facetten, wie das UPPS-Modell (Whiteside & Lynam, 2001; Whiteside et al., 2005) mit den vier Faktoren *Dringlichkeit*, *Absicht*, *Ausdauer* und *Risikobereitschaft*. Hinsichtlich appetitiver Aggression wurde dieses Modell bisher jedoch nicht untersucht und gleichzeitig ist nicht bekannt, wie sich die Zusammenhänge zwischen Traumatisierungserfahrungen und Aggression vermittelt über Impulsivität bei Trauma-Hochrisikopopulationen gestalten.

Ein in diesem Kontext außerdem untersuchtes Phänomen ist die Zunahme gesundheitlich bedenklichen Risikoverhaltens wie überhöhte Geschwindigkeit beim Autofahren oder exzessiver Substanzkonsum nach dem Überleben potenziell traumatischer Ereignisse. Es wird vermutet, dass es sich hierbei um eine Bewältigungsstrategie zur Reduktion negativen Affekts handelt (Ben-Zur & Zeidner, 2009; Rheingold et al., 2004; Tull et al., 2016). Jedoch gibt es auch widersprüchliche Befunde, vor allem, wenn Risikoverhalten domänenübergreifend mittels der sogenannten *balloon analogue risk task* (BART), einer computerbasierten Aufgabe zur Messung der generellen Risikobereitschaft, erfasst wurde (Sujan et al., 2014; Tull et al., 2009). Dies deutet darauf hin, dass die Art der traumatischen Erfahrung eine große Rolle bei der Entstehung von Risikoverhalten spielt.

Während sich mittels *Narrativer Expositionstherapie für gewaltbereite Täter* (FORNET) die PTBS-Symptomatik nachweislich reduziert (Hermenau, Hecker, Schaal, et al., 2013; Hinsberger, Holtzhausen, et al., 2016; Köbach, Schaal, Hecker, et al., 2015), konnte eine Verringerung der Attraktion von Gewalt aufgrund der Intervention bisher nicht gezeigt werden. Eine mögliche Erklärung ist der Einfluss sozialer Anerkennung, die sowohl eine Rolle bei der Entstehung der PTBS spielt (Maercker et al., 2009) und in Zusammenhang mit aggressivem Verhalten steht (Sommer et al., 2016; Twenge et al., 2001). Dieser Zusammenhang wurde jedoch nicht hinsichtlich der FORNET beforscht.

Mit der vorliegenden Dissertation wurde in verschiedenen Studien folgende Fragestellungen untersucht: 1) Welche Auswirkungen haben Gewalterfahrungen bei ehemaligen weiblichen Mitgliedern bewaffneter Gruppen auf die psychische Gesundheit und appetitive Aggression und lässt sich aktuell aggressives Verhalten vorhersagen? 2) Gibt es geschlechtsspezifische Einflussfaktoren in der Entwicklung appetitiver Aggression? Welche spezifischen Gewalttaten sagen appetitive Aggression bei Frauen vorher? 3) Welchen Einfluss haben

verschiedene Impulsivitätsfacetten auf den Zusammenhang zwischen Gewalterfahrungen und Aggression in einer Stichprobe hoch belasteter Personen mit Flüchtlingsstatus? 4) Wie ändert sich Risikoverhalten in Abhängigkeit von der Art des Traumas in der o.g. Stichprobe? 5) Welche Rolle spielt soziale Anerkennung in der Reduktion von appetitiver Aggression und PTBS durch die FORNET bei jungen Straftätern aus Südafrika?

Die Ergebnisse zeigten, dass 1) Frauen mit aktiver Kampferfahrung im Vergleich zu Frauen mit Mitgliedschaft in bewaffneten Gruppen, aber ohne Kampferfahrung und im Vergleich zu Zivilistinnen die höchste traumaspezifische Beeinträchtigung und die höchsten Aggressionswerte aufwiesen. Für alle drei Gruppen waren negative Kindheitserfahrungen neben appetitiver Aggression in der Prädiktion von aggressivem Verhalten entscheidend. Demnach sind Frauen in Krisenregionen von unterschiedlicher Gewaltexposition betroffen und gleichzeitig an der transgenerationalen Aufrechterhaltung der Gewaltspirale beteiligt. 2) Appetitive Aggression zeigte eine klare geschlechtsspezifische Entwicklung durch signifikante Moderationseffekte. Während traumatische Erfahrungen bei Männern die Attraktion von Gewalt begünstigten, führten sie bei Frauen zu einem gegenteiligen Effekt. Bereits ausgeübte Gewalt hatte bei beiden Geschlechtern einen prädiktiven Wert, spielte bei Frauen jedoch eine größere Rolle. Es wird vermutet, dass bei Frauen die Schwelle zur veränderten Wahrnehmung von Gewalt verspätet als adaptive Reaktion auf eine gewalthaltige Umgebung auftritt. 3) Es gab keine Hinweise auf einen indirekten Effekt von Traumatisierung auf reaktive oder appetitive Aggression über die untersuchten Impulsivitätsfacetten in einer hochbelasteten Stichprobe. Reaktive Aggression wurde durch PTBS und negative Kindheitserfahrungen vorhergesagt, während letzteres, zusammen mit Risikobereitschaft, mit appetitiver Aggression zusammenhing. Der negative und langanhaltende Effekt früher Kindheitserfahrungen auf späteres Verhalten konnte mit der Studie bestätigt werden. Es wird angenommen, dass Fehler in der Informationsverarbeitung zu einer negativen Bewertung neutraler Umweltreize und damit zu erhöhter reaktiver Aggression führt. Der Zusammenhang zwischen appetitiver Aggression und Risikobereitschaft ist ein weiteres Indiz für das Auftreten positiver Emotionen im Zusammenhang mit der Ausübung von Gewalt. 4) Unterschiedliche Arten von traumatischen Erlebnissen hatten einen differentiellen Effekt auf die Ausübung von Risikoverhalten – je nach Typ entweder steigernd oder verringernd. Es wird vermutet, dass peri- und posttraumatische Angst, die je nach Traumotyp unterschiedlich intensiv auftritt, für die Vermeidung von Risiko verantwortlich ist. 5) Der Faktor *Erlebtes Generelles Unverständnis*

behinderte die Reduktion von appetitiver Aggression und PTBS nach Behandlung mit FORNET bei jugendlichen Straftätern. Es zeigt sich, dass soziale Anerkennung ein wichtiger Faktor zur Implementierung in zukünftige Interventionen ist.

Weitere Forschung sollte sich einerseits auf den Gewinn epidemiologischer Daten über die aktive Beteiligung von Frauen an bewaffneten Konflikten fokussieren, um Prädiktoren und Folgen für die psychische Gesundheit zu berechnen und Interventionsbedarf ableiten zu können. Andererseits sollte untersucht werden, ob sich die Ergebnisse zur geschlechtsspezifischen Entwicklung appetitiver Aggression auf andere Kontexte generalisieren lassen und welche anderen Risiko- und Schutzfaktoren eine Rolle spielen. Bezüglich des Zusammenhangs zwischen Traumatisierung und Aggression mittels Impulsivität sollte die Annahme der fehlerhaften Informationsverarbeitung geprüft werden. Weiterhin sollte geprüft werden, ob dies auch die Ursache des Einflusses von sozialer Anerkennung auf die Reduktion von appetitiver Aggression ist. Zuletzt sollten Studien den genaueren Zusammenhang zwischen domänenspezifischem Risikoverhalten einerseits und domänenübergreifenden Risikoeinstellungen z.B. durch den BART untersuchen.

Um die Gewaltspirale zu durchbrechen, sollte aufgrund der Teilnahme von Frauen an bewaffneten Konflikten in Programmen zur Entwaffnung, Demobilisierung und Reintegration (DDR) bewaffneter Gruppen eine systematische Integration weiblicher Kämpferinnen erfolgen, anstatt diese, wie häufig geschehen, von DDR Programmen auszuschließen (McKay & Mazurana, 2004). Darüber hinaus verdeutlicht die Dissertation die Notwendigkeit geschlechtsspezifischer Ansätze, nicht nur in der Reintegration ehemaliger Kämpferinnen und Kämpfer bewaffneter Gruppen, sondern allgemein bei Interventionsprogrammen zur Reduktion appetitiver Aggression. Weiterhin wird aufgrund des massiven Einflusses früher Kindesmisshandlung die Wichtigkeit der Ausweitung von Präventionsprogrammen verdeutlicht sowie der Erreichbarkeit des Angebots auch für Personen ohne gesicherten Aufenthaltsstatus in Deutschland. Hinsichtlich erhöhten Risikoverhaltens ist dies vor allem bei therapeutischen Interventionen für Opfern nicht-organisierter Gewalt zu berücksichtigen. Der Einfluss von gesellschaftlicher Anerkennung erlebter Gewalt auf die zukünftige Gewaltreduktion zeigt, dass diesem in der Prävention ein hoher Wert beigemessen werden muss. Dies ist auch im Hinblick auf die momentane Flüchtlingssituation mit einem hohen Anteil traumatisierter Personen in Deutschland relevant.

## Record of achievement

Since all articles in the thesis were established in cooperation with several colleagues, the following list indicates my own research contributions for each manuscript:

**1. Appetitive aggression and adverse childhood experiences shape violent behavior in females formerly associated with combat** (published in *Frontiers in Psychology*, 6, 1756, doi:10.3389/fpsyg.2015.01756)

Mareike Augsburger, Danie Meyer-Parlapanis, Manassé Bambonye, Thomas Elbert, Anselm Crombach.

Contributions:

- I designed the study together with colleagues.
- I carried out a significant number of clinical interviews.
- I supervised further data collection.
- I conducted the statistical analysis.
- I drafted the manuscript.

**2. Appetitive aggression and the sexes**

**2.1. Surrendering to the call of violence – Sex-linked biographical influences on the development of appetitive aggression** (submitted for publication)

Mareike Augsburger, Danie Meyer-Parlapanis, Thomas Elbert, Corina Nandi, Manassé Bambonye, Anselm Crombach.

Contributions:

- I designed the study concerning the female sample from 2014 with colleagues.
- I carried out a minor amount of clinical interviews and supervised clinical interviews in the female sample from 2014.
- I conducted the statistical analysis.
- I drafted the manuscript.

**2.2. Loving or fearing the hunt: The prediction of appetitive aggression and PTSD by types of events experienced. A replication study with females** (unpublished supplemental material)

Mareike Augsburger, Thomas Elbert, Anselm Crombach.

Contributions: see 2.1

**3. Relations between traumatic stress, dimensions of impulsivity, and reactive and appetitive aggression in individuals with refugee status** (published in *Psychological Trauma: Theory, Research, Practice, and Policy*, doi:10.1037/tra0000227)

Mareike Augsburger, Katalin Dohrmann, Maggie Schauer, Thomas Elbert.

Contributions:

- I designed the study together with colleagues.
- I carried out a large number of clinical interviews.
- I supervised other student interviewers.
- I conducted the statistical analysis.
- I drafted the manuscript.

**4. When do traumatic experiences alter risk-taking behavior? A machine learning analysis of reports from refugees** (submitted for publication)

Mareike Augsburger, Thomas Elbert.

Contributions:

- I designed the study together with colleagues.
- I carried out a large number of clinical interviews including the computer game.
- I supervised other student interviewers.
- I conducted the statistical analysis.
- I drafted the manuscript.

**5. Associations between societal disapproval and change in symptoms of PTSD and appetitive aggression following treatment among South African high-risk males** (submitted for publication)

Jessica Sommer, Martina Hinsberger, Leon Holtzhausen, Debra Kaminer, Soraya Seedat, Thomas Elbert, Mareike Augsburger, Andreas Maercker, Roland Weierstall

Contributions:

- I coordinated the third follow-up assessment of the project.
- I supervised interviewers at the third follow-up of the project.
- I reviewed and commented on the manuscript.

**“Our aggression is a deep instinct  
which survives in all kinds of manifestations in modern man.”**

(Robert Winston)





# 1 Introduction

The year 2014 saw the largest number of armed-conflict related fatalities worldwide since the end of the Cold War when excluding the Rwandan Genocide (Melander, 2015; Pettersson & Wallensteen, 2015). These figures are also reflected in highest levels of forced global displacement ever registered (UNHCR, 2016). Already much earlier, in 1996, the World Health Organization (WHO) has declared violence to be a major public health problem (Krug, Mercy, Dahlberg, & Zwi, 2002). Analyzing factors that contribute and maintain conflict is imperative in light of these numbers. Particularly, what are the psychological factors driving individuals to resort to brutal forms of violence? The social imperative to understand this has become more urgent in light of recent social and geopolitical upheavals in the world. Specifically, the enormous rise in the number of refugees entering Western Europe beginning last year, combined with the intensified number of terrorist attacks on European soil, have caused fear, uncertainty and anger amongst the local population (Wike, Stokes, & Simmons, 2016). But how do mental health and particularly trauma-related psychological problems change the perception of violence? Under which conditions does exposure to traumatic stress turn into violence? Are there sex-specific trajectories? The current thesis seeks to explore these questions by focusing on the concept of appetitive aggression. The following chapters provide an overview of this and other central concepts and the current state of research. Subsequently, empirical studies and their results are described and discussed. An overall discussion, implications and a final conclusion follow.

## 1.1 Appetitive aggression

Individuals involved in combat frequently report feeling positive or even ecstatic emotions when committing violence. This is illustrated by the testimony of this German World War II soldier (Neitzel and Welzer (2011), p. 87, as cited in Elbert et al., 2017 [author's translation]):

*“I would say well, on the first day it was terrible. Then I said: Shit, orders are orders. On the second and third day I said: I don’t care one way or another, and on the fourth day, I started to have fun with it.”*

Apparently, in the context of war, individuals’ perception of violence changes - from threatening or disgusting to being appealing. Some years ago, researchers began

systematically investigating this phenomenon and framed the term *appetitive aggression* (Elbert et al., 2017; Elbert et al., 2010). It describes feelings of excitement and pleasure when perpetrating atrocities. Appetitive aggression is conceptualized as an approach motivation towards violent cues, and can result in an addictive-type of craving for violence. Moreover, it is characterized by high autonomic arousal; individuals might become so driven by violence that they lose control (Elbert et al., 2017; Köbach, Schaal, & Elbert, 2015).

The occurrence of appetitive aggression has been confirmed by the testimony of thousands of individuals, including demobilized combatants and active soldiers from conflict regions throughout the world (e.g., Hecker et al., 2012; Nandi, Crombach, Bambonye, Elbert, & Weierstall, 2015; Weierstall, Bueno-Castellanos, et al., 2013; Weierstall, Haer, Banholzer, & Elbert, 2013), including also former child soldiers (e.g., Hermenau, Hecker, Maedl, Schauer, & Elbert, 2013; Weierstall, Schalinski, Crombach, Hecker, & Elbert, 2012). With respect to civilian samples, prevalence of appetitive aggression was high in adolescents with a criminal background in South Africa (Weierstall, Hinsberger, et al., 2013), in former and current street children from Burundi (Crombach & Elbert, 2014), and in displaced individuals (Hecker, Fetz, Ainamani, & Elbert, 2015; Mueller-Bamouh, Ruf-Leuschner, Dohrmann, Schauer, & Elbert, 2016). Forensic inpatients also reported high levels of appetitive aggression (Dudeck et al., 2016). These results demonstrate that appetitive aggression emerges in response to conflict and develops as a functional adaptation in order to cope with extreme violent conditions (Crombach & Elbert, 2014).

Individuals get drawn into a cycle of violence following self-committed violent acts (Hecker et al., 2012; Köbach, Schaal, & Elbert, 2015; Weierstall, Schalinski, et al., 2012). Subsequently, appetitive aggression predicts an ongoing perpetration of aggression (Crombach & Elbert, 2014; Mueller-Bamouh et al., 2016). Having applied a longitudinal research design with active Burundian soldiers at different stages of deployment, Nandi, Crombach, Elbert, et al. (2015) found evidence that pre-deployment appetitive aggression best predicted the likelihood of committing violent acts during deployment, which likewise increased levels of appetitive aggression after deployment. A subsequent study revealed that high levels of appetitive aggression resulted in violence towards the community, whereas violence committed by an individual against their own children and spouse were mainly driven by their own experiences of childhood maltreatment (Nandi, Bambonye, et al., 2015).

Taken together, these studies derived from different settings point to the mutual

reinforcement of violent acts and appetitive aggression. They indicate the high risk of further violence in post-conflict regions due to a threshold shift in the perception of violence. Mass atrocities and cruelties have been the result (Elbert et al., 2017). When conflict terminates and affected regions begin to regain stability and peace, the transition from “perpetrator” mode into “civilian” mode within a peaceful society is difficult. Having an attraction to violence impedes successful reintegration and compromises re-established stability (Maedl, Schauer, Odenwald, & Elbert, 2010), fueling an ongoing cycle of violence.

### **1.1.1 Relation to other types of aggression**

Despite its tremendous societal cost, researchers have not thus far attained conceptual clarity or a uniform definition of aggression. In general, aggression refers to “*behaviors that are intended to inflict harm*” (Nelson & Trainor, 2007, p. 536). Violence is defined as an extreme form of aggression, with the intention of severely harming or killing a person (Anderson & Bushman, 2002). Throughout this thesis we will use a typology of aggression based on its *function* because we are interested in both the beneficial and disruptive effects for the individual and the society (see Ramírez, 2009; Ramírez & Andreu, 2003). Following this approach, aggression can be broadly dichotomized into *goal-oriented/instrumental/proactive* and *affective/reactive* types (McEllistrem, 2004; Ramírez, 2009). The first category describes a premeditated and controlled form of aggression being executed for the purpose of achieving an anticipated external resource such as material gain, social status, or territory. The second category of aggression refers to a defensive reaction towards provocation or discomfort, usually in an angry fashion and accompanied by emotions with a negative value. The state of arousal related to reactive aggression depends on the proximity of the perceived threat (Elbert et al., 2017). This category of aggression is also assumed to occur automatically without thinking about potential consequences (see Dodge & Coie, 1987; Nelson & Trainor, 2007; Ramírez, 2009).

For the sake of clarity in this thesis, we will use the term *reactive* in contrast to *proactive* types of aggression. Regarding *appetitive* aggression, neither of these forms of aggression ultimately captures its particular characteristics. Appetitive aggression differs from reactive dimension, in that it does not counter a threat, and is carried out in a positive emotional state. Evidence for this differentiation was also provided by a study demonstrating that activated brain regions, as measured by magnetoencephalography, distinguish following the experimental induction of appetitive and reactive aggression in students (Moran, Weierstall,

& Elbert, 2014). Instead appetitive aggression might be conceptualized as an extension of proactive aggression (Weierstall, Schaal, Schalinski, Dusingizemungu, & Elbert, 2011). The anticipation of reward is also inherent in appetitive aggression. But its primary reward is not externally driven or linked to the primary gain of external resources. Rather, harming an individual is itself pleasurable and intrinsically reinforcing. From a broader perspective, it could be argued that all types of proactive aggression can be traced back to internally self-rewarding motivators and gaining of resources, making appetitive aggression the fundamental driver of human behavior and conflict. However, a characteristic of appetitive aggression is high autonomic arousal and the appearance of positive emotions (Elbert et al., 2010). This aspect does not match the classical concept of proactive aggression carried out in unemotional states and in states of low physiological arousal (Bobadilla, Wampler, & Taylor, 2012), further highlighting the difference of appetitive aggression.

## **1.2 Female aggression**

The importance of investigating trajectories of aggression and particularly appetitive aggression in females becomes evident with respect to growing numbers of active female agents in unstable regions and in terrorist movements (Laster & Erez, 2015). Estimates suggest that up to 30% of members of armed groups in conflict settings are women (Brett, 2002; Mazurana & Carlson, 2004; McKay & Mazurana, 2004), and similar numbers have been reported regarding female agents in terrorist groups (for a review see Bloom, 2011; Nacos, 2005). Regarding global security, increasing recruitment of female combatants has devastating effects. For instance, women can pass security checkpoints more easily due to culturally enforced restrictions on body searches (Bloom, 2011). Consequently, the identification of personal motives of female fighters with respect to the development of appetitive aggression and aggressive acts is essential.

Research demonstrates that males and females pursue different strategies in carrying out aggressive acts (Campbell, 2006; Cross & Campbell, 2011). In his meta-analytical review Archer (2004) showed that differences between the sexes were most pronounced when aggression was expressed in a direct physical manner. In contrast to this, little evidence for sex differences has been found in intimate partner violence in heterosexual relationships (Richardson, 2005; Straus & Ramirez, 2007). The data shows that women have a higher tendency to show physical aggression, but men have a greater likelihood of injuring their

partners (Archer, 2000a, 2000b). With respect to aggression in response to provocation, which would be best conceptualized as reactive aggression, sex differences diminish (Bettencourt & Miller, 1996; J. D. Miller & Lynam, 2006). Some researchers have emphasized social factors and gender roles as reasons for sex differences in aggression (e.g., Reidy, Sloan, & Zeichner, 2009; Richardson & Hammock, 2007; Wyckoff & Kirkpatrick, 2016), whilst others have focused on evolutionary beneficial sex-specific strategies (e.g., Campbell, 2013a; Campbell, 2013b; Cross & Campbell, 2014).

Regarding appetitive aggression, it has hitherto been regarded as a primarily male phenomenon (e.g. Elbert et al., 2010; Nell, 2006). However, recent evaluations of appetitive aggression in females have begun to complicate this picture: Having included male and female combatants in Colombia Weierstall, Bueno-Castellanos, et al. (2013) did not find sex differences in appetitive aggression. In a pilot investigation in Burundi, females with prior combat experience during the civil war were compared to males matched by levels of experienced traumatic stress. Analysis revealed that males and females did not differ in levels of appetitive aggression, as long as they had taken part in combat. Females without combat experience showed significantly less appetitive aggression than males without combat experience (Meyer-Parlapanis et al., 2016). The following quote demonstrates how a female former combatant experiences an intense enjoyment of aggressive acts (participant from Meyer-Parlapanis et al., 2016):

*“When I tortured someone, I liked to do it slowly. Using my bare hands, I would scratch and pull off the penis. Sometimes it would take more than an hour.”*

But apart from this primary investigation, there has been no exploration of female appetitive aggression.

### **1.3 Victimization and posttraumatic stress disorder**

War-affected populations frequently suffer from high impairment due to trauma-related mental disorders (Bogic, Njoku, & Priebe, 2015; Fazel, Wheeler, & Danesh, 2005; Richter, Lehfeld, & Niklewski, 2015; Steel, Silove, Phan, & Bauman, 2002). Cumulative exposure to traumatic events is linearly associated with the development of posttraumatic stress disorder (PTSD): If the traumatic load exceeds a certain limit, almost all individuals affected meet the criteria for its diagnosis (Dohrenwend et al., 2006; Neuner et al., 2004). This dose-response

relationship is called the *building block effect* (Kolassa & Elbert, 2007; Schauer et al., 2003). According to the criteria of the fourth version of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV; American Psychiatric Association [APA], 2000) a PTSD diagnosis requires the experience of, confrontation with or witnessing of at least one traumatic event (criterion A). This is defined as any event that leads to serious injury or death or threatens one's own or other's physical integrity with intense peritraumatic reactions of fear, horror, or helplessness. In the current thesis, we assessed different events, ranging from non-personal incidents such as natural disasters or accidents, to organized violence such as war and torture, as well as non-organized interpersonal events, such as physical or sexual assaults, in order to gain insight into cumulative effects of exposure and the traumatic load. Further, following DSM-IV (APA, 2000) the occurrence of three symptom clusters is mandatory: Intrusions (criterion B), avoidance (criterion C), and hyperarousal (criterion D). These symptoms have to result in significant impairment (criterion E), independent of medical or other conditions (criterion F)<sup>1</sup>.

The fear network model explains the emergence of PTSD: Under normal conditions, all memories are stored in an associative network structure (Kolassa & Elbert, 2007; Rockstroh & Elbert, 2010). New experiences update previous network structures; memory aspects are merged into one network. Under healthy conditions, memories are stored in a consistent and cohesive manner with controllable access or recall. However, in individuals with PTSD, the emotional, cognitive, behavioral and physiological aspects of the traumatic events (hot memory contents) are detached from contextual and episodic information (cold memory – the *when* and *where*). Accordingly, memory contents become activated in an uncontrollable and disturbing manner by triggering a single aspect of the network, for example through an external reminder – resulting in a fear reaction and in symptoms of PTSD.

### **1.3.1 Aggression following traumatic stress**

High prevalence of PTSD in a community can have broader consequences that go beyond individual suffering. In military veterans, a rise of aggressive acts after returning from deployment has been reported (e.g., Byrne & Riggs, 1996; Jakupcak et al., 2007; MacManus et al., 2015; Morland, Love, Mackintosh, Greene, & Rosen, 2012), and a similar pattern has

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<sup>1</sup> Since all diagnostic measurements in the current thesis refer to DSM-IV, more recent DSM-5 criteria are not further reported here.

been confirmed in civilian populations. High levels of violence were present in war-affected families (Catani, Jacob, Schauer, Kohila, & Neuner, 2008; Saile, Ertl, Neuner, & Catani, 2014). Moreover, a meta-analysis (Orth & Wieland, 2006) and very recent reviews (Birkley & Schumm, 2016; Rasche et al., 2016) provide evidence for a strong link between enhanced aggression and PTSD. People with PTSD can find themselves in a state of high arousal with disturbing emotions of anger and fear. These outbursts of aggression conform to reactive rather than proactive patterns of aggression, whereas difficulties in emotional regulation have been suggested as the main driver (Jakupcak et al., 2007; Marsee, 2008; Stimmel, Cruise, Ford, & Weiss, 2014).

With respect to appetitive aggression, two patterns of findings have emerged: First, up to a certain degree of severity, high levels of appetitive aggression buffer against the development of PTSD (e.g., Hecker, Fetz, et al., 2015; Hecker, Hermenau, Maedl, Schauer, & Elbert, 2013; Nandi, Crombach, Bambonye, Elbert, & Weierstall, 2016; Weierstall, Bueno-Castellanos, et al., 2013; Weierstall, Huth, Knecht, Nandi, & Elbert, 2012; Weierstall et al., 2011; Weierstall, Schalinski, et al., 2012). Second, victimization in the context of war and conflict was related to higher levels of appetitive aggression (Nandi, Crombach, Bambonye, et al., 2015; Sommer et al., 2017). Following the fear network model, researchers have postulated an opponent hunting network working in a similar manner. In contrast to the fear network, the hunting network incorporates appealing and exciting aspects of violent acts at different levels of perception. It explains why individuals become drawn into violence when being triggered by violent cues instead of reacting with fear (Elbert et al., 2010). Both networks are thought to work in opposition to each other. Depending on the type of memory processing, individuals revert to either an “aggressor mode” or “traumatized mode” (Nandi et al., 2016).

Taken together, engagement in war-related adversities is not necessarily traumatic. Rather the interrelation between exposure to and involvement in violent acts, together with the subsequent effects of PTSD and appetitive aggression, is complex. We do not know exactly the factors that determine whether a violent event is perceived as appetitive and thereby integrated into the putative hunting network, or traumatic, and integrated into the trauma network.

### 1.3.2 Adverse childhood experiences

Research shows that also the timing of traumatic experiences matters. McLaughlin, Conron, Koenen, and Gilman (2010) have demonstrated that exposure to childhood adversities increases the vulnerability to develop mental disorders in response to stressors during adulthood in both sexes. Traumatic experiences early in life have a strong impact on brain development and developmental trajectories (e.g., Cicchetti & Toth, 2005; Enlow, Blood, & Egeland, 2013; Teicher et al., 2003; Teicher & Samson, 2013; Teicher, Samson, Polcari, & McGreenery, 2006) and a deleterious impact on mental health (Edwards, Holden, Felitti, & Anda, 2003; Teicher et al., 2006). Accordingly, assessing the unique contribution of adverse childhood experiences to the pathway from traumatic stress to aggression is essential.

Childhood maltreatment is defined as any action of a caregiver that harms the child (Leeb, Paulozzi, Melanson, Simon, & Arias, 2008). This incorporates physical, sexual, and psychological abuse, as well as different types of neglect and lack of supervision. They also include other sources of stress, encompassing peer victimization or witnessing violence towards a caregiver or siblings (Sansen, Iffland, & Neuner, 2014; Teicher & Vitaliano, 2011). Different types of childhood maltreatment are likely to co-occur at the same time and over a longer period of time (Dong et al., 2004; Edwards et al., 2003).

Despite its tremendous burden for the individual, adversities experienced during childhood are known to lead to later aggressive and violent behavior, denoted by the term *cycle of violence* (Widom, 1989). Evidence for this turnover from yesterday's victim to tomorrow's perpetrator has been revealed by a large body of research (e.g., Glasser et al., 2001; Maas, Herrenkohl, & Sousa, 2008; Topitzes, Mersky, & Reynolds, 2012; Trabold, Swogger, Walsh, & Cerulli, 2015; Widom, 2014; Wilson et al., 2009), with physical abuse and multi-type maltreatment being the most consistent predictors of violence perpetration in youths (Maas et al., 2008). These relations have been also demonstrated cross-culturally: An association has been demonstrated in different retrospective studies with respect to the negative impact of guardians' own history of childhood maltreatment child-rearing practices in war-affected families in different Eastern African countries (Crombach & Bambonye, 2015; Rieder & Elbert, 2013; Saile et al., 2014). For appetitive aggression, Nandi and colleagues could not find a direct association between appetitive aggression and childhood maltreatment in their study with Burundian soldiers and ex-combatants. However, the interaction between lifetime perpetrated violent acts and exposure to childhood maltreatment was an important predictor



of appetitive aggression (Nandi, Crombach, Bambonye, et al., 2015). Besides this, no other study investigating this association exists. It is likely that under adverse living conditions, a complex pattern of experiences linking both perpetration and victimization allows the emergence of appetitive aggression.

### **1.4 Affecting pathways from trauma to aggression: Impulsivity**

Impulsivity describes reckless behavior with poor planning (for details see Whiteside & Lynam, 2001). It is a behavioral tendency that links exposure to traumatic events, subsequent PTSD, and increased aggression (see Marsee, 2008; Rasche et al., 2016; Thibodeau, Cicchetti, & Rogosch, 2015; Tull et al., 2016). Studies have revealed an increase in impulsivity after exposure to childhood maltreatment (Braquehais et al., 2010; Evren et al., 2013) and in response to symptoms of PTSD (Contractor, Armour, Forbes, & Elhai, 2016; Kotler et al., 2001; Weiss, Tull, Anestis, & Gratz, 2013; Weiss et al., 2012). Alterations in impulsive tendencies have been traced back to deficits in emotion regulation, self-control and frequent outbursts of anger, elicited by the hyperarousal symptom cluster (Contractor, Armour, Wang, Forbes, & Elhai, 2015; Tull et al., 2016; Weiss et al., 2013; Weiss et al., 2012). Additionally, a link between violent offending, criminal or aggressive behaviors subsequent to elevated levels of impulsivity, has been demonstrated. A large longitudinal study following children from birth until adulthood revealed that the related concept of low self-control during childhood predicted outcomes of criminal offending independently of intelligence or social context (Moffitt et al., 2011). In an experimental study DeWall et al. (2007) were able to show that the number of aggressive responses after having been provoked was dependent on the participants' trait self-control. Research on impulsivity also contributed to the differentiation of types of aggression. Barratt (1994) has suggested that individuals with high levels of impulsivity might have difficulties in controlling feelings of anger caused by external stimuli, therefore facilitating aggressive responses. J. D. Miller and Lynam (2006) have analyzed the relation between reactive/proactive aggression and impulsivity in a sample of young adults. Whereas reactive aggression was positively associated with impulsivity, proactive aggression did not correlate. These results were confirmed in US undergraduates: Low self-control was related to higher reactive aggression (Latzman & Vaidya, 2013).

Despite these findings, researchers have criticized the one-dimensional perspective of impulsivity and suggested a multi-faceted view for understanding aggression (Lynam & Miller, 2004). Whiteside and Lynam (2001) identified four distinct facets after having applied different commonly used and well-established measures of impulsivity: *Urgency*, *premeditation*, *perseverance*, and *sensation seeking* (UPPS model). According to the authors, these facets are “discrete psychological processes that lead to impulsive-like behaviors.” (Whiteside & Lynam, 2001, p. 685). *Urgency* describes the difficulty in controlling strong impulses. *Premeditation* means an individual’s tendency to carefully think before engaging. *Perseverance* is defined by maintenance of concentration in boring or difficult tasks. Lastly, *sensation seeking* describes the thrill of adventure and risk (Whiteside & Lynam, 2001). In a subsequent study the UPPS model was applied to individuals with different psychopathological conditions. Proving its construct validity, the different facets had unique contributions to the individual disorders (Whiteside et al., 2005). Additionally, the facets were differentially related to self-reports of deviance (Lynam & Miller, 2004). With respect to alterations of impulsivity facets in PTSD, evidence is mixed. In a study with substance use disorder patients, higher levels of urgency were associated with exposure to traumatic events (Weiss et al., 2013; Weiss, Tull, Sullivan, Dixon-Gordon, & Gratz, 2015). Undergraduates with symptoms of PTSD showed an increased level of sensation seeking (Contractor et al., 2016), but another study investigating a community sample did not find any relations between impulsivity facets and trauma exposure (Ceschi, Billieux, Hearn, Furst, & Van der Linden, 2014). The differential impact of impulsivity facets on different types of aggression has not yet been thoroughly investigated. Those studies that have been carried out demonstrate the superiority of the multi-faceted impulsivity model over a one-dimensional perspective and show that reactive and proactive types of aggression are related to different dimensions (e.g., Hecht & Latzman, 2015; Latzman & Vaidya, 2013; J. D. Miller, Zeichner, & Wilson, 2012).

So far the relationship between appetitive aggression and facets of impulsivity scrutiny has not yet been investigated. Additionally, no single study has assessed the impact of impulsivity in the pathway from psychological trauma to appetitive aggression.

## 1.5 Beyond aggression: Risk-taking behavior

Exposure to traumatic events and PTSD not only culminate in the perpetration of aggression, but also result in other dysfunctional and potentially destructive types of behavior, such as substance abuse, dangerous driving, or risky sexual practices. These behaviors can be subsumed under the term *risk-taking behavior*. In the context of the present thesis we define risk-taking behavior as behaviors that present the potential for benefit or reward, but also loss or negative outcome, both with unknown probabilities (Ben-Zur & Zeidner, 2009; Leigh, 1999). A growing body of research indicates that risk-taking behavior in different domains increases after being exposed to traumatic events and in the presence of PTSD symptoms (for reviews regarding civilians see Ben-Zur & Zeidner, 2009; Rheingold et al., 2004; Tull et al., 2016). Risk-taking behaviors following PTSD impede treatment success and worsen outcomes of functionality (Tull et al., 2016). Acknowledging this significant association, enhanced risk-taking behaviors have even been incorporated as a relevant diagnostic criterion for PTSD in the more recent DSM-5 version as “*self-destructive or reckless behavior*” (APA, 2013, p. 272). Models trying to explain these associations range from theories of affect regulation, cognitive-based models involving alterations in information processing or cognitions, and suppression of cortical processes by amygdala activation (Ben-Zur & Zeidner, 2009). Similar to the relation between impulsivity and trauma, researchers are also investigating tactics of emotional regulation as a coping strategy in the presence of negative affect induced by traumatic stress (Ben-Zur & Zeidner, 2009; Tull et al., 2016). It is thought that involvement in risk-taking behavior, with its perceived short-term beneficial outcome (e.g. in the case of drinking or dangerous driving) reduces negative affect.

Though a number of studies have indicated a robust link between PTSD symptoms and risk-taking behavior, when assessing risk-taking behavior across domains, such as with the computer-based balloon analogue risk task (BART; Lejuez et al., 2002), studies have yielded ambivalent results (Bornovalova, Gwadz, Kahler, Aklin, & Lejuez, 2008; Sujana et al., 2014; Woerner, Kopetz, Lechner, & Lejuez, 2016). This indicates, that specific types of traumatic events might have a differential impact. It is possible that mortality salience plays an important role (for a review see Ben-Zur & Zeidner, 2009), resulting in risk aversive decision making in the BART (Heilman, Crisan, Houser, Miclea, & Miu, 2010). However, no study in the civilian setting has systematically investigated the way that general risk-taking behavior, as measured by the BART, is affected by different types of traumatic events as well as PTSD

symptoms. Moreover, no study has examined the constellation of these factors in a high-risk population for psychological trauma.

## **1.6 Outlook: Social acknowledgment in the cycle of violence**

A clinical intervention that has been developed with the aim of reducing both PTSD and the appealing aspects of aggression among former combatants and offenders is Narrative Exposure Therapy for Forensic Offender Rehabilitation (FORNET; Elbert, Hermenau, Hecker, Weierstall, & Schauer, 2012; Hecker, Hermenau, Crombach, & Elbert, 2015). Being an extension of the evidence-based trauma intervention Narrative Exposure Therapy (NET; Schauer, Neuner, & Elbert, 2011a), FORNET fosters the inclusion of traumatic and appealing cues of violence into a coherent memory network structure. Initial randomized-controlled trials have demonstrated the feasibility of this intervention in war-and-crisis affected regions and its efficacy with respect to reducing psychopathology (Hermenau, Hecker, Schaal, et al., 2013; Hinsberger, Holtzhausen, et al., 2016; Köbach, Schaal, Hecker, et al., 2015) as well as frequency of offenses committed (Crombach & Elbert, 2015). However, the intervention has failed to reduce appetitive aggression. Possibly, perceived social acknowledgment might play an important role in explaining this puzzling result: A lack of social support in the aftermath of psychological trauma was more predictive for development of PTSD than pre-trauma factors such as age or sex (Brewin, Andrews, & Valentine, 2000). The term *social acknowledgment* describes “a victim’s experience of positive reactions from society that show appreciation for the victim’s unique state and acknowledge the victim’s current difficult situation.” (Maercker & Müller, 2004, p. 345). Its buffering effect over the development of PTSD has been confirmed in several reviews and studies (e.g., Maercker et al., 2009; J. Mueller, Orth, Wang, & Maercker, 2009; Nietlisbach & Maercker, 2009b; Sharp, P., & Allen, 2012). Regarding an association between social factors and aggression, a laboratory experiment revealed that manipulated social exclusion resulted in higher aggressive behavior of the participants towards the person who had insulted them (Twenge et al., 2001). Other studies also highlight the importance of perceived social support in preventing aggression arising from victimization (Benhorin & McMahon, 2008; Scarpa & Haden, 2006).

Empirical research specifically concerning appetitive aggression is scarce: A positive association between a denial of social acknowledgment (*general disapproval*) and appetitive aggression has been reported in South African male young adults with high risk for trauma

and violence (Sommer et al., 2016). Accordingly, *general disapproval* might be also a driving factor in treatment success derived from FORNET. However, these associations have not been investigated so far.

## 2 Rationale for the current thesis

So far research concerning appetitive aggression has mainly focused on East African post-crisis regions. Considering that appetitive aggression is a fundamental human trait, then a full understanding of this requires a broader sampling of the various cultures and social contexts in which it manifests itself. To this end, the current thesis included the following: Post-conflict settings; violent living conditions; and individuals who have fled violence and war. Another critical gap in the research thus far is appetitive aggression in females, as up until now, appetitive aggression has been considered almost exclusively a male phenomenon.

The aim of the current thesis was thus to examine the interplay between traumatic stress exposure and appetitive aggression, taking into account sex-specific trajectories, as well as potential other risk and moderating factors such as social acknowledgement and impulsivity. Moreover, sequels of exposure to traumatic stress beyond aggression should be investigated. In this thesis, I seek to answer the following research questions:

1. To what degree are females affected by trauma-related mental health as a consequence of varying proximity to warfare? What can predict current aggressive behavior in daily life in these females?
2. Appetitive aggression and the sexes
  - 2.1. How do sex-specific pathways differentially drive male and female individuals into appetitive aggression?
  - 2.2. What types of offenses best predict appetitive aggression in females?

Regarding the first research question, I investigated risk factors for recent and ongoing perpetration of violent acts in women from Burundi. With respect to the second question this sample also provided the opportunity to examine the hypothesis of sex-specific pathways for the development of appetitive aggression together with a male sample from the same setting. I was also interested in what type of offenses could best predict appetitive aggression in these females.

3. What roles do different dimensions of impulsivity have in the pathway from adverse experiences to reactive and appetitive types of aggression?
4. How does exposure to types of violence and traumatic events alter risk-taking behavior?

To answer questions three and four, I recruited a sample of displaced individuals who applied for asylum in Germany. Here I examined the impact of impulsivity facets in the pathway from adverse lifetime experiences to different types of aggression. Additionally, I investigated how specific types of traumatic experiences differentially affect a global shift in risk-taking in a sub-sample.

5. Does social acknowledgment of traumatic experiences contribute to changes in appetitive aggression and PTSD symptoms following treatment?

Concerning the last question, the impact of social acknowledgment following an intervention addressing both an attraction to violence and trauma symptoms was assessed by means of a longitudinal design in a group of South African adolescents who were both perpetrator and victim.

## **2.1 Settings of post-war and crisis**

The following sections give a short overview of each area in which data collection took place.

### **2.1.1 Fragile states and post-crisis regions: The case of Burundi**

Burundi is a post-crisis region, which has not yet fully recovered from long lasting periods of violence and fighting. Situated in the African Great Lakes Region, it is one of the poorest regions in the world according to the Human Development Index (United Nations Development Programme, 2015, p. 210). Following its independence in 1962, Burundi suffered a series of violent ethnic conflicts between Hutu rebels and a government ruled mainly by Tutsis. These conflicts escalated in a long-lasting civil war leaving over 300,000 people dead and many more displaced (Uvin, 2009). A ceasefire agreement was signed in 2006 by the last major rebel group, official demobilization of combatants lasted until 2009 (World Bank, 2009), resulting in large numbers of ex-combatants trying to transition from war to a civilian life. Behind the obvious economic problems, there are serious endemic mental health problems. Trauma-related disorders among both former combatants and the civilian population are common, and due to a lack of psychological and medical treatment (World Bank, 2009), the overall population continues to grapple in the aftermath of the conflict. The situation for Burundi's inhabitants worsened in the lead-up to the presidential

election in 2015, with increasing outbursts of violence, driving the country back to conditions of conflict and violence (United Nations, 2015).

### **2.1.2 Fleeing war and terror: Asylum seekers in Germany**

With about 65 million forcibly displaced individuals, a worldwide refugee crisis has emerged in 2015 according to the United Nations (UNHCR, 2016). Germany has been concerned with this crisis by having its largest number of asylum claims since 1953 (Bundesamt für Migration und Flüchtlinge [BAMF; Federal Office for Migration and Refugees], 2016), being at the top of the list for new asylum applications worldwide (UNHCR, 2016). Most frequent countries of origin except Albania were war-torn regions such as Syria, Kosovo, Afghanistan, and Iraq (BAMF, 2016). Accordingly, prevalence of trauma-related disorders is high. An investigation in an initial reception center in Bavaria revealed a PTSD rate of 29% in a randomly chosen sample of 125 asylum-seekers (Richter et al., 2015). Lower but still alarming numbers were reported by Führer, Eichner, and Stang (2016) with a prevalence of 18%. Despite varying rates, prevalence of PTSD in individuals seeking asylum is high, indicating that this specific population requires attention regarding associations between traumatic stress and aggression.

### **2.1.3 Living under continuous stress: Adolescents in South Africa**

Though South Africa is an economically stable country and not facing state-based conflict, it carries an immense burden: Violence and injuries are the second most frequent cause of death and disability-adjusted life years (Mayosi et al., 2012; Seedat, Van Niekerk, Jewkes, Suffla, & Ratele, 2009). A major problem contributing to high levels of violence are the existence of rival gangs with never-ending fights and counter attacks as well as high prevalence of mob justice among the population (Dixon & Johns, 2001). In order to describe this ongoing threat to life, researchers in South Africa have framed the term *continuous traumatic stress* (e.g., Eagle & Kaminer, 2013; Kaminer, Eagle, & Crawford-Browne, 2016). Young adolescent males from low-income communities are especially vulnerable to being caught in this cycle of violence. This is exacerbated by uncertain prospects for the future and subsequent high involvement in gang memberships (Hinsberger, Sommer, et al., 2016; Weierstall, Hinsberger, et al., 2013). Investigating the interplay between violence and traumatic stress in these male young offenders might help to break the cycle of violence in this region.



### **3 Appetitive aggression and adverse childhood experiences shape violent behavior in females formerly associated with combat**

#### **3.1 Abstract**

This study investigated the impact of violent experiences during childhood, posttraumatic stress disorder (PTSD) and appetitive aggression on everyday violent behavior in Burundian females with varying participation in war. Moreover, group differences in trauma-related and aggression variables were expected. Appetitive aggression describes the perception of violence perpetration as fascinating and appealing and is a common phenomenon in former combatants.

Semi-structured interviews were conducted with 158 females, either former combatants, supporters of armed forces or civilians during the civil war in Burundi. The PTSD Symptom Scale Interview was used to assess PTSD symptom severity, the Appetitive Aggression Scale to measure appetitive aggression and the Domestic and Community Violence Checklist to assess both childhood maltreatment and recent aggressive behavior.

Former combatants had experienced more traumatic events, perpetrated more violence and reported higher levels of appetitive aggression than supporters and civilians. They also suffered more severely from PTSD symptoms than civilians but not than supporters. The groups did not differ regarding childhood maltreatment. Both appetitive aggression and childhood violence predicted ongoing aggressive behavior, whereas the latter outperformed PTSD symptom severity.

These findings support current research showing that adverse childhood experiences and a positive attitude towards aggression serve as the basis for aggressive behavior and promote an ongoing cycle of violence in post-conflict regions. Female members of armed groups are in need of demobilization procedures including trauma-related care and interventions addressing appetitive aggression.

*Keywords:* Posttraumatic stress disorder (PTSD), trauma, childhood maltreatment, violence, aggression, female combatant, Burundi, post-conflict country.

## 3.2 Introduction

Even several years after the establishment of peace, the inhabitants in post-conflict regions still struggle with the aftermath of war. Poverty, poor health, lack of security and high rates of violence pose major challenges to both the individual and the overarching society (Saile et al., 2014). War-affected individuals often contend with significant mental health complications. In line with the *building block effect*, i.e., mental ill-health due to cumulative exposure to traumatic stressors (Neuner et al., 2004), prevalence rates of posttraumatic stress disorder (PTSD) in war-affected populations are severely elevated (e.g. Karunakara et al., 2004; Nandi, Crombach, Bambonye, et al., 2015; Steel et al., 2002). In addition, a growing body of research demonstrates a link between traumatization and enhanced aggressive behavior in military personnel that continues after deployment (Byrne & Riggs, 1996; MacManus et al., 2013; Morland et al., 2012). For some individuals returning from combat, PTSD symptoms, such as hyperarousal and angry outbursts, are exhibited in violent behavior (Galovski & Lyons, 2004; Orth & Wieland, 2006).

Though high rates of PTSD are present among former combatants, hyperarousal cannot fully account for the high prevalence of violence observed in post-war societies. In fact, Elbert et al. (2010) postulated that active combatants and child soldiers might perceive the perpetration of brutal aggressive acts as appealing and intrinsically rewarding. This perception of violence as exciting, i.e. appetitive aggression, has been reported by a variety of combatants in different post-conflict regions. Several studies suggest that appetitive aggression helps combatants maintain functionality and cope with trauma-related mental health symptoms in life threatening and violent environments (e.g. Hecker et al., 2012; Weierstall, Bueno-Castellanos, et al., 2013; Weierstall, Haer, et al., 2013). While developing appetitive aggression in such adverse environments seems to be beneficial in order to regain feelings of power and control, it most likely also enhances the likelihood of violent behavior (Crombach & Elbert, 2015). Moreover, high levels of appetitive aggression impede the successful reintegration of former combatants (Maedl et al., 2010).

Beyond the impact of PTSD and appetitive aggression in explaining ongoing violence in post-conflict regions, research has also focused on the effect of childhood maltreatment. According to the *cycle of violence* hypothesis (Widom, 1989), adverse childhood experiences culminate in aggressive behavior towards one's own children – thus producing an ongoing climate of violence in families. This trans-generational effect of childhood maltreatment was also observed in Sub-Saharan African post-conflict regions. Rwandan parents with histories of childhood abuse had an elevated risk of perpetrating violence against their own children (Crombach & Bambonye, 2015; Rieder & Elbert, 2013; Roth, Neuner, & Elbert, 2014). However, the impact of childhood maltreatment and trauma-related disorders on abusive child-rearing practices is not yet fully understood (Catani, 2010; Pears & Capaldi, 2001).

The majority of studies focusing on the relationship between combat exposure and ongoing violence in post-conflict regions almost exclusively focused on male combatants or soldiers (Coulter, Persson, & Utas, 2008; Herrmann & Palmieri, 2010; McKay & Mazurana, 2004). However, studies indicate that females in conflict regions are also active agents of warfare and make up a proportion to 30% of members of armed groups (Brett, 2002; Mazurana, 2004). Girl soldiers were part of fighting forces in 55 countries, 38 of these were involved in internal wars between 1990-2003 (McKay & Mazurana, 2004). Females cover a variety of tasks, ranging from supportive, caretaking roles (e.g. cooking or washing) to performing as armed combatants (Annan, Blattman, Mazurana, & Carlson, 2009; Coulter et al., 2008; Mazurana & Carlson, 2004). Some also hold central commanding roles, having achieved high-ranking military positions and authority (Coulter et al., 2008; Mazurana, 2004). For many, membership in an armed group is accompanied by an expansion of traditional gender roles and thereby new possibilities (Coulter et al., 2008).

Though the number of quantitative studies about women or girls at war has been increasing, little is known about the challenges with which female, former members of armed groups contend post-war. Only a minority have been formally included in disarmament, demobilization, and reintegration processes (E. Schauer & T. Elbert, 2010). In a review of US soldiers, female active-duty service members were found to be at the same risk for developing PTSD as their male counterparts (Chaumba & Bride, 2010). In a survey about youth in Uganda, girls abducted by Lord's Resistance Army (LRA) reported 20% higher rates of psychological distress compared to female non-abductees, even years after their return home (Annan, Blattman, Mazurana, & Carlson, 2011). Investigating appetitive aggression,

Meyer-Parlapanis et al. (2016) found that females can develop levels comparable to males when having experienced similar combat-related events. Aiming to further strengthen the knowledge about the challenges female ex-combatants face post-war, particularly in Sub-Saharan African post-conflict regions, the present study was conducted.

Burundi was selected for data collection owing to its continued struggle in the aftermath of a long-lasting civil war. It is a small but densely populated state in the African Great Lakes Region that has suffered a long history of ethnic violent conflicts. In 1993 the conflict escalated into a civil war between the Tutsi-dominated army and armed Hutu rebel groups (United States Institute of Peace, 2002). Throughout this conflict over 300,000 people, mostly civilians, were killed. The war ended in 2006 (Uvin, 2009), and the last demobilizations of rebel members officially took place in 2009 (World Bank, 2009). Today, the country continues to grapple with high levels of violence. The recent violent outbursts in response to political elections exemplify the sustained fragility of peace in Burundi (United Nations, 2015).

With the present study it was aimed to assess how females in settings like Burundi cope with adverse experiences made throughout their lives. Female, former members of armed groups were compared to civilians who had never been active agents in the civil war. Former rebels were further allocated to two groups: Combatants having participated in active fighting or supporters having been only involved in supportive, non-military tasks. We investigated differences in exposure to childhood violence and traumatic events, as well as the perpetration of violent acts and their consequences for mental health in terms of PTSD and appetitive aggression. Moreover, we assessed predictors of low-threshold daily aggressive behavior to gain insight into the cycle of violence. The highest levels of exposure to both traumatic and perpetrated events were expected within former members of armed groups as well as high levels of appetitive aggression in former combatants due to their combat experience. A similar pattern was assumed to hold true for PTSD symptoms because of the building block effect. Finally, threshold changes in aggressive behavior were expected between the groups. It was hypothesized that high levels of appetitive aggression and PTSD contribute to perpetrating more recent aggressive acts. Furthermore, the impact of experienced childhood maltreatment on the assumed relationships between PTSD, appetitive aggression and violent behavior was of interest.

### 3.3 Materials and Methods

#### 3.3.1 Participants

Semi-structured diagnostic interviews were conducted with 158 women in Burundi who had either been former combatants ( $n = 54$ ), supporters of armed groups without involvement in fighting ( $n = 50$ ), or civilians (serving as control group,  $n = 54$ ). One former combatant was excluded prior to data analysis due to discrepancies in the information provided. Demographics of the three groups are shown in table 3.1.

Respective statistical tests indicated no significant differences between the groups in age, number of children, education and working situation (all  $p \geq .07$ ). Former combatants and supporters did not differ regarding military variables (all  $p \geq .37$ ).

**Table 3.1.** Participant Demographics and military involvement.

	<b>Fighter (<math>n = 53</math>)</b>	<b>Supporter (<math>n = 50</math>)</b>	<b>Control (<math>n = 54</math>)</b>
<b>Demographics</b>			
Age, years, $M$	30.83	32.94	30.45
( $SD$ ) [ $range$ ]	(7.18) [20-55]	(9.55) [18-58]	(7.76) [19-58]
Education, years, $M$	6.62	4.78	5.35
( $SD$ ) [ $range$ ]	(3.78) [0-13]	(3.58) [0-13]	(4.74) [0 -16]
Children, No., $M$	2.51	3.02	3.15
( $SD$ ) [ $range$ ]	(2.03) [0-7]	(2.36) [0-10]	(2.2) [0-8]
<b>Variables regarding membership in armed groups</b>			
Child soldier, No., (%)	31 (59)	26 (52)	NA
Joined by force, No., (%)	18 (34)	16 (33)	NA
Duration, years, $M$	4.77	4.76	NA
( $SD$ ) [ $range$ ]	(2.23) [2-11]	(3.00) [1-15]	

*Note.*  $M$  = mean,  $SD$  = standard deviation, No. = number, NA = not applicable.

### **3.3.2 Procedure**

Data collection was carried out in fall 2014 in Bujumbura, Burundi. Former armed group members were invited to the study with the help of a local contact person from an official national veteran association. Female civilians inhabiting the same neighborhoods as the former members of armed groups were invited to participate as controls. A mixed team of experienced clinical psychologists from the University of Konstanz and trained local psychology students conducted the interviews. The latter either worked as translators (English/French – Kirundi) or performed interviews on their own following intensive training. They had gathered extensive experience in previous projects and were closely supervised to guarantee high interviewer reliability. Each interview lasted about 2-3 hours and took place in either the rooms of the Centre for Mental Health (Centre Akabanga) or at a military training compound (Camp Muha) in Bujumbura, both provided by the Burundian army. Interviewers ensured that the interviews were conducted privately. Participants received 10,000 BIF (approximately 5€) for compensation and a refund of transport costs. In addition, respondents were offered to participate in another study (not reported here). The Ethical Review Boards of both the University of Konstanz and the University Lumière of Bujumbura approved the study. All participants provided informed consent.

### **3.3.3 Measures**

All instruments were translated and blindly back translated from a validated English or French version into Kirundi. Differences in meaning were discussed with both translators and a team of local psychologists until a consensus was reached.

#### **3.3.3.1 Socio-demographics and military involvement**

Participants were asked for age, level of education, working situation and number of children. When applicable, details about participation in the rebel movement were asked (year of and age at entry, forced or voluntary joining, duration spent in the armed group).

#### **3.3.3.2 Traumatic event types**

A 20-item event list that has been applied in different contexts with populations affected by violent conflicts (Nandi, Crombach, Bambonye, et al., 2015; Neuner et al., 2004) was used to assess lifetime traumatic load. Events from the Posttraumatic Diagnostic Scale (Foa, Cashman, Jaycox, & Perry, 1997) were incorporated as well as different war-related

witnessed and self-experienced events (e.g. being attacked). It was asked whether or not certain events had been experienced. Thus, items were coded dichotomously with 0 (no) or 1 (yes). Event types were summed up to measure the total traumatic load.

### **3.3.3.3 Perpetrated event types**

To assess lifetime self-committed violence, 15 different types of perpetrated violence (e.g. committed assaults, mutilation) were assessed. The checklist has been applied in different combatant samples (Weierstall & Elbert, 2011). Coding of items was the same as for traumatic event types.

### **3.3.3.4 Childhood violence**

Exposure to violence during childhood was assessed with a 30-item culturally adapted version of the Domestic and Community Violence Checklist (DCVC, for details see Crombach & Elbert, 2014; Hermenau et al., 2011). It incorporates different experiences of maltreatment from various dimensions (psychological, physical, sexual violence, neglect) ranging from small (e.g. being pinched) to very severe events (e.g. sexual abuse). Again, all items were coded dichotomously and summed up. The sum score represents the number of experiences, ranging from 0-30.

### **3.3.3.5 Current aggressive behavior**

In order to measure the level of perpetration of violence, questions from the DCVC were also asked from a perpetrator's perspective (e.g. have you pinched someone) during the period of the last three months. Three items were added to assess reactive components of current aggression (e.g. Have you fought back, because you were attacked), whereas one item was removed (having witnessed sexual abuse), as this was not transformable into a perpetrator's perspective. Items were coded in the same manner and summed up as above, reaching a sum score from 0-32.

### **3.3.3.6 Appetitive aggression**

To assess the extent of propensity towards appetitive aggression the Appetitive Aggression Scale (AAS) was used (Weierstall & Elbert, 2011). It contains 15 items about the positive and exhilarating perception of violence related to a combatant setting (e.g., "Is it exciting for you if you make an opponent really suffer?") and was rated on a five-point Likert scale ranging from 0 (I totally disagree) to 4 (I totally agree). Items were summed up to create a

sum score between 0-60. Internal consistency was very high in the current study (Cronbach's  $\alpha = .95$ ).

### **3.3.3.7 PTSD symptom severity**

The PTSD Symptom Scale-Interview (PSS-I, Foa, Riggs, Dancu, & Rothbaum, 1993; Foa & Tolin, 2000) was used to assess the frequency of PTSD symptoms. It is comprised of 17 items, each referring to one of the symptoms for PTSD according to DSM-IV (APA, 2000). Answers are scored on a four-point Likert scale ranging from 0 (not at all) to 3 (five or more times per week/almost always). Items are summed up to a sum score ranging between 0-51. The PSS-I has proven validity in comparable samples (Ertl et al., 2010) and good psychometric properties (Foa & Tolin, 2000). Internal consistency in the current study was high (Cronbach's  $\alpha = .94$ ).

### **3.3.4 Data analysis**

SPSS 21.0 was used for statistical analysis. A MANOVA, followed by alpha-adjusted univariate *F*-tests, was calculated to assess group differences regarding *childhood violence, traumatic events, perpetrated event types, PTSD symptom severity* and *appetitive aggression*. Post hoc tests were conducted using Games-Howell. To assess predictors of *current aggressive behavior* hierarchical multiple linear regression analyses were conducted. Group membership was dummy-coded with combatants as reference group. No univariate or multivariate outliers were found. Skewness and kurtosis of variables as well as homogeneity of variances among groups gave no rise for concern. Pillai's criterion was used in the MANOVA due to its robustness against violations of homogeneity of covariance. The residuals of the regression analysis were normally distributed and independent, assumptions of homoscedasticity and linearity met. Multicollinearity was of no concern. All analyses were two-tailed and based on  $\alpha = .05$  level of significance.

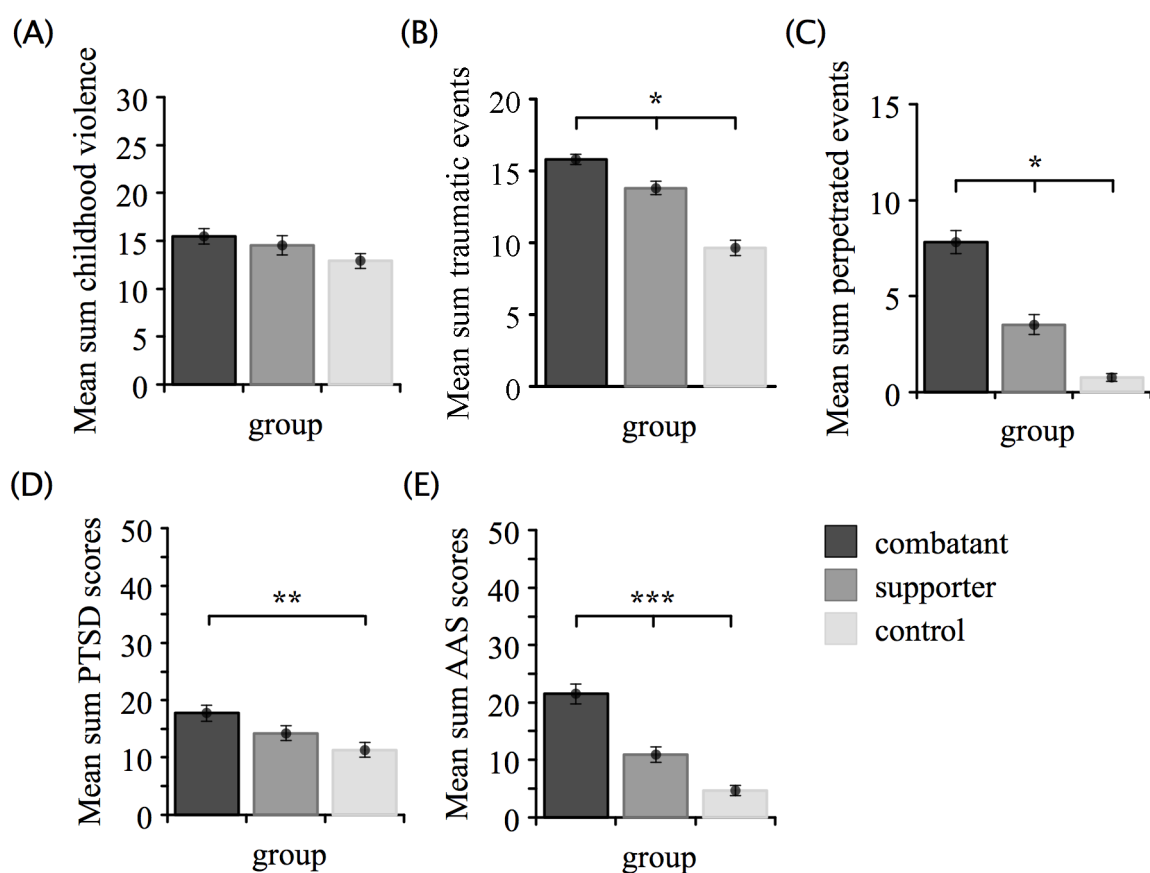
## **3.4 Results**

### **3.4.1 Group differences in outcomes related to trauma and aggression**

Using Pillai's trace, MANOVA showed a significant multivariate effect of group membership,  $V = .54$ ,  $F(8, 298) = 13.86$ ,  $p < .001$ . Univariate *F*-tests revealed significant group differences with large effect sizes in *traumatic event types*,  $F(2, 152) = 46.92$ ,  $p < .001$ ,



$\eta_p^2 = .38$ , *perpetrated event types*,  $F(2, 152) = 59.01$ ,  $p < .001$ ,  $\eta_p^2 = .44$  and *appetitive aggression*,  $F(2, 152) = 41.17$ ,  $p < .001$ ,  $\eta_p^2 = .35$ . Former combatants had significantly higher rates compared to both former supporters and controls. A group difference with moderate effect size was found for *PTSD symptom severity*,  $F(2, 152) = 5.96$ ,  $p < .01$ ,  $\eta_p^2 = .07$ . Combatants suffered more severely from PTSD symptoms than controls, but did not differ from supporters. Groups did not differ regarding *childhood violence*,  $F(2, 152) = 2.38$ ,  $p = .1$ . The results of post hoc comparisons are illustrated in figure 3.1.



**Figure 3.1.** Differences between the three groups regarding (A) childhood violence, (B) traumatic event types, (C) perpetrated event types, (D) PTSD symptom severity and (E) appetitive aggression. Mean sum scores are plotted on the ordinate, whereas each bar refers to a group. \*  $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

### 3.4.2 Prediction of current violent behavior

As illustrated in table 3.2, trauma-related variables (traumatic event types, childhood violence, PTSD symptom severity) were moderately associated. Appetitive aggression and perpetrated event types showed a strong association. Overall, trauma- and aggression-related variables correlated with of moderate to high size.

**Table 3.2.** Correlations between outcome variables

Variable	1.	2.	3.	4.	5.	6.
1. Childhood violence	1					
2. Traumatic event types	.48***	1				
3. Perpetrated event types	.36***	.64***	1			
4. PTSD symptom severity	.47***	.54***	.45***	1		
5. Appetitive aggression	.19*	.53***	.81***	.4***	1	
6. Current aggressive behavior	.51***	.41***	.49***	.34***	.44***	1

Note. \* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$ .

To assess predictors for current aggressive behavior, in a first step the two dummy-coded variables of *group membership* variables were entered ( $F(2,152) = 3.77, p = .025, R^2_{\text{adjusted}} = .04$ ). Belonging to the group of controls ( $p < .01$ ) or supporters ( $p = .09$ ) was associated with lower levels of current aggressive behavior compared to combatants. After adding *appetitive aggression* and *PTSD symptom severity* as predictors in the second step, there was a significant model improvement ( $F(2,150) = 18.01, p < .001, R^2_{\text{adjusted}} = .21$ ). As illustrated in table 3.3, both, *PTSD symptom severity* and *appetitive aggression* were positively related to current aggressive behavior. Group membership proved insignificant. After including *childhood violence*, the model substantially improved in terms of variance explained ( $F(1,149) = 40.03, p < .001, R^2_{\text{adjusted}} = .37$ ). Higher levels of both *appetitive aggression* and *childhood violence* were significantly related to current aggressive behavior. However, *PTSD symptom severity* now failed to reach significance. Adding interaction terms did not improve the model in terms of higher variance explained, nor did they reach significance.

**Table 3.3.** Multiple Regression Analysis for the prediction of current aggressive behavior.

	b	SE B	$\beta$	<i>t</i>
Step 2				
Dummy control	.94	1.03	.09	.91
Dummy supporter	.52	.94	.05	.55
Appetitive aggression	.17	.04	.41	4.43***
PTSD symptom severity	.10	.04	.20	2.51*
Step 3				
Dummy control	1.29	.92	.13	-1.4
Dummy supporter	.5	.84	.05	.6
Appetitive aggression	.17	.03	.43	5.16***
PTSD symptom severity	-.01	.04	-.02	-.25
Childhood violence	.36	.06	.46	6.33***

*Note.* N = 155; SE = Standard Error; combatants were used as reference group. The constant is not shown due to better readability; \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

### 3.5 Discussion

In the present study former combatants reported higher exposure to traumatic events and greater involvement in lifetime perpetration of aggressive acts compared to both former supporters and civilians. In accordance with the *building block effect*, symptoms of PTSD were also highest among former combatants. Being an active agent of warfare resulted in greater damage of trauma-related mental health in comparison to those who had witnessed war-related actions or were victims of the civil war. These results coincide with previously published studies on former male combatants presenting high impairment due to PTSD (e.g. Nandi, Crombach, Bambonye, et al., 2015; Weierstall, Bueno-Castellanos, et al., 2013) and on psychological problems in former girl soldiers (Annan et al., 2011).

Severe physical punishment as well as high rates of sexual abuse are typical experiences for girls when growing up in armed groups (McKay & Mazurana, 2004). As more than 50% joined the armed groups when they were younger than 18, they were at particular risk for exposure to high levels of violence during childhood. However, the individuals in the three groups did not differ regarding their exposure to adverse experiences during childhood. A possible explanation could be that domestic violence and corporal punishment are a widespread phenomenon within the Burundian society. Thus, all females are likely to have experienced severe forms of childhood maltreatment. Moreover, due to the civil war and irrespectively of their own involvement many girls grew up in disrupted families and adverse conditions.

Regarding appetitive aggression, the highest levels were present among former female combatants even several years after the end of the civil war. Compared to civilians, elevated levels of appetitive aggression were also found in supporters. A recent study on Burundian former male combatants and active soldiers identified both exposure to traumatic events and lifetime involvement in violent offenses as principal risk factors for appetitive aggression (Nandi et al., 2015). These factors might also account for differences in appetitive aggression between former female supporters and civilians, as the former reported greater exposure to traumatic events and perpetration of violent acts. Overall, these results further support the idea that females are capable of developing levels of appetitive aggression similar to their male counterparts (Meyer-Parlapanis et al., 2016) and can be considered as stable and long-term adaptation to adverse and insecure environments (Crombach & Elbert, 2014). However,

the impact of factors contributing to the development of appetitive aggression might differ between the genders. Furthermore, evidence was provided that appetitive aggression, PTSD symptoms and violence experienced during childhood are important factors explaining the perpetration of everyday violence. Consistent to previous research, appetitive aggression appears to be crucial in thriving, ongoing violent behavior in post-conflict regions (Crombach & Elbert, 2014), highlighting the importance to focus on in demobilization processes of former combatants.

In contrast to appetitive aggression, PTSD and violence experienced during childhood seem to influence aggressive behavior via the same mechanism, indicated by the fact that the former lost its predictive value as soon as the latter was included in the regression model. Research has found PTSD symptoms of hyperarousal to be associated with deficits in self-regulatory competences (Galovski & Lyons, 2004; Orth & Wieland, 2006; Tull, Barrett, McMillan, & Roemer, 2007). Also a history of childhood abuse is related to a lack of the development of behavioral control strategies (Brodsky et al., 2001; Roy, 2005). On a neurobiological level, both are linked to altered neurobiological brain circuitries (Braquehais et al., 2010; Elbert, Rockstroh, Kolassa, Schauer, & Neuner, 2006; Kolassa & Elbert, 2007), which partially overlap with neurobiological changes found in persons with low behavioral control strategies (Braquehais et al., 2010). These alterations in the neural circuitry due to impeded regulatory competences predispose individuals to react aggressively (Davidson, 2000; DeWall et al., 2007) and are likely to be the underlying mechanism of childhood maltreatment outperforming PTSD in predicting current aggressive behavior. Hereby, primarily anger-driven reactive forms of aggression are affected, whereas appetitive aggression presents a distinct brain pattern (Moran et al., 2014). Thus, appetitive aggression and childhood maltreatment independently contribute to different forms of aggression resulting in an overall enhanced level of aggressive acts further promoting the cycle of violence.

The current study has some limitations. Relying on self-report, memory effects and social desirability might have biased reporting appetitive aggression and aggressive acts, possibly underestimating their impact. Furthermore, the context in which violent acts occurred was not assessed. In a traditional patriarchal society such as Burundi it is likely that the females perpetrated a significant part of violence against their own children, promoting a trans-generational cycle of violence (Crombach & Bambonye, 2015; Roth et al., 2014). However,

females reported both domestic and community violence, hence posing a threat to the overall development of a peaceful society. A more detailed assessment of the context might have yielded information about who is affected most by enhanced female aggressiveness.

The retrospective cohort-design limits interpretations regarding causality and direction of the reported effects. Only the chronological restrictions of the variables within the aggression model render the determined relationships between cause-and-effect plausible. Furthermore, selective dropout might have influenced the results. Severely affected women with high rates of PTSD might not have been able to participate in the interviews. Lastly, buffering effects of the community were not targeted in the current study. It is unclear, if social rejection of former fighters, who might have violated traditional gender roles, also occurred in the Burundian context. Moreover, the impact of social support, which can serve as a protective factor especially among females (Chaumba & Bride, 2010), has not been approached at all.

### **3.6 Conclusion**

The present study demonstrates that in order to disrupt the cycle of violence in post-conflict regions and to help promote and sustain long lasting peace building processes, it is essential to address adverse childhood experiences, appetitive aggression and trauma-related ill-health in females formerly associated with combat. Moreover, neglecting to provide adequate resources to females in demobilization processes (E. Schauer & T. Elbert, 2010) leaves them vulnerable in the challenges related to their victimhood. Living in societies in which women are typically charged with the role of homemaking, these untreated female members of armed groups often transition directly into the roles as caregivers for their children. For those suffering from PTSD symptomology and other mental health complications, trading in guns for cooking spoons invariably places their children at risk for being the next in the cycle of violence. Hence prospective studies should be aimed at implementing therapeutic interventions in this particular population, comprising perspectives of both perpetrator and victim. Moreover, the evaluation of their effectiveness in terms of decreasing future aggressive acts and improving mental health is a meaningful next step. Lastly, in order to further disentangle the cycle of violence precedents and risk factors of appetitive aggression should be identified with a focus on potential differences in its development between males and females.

## **4 Appetitive aggression and the sexes**

### **4.1 Surrendering to the call of violence – Sex-linked biographical influences on the development of appetitive aggression**

#### **4.1.1 Abstract**

Appetitive aggression (AA) is the attraction to violent behavior, which can peak in the experience of a combat high. In various war scenarios, members of armed groups have reported developing a desire to fight, and even hunt, humans. More recently, we have reported that the phenomenon can also be observed in female ex-combatants. However, it has not been tested as to whether both sexes show similar pathways in the development of appetitive aggression. We investigated moderation effects of sex on previously identified risk factors for AA by means of regression analyses in a sample of individuals with varying degrees of combat participation ( $n = 602$ ) and subsequently in a subsample of combatants ( $n = 109$ ). Regression analyses revealed significant moderation effects of sex. Childhood maltreatment and traumatic events had positive associations on AA for males but a negative (childhood maltreatment) or no (traumatic events) association for females. Perpetrated events were more strongly correlated with AA for females than for males. This pattern was pronounced for the combatant sample. These results are in favor of sex-linked pathways. In both sexes, AA may have evolved as a biologically prepared response to cruel environments but might develop along different trajectories. The current study highlights the need for addressing AA in order to support peace-building processes and emphasizes sex specific starting-points.

*Keywords:* Appetitive aggression, combat, sex differences, gender, child abuse.

#### **4.1.2 Background**

More than 1.5 billion individuals live amidst insecure conditions and violent conflicts which span years and decades and often spiral into multiple, overlapping cycles of violence (World Bank, 2011). In the presence of ongoing conflict, these individuals are likely to develop an inclination towards aggression stemming from the potentially appealing aspects of violent

behavior (Elbert et al., 2017; Elbert et al., 2010; Weierstall & Elbert, 2011). In contrast to reactive types of aggression, i.e. a response to a perceived threat, appetitive aggression is intrinsically rewarding and associated with positively evaluated emotions such as excitement. For further distinction from other types of aggression see Elbert et al. (2017).

The phenomenon of appetitive aggression has been reported by multiple combatant populations throughout the world, even years after the official conclusion of the armed conflicts (e.g., Hecker et al., 2012; Hermenau, Hecker, Maedl, et al., 2013; Weierstall, Haer, et al., 2013) and, to a lesser extent, in members of armed groups carrying out supportive, non-military tasks (Augsburger, Meyer-Parlapanis, Bambonyé, Elbert, & Crombach, 2015). It is likely to contribute to an elevated risk of rejoining an armed force after demobilization or a gang after a prison sentence (Maedl et al., 2010). While initially the attraction to violence was considered a potentially predominantly male phenomenon (Elbert et al., 2010; Nell, 2006), recent studies have revealed the occurrence of similar levels of appetitive aggression in both sexes involved in post-conflict regions (Augsburger et al., 2015; Meyer-Parlapanis et al., 2016). Beyond the evidence that combatants are drawn into a cycle of violence due to the intrinsically rewarding perpetration of aggression (Hecker et al., 2012; Weierstall, Schalinski, et al., 2012), the identification of further risk factors for high traits in appetitive aggression has remained challenging and so far only been investigated in males. The purpose of the current study was to assess associations between risk factors in the development of appetitively aggressive behavior in males and females.

Concerning the etiology of aggressive behavior, researchers have focused on the role of adverse childhood experiences. Over two decades ago, Widom (1989) demonstrated that a history of child abuse manifests itself in one's own perpetration of violence on subsequent generations, known as the cycle of violence. Several studies support this view (for a review see Maas et al., 2008). Additionally, exposure to lifetime traumatic events and subsequent symptoms of posttraumatic stress disorder increased the appeal of aggressive acts in military veterans (MacManus et al., 2013) and civilians (Rasche et al., 2016; Reijneveld, Crone, Verhulst, & Verloove-Vanhorick, 2003; Taft, Schumm, Orazem, Meis, & Pinto, 2010). With respect to research in former conflict regions in Eastern Africa, maltreatment experienced by parents during their childhoods was a significant predictor of violence they later perpetrated against their own children (Crombach & Bambonye, 2015). Regarding appetitive aggression specifically, the impact of childhood maltreatment and traumatic events were tested in a



study with male Burundian former combatants and active soldiers. Childhood maltreatment strengthened the association between self-perpetrated violence and appetitive aggression. Lifetime traumatic events additionally predicted appetitive aggression (Nandi, Crombach, Bambonye, et al., 2015). Moreover, positive associations between appetitive aggression and former exposure to violence were evident in South African male adolescents (Hinsberger, Sommer, et al., 2016; Sommer et al., 2017).

Some researchers assumed sex-specific pathways in the transition from self-experienced childhood abuse towards aggressive behavior and crime. For instance, Cullerton-Sen et al. (2008) reported a greater risk of physical aggression after experiences of maltreatment for boys than for girls. Accordingly, in a longitudinal study both physical and emotional child maltreatment predicted adult crime but through different pathways for males and females (Lee, Herrenkohl, Jung, Skinner, & Klika, 2015). In addition, externalizing behaviors during childhood in response to child abuse were related to later crime commission for males only, whereas internalizing behaviors predicted female crime (Jung et al., 2015). In contrast, other studies found a direct association between exposure to family violence and subsequent proactive aggression only for adolescent females (Calvete & Orue, 2013). Accordingly, child sexual abuse was related to increased frequency of aggressive acts in women but not in men (Trabold et al., 2015). Moreover, others reported no sex differences for the relation between child abuse and adolescent delinquency or adult crime (Arata, Langhinrichsen-Rohling, Bowers, & O'Brien, 2007; Topitzes et al., 2012).

To date the hypothesis of sex-specific risk factors for the development of appetitive aggression has not been investigated. We aimed to answer this question by testing moderation effects of sex on the prediction of appetitive aggression by previously identified risk factors, as moderation allows specifying conditions under which predictor and outcome are related (Hayes, 2013). More specifically, we investigated if sex moderated the association between appetitive aggression and perpetrated events, lifetime traumatic events, and childhood maltreatment respectively in a Burundian sample comprising of males and females with varying levels of combat participation. For this reason we chose to include civilians as well as combatants to reflect this wide array of diverse life experiences incurred during the civil war in Burundi. Additionally, our analysis procedure was two-folded: In a first step, a mixed sample of Burundian male and female former members of armed groups and civilians

were analyzed. In a second step these results were validated in a sample comprising only of male and female former combatants having had similar experiences during fighting.

Burundi is a small country and located in the African Great Lakes region. Similar to its neighbor Rwanda, Burundi's past is characterized by ethnic conflicts between Hutus and Tutsis, resulting in the death of over 300.000 civilians and a long-lasting civil war being waged until its formal termination in 2006 (Uvin, 2009). Despite the last official demobilizations of armed group members having taken place in 2009 (World Bank, 2009), the country continues to struggle with reinstating stability and security in the face of persistent outbreaks of violence (United States Department of State - Bureau of Democracy, 2013).

### **4.1.3 Method**

#### **4.1.3.1 Procedure**

This cross-sectional study combines data from two assessment periods in 2012 and 2014. A team of experienced clinical psychologists from the University of Konstanz, Germany and advanced psychology students from the University Lumière in Burundi collected the data. Students had received a multiple weeks of training in psychological diagnostics and concepts of aggression and traumatic stress. Clinical psychologists conducted first interviews with local students as translators (Kirundi – French or English). Local students conducted subsequent interviews under continuous on-site supervision; a personal debriefing and discussion regarding ratings together with a clinical psychologist took place after the end of each interview. Places for data collection varied depending on the external circumstances such as security concerns, and took place at University Lumière de Bujumbura (in 2012), at the Centre for Mental Health of the Burundian army (in 2014), and at training facilities provided by the Burundian army (in 2012 and 2014). All interviewers ensured a private atmosphere, devoid of third party observation. Former members of armed groups were contacted through the local veteran's association; civilians were recruited from the same living quarters in and around Bujumbura, the capital of Burundi. By means of this approach, participants were individuals with different levels of combat participation who were all living in similar socioeconomic conditions. Inclusion criteria for all participants were legal age, no signs of acute drug or alcohol intoxication and previous membership in one of Burundi's armed groups for former members, respectively no previous affiliation for civilians.

Participation in the study was voluntary; all participants provided informed consent. They received financial compensation equivalent to 5€ (2012, 2014) and a refund of transportation costs (2014). Ethical review boards of the University Lumière de Bujumbura, Burundi, and of the University of Konstanz, Germany, approved the project. Sample sizes were determined according to the feasibility of data collection in post-conflict regions.

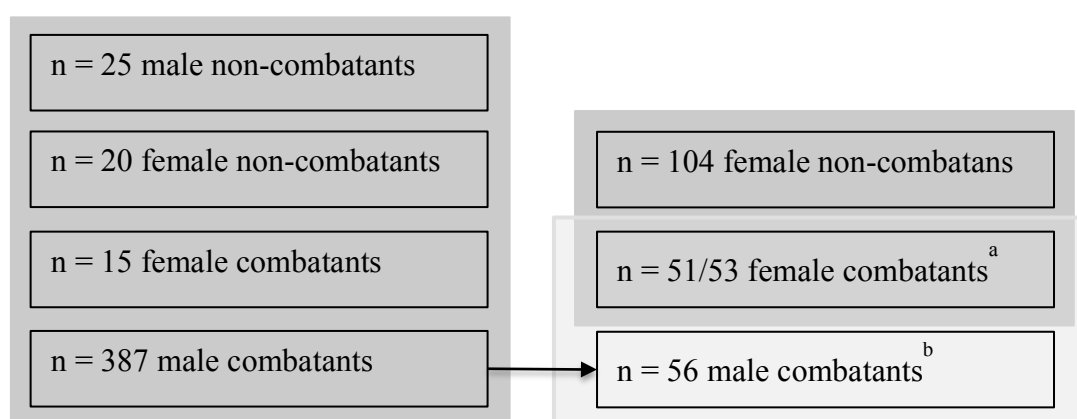
#### 4.1.3.2 Participants

All individuals invited agreed to participate. In total semi-structured interviews were conducted with 605 Burundian participants. Three female combatants were excluded prior to data analysis due to discrepancies in the information provided.

The overall sample in the first analysis consisted of 453 former combatants (387 males, 66 females) who had been demobilized after the end of the civil war and 149 participants without combat experience (25 males, 124 females). The latter were either civilians or former members of armed groups having performed non-military tasks. In the second analysis all combatants assessed in 2014 were included, namely 53 female combatants and 56 male combatants who had been reassessed in 2014. Figure 4.1 provides an overview of details regarding the assessment periods and the composition of the samples.

#### Assessment 2012

#### Assessment 2014



**Figure 4.1.** Composition of the two samples. Dark gray shaded areas refer to the overall sample, light grey shaded fields refer to the combatant sample. <sup>a)</sup> Two female participants from 2014 were excluded from the overall analysis because they had already participated in 2012. <sup>b)</sup> 56 male combatants from 2012 with highest scores of both appetitive aggression and posttraumatic stress disorder were again interviewed in 2014.

#### **4.1.3.3 Measures**

Questionnaires were translated from validated English or French versions to Kirundi and blindly back translated. Potential divergences in meaning were discussed with all parties until consensus was reached. In addition to socio-demographic data and combat experience (yes/no), the following measures were applied:

##### **4.1.3.3.1 Traumatic events**

To measure lifetime traumatic load, self-experienced (e.g. having survived a natural disaster) and witnessed (e.g. witnessed killing of someone) event types were assessed by means of a dichotomously coded event list with 19 items (response options: Yes/no). Events included specific, war-related incidents and events of the Posttraumatic Diagnostic Scale (Foa et al., 1997). The event list has been applied in various war-affected populations in Africa (e.g., Neuner et al., 2004). Items were summed up to indicate the number of different experienced event types, ranging between 0 and 19.

##### **4.1.3.3.2 Perpetrated events**

Lifetime self-committed violence was assessed in the same manner as the traumatic load with a checklist previously used in combatant samples (Weierstall & Elbert, 2011). We assessed the lifetime perpetration of 14 different types of violence (e.g., physical assault, sexual assault, homicide).

##### **4.1.3.3.3 Childhood maltreatment I**

In both 2012 and 2014 abuse experienced before the age of 18 was assessed via 4 items covering the major domains of possible abuse (Teicher et al., 2006): Sexual abuse, neglect, physical abuse, and frequent verbal abuse. As before, items were coded dichotomously, confirming occurrence during childhood, and summed up, ranging between 0-4.

##### **4.1.3.3.4 Childhood maltreatment II**

In order to further analyze the role of child maltreatment, in 2014 it was also assessed with a detailed checklist of 30 items. The checklist was derived from the domestic and community violence checklist, which had already been used with various samples of children in East Africa (Crombach & Elbert, 2014; Hermenau et al., 2011). It covers adverse childhood experiences from different domains including verbal, physical, and sexual abuse and neglect, and additionally assesses different degrees of intensity (e.g. being slapped, being hit with an object, being punched). The items refer to the first 18 years of the participant's life. Answers

were coded dichotomously (yes/no) and summed up to reach a total score ranging between 0-30. This checklist was applied to the participants in 2014 only.

#### **4.1.3.3.5 Appetitive Aggression**

A positive and exhilarating perception of violence was assessed using the 15-items Appetitive Aggression Scale (AAS). The AAS has been validated on 1,632 participants from war-affected regions. It presents good psychometric properties regarding validity and reliability. Factor analysis revealed one single factor, suggesting that it assesses a distinct construct of human aggression (Weierstall & Elbert, 2011). The AAS has been successfully applied in various post-crisis settings. Ratings were made on a five-point Likert scale from total disagreement (0) to total agreement (4) and summed up, reaching a sum score between 0-60. Cronbach  $\alpha$  coefficient was .92 for the overall sample and .89 for the combatant sample.

#### **4.1.3.4 Data analysis**

Using R, robust multiple linear regression analyses were applied to predict appetitive aggression (Rousseuw et al., 2015). This approach allows dealing with the presence of non-normal and heteroscedastic data. In order to facilitate interpretation, continuous predictors were mean centered before entering into the regression equation (Hayes, 2013). Categorical variables (*sex*, *combat experience*) were dummy-coded with males and no combat experience as reference groups. In a first step previously identified risk factors (*combat experience*, *child maltreatment*, *perpetrated event types*, *traumatic event types*) and respective interactions between these variables and *sex* were entered into the regression model. Additionally, *age* and its interaction with *sex* were included as covariates. Subsequently, non-significant predictors and interactions except *sex* were removed from the model. Robust adjusted  $r$  squared was used as fit index. Robust Wald test with pseudo degrees of freedom was applied for model comparison.

#### **4.1.4 Results**

In the overall sample ( $n = 412$  males,  $n = 190$  females), males were older (mean years 35.6, SD = 8.7 versus 30.4, SD = 7.9,  $p < .001$ ), better educated (mean years = 6.6 (SD = 3.2), versus mean = 5.6 (SD = 3.9),  $p < .001$ ), had fewer children (mean = 2.11 (SD = 2.1) versus mean = 2.8 (SD = 2.1),  $p < .001$ ), had experienced more traumatic event types (mean = 13.6 (SD = 2.5) versus mean = 12.3 (SD = 3.8),  $p < .001$ ) and had perpetrated more violent acts

than females (mean = 8.1 (SD = 3.6), versus mean = 3.7 (SD = 4.3),  $p < .001$ ). Males also reported higher levels of appetitive aggression (mean = 27.4 (SD = 22.5), versus mean = 13.0 (SD = 13.6),  $p < .001$ ). Experienced maltreatment during childhood did not differ between the sexes (mean .9 (SD = 1.0) versus mean = 1.1 (SD = 1.2),  $p = .27$ ).

In the combatant sample ( $n = 56$  males,  $n = 53$  females), the sexes only differed in age and traumatic event types. Males were older than females (mean = 39.8 (SD = 10.03), versus mean = 31.0 (SD = 7.4),  $p < .001$ ) and had experienced fewer traumatic event types (mean = 14.2 (SD = 2.3) versus mean = 15.9 (SD = 2.8),  $p < .001$ ). They had comparable levels of education (mean years males = 7.0 (SD = 2.8), mean years females = 6.5 (SD = 3.7),  $p = .52$ ), and numbers of children (mean males = 3.1 (SD = 2.3), mean females = 2.6 (SD = 2.0),  $p = .26$ ). Experienced childhood maltreatment was similar (mean males = 14.8 (SD = 5.9), mean females = 15.5 (SD = 5.8),  $p = .73$ ). Also perpetrated events (mean males = 6.3 (SD = 3.3), mean females = 7.0 (SD = 4.1),  $p = .34$ ) and appetitive aggression (mean males = 21.1 (SD = 9.1), mean females = 21.25 (SD = 11.7),  $p = .77$ ) did not differ between the sexes in the combatant sample. Correlations between the variables are shown in table 4.1.

#### 4.1.4.1 Regression analyses

Regarding the overall sample, all predictors and interactions except *sex* were significant (*child maltreatment* and *sex x perpetrated events* only marginally). The covariate *age* and its interaction with *sex* also reached significance. Adjusted R squared was .63 (SE = 9.34), the model was superior to the null model with  $F(576,11)=1358.3$ ,  $p < .001$ .

Results were similar for the combatant sample. However, neither *age* nor *traumatic events* nor their interactions had any impact on the prediction of appetitive aggression and consequently were removed from the model. Coefficients for *child maltreatment* as well as the interaction *perpetrated events x sex* reached significance in the combatant sample. All other variables showed the same pattern as in the overall sample. Adjusted R squared was .52 (SE = .54), with  $F(103,5)=161.03$ ,  $p < .001$ . The regression models for both samples are shown in table 4.2.

**Table 4.1.** Correlation matrix grouped by sex for the overall sample (A) and the combatant sample (B)

A. Overall sample (male/female)					
	Age	CM I <sup>a</sup> / II <sup>b</sup>	Traumatic events	Perpetrated events	AAS Sum Score
Combat	.21***/-.04	.07/.23**	.18***/.44***	.37***/.63***	.32***/.62***
Age	--	-.12*/-.13	-.12*/.11	-.15**/.02	-.18***/.04
Child maltreatment I (CM I) <sup>a</sup>	--	--	.21***/.34***	.23***/.29***	.25***/.19**
Traumatic events	--	--	--	.51***/.65***	.43***/.57***
Perpetrated events	--	--	--	--	.62***/.76***
B. Combatant sample (male/female)					
Age	--	-.69***/-.35*	-.45***/-.21	-.67***/-.21	-.61***/-.15
Child maltreatment II (CM II) <sup>b</sup>	--	--	.42**/.65***	.58***/.34*	.63***/.13
Traumatic events	--	--	--	.35**/.4**	.35**/.29*
Perpetrated events	--	--	--	--	.5***/.75***

*Note.* Spearman's Rho rank correlations were calculated for continuous variables, point-biserial correlation for relations with the dichotomous variable (combat) in the overall sample. <sup>a)</sup> refers to the 4-item questionnaire of child abuse used in the total sample; <sup>b)</sup> refers to the more detailed assessment during 2014. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

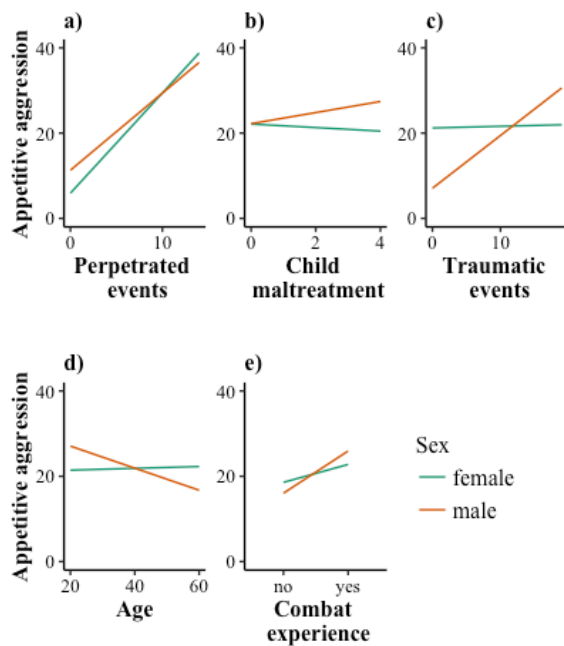
**Table 4.2.** Final models predicting appetitive aggression from a sex-linked pathway perspective for the overall sample (A) and the combatant sample (B)

	A. Overall sample ( <i>n</i> = 602)				B. Combatant sample ( <i>n</i> = 109)			
	<i>B</i>	95 % CI	SE	<i>t</i>	<i>B</i>	95 % CI	SE	<i>t</i>
Age	<b>-.26***</b>	<b>[-.41, -.11]</b>	<b>.08</b>	<b>-3.94</b>				
Sex	2.60	[-1.20, 6.41]	1.94	1.34	-.70	[-3.64, 2.24]	1.48	-.47
Combat	<b>9.90***</b>	<b>[6.44,13.36]</b>	<b>1.76</b>	<b>5.62</b>	/	/	/	/
Child maltreatment <sup>a,b</sup>	<b>1.30<sup>o</sup></b>	<b>[-.02, 2.62]</b>	<b>.67</b>	<b>1.94</b>	<b>.71***</b>	<b>[0.46, 0.97]</b>	<b>.13</b>	<b>5.56</b>
Perpetrated events	<b>1.81***</b>	<b>[1.403, 2.21]</b>	<b>.20</b>	<b>8.84</b>	<b>.68*</b>	<b>[0.12, 1.24]</b>	<b>.28</b>	<b>2.42</b>
Traumatic events	<b>1.24***</b>	<b> [.69, 1.79]</b>	<b>.28</b>	<b>4.4</b>				
Sex * combat	<b>-5.69*</b>	<b>[-10.63, -.75]</b>	<b>2.51</b>	<b>-2.26</b>	/	/	/	/
Sex * child maltreatment <sup>a,b</sup>	<b>-1.72*</b>	<b>[-3.36, -.07]</b>	<b>.84</b>	<b>-2.05</b>	<b>-1.06***</b>	<b>[-1.49, -0.62]</b>	<b>.22</b>	<b>-4.82</b>
Sex * perpetrated events	<b>.54<sup>o</sup></b>	<b>[-.07, 1.15]</b>	<b>.31</b>	<b>1.75</b>	<b>1.66***</b>	<b>[0.92, 2.40]</b>	<b>.37</b>	<b>4.46</b>
Sex * traumatic events	<b>-1.20***</b>	<b>[-1.84, -.56]</b>	<b>.33</b>	<b>-3.67</b>				
Sex * age	<b>.28**</b>	<b>[.09, .47]</b>	<b>.10</b>	<b>2.90</b>				

*Note.* The intercept was removed due to better readability. Unstandardized b-coefficients of the centered model with 95 % confidence intervals, standard errors (SE) and t-values are shown. <sup>a)</sup> refers to the 4-item questionnaire of child abuse used in the total sample; <sup>b)</sup> refers to the more detailed assessment during 2014. <sup>o</sup> *p* < .08\* *p* < .05, \*\* *p* < .01, \*\*\* *p* < .001. Significant coefficients are shown in boldface.

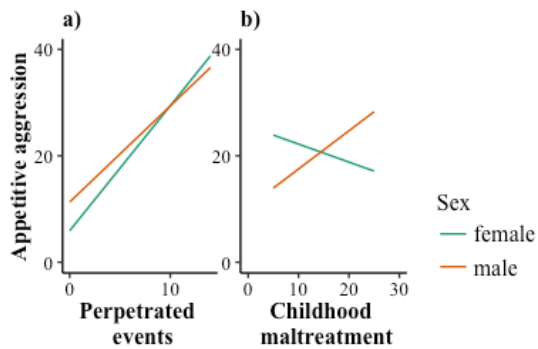


From figure 4.2 it can be derived that in the overall sample for females the association between *perpetrated events* and appetitive aggression was stronger than for males. There was a reverse effect for *combat experience*, with a stronger association existing for males. Moreover, *traumatic events* were correlated with appetitive aggression for males but not females. The same applied to the *age* of the participants, which was negatively related among males. Lastly, *child maltreatment* was only positively associated with appetitive aggression for males.



**Figure 4.2.** Two-way interactions in the overall sample between sex and perpetrated events (a), child abuse (b), traumatic events (c), age (d), combat experience (e), respectively. Only four items were available for the overall sample to indicate childhood maltreatment.

Interaction effects of the combatant sample are visually displayed in figure 4.3. They indicate that the interaction effect between perpetrated events and sex was even more pronounced in combatants. Additionally, traumatic events in the combatant sample were negatively associated with female appetitive aggression.



**Figure 4.3.** Two-way interaction in the combatant sample between sex and perpetrated events (a) and sex and childhood maltreatment (panel b). In this sample, childhood maltreatment was assessed with a detailed 30 item checklist.

#### 4.1.5 Discussion

The aim of the current study was to investigate whether sex moderated relations between risk factors and appetitive aggression. Our results are in line with the assumption of sex-specific pathways. Both adverse childhood experiences and lifetime traumatic events had a positive association with appetitive aggression – but only for males. For females, there was no significant relation between appetitive aggression and traumatic events and a reversed relation between childhood maltreatment and appetitive aggression. Our results are concordant with studies showing positive associations between physical aggression and childhood abuse for males only (Cullerton-Sen et al., 2008). Moreover, our results are supported by two longitudinal studies that show different trajectories for males and females in the transmission from child abuse to adult crime (Jung et al., 2015; Lee et al., 2015).

However, our results stand in contrast to studies in civilians presenting a stronger positive association between adverse childhood experiences and aggression for females than for males (Calvete & Orue, 2013; Trabold et al., 2015) and with studies who did not find evidence for sex-specific pathways (Arata et al., 2007; Topitzes et al., 2012). The following notions highlight differences between previous studies and our study and may play a role in explaining inconsistent findings:

First, in most retrospective studies, participants had been selected because of their involvement in the criminal justice system (Topitzes et al., 2012; Trabold et al., 2015). Concerning longitudinal studies, children within state-supervised settings due to prior familial abuse experiences were surveyed (Calvete & Orue, 2013; Jung et al., 2015; Lee et al., 2015). However, in the current study, participants with a broad background of experiences were included, both civilians (who had also witnessed the Burundian civil war) and former members of armed groups, representing a less selective population. Second, aggression-related outcome variables in previous studies ranged from externalizing symptoms or aggressive acts (Cullerton-Sen et al., 2008; Jung et al., 2015), to proactive aggression (Calvete & Orue, 2013), to intimate partner violence (Trabold et al., 2015), to criminal activities or delinquency (Arata et al., 2007; Lee et al., 2015) or to official court records (Topitzes et al., 2012). While these studies differently conceptualized aggression or aggressive behavior, none specifically took into account appetitive aggression. Since appetitive aggression seems to be an adaptation to violent environments (Crombach & Elbert, 2014) and develops under continuous threat (Hinsberger, Sommer, et al., 2016), sex-specific

trajectories are likely to differ from other types of aggression. Third, the majority of studies regarding sex-specific pathways were correlational designs with adolescent samples (Arata et al., 2007; Calvete & Orue, 2013; Cullerton-Sen et al., 2008). Consequently, pathways regarding adult aggression might be different.

Appetitive aggression is likely to develop as an adaptation strategy under conditions of extreme stress and threat (Crombach & Elbert, 2014). From this point of view, sex-specific trajectories in long-term stress reactions and adaptation are advantageous. Following the evolutionary perspective of Campbell (2013a, 2013b), males and females are thought to have participated differently in raising offspring: The survival of descendants may have relied to a greater extent on the mothers' rather than the fathers' survival, and thereby it is beneficial for mothers to be at a reduced risk for injury. Since lower levels of appetitive aggression reduce the overall inclination toward aggression and also subsequent risk of injury due to fighting (Augsburger et al., 2015), they increase the chances for reproductive success. Consequently, behavioral changes in response to adverse childhood experiences may be associated with reduced risk for appetitively aggressive behavior in females but not in males. This interpretation also fits with previous research showing that females tend to employ less risky forms of aggressiveness more often, such as relational aggression (Archer, 2004; Cullerton-Sen et al., 2008).

However, females are willing to risk high levels of injury when it is necessary to immediately protect their offspring against a perceived threat – i.e., they may demonstrate strong reactive aggression (Campbell, 2013b). Originating from these behavioral reactions, a threshold shift in the perception of violence might occur when the threat persists, as is the case in post-conflict regions – transitioning from reactive to appetitive aggression. This interpretation aligns with our results, as lifetime perpetrated acts more positively associated with appetitive aggression for females than for males. Regarding the interaction between age and sex in the overall sample, potential confounding variables such as the combat intensity associated with growing up during certain periods of the civil war are likely to be a reason for the moderation effects of sex.

Furthermore, some female former members of armed groups performed non-military tasks during their service, complicating comparisons with the male, non-combatant group. To account for this potential confound, the overall model was proven in an exclusive sample of male and female former combatants assessed during the same time period. Despite the male

former combatant group consisting of participants who had been interviewed again in 2014 due to high posttraumatic stress disorder related impairment and elevated levels of appetitive aggression, they did not significantly differ from female combatants in the aforementioned event types, indicating similar experiences shared overall between male and female combatants. This replication of the main results found in the overall sample demonstrates robust sex linked effects in the development of appetitive aggression. The more detailed assessment of childhood maltreatment with a different questionnaire in this second analysis adds even more weight to the stability of our findings.

#### **4.1.5.1 Limitations of the study**

Since our research design was correlational in nature, determining a cause-and-effect relationship is not possible. Moreover, effects might be underestimated due to the retrospective design. Additionally, types of traumatic events such as experiences of sexual violence are known to differ between the sexes and may thus be one of the drivers of the sex-specific trajectories. Lastly, numbers of female combatants in relation to male combatants in the overall analysis was very small, compromising generalizability of our findings.

#### **4.1.5.2 Conclusion**

Our study substantially differs from other approaches regarding study design, specific sample, and setting. Nevertheless, this initial investigation of sex-linked pathways in the development of aggression points to the possibility that appetitive aggression is fostered in conflict regions but along different trajectories for both sexes. Hence, a sex-specific approach is suggested when targeting risk factors in demobilization and reintegration programs. Future longitudinal studies should investigate sex-specific mechanisms in the development of appetitive aggression.

#### **4.1.6 Acknowledgments**

Greatest thanks to all researchers and students from Burundi and Germany who supported this project and the Burundian Ministry of Defense. Moreover, we sincerely thank all the people who were willing to participate in the study. The authors declared no conflicts of interest with respect to the authorship or the publication of this article.

## **4.2 Hunter or prey: Predicting appetitive aggression and PTSD by event types. A study with women from a post-conflict region**

### **4.2.1 Abstract**

Individuals exposed to violent events perceive those as either traumatic or as appealing and exciting. The former increases the risk of suffering from posttraumatic stress disorder (PTSD), whereas the latter fuels the development of appetitive aggression. Two recent studies with Congolese and Burundian former male combatants have shown that distinct violent cues related to hunting might be associated with appetitive aggression. The current study aimed to transfer these findings to a sample of female former combatants and civilians from Burundi. We applied random forests with conditional interference trees to investigate whether specific perpetrated, witnessed, and self-experienced event types as well as experiences of childhood maltreatment were associated with PTSD or appetitive aggression. A clear pattern emerged: Appetitive aggression was related to all perpetrated event types except sexual assault; and mainly driven by acts of killing and mutilation. The model revealed a high predictive performance. In contrast, the model concerning PTSD lacked accuracy. Although its interpretability is very limited, and further research needs to clarify this, it suggested that self-experienced and witnessed but not perpetrated event types are associated with PTSD. The analysis of females revealed similar results to those of the males in previous studies, pointing to the fact that generic cues associated with the perpetration of violence elicit appetitive aggression. However, in contrast to the earlier findings for males, we found little additional impact of traumatic events or adverse childhood experiences on appetitive aggression for females. Such sex-related differences in development highlight the need for sex-specific approaches when addressing appetitive aggression and PTSD.

*Keywords.* Appetitive aggression, PTSD, sex differences, gender differences, Burundi, combat, random forests, machine learning.

### **4.2.2 Introduction**

People who were active in conflict report elevated levels of appetitive aggression even years after the end of the war (e.g., Hecker et al., 2012; Nandi, Crombach, Bambonye, et al., 2015),

but several studies also evidence the high prevalence of combat-related psychological problems such PTSD among former combatants or military veterans (Betancourt et al., 2013; Johnson et al., 2008; Odenwald et al., 2007; Phelps, Wade, & Forbes, 2016). Due to a dose-response relationship between exposure to trauma and PTSD, individuals within war-affected regions are particularly vulnerable to the development of PTSD (Neuner et al., 2004; Schauer et al., 2003).

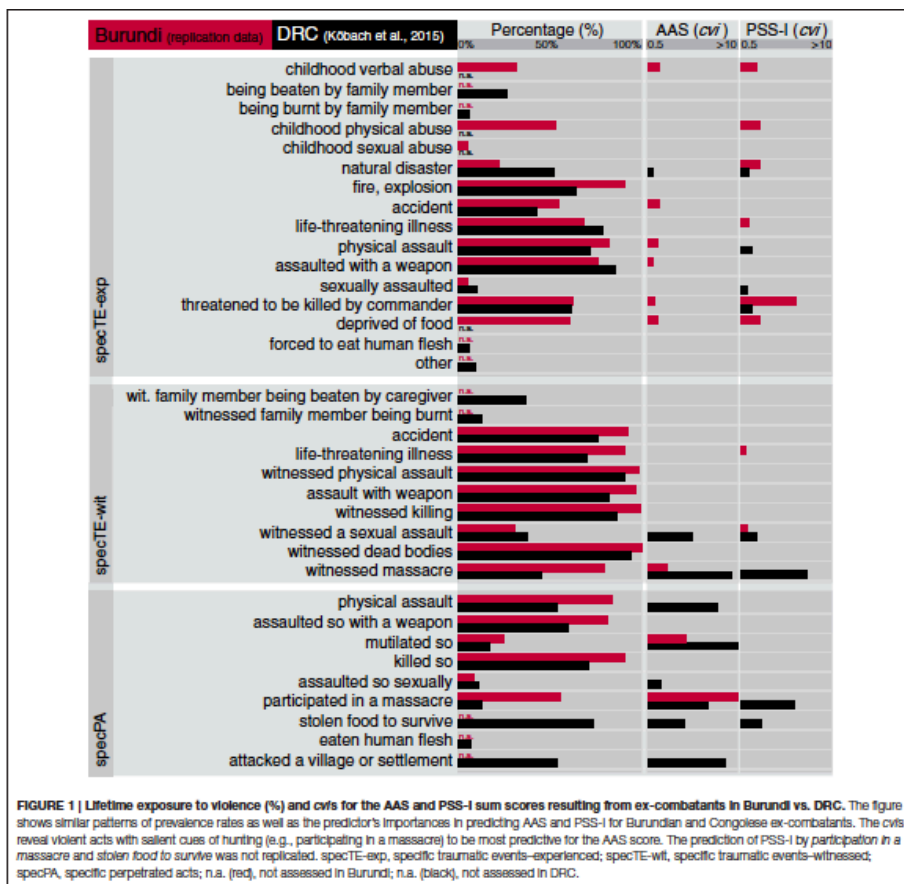
With respect to the interplay between appetitive aggression and PTSD, many studies support the hypothesis that appetitive aggression can buffer against the development of PTSD up to a certain degree (e.g., Hecker, Fetz, et al., 2015; Hecker et al., 2013; Nandi et al., 2016; Weierstall, Huth, et al., 2012). On the other hand, it has become evident that exposure to traumatic events fuels the development of appetitive aggression, for instance in combatants and active soldiers in Burundi (Nandi, Crombach, Bambonye, et al., 2015; Nandi, Crombach, Elbert, et al., 2015), or in juvenile offenders from low-income areas in South Africa (Hinsberger, Sommer, et al., 2016; Sommer et al., 2017), with a positive association between symptoms of PTSD and appetitive aggression (Hinsberger, Sommer, et al., 2016). Accordingly, the interplay between PTSD and appetitive aggression is far from understood. Cues associated with violence and conflict might be differentially perceived, either as traumatic – resulting in symptoms of PTSD, or as appealing and fascinating - resulting in the development of appetitive aggression. A potential explanation is an opposing fear and hunting network suggested by Elbert et al. (2010). Perceived cues can either be stored in the fear-network, thus giving them a negative valence, or in the hunting-network, which gives them a positive valence. Accordingly, particular cues will elicit approach or avoidance behavior, depending on the valence.

In order to determine the unique contribution of types of events - self-experienced, witnessed or perpetrated - Köbach, Schaal, and Elbert (2015) modeled their differential effects fueling the development of appetitive aggression or PTSD by means of a machine learning model of random forest with conditional interference trees (Breiman, 2001a). In their study with recently demobilized Congolese male combatants, they revealed evidence that appetitive aggression was best predicted by *having mutilated another person, having attacked a village or settlement*, and having *physically assaulted* another person. PTSD was best predicted by *having stolen food* for the sake of survival, and *been threatened to be killed by the commander*. Interestingly, *participating or witnessing a massacre* and *witnessing a sexual*

*assault* were related to both. These results are printed in black in figure 4.4. Recently, the study has been replicated in a different setting with former Burundian combatants (Köbach, Nandi, et al., 2015), supporting the prior pattern. It demonstrated that *participation in a massacre* together with *mutilation of another person* resulted in increased levels of appetitive aggression. With respect to traumatic event types, *witnessing a massacre* was most predictive; several other events also played a minor role. Regarding PTSD symptom severity, concordant with the previous study, the experience of *been threatened to be killed by the commander* had the largest impact, followed by *deprivation of food*, *survival of a natural disaster*, and different experiences of *childhood abuse* (both verbal and physical). The results are printed in red in figure 4.4. The authors concluded that the dichotomy of perpetrator and victim seems obsolete in light of the complex pattern provoking either appetitive aggression or PTSD.

Based on the determination of different pathways driving appetitive aggression in males and females in the study above, a close look at patterns of experiences eliciting either approach motivation (appetitive aggression) or avoidance (PTSD) in females is necessary. With the current study, we sought to transfer the findings of Köbach, Nandi, et al. (2015) to a sample of females. We followed the recommendations of Brandt et al. (2014) for replicating effects. Their suggested checklist can be found in appendix A.





**Figure 4.4.** Variable importance in predicting appetitive aggression and PTSD (two right panels) for the Congolese (in black) and Burundian (in red) male combatants. Figure from Köbach, Nandi, et al. (2015, p.4).

### 4.2.3 Method

The study is a sub-analysis of females presented in the study above, section 4.1.

#### 4.2.3.1 Procedure

Data was collected during two assessments in 2012 and 2014 by a mixed team of German researchers from the University of Konstanz and trained Burundian students from the University Lumière in Bujumbura. Legal age and an absence of acute drug or alcohol intoxication were inclusion criteria. Participation in the study was voluntary and all participants provided informed consent. Participants were reimbursed for travel expenses and received financial compensation. The Ethical review board of both universities approved the study. For details about procedures see 4.1.3.1.

#### **4.2.3.2 Participants**

For the current analysis, all female participants described in detail in section 4.1.3.2 were included, resulting in a total sample size of 190. Of these, 66 were former fighters, having performed military tasks, 50 had performed supportive tasks within armed groups, and 74 were civilians with no affiliation.

#### **4.2.3.3 Measures**

All measures were applied as semi-structured interviews in Kirundi from back-translated English or French versions and with the help of a native translator, if necessary. For details regarding measurements see section 4.1.3.3.

##### **4.2.3.3.1 Appetitive Aggression**

The first outcome variable in the current study was the appetitive aggression sum score as measured by the 15-items Appetitive aggression scale (AAS; Weierstall & Elbert, 2011) with ratings on a five-point Likert scale from 0 (*total disagreement*) to 4 (*total agreement*). For further details see section 4.1.3.3.5.

##### **4.2.3.3.2 PTSD symptom severity**

The second outcome variable was the PTSD symptom severity, as measured by the sum score of the PTSD Symptom Scale Interview version (PSS-I; Foa et al., 1993; Foa & Tolin, 2000). With 17 items on a four-point Likert scale (ranging from 0 [*not at all*] to 3 [*five or more times per week/almost always*]) each question refers to one of the symptoms for PTSD according to DSM-IV (APA, 2000). See section 3.3.3.7 for further details.

##### **4.2.3.3.3 Traumatic event types**

Specific self-experienced and witnessed traumatic event types were assessed by means of an event list with items from the Posttraumatic Diagnostic Scale (Foa et al., 1997), as well as other items referring to war-related events (Nandi, Crombach, Bambonye, et al., 2015; Neuner et al., 2004). See section 4.1.3.3.1 for details. In order to ensure comparability with the analysis of Burundian men in Köbach, Nandi, et al. (2015), item selection was restricted to those items having been applied in this study. Accordingly, the traumatic event list was limited to 17 items out of the original 19 items. Instead of calculating a sum score, all items were included as separate predictors with a dichotomous coding (yes/no).

#### **4.2.3.3.4 Perpetrated events**

To measure different acts of lifetime perpetration of violence (e.g., assault with a weapon) a checklist already used in similar settings (Weierstall & Elbert, 2011) was applied. See section 4.1.3.3.2 for details. As before all items were included as separate predictors, and in accordance with Köbach, Nandi, et al. (2015), item number was restricted to six items out of the original 14 items with a dichotomous coding (yes/no).

#### **4.2.3.3.5 Childhood maltreatment I**

Exposure to childhood maltreatment was assessed with one dichotomously coded item for each domain according to Teicher et al. (2006). See section 4.1.3.3.3 for details. The item reflecting experienced neglect was excluded from the analysis in order to maintain consistency with Köbach, Nandi, et al. (2015).

#### **4.2.3.4 Data analysis**

As in the analyses of Köbach, Nandi, et al. (2015), random forest with conditional interference trees were applied in order to predict appetitive aggression and PTSD symptom severity, respectively, by the single items from the different event lists. Random forests are a nonparametric regression-like machine learning tool that recursively partitions the data. At each split a random subset of predictors instead of the entire predictor set is incorporated. For details see Köbach, Schaal, and Elbert (2015) and Breiman (2001a).

In contrast to the study with Burundian males (Köbach, Nandi, et al., 2015), we did not compare the predictive performance of the event list sum scores with the performance of single items, because the area of application for random forests is the simultaneous incorporation of a large number of predictors into one single model (Breiman, 2001a).

Following the suggestions of Kuhn and Johnson (2013) the data was split in a training set (70% of the data) and a test set (30%). Splitting was random but stratified due to large variance in the outcome variable and based on four percentiles of the two outcome variables (AAS and PSS-I respectively). Because random forests cannot deal with missing values, these were removed from the analysis. The models were taught on the training set. Tuning was done by systematically adjusting numbers of predictors entered into the models at each step of node splitting (mtry). Performance of the trained models was calculated with out-of-bag (OOB) samples, meaning, that at each step of resampling a random subset of the data was used. Root mean squared error (RMSE) was used as an index of performance. Model

prediction performance was finally evaluated by applying the predictions to the test set. A pseudo r-squared of the test set was calculated by subtracting the quotient between the mean-squared error and the variance of the observations in the test set from one. Variable importance ( $v_i$ ) was calculated by means of a conditional permutation scheme, which is advantageous for correlated predictor variables (Strobl, Boulesteix, Kneib, Augustin, & Zeileis, 2008). The analysis was carried out using the packages *caret* (Kuhn et al., 2016) and *party* (Hothorn, Hornik, & Zeileis, 2006) implemented in *R*.

#### 4.2.4 Results

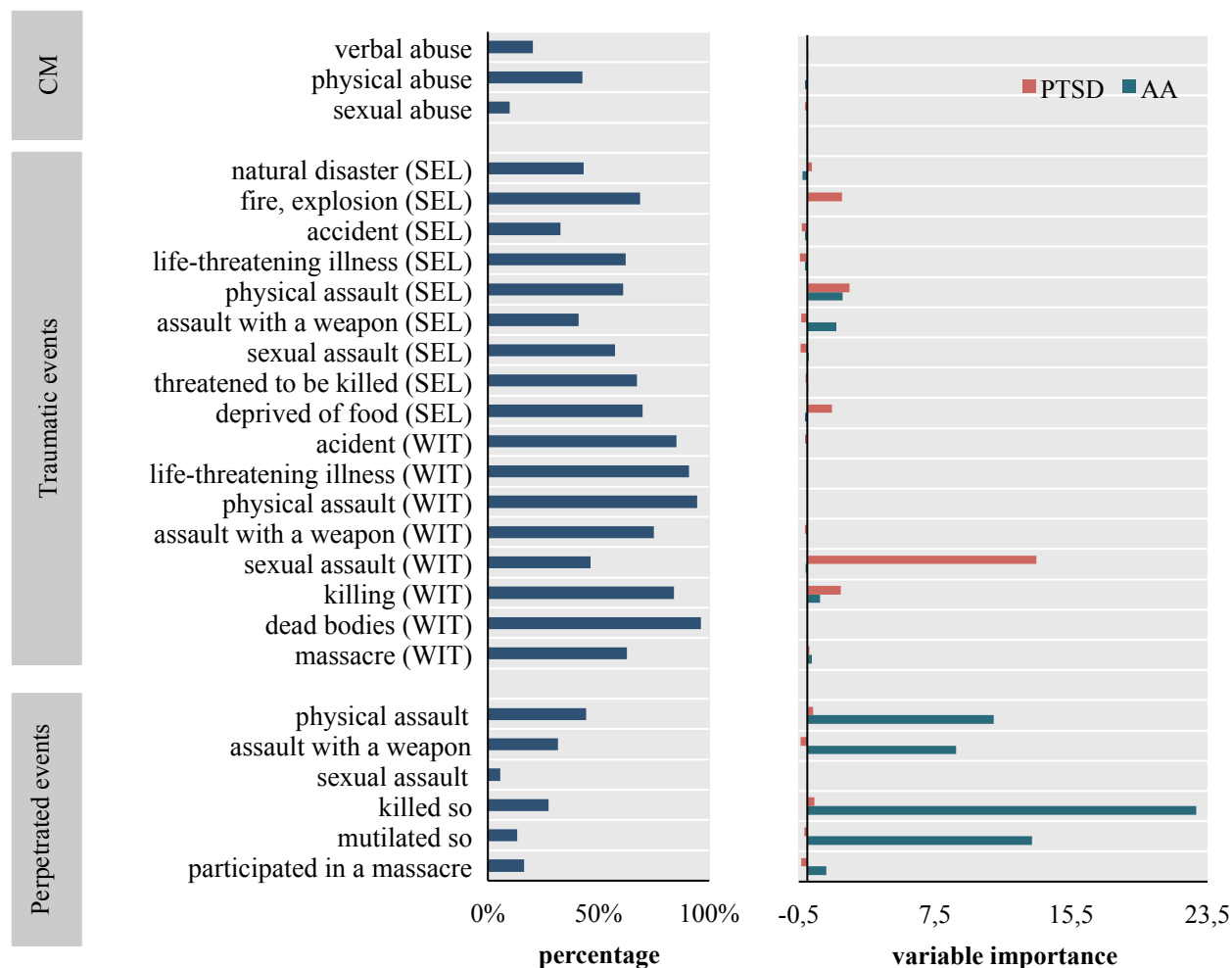
Females' mean age was 30.4 years ( $SD = 7.9$ ). They had completed 5.6 ( $SD = 3.9$ ) years of school education. Mean number of children was 2.8 ( $SD = 2.1$ ). Females had experienced a mean of 12.3 ( $SD = 3.8$ ) traumatic event types. The mean number of perpetrated event types was 3.7 ( $SD = 4.3$ ) and the mean score for appetitive aggression was 13.0 ( $SD = 13.6$ ). The mean number of experiences of childhood maltreatment was 1.1 ( $SD = 1.2$ ). For further details regarding participants' characteristics and socio-demographic information see the first paragraph of the results section in 4.1.4.

##### 4.2.4.1 Random forests

The training set consisted of 129 samples. Out-of-bag resampling in order to obtain the best number of predictors entered into the model at each step was  $mtry_{AA} = 10$  with lowest RMSE of 8.74 for appetitive aggression and  $mtry_{PTSD} = 16$  with smallest RMSE of 10.30 for PTSD, respectively. 500 trees were grown. Predicting appetitive aggression with the test set of 54 samples revealed a high accuracy with 64% of variation explained (pseudo r-squared = .639). The left panel of figure 4.5 presents frequencies of items answered with "yes". On the right panel variable importance ( $v_i$ ) for predicting appetitive aggression is shown. The *killing of another person* ( $v_i = 22.84$ ) followed by *mutilation* ( $v_i = 13.17$ ), *physical assault* ( $v_i = 10.94$ ), and *assault with a weapon* ( $v_i = 8.73$ ) served as the most important predictors. To a limited extent also *self-experienced physical assault* ( $v_i = 2.06$ ), and *assault with a weapon* ( $v_i = 1.69$ ) contributed to the development of appetitive aggression.

With respect to the prediction of PTSD, model performance was insufficient, with a pseudo r-squared of 0.016 for the test set. Accordingly, only 2% of variation could be explained when applying random forests for predicting PTSD with the item selection presented in Köbach, Nandi, et al. (2015). The most important variable in this model was *being sexually assaulted*

( $vi = 13.43$ ), and to a small degree *being physically assaulted* ( $vi = 2.49$ ), *experiences of a fire or an explosion* ( $vi = 2.03$ ), *witnessed the killing of another person* ( $vi = 1.96$ ), and *being deprived of food as an adult* ( $vi = 1.47$ ). In an attempt to improve model accuracy for the prediction of PTSD, we ran the model a second time, now with all items as described in section 4.2.3.3. However, this only marginally improved performance (pseudo r-squared = 0.03), and still leaving an inadequate model.



**Figure 4.5.** Percentages of items responded with “yes” (left panel) and variable importance in the random forests conditional interference model predicting appetitive aggression (right panel, in blue-green) and PTSD (in red). CM = childhood maltreatment, SEL = self-experienced, WIT = witnessed, PTSD = posttraumatic stress disorder, AA = appetitive aggression.

#### 4.2.5 Discussion

The current study sought to apply the findings of Köbach, Nandi, et al. (2015) about consequences of exposure to violence in a sample of females. In detail, we investigated whether specific types of events experienced in the context of conflict might elicit either a fear reaction, leading to symptoms of PTSD, or are related to the pleasurable aspects of committing violence, that is appetitive aggression. In accordance with previous studies, our results reiterate the previous finding that women can find the perpetration of violence to be pleasurable and exciting (Meyer-Parlapanis et al., 2016). Together with the results reported from male combatants in Burundi (Köbach, Nandi, et al., 2015), and our analysis of moderation effects of sex in the section above, these findings confirm the hypothesis that pathways towards appetitive aggression are sex-specific with respect to the impact of specific types of events. Whereas in the male sample certain specific experiences of lifetime and childhood traumatic events also contributed to the emergence of appetitive aggression, this was only very limited for females. Nevertheless, for these women a very clear pattern emerged: All perpetrated events except committed sexual violence were associated with appetitive aggression. Traumatic events such as experiences of childhood maltreatment and lifetime experienced or witnessed events did not provide meaningful predictors of appetitive aggression; only a minor contribution was revealed for experiences of *having been physically assaulted* and *assaulted with a weapon*. Accordingly, evidence is emerging that for females, their own perpetration of violent acts serves as an important basis for a growing fascination with committing violence.

Though males and females differ regarding the impact of lifetime traumatic and childhood events on appetitive aggression, they exhibit similarities with respect to the effect of specific perpetrated event types. For both sexes in the Burundian samples, as well as in the Congolese sample (Köbach, Schaal, & Elbert, 2015) *mutilation of another person* played an important role for predicting appetitive aggression. This is interesting, because male and female samples differed with respect to intensity of combat experience (in the current sample, civilians as well as ex-combatants were included, in contrast to the combatant-only male sample), concomitant differences in types of events experiences (e.g. being sexually assaulted) as well as important socio-economic differences (e.g. age or duration within armed groups). Yet the results indicate that generic violent cues being associated with the perpetration of violence might elicit appealing aspects in both sexes. Köbach, Nandi, et al. (2015) suggested that these cues of violence might refer to hunting behavior, such as

suffering or pain of the victim and eliciting an approach motivation. Indeed, a first study in a laboratory setting gained first insights that the scent of blood can be associated with a positive valence for both sexes, but might also depend on the fertile phase for females (Moran et al., 2015). Nevertheless, mechanisms are not fully understood at this time.

### **4.2.5.1 Limitation**

Some limitations have already been mentioned in section 4.1.5.1. The cross-sectional design only allows a possible interpretation regarding cause-effect relationships, whereas a determination remains impossible. Moreover, due to the statistical design, a direct test of the effect of participants' sex was not possible.

With respect to the prediction of PTSD, we failed to replicate the findings of Köbach, Nandi, et al. (2015) due to very poor model accuracy. Accordingly, the results for PTSD must be interpreted with care, and it cannot be said conclusively whether perpetrated events are associated with higher scores of PTSD in females. The poor predictive performance might be explained in light of the building block effect. In these terms, it is not a specific traumatic event on its own (except likably experiences of sexual violence) that is responsible for the development of PTSD, but rather the cumulative impact that eventually exceeds an individual's coping threshold (Neuner et al., 2004). Lastly, not all types of events were incorporated into the current analysis as we wanted to maintain exact comparability with the study of Köbach, Nandi, et al. (2015). Having included these items might have gained a deeper understanding of the associations between exposure to violent cues and its consequences.

### **4.2.5.2 Conclusion**

The current study further highlights the need for a sex-specific approach when targeting appetitive aggression in males and females. Further research is needed in order to determine what aspects in violent cues differentially predict the development of appetitive aggression or PTSD in the sexes.

## **5 Relations between traumatic stress, dimensions of impulsivity, and reactive and appetitive aggression in individuals with refugee status**

### **5.1 Abstract**

#### **Objective**

Traumatic stressors and other forms of adversity especially when experienced during childhood shape aggressive behavior. Effects of differential dimensions of impulsivity on the relationship between psychological trauma, reactive aggression (defensive survival response to threat), and appetitive aggression (the pleasure of attacking and fighting) have not yet been assessed.

#### **Method**

Using structural equation modeling we sought to uncover precursors of reactive and appetitive aggression investigating a sample of 94 adult individuals with refugee status. We were interested in direct effects of childhood maltreatment and PTSD and indirect effects via impulsivity dimensions.

#### **Results**

For reactive aggression there was a direct link between childhood maltreatment, and PTSD symptoms, and marginally sensation seeking. Childhood maltreatment and sensation seeking best predicted appetitive aggression. There was no evidence for indirect effects of impulsivity.

#### **Conclusions**

Fear-driven response to perceived threat based on inadequate cognitive appraisal is assumed to cause pathological reactive aggression, whilst excessive appetitive aggression can be explained by repeated experiences of thrill and excitement during violent acts. Prevention of early traumatic stress and adversities seems key to breaking the cycle of violence.

*Keywords:* Appetitive aggression, impulsivity, childhood maltreatment, posttraumatic stress disorder (PTSD), refugees.



## 5.2 Background

The occurrence of posttraumatic stress disorder (PTSD) among displaced individuals is acute (Führer et al., 2016; G. A. Miller, Elbert, & Rockstroh, 2005). Additionally, experiences of child maltreatment are particularly likely in war-affected families (Catani et al., 2008). Repeated exposure to traumatic stressors may not only cause PTSD and depression, but also elevate aggression: This has been frequently demonstrated both in military (for a review see MacManus et al., 2015; Nandi et al., 2016) and civilian (e.g. Hecker, Fetz, et al., 2015; Marsee, 2008; Taft et al., 2010) contexts. Moreover, a large body of research has revealed that a history of child abuse drives later delinquency and aggressive behavior (Cicchetti & Toth, 2005; Lansford et al., 2007; for a review see Rasche et al., 2016). In distinguishing between different types of aggression, one can say that *reactive aggression* refers to a defensive fight response to a perceived threat, coming along with high negative affect (McEllistrem, 2004). Regarding age effects of reactive aggression, a longitudinal study suggested a peak at age 15 with a decline afterwards in high-risk boys (Barker, Tremblay, Nagin, Vitaro, & Lacourse, 2006). In a cross-sectional study with a clinical sample, in the high-risk group, aggression was positively associated with age, whilst negatively associated in low-risk groups (Smeets et al., 2016). In contrast to reactive aggression, *appetitive aggression* is driven by the appeal of perpetrating violence. High levels of appetitive aggression are commonly observed in the presence of combat and war (Augsburger, Meyer-Parlapanis, et al., 2016; Elbert et al., 2017). Beyond war scenarios, high levels of appetitive aggression have been reported for forensic inpatients (Dudeck et al., 2016), adolescent gangsters (Hinsberger, Sommer, et al., 2016), and unaccompanied minors seeking asylum (Mueller-Bamouh et al., 2016).

Symptoms of PTSD have been associated with increased reactive rather than appetitive aggression in displaced populations that resettled in Uganda (Hecker, Fetz, et al., 2015) and were related to reactive aggression in US adolescents after survival of a hurricane (Marsee, 2008). In both studies, sex did not affect these associations. Regarding child abuse it correlated with appetitive aggression in a study with active soldiers from a post-conflict setting (Nandi, Bambonye, et al., 2015). It was also related to both reactive and proactive types of aggression in adolescents from a juvenile justice facility (Hoeve et al., 2015). It is controversial as to whether aggression following exposure to traumatic events is sex-specific (Begić & Jokić-Begić, 2002). Direction of effects might depend on the definitions of

aggression and sample type utilized. Concerning appetitive aggression, a positive association between exposure to traumatic events and appetitive aggression has been reported for male but not female individuals (Augsburger, Meyer-Parlapanis, et al., 2016).

Individuals suffering from PTSD frequently report difficulties in the adaptive control of potentially distressing emotions (Tull et al., 2007). Moreover, it is known that traumatic stress results in neurobiological alterations in the brain, which likewise affect self-regulatory competences in the presence of strong negative affect (Elbert et al., 2006). These alterations in emotional competences are not limited to PTSD but also occur in response to early experiences of child maltreatment (Teicher et al., 2003). Closely connected to behavioral regulation and inhibition is the construct of impulsivity, which might play an essential role in the pathway from traumatic experiences to aggressive acts. Impulsivity is multidimensional and can be framed within four distinct dimensions: *urgency*, *premeditation*, *perseverance*, and *sensation seeking* (UPPS model; Whiteside et al., 2005). Whereas a lack of perseverance is related to difficulties staying focused in long-lasting and difficult tasks, lack of premeditation describes the individual's tendency to act and decide without thinking about possible consequences. Moreover, urgency accounts for the individual's rash behavioral reactions following intensive emotional states. Sensation seeking describes the individual's need for thrilling and exciting adventures (Whiteside & Lynam, 2001; Whiteside et al., 2005). Some researchers have also included a fifth dimension, that is, positive urgency, which refers to rash actions in positive affective states (UPPS-P, Cyders et al., 2007).

Though studies have demonstrated alterations in impulsiveness after exposure to traumatic events and childhood maltreatment (for a review see Tull et al., 2016), research regarding specific dimensions is limited. Patients with substance use disorder reported higher levels of urgency when having experienced traumatic events (Weiss et al., 2013; Weiss et al., 2015), whereas a tendency for sensation seeking was found in undergraduate students presenting symptoms of PTSD (Contractor et al., 2016). In contrast, Ceschi et al. (2014) did not find associations between UPPS dimensions and exposure to traumatic events in a community sample. Regarding the relation between impulsivity and aggression, in their meta-analysis Berg, Latzman, Bliwise, and Lilienfeld (2015) investigated how dimensions of impulsivity were differentially related to outcomes of aggression and antisocial behavior. Having included 14 studies, they determined strong associations for aggression and negative urgency as well as sensation seeking, whereas no effects could be detected for both premeditation and

perseverance. Moreover, Bousardt, Hoogendoorn, Noorthoorn, Hummelen, and Nijman (2016) found negative urgency to be the strongest predictor for physical aggressive acts in forensic inpatients in comparison to other impulsivity dimensions.

The impact of impulsivity on different types of aggression has rarely been investigated. In a large sample of undergraduates, a lack of both perseverance and premeditation was associated with both reactive and proactive types of aggression (Latzman & Vaidya, 2013). However, the authors did not assess associations for remaining facets of impulsivity according to the UPPS model. J. D. Miller et al. (2012) investigated relations in undergraduate students by means of simultaneous regressions and reported associations to reactive aggression for both negative urgency and sensation seeking, whereas none of the impulsivity dimensions was related to proactive aggression. Similar results were shown by Hecht and Latzman (2015) in undergraduates. They also identified negative urgency as a predictor of reactive aggression and a lack of perseverance. Proactive forms of aggression were best predicted by both negative and positive urgency.

Though both early childhood and symptoms of PTSD have been linked to aggressive and violent acts (Cicchetti & Toth, 2005; Hecker, Fetz, et al., 2015; Hovee et al., 2015; Lansford et al., 2007; MacManus et al., 2015; Marsee, 2008; Nandi et al., 2016; Taft et al., 2010), and likewise are known to enhance impulsiveness-related actions (Contractor et al., 2016; Tull et al., 2007; Weiss et al., 2013; Weiss et al., 2015), no study investigated the differential effects of impulsivity dimensions in the pathway from adverse childhood experiences and traumatic stress to both appetitive and reactive aggression. Moreover, considering the high prevalence of both PTSD and child maltreatment among war-affected populations, trauma-related predictors of aggression need to be investigated.

In the current study we aimed to address these issues. Using structural equation modeling (SEM), we simultaneously incorporated multivariate relations between effects into one single model. We predicted direct paths from childhood maltreatment to both reactive and appetitive aggression, and PTSD symptoms to reactive aggression, as well as indirect paths via four differential impulsivity facets according to the UPPS model. We chose not to consider positive urgency, because no German validated short version was available at the time of data collection. Correlations between appetitive and reactive types of aggression were expected, as they are related to one another (J. D. Miller et al., 2012), as well as relations between facets of impulsivity. We conceptually decided to include PTSD symptom severity instead of the

lifetime traumatic load in terms of number of experienced traumatic events, because we were specifically interested in alterations due to pathological trauma symptomology.

## **5.3 Methods**

### **5.3.1 Procedure**

The Centre for Psychotraumatology at the University of Konstanz offers treatment for traumatized individuals with refugee status. Data was collected at the center between April 2014 and December 2015. Semi-structured interviews were conducted by experienced clinical psychologists or trained master's-level students under close supervision and, in 78% of the cases, with the help of trained translators. Interpreters were asked to translate word by word, with no changes in meaning and in the first person. Evidence has suggested that the use of professional translators in clinical settings provides an effective method for getting reliable information (Bauer & Alegría, 2010; Farooq, Fear, & Oyebode, 1997).

Interviews lasted about three to six hours in total and were usually divided into two or three appointments, depending on the mental load of the participants. A third appointment was made if interviews could not be finished within two appointments of two hours each.

Participants who met inclusion criteria (age over 18, absence of neurological or psychotic disorders) were recruited through the accommodation centers for asylum seekers. Individuals who sought help at the Center for Psychotraumatology were also offered participation in the study. All respondents (irrespective of inclusion in the study) received reimbursement of travel expenses, and, if necessary, a psychodiagnostic report and arrangement of treatment. All participants provided written informed consent. The Ethics committee of the University of Konstanz approved the study.

### **5.3.2 Measures**

In addition to the measurements indicated in the next sections, other comorbid conditions and more detailed socio-demographic information were assessed in parts of the sample including depression, suicidality, psychosomatic symptoms, exposure to war and torture, trauma-related dissociations, work and social adjustment problems, delinquency, and risk behavior by means of a computer game (not further reported here).

### **5.3.2.1 Sociodemographic data**

Sociodemographic data included age, sex, and country of origin, residence status, years of education, marital status, and number of children.

### **5.3.2.2 Childhood maltreatment**

Childhood maltreatment that respondents had experienced under the age of 18 years was assessed with the KERF, a 20-item German short version (Isele et al., 2014) of the Maltreatment and Abuse Chronology of Exposure Scale (MACE, Teicher & Parigger, 2011). The KERF asks for physical abuse by parents, physical abuse by siblings, emotional abuse by parents, emotional abuse by siblings, sexual abuse, physical neglect, emotional neglect, witnessed violence towards parents, witnessed violence towards siblings, and peer violence. Items were coded dichotomously. Following the instructions, we created ten subscales, ranging from 0 to 10. An overall score between 0 and 100 was then calculated by adding up the subscale totals. Cronbach's alpha was .84 for the overall score of the present study.

### **5.3.2.3 Aggression**

To assess the frequency of both reactive and appetitive aggression, we used the Appetitive and Facilitative Aggression Scale (AFAS; Hecker, Hermenau, Sachser, & Weierstall, 2016). The AFAS asks for different levels of involvement in aggressive behaviors (verbal and physical) within the last four weeks. The items for appetitive aggression refer to acting aggressively because of feelings of positive arousal (e.g. "Did you provoke others, simply because it was fun for you?") and were an adapted version of the Appetitive Aggression Scale for the civilian setting, which has also been tested regarding its validity when applying with the help of translators (Weierstall & Elbert, 2011). For reactive aggression, it recorded the frequency of reactions towards an unpleasant and perceived threat with negatively aroused state. Items were created according to the Circumplex model of Affect (Russell, 1980) with physical pain and social exclusion as potential stressors provoking a reactive aggressive reaction (e.g., "Did you kick an object or throw it around out of frustration?"). Both scales consist of 15 items each with answers based on a five-point Likert scale ranging between 0 (*never*) and 4 (*very often*). Items were summed up to receive a total score for appetitive aggression and reactive aggression, respectively, each ranging between 0 and 60. The AFAS has been successfully applied in war-affected both civilian and combat populations (Hecker, Fetz, et al., 2015; Köbach, Schaal, & Elbert, 2015). Cronbach's alpha in the current study was .87 for reactive aggression and .78 for appetitive aggression.

#### **5.3.2.4 PTSD symptom severity**

The German translation of the PTSD Symptom Scale Interview Version (PSS-I, Ehlers, Steil, Winter, & Foa, 1996; Foa et al., 1993) was applied in order to assess PTSD symptom severity according to criteria of DSM-IV (APA, 2000). The scale consists of 17 questions on a four-point Likert scale, whereas each refers to one symptom of PTSD grouped into the three symptom clusters (intrusion, avoidance, hyperarousal). Items were summed up to receive a score between 0 and 51. The PSS-I has proven to be a reliable and valid instrument (Foa & Tolin, 2000) and is a valid instrument when applied with translators (Ertl et al., 2010). Cronbach's alpha coefficient for the current study was .95.

#### **5.3.2.5 Impulsivity**

The four dimensions of impulsivity according to the UPPS model (Whiteside et al., 2005) were assessed by means of a German short version (I8, Kovaleva, Beierlein, Kemper, & Rammstedt, 2012) with two items for each dimension. Item formulation is based on the German translation of the shortened UPPS impulsivity scale (Keye, Wilhelm, & Oberauer, 2009), e.g. "I sometimes do things to cheer myself up that I later regret" (urgency) or "I plan my schedule so that I get everything done on time" (perseverance). Agreement was asked on a five-point Likert scale ranging between 1 (*totally disagree*) to 5 (*totally agree*). Answers for each subscale were averaged to receive a score for every dimension between 1 and 5. The I8 has been proven as a valid and reliable measurement (Kovaleva et al., 2012). Whereas high scores of urgency and sensation seeking refer to high impulsivity, high scores in premeditation and perseverance are related to low levels of impulsivity. Cronbach's alpha coefficient in the current study was sufficient between .62 (perseverance) and .83 (premeditation).

### **5.3.3 Participants**

Initially, 94 participants were eligible for study participation. Nine participants missed parts of the interviews, due to substantial psychopathology (for details see figure B1 in appendix B). For these, the missing data was estimated by maximum likelihood procedure. The overall majority was male (85 %) with mean age of 30.1 years (SD = 8.8; range = 19-61). Two thirds (65%) had been arrested due to political, religious or cultural reasons in their home country, and 66% were diagnosed with PTSD according to the DSM-IV.

Afghanistan (16%), Syria (15%), Iran (10%), Nigeria (9%) and Gambia (9%) were the most frequent countries of origin, followed by Iraq (5%), Sri Lanka (4%) and Togo (4%). Three

participants came from Cameroon (3%) and three from Pakistan (3%); two each (2%) from Macedonia, Sudan, Sierra Leone, Eritrea; and one each (1%) from India, Somalia, Russia, Turkey, Kosovo, Chechenya, Albania, and Bosnia and Herzegovina.

Participants had completed 9.2 years of education (SD = 3.9; range = 0-16). Most common family status was single (57%), followed by married (32%) and divorced (6%). Two participants reported living in a partnership, one was separated from his partner. Mean number of children was 1.06 (SD = 1.6; range = 0-8). The asylum status of the majority of participants was still pending (76%), whereas for 18% the decision had been negative. Two participants had received residence permits, one lived illegally in Germany; and one was, though older than 18 years, still within the regulations for unaccompanied minors without asylum procedure.

### **5.3.4 Data analysis**

For bivariate associations Spearman's Rho was calculated. Robust single-indicator structural equation modeling was used for testing multivariate patterns. Because we only had one indicator for each latent variable, we used model-based corrections of measurement error, following the recommendations of Cole and Preacher (2014). Accordingly, unique variance was fixed to its product with one minus its reliability using Cronbach's alpha to reflect measurement error. Maximum-likelihood parameter estimation with robust standard errors was performed. This approach allows analyzing non-normal data with small sample sizes. In detail, the Yuan-Bentler extension of the Satorra-Bentler-corrected chi-square test statistic, which can deal with missing data, was applied. Hereby the chi-square test statistic is rescaled in a manner that reflects the level of kurtosis in the data (Yuan & Bentler, 2000). These adjustments have been proven effectiveness in non-normal data (Savalei & Bentler, 2005). Moreover, because a newer simulation study showed superiority of mean- and variance adjusted chi-square test statistics over only-rescaled tests in terms of Type I and II error control in small samples (Savalei, 2010), all results were validated by computing an adjusted test statistic of the Satorra-Bentler-corrected chi-square (Satterthwaite approach, for details see Rosseel et al., 2015). Because this correction cannot handle missing data, complete case analyses were performed and compared to the full-information model.

The first model included paths from PTSD symptom severity and childhood maltreatment to all four dimensions of impulsivity. Moreover, paths were drawn from childhood maltreatment

to both types of aggression and from PTSD to reactive aggression. Next, non-significant paths were removed. The model was chosen according to several fit indices. Root-mean-square error of approximation (RMSEA) below .06, standardized root-mean-square residual (SRMR) below .08 indicate good fit (Hu & Bentler, 1999). Tucker-Lewis index (TLI) and comparative fit index (CFI) close to .90 were seen as acceptable (Hu & Bentler, 1999). Different models were compared by means of small-sample-size-corrected Akaike and adjusted Bayesian information criterion (corrAIC, adjBIC, respectively). Larger values indicate worse fit. Data analysis was carried out within the R environment using the *lavaan* package (Rosseel et al., 2015).

## 5.4 Results

Table 5.1 shows results of bivariate correlations between variables. As assumed, PTSD symptom severity was related to reactive, but not appetitive aggression. Moreover, it showed negative associations for premeditation and perseverance. For childhood maltreatment, significant relations appeared to both types of aggression as well as all dimensions of impulsivity except sensation seeking. Thus, higher levels of impulsivity came along with greater experiences of PTSD symptoms, and adverse childhood experiences, respectively. For reactive aggression, there was a strong relationship to all impulsivity facets except sensation seeking. In contrast, a reversed pattern held true for appetitive aggression. It correlated with sensation seeking, but with no other facets of impulsivity. Moreover, both types of aggression were positively associated, and all dimensions of impulsivity except sensation seeking correlated amongst each other.

In the best fitting structural equation model, both PTSD symptom severity and childhood maltreatment predicted premeditation and perseverance in the direction that more severe PTSD or history of maltreatment indicated lower levels of premeditation and perseverance and thus higher scores of impulsivity. Moreover, higher levels of childhood maltreatment were related to higher levels of urgency. In contrast, sensation seeking was not associated with any of these predictors. However, it was significantly related to aggression, both appetitive and reactive forms. For appetitive aggression, there was also a direct path from childhood maltreatment. The same applied for reactive aggression, and additionally, PTSD symptoms also predicted reactive aggression. There was no other association between

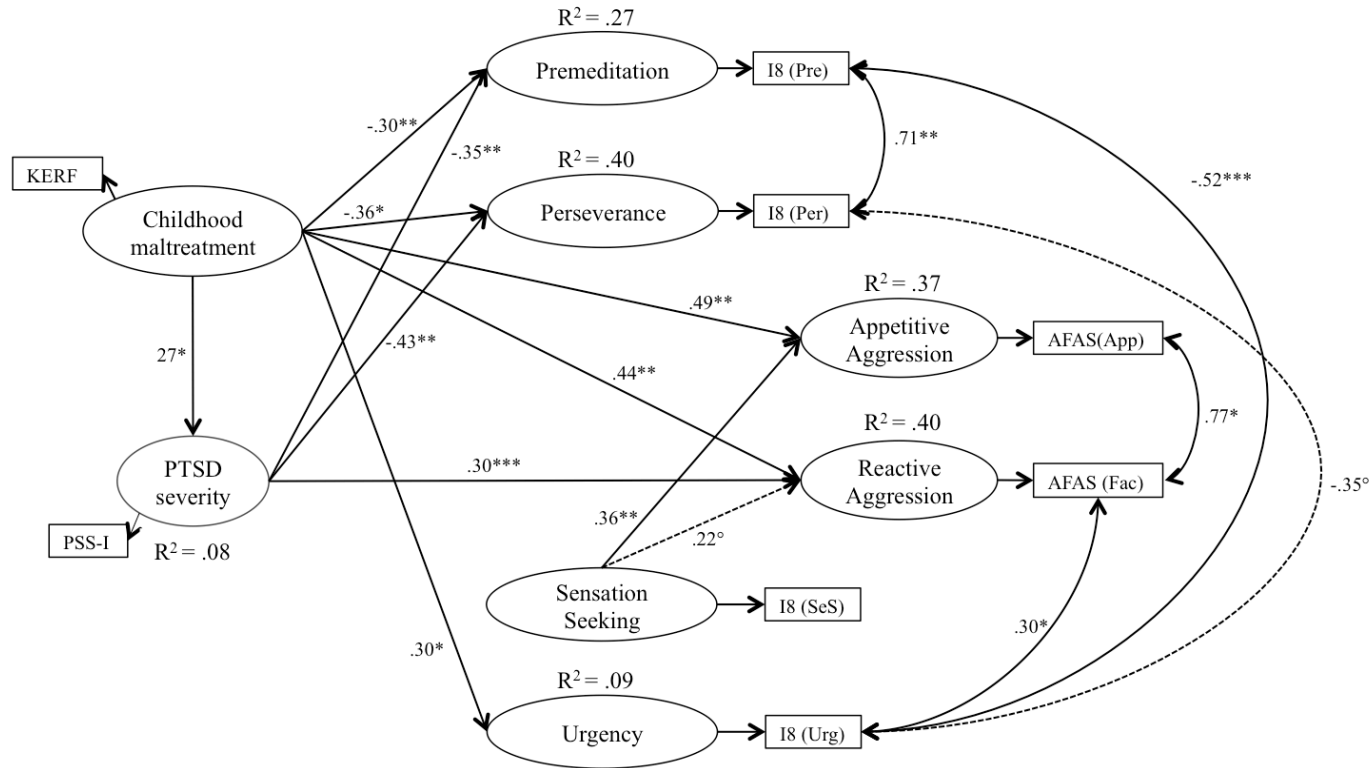


aggressive types and premeditation or perseverance. Significant covariance was found between the two exogenous variables childhood maltreatment and PTSD severity. Moreover, residual covariance was significant between appetitive and reactive aggression, between urgency and reactive aggression, urgency and premeditation, and marginally between urgency and perseverance. Additionally, residuals between appetitive aggression and premeditation, as well as between premeditation and perseverance, were related. Fit indices presented good fit:  $\chi^2(7, n = 94) = 7.07, p = .42$ . RMSEA = .01 [90% CI: .00-.12], SRMR = .04, both TLI and CFI > .99, corrAIC = 3640.34 adjBIC = 3758.62. The whole model is visually displayed in figure 5.1. More detailed information about coefficients can be found in table 5.2.

**Table 5.1.** Descriptive Statistics and Correlations for Childhood Maltreatment, PTSD Symptoms, Aggression Types, and Impulsivity Dimensions

	1	2	3	4	5	6	7	8	<i>M</i>	<i>SD</i>	Range
1. Childhood maltreatment	-								25.6	17.9	0-83
2. PTSD symptoms	.22*	-							20.2	12.9	0-44
3. Appetitive Aggression	.33**	-.07	-						2.5	4.4	0-22
4. Reactive Aggression	.40**	.32**	.45**	-					7.4	8.0	0-45
5. Urgency	.21*	.14	.2	.25*	-				2.8	1.3	1-5
6. Premeditation	-.27*	-.39**	-.15	-.31**	-.47**	-			3.6	1.2	1-5
7. Perseverance	-.25*	-.40**	-.08	-.34**	-.32**	.57**	-		3.8	1.1	1-5
8. Sensation Seeking	-.10	-.15	.37**	.09	.08	-.06	-.09	-	3.1	1.4	1-5

*Note.* Spearman's rho coefficient was calculated. PTSD = posttraumatic stress disorder. \*  $p < .05$ , \*\*  $p < .01$ .



**Figure 5.1.** Structural equation model indicating pathways from experiences of childhood maltreatment and posttraumatic stress disorder (PTSD) symptoms to types of aggression via dimensions of impulsivity. Standardized path coefficients are shown. Standard errors were omitted for clarity. Rectangles refer to manifest variables (respective questionnaires), circles to latent constructs. I8 = Impulsivity Scale, KERF = German version of Maltreatment and Abuse Chronology of Exposure Scale, PSS-I = PTSD Symptom Scale Interview, AFAS = Appetitive and Facilitative Aggression Scale, Pre = Premeditation, Per = Perseverance, SeS = Sensation Seeking, App = Appetitive, Fac = Facilitative. Asterisks indicate level of significance, °  $p < .1$ . \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

**Table 5.2.** Parameter estimates of the structural equation model

	b	SE	<i>p</i> -value
Perseverance			
Childhood maltreatment	-.02	.01	.013
PTSD severity	-.03	.01	.001
Premeditation			
Childhood maltreatment	-.02	.01	.010
PTSD severity	-.03	.01	< .001
Urgency			
Childhood maltreatment	.02	.01	.024
PTSD symptoms			
Childhood maltreatment	.21	.09	.018
Appetitive Aggression			
Childhood maltreatment	.12	.04	.001
Sensation Seeking	1.15	.42	.006
Reactive Aggression			
Childhood maltreatment	.20	.07	.002
PTSD severity	.18	.05	< .001
Sensation Seeking	1.38	.79	.082

*Note.* Unstandardized b-coefficients and robust standard errors (SE) are shown.

There was no difference between the full information model and the complete case model with mean and variance adjusted and scaled  $\chi^2$  test statistic, which is better suited for small sample sizes. The latter had the following fit indices:  $\chi^2(6.61, n = 85) = 5.94, p = .50$ , RMSEA < 0.001 [90% CI: .000-.122], SRMR = .04, both TLI and CFI > .95 corrAIC = 3471.48 adjBIC = 3576.46. In a model with paths from childhood maltreatment and PTSD severity to sensation seeking, model fit decreased (corrAIC = 3645.42, adjBIC = 3765.25). Accordingly, these paths were constraint to zero in the final model. Moreover, the reversed direction of paths from types of aggression to dimensions of impulsivity did not fit the data ( $\chi^2(9, n = 94) = 38.52, p < .001$ , RMSEA = .19 [90% CI: .13-.25], SRMR = .06, TLI = .81, CFI = .41, corrAIC = 3660.52, adjBIC = 3776.46.

## 5.5 Discussion

The aim of the present study was to investigate patterns between exposure to traumatic events, aggression and facets of impulsivity in a population of individuals displaced by war and crisis. Whilst we had expected indirect pathways between traumatic events and alterations in aggression via dimensions of impulsivity regarding the SEM, we only found evidence for direct pathways: Both exposure to childhood maltreatment and severity of PTSD symptoms were related to higher impulsivity as indicated by lower premeditation and perseverance. Additionally, childhood maltreatment in the SEM was associated with greater urgency. In contrast, none of these impulsivity dimensions were related to aggression. Instead, there were only direct paths from childhood maltreatment to both reactive and appetitive aggression and from PTSD to reactive aggression. The latter observation is in line with Nandi et al. (2016). Sensation seeking also predicted both appetitive and marginally reactive aggression, and was unrelated to any kind of traumatic experiences. These findings stand in contrast to other studies demonstrating pathways from impulsivity dimensions to types of aggression (Hecht & Latzman, 2015; Latzman & Vaidya, 2013; J. D. Miller et al., 2012) and from traumatic experiences to alterations in impulsivity facets (Contractor et al., 2016). Yet, concepts of aggression varied and results regarding the specific facets of dimension were inconsistent. Moreover, previous studies did not assess displaced populations.

When we compared results of the SEM with bivariate correlations in our study, reactive aggression was indeed associated with all dimensions of impulsivity except sensation seeking, whilst the opposite pattern emerged for appetitive aggression. This suggests that exposure to traumatic events might be relevant in displaced populations when identifying pathways from facets of impulsivity to aggression. Moreover, shared variance between reactive aggression and facets of impulsivity is likely to explain results differing from Contractor et al. (2016).

In contrast to authors suggesting that individuals are likely to reactively aggress as a consequence of experiencing high levels of unpleasant arousal when generally presenting deficits in effective regulation of emotional states (J. D. Miller et al., 2012) our results suggest that aggression following PTSD is not necessarily related to impulsive tendencies. As the evaluation of daily environmental stimuli as life-threatening is inherently occurring in

PTSD, (re)acting aggressively seems to be an adaptive strategy in order to face the potential threat and enhance survival. It might be that fear resulting from inaccurate cognitive appraisal of situations drives aggression rather than problems in behavioral regulation per se do. Moreover, it is likely, that increased aggression occurs less in individuals with dissociative types of PTSD, as their main fear response is a protective shut-down of behavioral responding, accompanied by parasympathetic dominance (M. Schauer & T. Elbert, 2010). Additionally, difficulties of concentration maintenance in PTSD might be a potential explanation for both low perseverance and premeditation, reflected by problems staying focused in a task under distracting conditions, and taking into account the consequences of an act prior to engagement (UPPS model; Whiteside et al., 2005).

Regarding childhood maltreatment, the results align with previous research indicating strong evidence of the negative impact of early stress and exposure to child abuse on maladaptive brain development resulting in failure of affect regulation, inadequate externalizing behavior, and psychopathology in general (Cicchetti & Toth, 2005; Teicher et al., 2003), particularly after experiencing multiple types of maltreatment (Teicher et al., 2006). Perturbations in the effective regulation of negative affective states, namely increased urgency (Whiteside et al., 2005) might result in impeded repertoire of actions and concordantly behavioral problems, in particular when being confronted with unfavorable conditions (J. D. Miller et al., 2012).

In accordance with the cycle of violence (Widom, 1989) the current study provides evidence that a history of child maltreatment promotes ongoing perpetration of aggression, including both reactive and appetitive types. It is important to note that in the current study enhanced aggression occurred independently from changes in impulsivity. Hovee et al. (2015) suggested emotional numbing to be the underlying reason for the relation between child abuse and rather instrumental goal-motivated aggression. However, our results indicate that appetitive aggression is not executed in an emotionless state but motivated by the desire for positive emotional arousal. In the study of Hecht and Latzman (2015) positive urgency was an important predictor of proactive aggression. Since we did not differentiate between positive and negative urgency, we were not able to replicate these findings. Yet the relationship between sensation seeking and appetitive aggression points to a similar interpretation: Sensation seeking refers to the tendency to engage in exciting and potentially dangerous activities (Whiteside et al., 2005). An emotionally arousing thrill when hunting humans resulting in a combat high has been reported by several appetitively aggressive

combatants (Elbert et al., 2017; Köbach, Schaal, & Elbert, 2015). This provides further evidence that appetitive aggression is an etiologically distinct concept, driven by an expectation for reward.

### **5.5.1 Limitations**

Though structural equation models enable analyzing path directions, proof of cause-effects remains impossible in a correlational design. The current sample of individuals with refugee status had been exposed to frequent traumatic events and presented severe levels of PTSD symptoms. It is possible that interactions differ for other groups of displaced individuals have been exposed to fewer traumatic events. As we could not include positive urgency, results might be different when referring to the UPPS-P model of impulsivity. Additionally, sample size in the current study was small, with too few women to extract potential sex differences. In any such study, social desirability might influence effects. Due to retrospective assessment, inaccuracies of memory and the willingness to recall might have influenced results. Lastly, high residual correlations between endogenous variables point to the fact that the relationship might be influenced by variables not taken into account in the current study. For instance variables such as the amount of exposure to traumatic events, of self-committed violent acts, cognitive factors like moral attitudes or locus of control might be relevant.

### **5.5.2 Conclusion**

The current study demonstrates that it is not simply a general lack in regulation of impulsiveness that may drive aggressive behavior in survivors of traumatic experiences. Childhood maltreatment seems to be the major driver for aggressive behavior, whereby reactive aggression is associated with PTSD and appetitive aggression with sensation seeking. Human studies are correlational in nature and thus investigations in different settings are needed to establish cause-effects pathways.

In light of the current, unprecedented levels of displaced individuals worldwide, particular attention is owed these individuals, who, not only having experienced war and crisis, but also domestic violence as children, are in dire need of psychological support. In order to break the cycle of violence in individuals seeking refuge abroad, practitioners should routinely screen for both exposure to childhood maltreatment and trauma-related disorders (e.g. PTSD), and apply trauma-specific evidence-based treatment for victimized individuals as needed. This is

especially necessary in the presence of behavioral problems presented by displaced individuals.

## **5.6 Acknowledgments**

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## **6 When do traumatic experiences alter risk-taking behavior? A machine learning analysis of reports from refugees**

### **6.1 Abstract**

Exposure to traumatic stressors and subsequent trauma-related mental changes may alter a person's risk-taking behavior. It is unclear whether this relationship depends on the specific types of traumatic experiences. Moreover, the association has never been tested in displaced individuals with substantial levels of traumatic experiences. The present study assessed risk-taking behavior in 56 displaced individuals by means of the balloon analogue risk task (BART). Exposure to traumatic events, symptoms of posttraumatic stress disorder and depression were assessed by means of semi-structured interviews. Using a novel statistical approach (stochastic gradient boosting machines), we analyzed predictors of risk-taking behavior. Exposure to organized violence was associated with less risk-taking, as indicated by fewer adjusted pumps in the BART, as was the reported experience of physical abuse, emotional abuse, and physical neglect in childhood. However, peer victimization, sexual abuse, and civil traumatic stressors were associated with higher risk taking. This suggests that the association between global risk-taking behavior and exposure to traumatic stress depends on the particular type of the stressors that have been experienced.

*Keywords:* Balloon analogue risk task (BART), risk-taking behavior, traumatic stress, posttraumatic stress disorder (PTSD), torture, child maltreatment, stochastic gradient boosting machines.

### **6.2 Background**

Risk-taking behavior describes behaviors involving the opportunity for both potential loss and reward with an uncertain outcome probability, such as drug consumption, delinquency, unhealthy eating habits or unprotected sex (Ben-Zur & Zeidner, 2009). Numerous studies have identified exposure to traumatic events and subsequent symptoms of posttraumatic

stress disorder (PTSD) as risk factors for increased risk-taking behavior (for reviews see Ben-Zur & Zeidner, 2009; Rheingold et al., 2004; Tull et al., 2016). For instance, both a history of different types of childhood maltreatment and lifetime traumatic experiences had a cumulative effect on risk-taking behaviors such as substance abuse and criminality (e.g., Adams et al., 2016). Childhood maltreatment was also a predictor of elevated risky sexual behavior during both adolescence (e.g., Wilson et al., 2015) and adulthood (e.g., Cavanaugh, Hansen, & Sullivan, 2010), with sexual abuse as a prominent risk factor (e.g., Lamoureux, Palmieri, Jackson, & Hobfoll, 2012; Moore et al., 2016). Moreover, depression symptoms mediated these associations in adolescents who had been abducted or threatened by armed groups in northern Uganda (Okello, Nakimuli-Mpungu, Musisi, Broekaert, & Derluyn, 2013). In their review, Ben-Zur and Zeidner (2009) concluded that elevated risk behavior might arise from exposure to life-threatening events. They also discussed different models explaining increased risk-taking behavior after trauma: Some argue that this might be a maladaptive coping strategy in order to overcome negative affect arising after being victimized. Cognition-based models consider modified information processing with respect to the evaluation of risk. Neuroscientific approaches emphasize exaggerated amygdalar activation in response to threat, which might result in an impeded capability to control behavior (for details see Ben-Zur & Zeidner, 2009; Rheingold et al., 2004).

The balloon analogue risk task (BART; Lejuez et al., 2002) aims to reflect shifts in real-life risk-taking behaviors by applying a paradigm with decisions made under uncertainty. In this computer-based game, participants inflate a virtual balloon. For each successful pump, they earn a small amount of money, but pumping also increases the probability of the balloon bursting, resulting in the loss of the money earned for this trial. Alternatively, participants can cash out and proceed to the next trial, thereby keeping the money they have accumulated thus far. Thus, inflation increases the chances of financial gain, but at the cost of an increased risk of losing the money. This reflects the definition of risk behavior with an outcome of potential reward or loss. Higher numbers of adjusted pumps – that is, the number of pumps in trials without a burst – are considered to be more prone to risk-taking (Lejuez et al., 2002). So far, the studies that used BART to assess risk behavior in individuals who have experienced traumatic stress have yielded ambivalent results. Crack- or cocaine-dependent patients with comorbid PTSD presented a greater number of adjusted pumps than patients without PTSD (Tull et al., 2009). Furthermore, higher risk behavior in the BART was related to experienced child abuse, and mediated associations to self-reports of increased HIV risk behavior

(Bornovalova et al., 2008). However, other studies found the opposite pattern of results. For instance, young adults with a history of child abuse took significantly less risk in the BART than participants without child abuse (Sujan et al., 2014). In a study by Woerner et al. (2016), there was no association between pumps in the BART and child abuse in a sample of adult substance abuse patients. Maner et al. (2007) yielded evidence that trait anxiety and worries in healthy undergraduate students that could not be traced back to negative affect were associated with risk-avoidant behavior in the BART.

In light of the heterogeneous results of previous studies, it is possible that specific types of child abuse and traumatic events differentially impact risk behavior. For instance, Moore et al. (2016) demonstrated in undergraduate college students that interpersonal events such as physical or sexual traumatic experiences were related to increased risky sexual behavior. In contrast, non-interpersonal events, such as car accidents, were less related to risky behavior. Since refugee populations present high rates of exposure to traumatic events and subsequent PTSD compared to the general population (Führer et al., 2016; Richter et al., 2015) and are also frequently affected by experiences of childhood maltreatment (Catani, 2010), they may be especially prone to risk-taking behavior. With respect to the current refugee crisis (UNHCR, 2016), assessing predictors of risk-taking behavior in displaced individuals is essential. However, literature regarding risk behavior among refugee populations is sparse. In a longitudinal study of Cambodian families who resettled in Canada, adolescents whose families were less exposed to pre-migratory political violence and war reported involvement in risk behavior, whereas those who were highly exposed reported less involvement (Rousseau, Drapeau, & Rahimi, 2003). In contrast, in a cross-sectional study with Cambodian refugee youths, direct and witnessed lifetime exposure to violence was related to higher engagement in risk behavior (Berthold, 2008). Regarding adult individuals, no study has assessed risk behavior in response to trauma exposure in displaced persons.

The objective of the current study was to examine whether specific types of trauma exposure, including those of war and torture with subsequent symptoms of PTSD and depression, were followed by an increase in risk behavior as measured by the BART in displaced individuals from various countries who have resettled in Germany. Taking into account the inconsistent results and the heterogeneous group of individuals regarding traumatic experiences, we chose to apply a novel approach for data analysis – a machine-learning procedure. This has several advantages over more conventional linear modeling techniques: Otherwise undetectable

complex non-linear associations between predictor and outcome variables can be modeled in a non-parametric regression-like fashion. Additionally, a large number of predictor variables can be tested simultaneously, even in comparatively small samples. Both would not have been possible using conventional statistical methods. In contrast to these methods, in which an a priori defined theoretical model is tested and evaluated by means of  $p$ -value based significance, machine learning offers a completely different data-driven approach: By means of successively updating a model, the computer sequentially detects the relation in the data (Breiman, 2001b). Since machine-learning algorithms are theoretically capable of completely reconstructing data structures and thus may lead to overfitting, performance is evaluated by predicting the response variable on an independent new data set that has not been used before during the process of model building.

Stochastic gradient boosting machines (GBM) refer to a specific type of machine-learning algorithms applying decision trees (Friedman, 2002). For modeling the response variable, the predictor space is successively partitioned according to a set of if-then statements until homogenous response regions have been identified. Splits of predictor variables take place when minimal prediction error is reached (Elith, Leathwick, & Hastie, 2008; Kuhn & Johnson, 2013). In this manner, a decision tree grows, which predicts the outcome variable by descending the leaves until the terminal nodes are reached. GBM are a powerful and highly robust modeling tool that can handle missing, non-normal data and can deal with predictor noise (Friedman & Meulman, 2003; Kuhn & Johnson, 2013). Regarding accuracy, boosting in comparison to other machine learning approaches was superior across different research fields such as epidemiology (Friedman & Meulman, 2003). Similar machine-learning techniques, such as random forests, have been already successfully applied to psychological topics (e.g., Köbach, Schaal, & Elbert, 2015; Schalinski & Teicher, 2015).

## **6.3 Method**

### **6.3.1 Procedure**

Participants were recruited at the Centre of Excellence for Psychotraumatology, University of Konstanz. The center provides a trauma-related mental health service for refugees. Participants were recruited in the refugees' accommodation centers. Moreover, individuals asking for psychological help who had contacted the center were also invited to participate in the study. Questionnaires were applied in semi-structured interviews in German or English

and, if necessary, with the help of trained translators (in 75% of cases). Interpreters were trained to translate literally and word-by-word in the first person. Experienced clinical psychologists or M.Sc. Psychology students under supervision conducted the interviews. After the end of the semi-structured interview, a computer-based task to measure risk behavior was applied in a separate laboratory room.

Participants received reimbursement for travel expenses as well as the monetary reward obtained in the computer task. If necessary, a psycho-diagnostic report was provided and further treatment arranged. The Ethics Committee of the University of Konstanz approved the study. All participants provided their written informed consent. See Augsburger, Dohrmann, Schauer, and Elbert (2016) for details regarding further interview modalities and procedures.

### **6.3.2 Measures**

#### **6.3.2.1 Socio-demographic variables**

Age, sex, level of education, country of origin, and family status, among others, were measured, but are not further reported here (see Augsburger, Dohrmann, et al., 2016).

#### **6.3.2.2 Childhood maltreatment**

Experiences of child abuse were assessed using the KERF (Isele et al., 2014), a German short version of the modified adverse childhood experiences scale with 20 items (MACE; Teicher & Parigger, 2011). The KERF has ten subscales and is coded dichotomously (yes/no). In order to reduce the number of predictors but to be able to differentiate between different types of child abuse, categories were created as follows: Sexual violence, physical violence (subscales physical violence by parents as well as by siblings), emotional violence (subscales emotional violence by parents as well as by siblings), witnessed violence (subscales witnessed violence towards parents as well as siblings), emotional neglect, physical neglect and peer violence. Items were summed within each category, ranging between 0-10 for sexual violence, emotional neglect, physical neglect and peer violence, and 0-20 for physical violence, emotional violence and witnessed violence.

#### **6.3.2.3 Exposure to war and torture**

A shortened version of the vivo checklist for exposure to war, terror and torture experiences was applied (Schauer, Neuner, & Elbert, 2011b). The checklist asks for different lifetime experiences related to torture (19 items), such as “*Have you suffered sham executions – that*

is, people acted as if they would kill you immediately?” and war (6 items), such as “Have you experienced violent house searches or anything similar?” Answers were dichotomously coded (yes/no) and summed to produce a total score ranging between 0-25. The checklist has been successfully applied in refugee populations (Mueller-Bamouh et al., 2016).

#### **6.3.2.4 Lifetime traumatic events**

Lifetime traumatic events not covered by the vivo checklist, such as natural disasters, domestic violence or traffic accidents were assessed by means of the shortened event list of the Posttraumatic Diagnostic Scale (Foa et al., 1997). Items were coded dichotomously (yes/no) and summed up to receive a score between 0-8.

#### **6.3.2.5 PTSD symptom severity**

PTSD symptom severity according to DSM-IV criteria (APA, 2000) was assessed by means of the Posttraumatic Stress Symptoms Interview (PSS-I), an interview version of the Posttraumatic Diagnostic Scale (Ehlers et al., 1996; Foa et al., 1993; Foa & Tolin, 2000). The frequency of symptoms was assessed on a four-point Likert scale from 0 (*not at all*) to 3 (*more than 5 times a week*). Symptom scores were summed, with a possible maximum of 51. Cronbach alpha was .96 for the current study.

#### **6.3.2.6 Depression symptoms**

Depression symptoms were assessed using the Patient Health Questionnaire (PHQ-9, Kroenke, Spitzer, & Williams, 2001). The frequency of symptoms was assessed using nine items based on DSM-IV criteria on a four-point Likert scale from 0 (*not at all*) to 3 (*almost every day*). Scores were summed, with a possible maximum of 27. The PHQ-9 has excellent psychometric properties and can establish the diagnosis of major depressive disorder according to DSM-IV (Gilbody, Richards, Brealey, & Hewitt, 2007). Cronbach's alpha was .92 for the current study.

#### **6.3.2.7 Risk-taking behavior**

Risk-taking behavior was measured using the BART (Lejuez et al., 2002). Participants received two euro cents for each successful pump. In total, there were 30 balloons. Following previous studies, the bursting point was random between the first and the last pump, with a probability of 1/128 at the time of the first pump, 1/127 for the next pump, and so on. The BART corresponds to self-reports of real-life risk behaviors in both adolescents (Aklin, Lejuez, Zvolensky, Kahler, & Gwadz, 2005; Lejuez, Aklin, Zvolensky, & Pedulla, 2003) and

adults (Lejuez et al., 2002; Lejuez, Simmons, Aklin, Daughters, & Dvir, 2004). Moreover, it presents convincing test-retest characteristics (White, Lejuez, & de Wit, 2008; S. Xu, Korczykowski, Zhu, & Rao, 2013). The software *The Psychology Experiment Building Language* was used for implementation (S. T. Mueller, 2014; S. T. Mueller & Piper, 2014). Instructions for the BART were read aloud by the translator in the respective language. In addition, the game interface as shown on the screen was explained. Those participants who were not familiar with the use of a computer were instructed on how to handle the computer mouse.

### **6.3.3 Participants**

The sample was a subsample of another study reported in Augsburger, Dohrmann, et al. (2016). In the current study, 56 participants were enrolled. Inclusion criteria were legal age and no signs of acute drug or alcohol intoxication or of psychosis. One individual had to be excluded from data analysis, as he did not understand the instructions of the computer game and pressed the button until each of the balloons had burst. For a second participant, a mean of only the first ten trials was calculated, as he did not want to play further.

The majority of participants were male (89%). Participants' age was between 19 and 53 years, with a mean of 29.5 (SD = 8.1, median = 28.5). The mean years of education was 9.4 (SD = 4.2), and education largely varied between 0 and 16 years (median = 11). The most frequent country of origin was Afghanistan ( $n = 10$ ), followed by Syria and Gambia (each  $n = 6$ ), and Nigeria and Iran (each  $n = 5$ ).  $N = 4$  participants originated from Iraq,  $n = 3$  from Sri Lanka. Other countries were Cameroon, Togo, Sudan, Pakistan, and Eritrea (each  $n = 2$ ), and India, Macedonia, Serbia, Somalia, Albania and Bosnia-Herzegovina (each  $n = 1$ ). Most participants were single ( $n = 33$ ) or in a relationship ( $n = 18$ ).  $N = 4$  were divorced.

### **6.3.4 Data analysis**

The dataset was randomly split into two sets: A training set in order to build the model (75 % of the data) and an independent test set to evaluate prediction accuracy. T-distribution was chosen as loss function, since its heavier tails make it more suitable for small samples (Peel & McLachlan, 2000). The optimal number of degrees of freedom was systematically varied until the best fit was reached. Using tenfold cross-validation with three repetitions, the model was tuned by testing the performance of varying parameters following the suggestions of Elith et al. (2008) for small datasets: Slow learning rates (shrinkage) were chosen (.005, 001,

.0005, .0001) in order to allow enough trees to grow. Tree complexity was set low, beginning with tree stumps and allowing up to three-way interactions between predictors. In order to avoid overfitting, we first fitted with 500 trees and went up to 3000 in steps of 100. The bag fraction – that is, the randomly chosen subsample of the data set used at each set of iteration – was set to .5. The best-tuned model with lowest root mean squared error (RMSE) was selected. Its prediction accuracy was tested on the remaining set not used for model building. Additionally,  $R^2$  (squared correlation between observed and fitted values) was calculated as fit index.

Exposure to different types of childhood maltreatment, experiences of war and torture as well as lifetime traumatic events and symptoms of depression and PTSD were entered as predictors. Since age and education varied in the study, these variables were also included as predictors. The contribution of each predictor to the overall model was determined by assessing the relative predictor importance following Friedman and Meulman (2003): The number of times a variable had been used for splitting was weighted by the squared improvement to the overall model after each split, averaged over trees. This value was scaled, being summed up to 100 for all predictors. In order to visualize the results of GBM, partial dependency plots were applied, presenting the association between a single predictor variable and the outcome by taking into account the average effect of all other predictor variables (Elith et al., 2008; Natekin & Knoll, 2013). The strength of interaction was assessed by calculating Friedman's H, which quantifies nonlinear interactions between variables on a scale between 0 and 1. Data analysis was carried out within the R environment using the packages *gbm* (Ridgeway, 2012) and *caret* (Kuhn, 2008).

## 6.4 Results

All participants had experienced a minimum of one traumatic event, and the overall majority of 93 percent had been exposed to various forms and frequencies of organized violence. The mean exposure to types of torture and war events (vivo checklist) was 7.9 (SD = 6.5, median = 5); the mean exposure in the PSS-I event checklist was 3.3 (SD = 1.4, median = 3).

Childhood maltreatment measured by the KERF was generally high and had been experienced by 94 % of participants, but the types presented a very heterogeneous pattern. Physical abuse was most common (85%; mean = 7.9, SD = 5.9, median = 6.6), followed by



emotional abuse (65%; mean = 4.8, SD = 4.8, median = 3.3). Peer violence, emotional neglect, and physical neglect were experienced by half of the participants (54%, 52%, and 50%, respectively; mean peer violence = 3.8, SD = 3.9, median = 3.3; mean emotional neglect = 3.1, SD = 3.5, median = 3.3; mean physical neglect = 2.3, SD = 2.7, median = 1.7). The least frequent adverse experiences during childhood were witnessing an event (37%, mean = 2.5, SD = 3.7, median = 0) and sexual abuse (17%, mean = .4, SD = 1.4, median = 0). Regarding PTSD diagnosis, 55% fulfilled criteria according to DSM-IV (PSS-I mean = 16.4, SD = 13.3, median = 18). The mean score in the PHQ-9 was 10.9 (SD = 7.8, median = 10), indicating a mild to intermediate severity of depression symptoms. Risk behavior as measured by the BART had a large range between 3.1 and 77.5 adjusted pumps. The mean number of adjusted pumps was 33.0 (SD = 18.9, median = 28.2).

#### **6.4.1 Bivariate associations between variables**

Correlations between predictor variables were all  $r < .8$ , and highest for PTSD severity with depression ( $r = .75, p < .001$ ). Accordingly, multicollinearity was of no concern. As expected, there was no meaningful linear association between adjusted pumps of the BART and respective predictor variables: Even the highest correlations that were found (with exposure to torture and war events ( $r = -.29, p = .03$ ) and with sexual abuse ( $r = .27, p = .05$ )) did not account more than 10% of the variance. Moreover, figure C1 in appendix C demonstrates that the correlation between adjusted pumps and sexual abuse arose from one individual having experienced severe abuse.

#### **6.4.2 Stochastic gradient boosting machine**

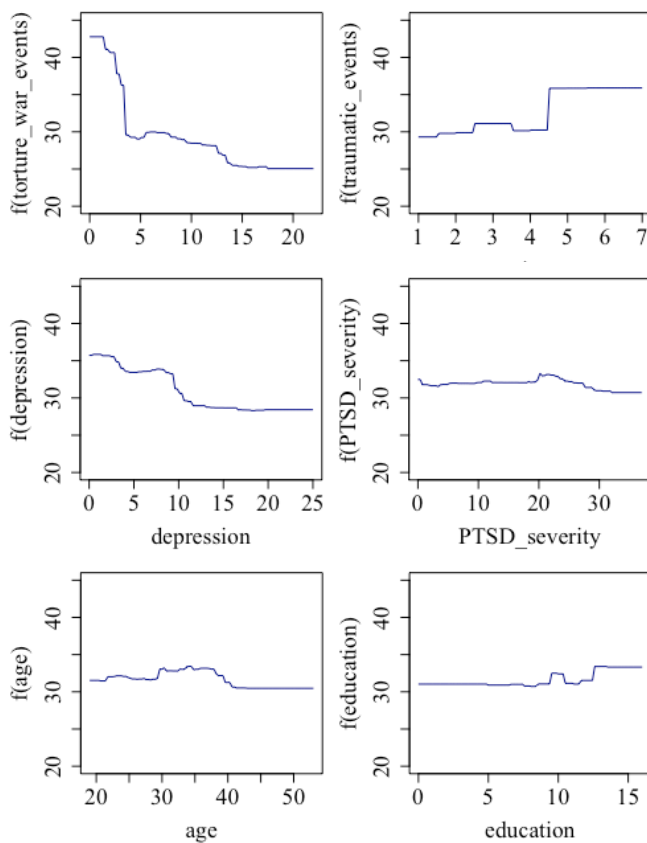
The trained model with the lowest RMSE of 18.28 ( $R^2 = .42$ ) was chosen, with a shrinkage of .005 and an interaction depth of 3. The model was built with 900 trees, and there were a minimum of three observations per node. Applying the model to the test set revealed a RMSE of 12.00.  $R^2$  was .23, indicating sufficient predictive performance.

Exposure to torture and war events was the most important predictor, capturing 23% of the overall importance. The second most important variable in predicting risk behavior was exposure to non-organized traumatic events (13%), followed closely by depression symptoms (12%). PTSD symptom severity (8%), level of education (8%) and age of participants (7%) were located mid-range. Figure 6.1 visualizes the patterns of association between predictor

variables and outcome by means of partial independency plots for the six most important variables (the other variables can be found in figure C2, appendix C). A high-risk behaving individual is characterized by no or little exposure to war and torture. However, exposure to other potentially traumatic events seems to increase risk behavior. Regarding mental health, an increasing depression severity led to a substantial drop in risk behavior. Accordingly, PTSD severity had a minimal peak at pronounced levels, followed by a slight decline alongside further increasing severity. Age presented a small peak between 30 and 40 years, but had an overall decreasing tendency. High levels of education favored higher risk behavior, though this effect was only visible from 10 years upwards.

Exposure to different types of child abuse did not play a major role (all below 5%), and only physical abuse exceeded this threshold with 6%. Experiences of both emotional and physical abuse – and to a lesser extent physical neglect – led to a descent in risk behavior. In contrast, violence perpetrated by peers as well as sexual abuse had a positive impact on risk behavior. The relevance of both emotional neglect and witnessed events was negligible.

Exploring two-way interactions resulted in an effect of age x education (Friedman's  $H = .21$ ), followed by education x PTSD severity ( $H = .17$ ), emotional neglect x PTSD severity ( $H = .16$ ), and emotional neglect x emotional abuse ( $H = .15$ ). All other interactions were of negligible size and there was no evidence for three-way interactions. As effects of two-way interactions were small regarding their overall contribution towards an explanation of variability in the BART, they are not further reported here.



**Figure 6.1.** Partial dependency plots for the first six predictor variables. For each predictor variable (displayed on the abscissas) the number of adjusted pumps (displayed on the ordinate) is shown as a function of the former.

## 6.5 Discussion

In the current study, high risk-taking behavior was predicted by little or no exposure to organized violence, such as war and torture, but high levels of otherwise experienced lifetime traumatic events, including domestic but also non-interpersonal threats. These results were concordant with Rousseau et al. (2003), who reported diminished risk behavior following more frequent exposure to pre-migratory organized violence in adolescent refugees. PTSD symptom severity, which is fueled by both exposure to domestic and to organized violence, contributed little to the variation of pumps in the BART. Increasing symptoms of depression were associated with lower risk behavior, which might be explained by clinical symptoms of fatigue or psychomotor retardation (APA, 2000).

In contrast to studies that reported increased levels of risk-taking behavior due to general experiences of child abuse as measured by self-reporting, such as increased substance abuse, criminality or risky sexual behavior (Adams et al., 2016; Cavanaugh et al., 2010; Wilson et al., 2015), the more fine-grained analysis of different types of childhood maltreatment in our study revealed small but complex impacts on global risk-taking behavior. Apart from peer violence, sexual abuse and emotional neglect, all other types of abuse (physical abuse, emotional abuse and physical neglect) were associated with reduced risk behavior.

In accordance with Moore et al. (2016), our results point to the importance of taking a differential look at types of traumatic events instead of using a global severity score when assessing a global marker of risk-taking behavior, as with the BART. This point of view can also explain the heterogeneity in results with respect to the few studies that have applied the BART: These studies were either not able to find shifts in risk taking following experiences of child abuse (Woerner et al., 2016), reported increased risk behavior associated with child abuse (Bornovalova et al., 2008) and PTSD (Tull et al., 2009), or reported effects in the opposite direction (Sujan et al., 2014).

Beyond this, it might be questioned whether self-reports of specific risk-taking behavior and a global assessment as measured by the BART present two sides of the same coin. Sujan et al. (2014) point to the possibility that laboratory-based measurements such as the BART capture momentary decisions, whereas self-reports refer to more general behaviors in real life. As the latter asks for involvement in specific types of risk behavior such as substance dependence or risky sexual behaviors during a defined period of time, it is likely that changes in risk behavior due to traumatic stress are domain specific. Consequently, the BART might assess decision components associated with risky behavior, but not engagement in risk-taking behaviors per se. In light of the evidence that risk aversion in the BART can be traced back to pessimistic risk appraisal in the presence of heightened fear (Maner et al., 2007), further research is needed to elaborate on the differential impact of types of traumatic stress on risk behavior assessed with the BART.

The current study is the first to assess risk behavior measured by a computer-based task in displaced individuals with extremely high levels of traumatic experiences. Moreover, since there is no research regarding culturally different concepts of risk behavior, education and societal values might vary and have an impact on engagement in risk behavior despite exposure to types of traumatic events.

### **6.5.1 Limitations**

Originally, GBM were invented for the purpose of mining high-dimensional data, but can be transferred to a small sample size setting as in the current study. Consequently, however, limited data were available to train the model, resulting in higher error rates. Prediction accuracy would have been improved if more data had been available; the current model does not predict very low and high levels of performance in the BART. This suggests that other parameters not taken into account in the model substantially contribute to differentiating between extremely risk-averse and risk-prone individuals. Moreover, due to the cross-sectional design of the study, causal directions regarding cause-effect remain to be assessed. Potential influences of participants' gender and cultural background could not be taken into account due to sample size characteristics. Finally, it seems difficult to suggest which real-world risk behavior a lab measurement such as the BART might reflect.

### **6.5.2 Conclusion**

The current study suggests that the experience of organized violence versus domestic and peer-related violence differentially impacts subsequent performance on a laboratory test for risk-taking behavior such as the BART.

## **6.6 Acknowledgments**

Our gratitude goes to all participants. Moreover, thanks to the team of the Centre of Excellence, who supported the data collection. We also thank James Moran for valuable language support.

## **7 Associations between societal disapproval and changes in symptoms of PTSD and appetitive aggression following treatment among high-risk South African males**

### **7.1 Abstract**

**Background:** In violent communities, social rejection as a person with victim-offender attributes is associated with more intense symptoms of posttraumatic stress disorder (PTSD) and a higher propensity towards violence, i.e. appetitive aggression. The successful community reintegration of individuals with both a history of violence exposure and perpetration may be necessary to enhance the treatment effects of interventions addressing PTSD and aggression.

**Objective:** In this study, the effects of treatment and post-treatment traumatic events, offenses, and social acknowledgment on changes in PTSD symptom severity and appetitive aggression from baseline to 8-month follow-up were investigated.

**Method:** Data were collected from 54 males recruited through a Cape Town offender reintegration program for an intervention study targeting trauma and aggression (n = 28 treatment; n = 26 wait-list). Changes in PTSD symptom severity after treatment were assessed with the PTSD Symptom Scale-Interview, changes in appetitive aggression with the Appetitive Aggression Scale (AAS), post-treatment traumatic events with an adapted version of the Child's Exposure to Violence Checklist, offenses with an adapted checklist from the AAS, and social acknowledgment with an adapted form of the Social Acknowledgment Questionnaire.

**Results:** Path analyses revealed negative relationships between ongoing societal disapproval and changes in PTSD symptom severity and appetitive aggression at 8-months, controlling for age. All other variables were non-significant, except for treatment, which was associated with PTSD symptom reduction.

**Conclusions:** As a complement to effective psychotherapeutic treatment, improvement relative to social acknowledgment may contribute significantly to the alleviation of PTSD symptoms and appetitive aggression. Psychological interventions therefore should not neglect the impact of societal factors on treatment effects.

*Keywords:* Violence, social acknowledgment, posttraumatic stress disorder, appetitive aggression, treatment efficacy.

## 7.2 Background

Short-term interventions such as the *Narrative Exposure Therapy for Forensic Offender Rehabilitation* (FORNET) have shown promising results in reducing both posttraumatic stress disorder (PTSD; Hermenau, Hecker, Schaal, et al., 2013; Köbach, Schaal, Hecker, et al., 2015) and aggressive behavior in victim-offender populations living in violent environments (Crombach & Elbert, 2015). Effective psychological treatment may be the core facilitator of such reductions in PTSD and the propensity toward violence – also known as *appetitive aggression* (Elbert et al., 2010) – in these populations. However, other non-psychological factors may mediate or hinder treatment effects and thus need to be considered. Recent research has demonstrated that the *social acknowledgment* of a person's past violent experiences is significantly associated with PTSD and appetitive aggression in victim-offender populations and may represent a key environmental factor at a societal level (Sommer et al., 2016). This study examined the association between such acknowledgment and treatment outcomes following a therapeutic psychological intervention.

In the literature, social acknowledgment is defined as a subtype of social support, referring not only to the emotional and instrumental support provided to an affected person by the immediate environment, but also to potential feelings of rejection and exclusion from the broader society because of one's violent past (Maercker & Müller, 2004). The term covers the three constructs of *general disapproval* and *family disapproval*, i.e. the invalidation of one's violent experiences or rejection by the social environment or family, and *recognition*, i.e. the perception that one's suffering is acknowledged and understood. Research has shown that general disapproval is associated with more severe PTSD symptoms (Jones, Müller, & Maercker, 2006; J. Mueller et al., 2009; Sommer et al., 2016). In relation to family

disapproval and recognition, the findings are more diverse, with results indicating that family disapproval is either positively associated with (Maercker & Müller, 2004) or unrelated to PTSD (Jones et al., 2006; Sommer et al., 2016). Recognition has been revealed to be either negatively related to (Maercker et al., 2009) or unrelated to PTSD (J. Mueller, Moergeli, & Maercker, 2008); however, in a South African victim-offender population, a positive relationship between recognition and PTSD was found, as discussed in Sommer et al. (2016).

Recently – and in line with research demonstrating that social exclusion and rejection are associated with aggressive behavior (DeWall, Twenge, Gitter, & Baumeister, 2009; Twenge et al., 2001) – Sommer et al. (2016) investigated the relationship between general disapproval and appetitive aggression, confirming a positive association, whereas recognition and family disapproval were found to be unrelated to appetitive aggression. Thus, general disapproval of violent experiences may influence not only the course of PTSD (Maercker & Horn, 2013) but also that of appetitive aggression, thereby impacting treatment outcomes.

This evidence notwithstanding, only a few studies have thus far investigated the effects of social factors during or after therapy on changes in PTSD. Tarrrier and colleagues have demonstrated that negative social relationships and a lack of social support are related to poorer treatment outcomes in PTSD patients (Tarrrier, Sommerfield, & Pilgrim, 1999; Tarrrier, Sommerfield, Pilgrim, & Faragher, 2000). Furthermore, improvements in social acknowledgment through an intervention incorporating techniques from Cognitive Behavioral Therapy (CBT) have been shown to mediate the reduction of PTSD in trauma victims after treatment (W. Xu et al., 2015). With regard to changes in appetitive aggression, scores decreased over time in a treatment trial in Congolese soldiers who received social support via a reintegration program (Hermenau, Hecker, Schaal, et al., 2013). However, the associations between social acknowledgment and changes in appetitive aggression have yet to be studied.

In conflict areas such as low-income communities in South Africa, where residents are constantly exposed to severe forms of community violence (Eagle & Kaminer, 2013), factors beyond social acknowledgment that can potentially influence changes in PTSD and appetitive aggression must be acknowledged, as we address in this study. For example, post-treatment traumatic events that occur in between two measuring points in longitudinal assessments may be associated with changes in PTSD symptoms, potentially reinforcing the trauma memory and decreasing the likelihood of overall improvement. In fact, in a psychological treatment



trial (Steketee, 1993), the stress response associated with *intermediate traumatic events* after treatment was found to be significantly related to relapse.

Regarding appetitive aggression, Elbert et al. (2010) suggest that violent environments (i.e. surroundings with many potential traumatic events) could be a breeding ground for appetitive aggression, as confirmed by a positive association between traumatic events and appetitive aggression (Sommer et al., 2016). Furthermore, as violence perpetration increases, aggression may be perceived more positively (Köbach, Schaal, Hecker, et al., 2015; Sommer et al., 2016; Weierstall, Hinsberger, et al., 2013). As a result, newly experienced traumatic events and newly committed offenses may rekindle an individual's "addiction to violence" (Hecker, Hermenau, et al., 2015) following the completion of a psychological treatment program and thereby decrease the likelihood of a reduction in appetitive aggression. This is especially relevant in South African contexts, where gang membership increases the probability of further violence perpetration (Jewkes et al., 2006) and victimization.

Finally, changes in PTSD may be related to changes in appetitive aggression, due to the interrelatedness of these two states. The perpetration of violence often co-presents with victimization (Malik, Sorenson, & Aneshensei, 1997), and PTSD has been shown to be related to aggression (Dyer et al., 2009; Jakupcak et al., 2007). Aggressive behavior may serve as a coping mechanism when individuals lack other skills to handle traumatic situations (Spaccarelli, Coatsworth, & Bowden, 1995), resulting in a "victim-to-victimiser cycle" (Glasser et al., 2001). This "fight" reaction, which is often seen in PTSD patients (DSM-5; APA, 2013), may be reflected in appetitive aggression to some extent, and reductions in PTSD may lead to reductions in appetitive aggression.

### **7.2.1 Objective**

The hypotheses for this study are based on recent findings on associations between social acknowledgment, PTSD, and aggressive behavior in a victim-offender sample of 290 South African males, published in Sommer et al. (2016). A sample of juvenile ex-offenders was assessed prior to and eight months after treatment as part of an intervention trial comparing FORNET, CBT, and a wait-list control group. The hypotheses are as follows: There are (1) negative relationships between both intermediate traumatic events and general disapproval and changes in PTSD and, in turn, positive associations between both treatment and recognition and changes in PTSD; (2) negative relationships between intermediate traumatic

events, offenses, and general disapproval and changes in appetitive aggression and, in turn, a positive association between treatment and changes in appetitive aggression; and (3) a positive relationship between changes in PTSD and changes in appetitive aggression. Due to a lack of available literature, no specific hypotheses were formulated for potential interaction effects with treatment.

## **7.3 Method**

### **7.3.1 Participants and study design**

Between 2013 and 2014, 405 South African males were recruited through a reintegration center for offenders and youth deemed to be at risk of experiencing and perpetrating violence. After screening, 89 participants met the inclusion criteria ( $\geq 8$  points on the PTSD Symptom Scale-Interview and  $\geq 9$  points on the Appetitive Aggression Scale) for the intervention study, which was conducted in several three-week-long camps. The 35 participants who were unable to attend the camp were assigned to the control condition “wait-list no camp”. All other participants were randomly assigned to either a treatment condition targeting trauma and aggression (eight FORNET sessions or seven CBT “Thinking for a Change” sessions; about two hours/session) or a control condition (“wait-list camp”). Further information on the treatments, therapists, and outcomes of the intervention study is detailed elsewhere (see Hinsberger, Holtzhausen, et al., 2016).

The present study included 54 participants who were assigned to the treatment trial and who participated in at least one of two post-treatment assessments (8.1 and 17.7 months post-treatment). Participants were Black Xhosa-speaking males from low-income areas in Cape Town, South Africa, aged 14 to 40 years ( $M = 22.3$ ,  $SD = 4.8$ ). At baseline, 59% of participants were currently attending or had previously attended a reintegration program, whereas 41% had not. Participants had attended school for 1 to 16 years ( $M = 10.26$ ,  $SD = 2.06$ ). To control for the impact of the treatment condition, a dummy variable was included in the path analyses, with those receiving treatment (FORNET/CBT) coded as “1” ( $n = 28$ ) and those in the control condition as “0” ( $n = 26$ ).

### **7.3.2 Materials**

After the interviewers were trained in the concepts of trauma and aggression, German and South African mental health experts, supported by local interpreters, conducted individual

structured interviews (translated from English to isiXhosa and back). Participants were followed-up with the same interview schedule being used pre- and post-treatment. Interviewers were blind to experimental conditions.

### **7.3.2.1 Intermediate traumatic event types**

Traumatic event types occurring between pre- and post-assessment were explored using an adapted version of the Child's Exposure to Violence Checklist (CEVC; Amaya-Jackson, 1998), comprising 36 items on the direct experiencing (e.g. "Have you been attacked with a weapon by a family member?") and witnessing (e.g. "Have you seen someone being killed?") of potentially traumatic events. Items were rated dichotomously: 1 if the event had been experienced, 0 if not. This measure has excellent psychometric properties (Fincham et al., 2009) and has previously been administered in South African high-risk males (Hinsberger, Holtzhausen, et al., 2016). Kuder-Richardson's alpha in this sample was .86. Traumatic event types were summed with a possible range from 0 to 36 points.

### **7.3.2.2 PTSD symptom severity**

PTSD symptom severity during the past two weeks was assessed with the PTSD Symptom Scale-Interview (Foa & Tolin, 2000), with each of the 17 items rated from 0 (*not at all*) to 3 (*very much*). The scale indicates the extent to which the index trauma evoked B (re-experiencing), C (numbing/avoidance), and/or D (hyperarousal) PTSD symptoms from the DSM-IV (APA, 2000). Studies have confirmed the measure's usefulness in terms of its psychometric properties in South African at-risk youth (Sommer et al., 2017). Items were summed with a possible range from 0 to 51 points.

### **7.3.2.3 Appetitive Aggression**

Attraction to violence was evaluated using the Appetitive Aggression Scale (AAS; Weierstall & Elbert, 2011), which has previously been administered in South African high-risk males (Hinsberger, Holtzhausen, et al., 2016). This questionnaire contains 15 statements (e.g. "Is it fun to prepare yourself for fighting?") to be rated from 0 (*I totally disagree*) to 4 (*I totally agree*) according to the respondent's current point of view. Items were summed with a possible range from 0 to 60 points.

### **7.3.2.4 Intermediate offence types**

Participants were asked to indicate whether they had committed any of 21 offense types from the AAS in the past six months (e.g. "Have you injured another person with a weapon (e.g. a

knife) in the past six months?”). This measure’s validity has been confirmed in at-risk South African youth (Sommer et al., 2016). Kuder-Richardson’s alpha in this sample was .91. Offense types were summed with a possible range from 0 to 21 points.

### **7.3.2.5 Social Acknowledgement**

The 16 items on the Social Acknowledgement Questionnaire (SAQ; Maercker & Müller, 2004), rated from 0 (*not at all*) to 3 (*completely*), examine the perception of recognition or disapproval from one’s family and society after traumatic events. A version adapted to participants in a victim-offender population has been successfully administered in a South African sample (Sommer et al., 2016). Of the three subscales, *recognition* captures positive aspects (e.g. “The reactions of my acquaintances were helpful”), whereas *general disapproval* (e.g. “Most people cannot understand what I went through”) and *family disapproval* (e.g. “My experiences are underestimated by my family”) reflect negative aspects of social acknowledgment. The item “My boss showed full understanding for any absence from work” was adapted (possible answer: *not applicable*) to account for the extremely high unemployment rate of Black Africans in South Africa (Statistics South Africa, 2016). The recognition score, which included the critical item, was thus divided either by 5 or 6, based on whether the item was rated or not. Cronbach’s alpha in this sample was: recognition,  $\alpha = .59$ ; general disapproval,  $\alpha = .73$ ; family disapproval,  $\alpha = .57$ . Items were summed for each subscale with a possible range from 0 to 3 points for recognition and 0 to 15 points for general disapproval and family disapproval.

### **7.3.3 Procedure**

Participants were invited to take part in the intervention trial and the follow-up visits with support from the above-mentioned reintegration center. Trained German and South African therapists offered individual treatment within the frame of the intervention study. Ethical approval was obtained from the Ethical Review Boards of the University of Konstanz and the University of Cape Town and from the Health Research Ethics Committee of Stellenbosch University; clinical trials registration ID: NCT02012738. Participants gave informed consent before the initial assessment (for minors, this was provided by parents/caretakers) and received financial compensation of 100 South African Rand per (follow-up-) Interview (ZAR; minimum hourly wage for full-time domestic workers: ZAR 10.59; (South African Department of Labour, 2014).

### **7.3.4 Data analysis**

The data analyses focused on the first post-treatment assessment, in which 39 participants took part; in order to include all 54 participants, missing values were estimated using maximum likelihood estimation on the basis of all the available data on the participants. Differences between treatment conditions with regard to all pre- and post-treatment variables relevant to the path analyses were tested with Mann-Whitney U-tests. Correlations between all variables included in the hypothesized path model were calculated using SPSS 21. Path analyses were conducted using AMOS 23. Intermediate traumatic events, offenses, general disapproval, recognition, and treatment represented predictors; changes in PTSD and appetitive aggression were considered outcomes. Model fit indices were the chi-square statistic ( $\chi^2$ ), which should be non-significant, the comparative fit index (CFI) and root mean square error of approximation (RMSEA).

## **7.4 Results**

### **7.4.1 Group comparisons and correlations**

Based on complete data for 39 participants, there were no significant differences between conditions with regard to any of the pre-treatment and post-treatment variables relevant to the present model ( $p > .05$ , Mann-Whitney U-test), except for changes in PTSD symptoms ( $p = .010$ ), for which significantly greater improvement was found in the treatment condition ( $M = 8.23$ ,  $SD = 13.41$ ) than in the control condition ( $M = -2.84$ ,  $SD = 12.12$ ). There was a significant variance in age ( $p = .010$ ) between the treatment ( $M = 23.64$ ,  $SD = 4.68$ ) and control conditions ( $M = 20.89$ ,  $SD = 4.53$ ), and age was consequently included in the model. Correlations between predictors and outcomes are shown in Table 7.1. Because family disapproval exhibited a significant correlation with changes in appetitive aggression, it was added as a control variable in the path analyses.

**Table 7.1.** Means, standard deviations (*SD*) and correlations (Spearman's rho) between potential predictors and change in PTSD and appetitive aggression

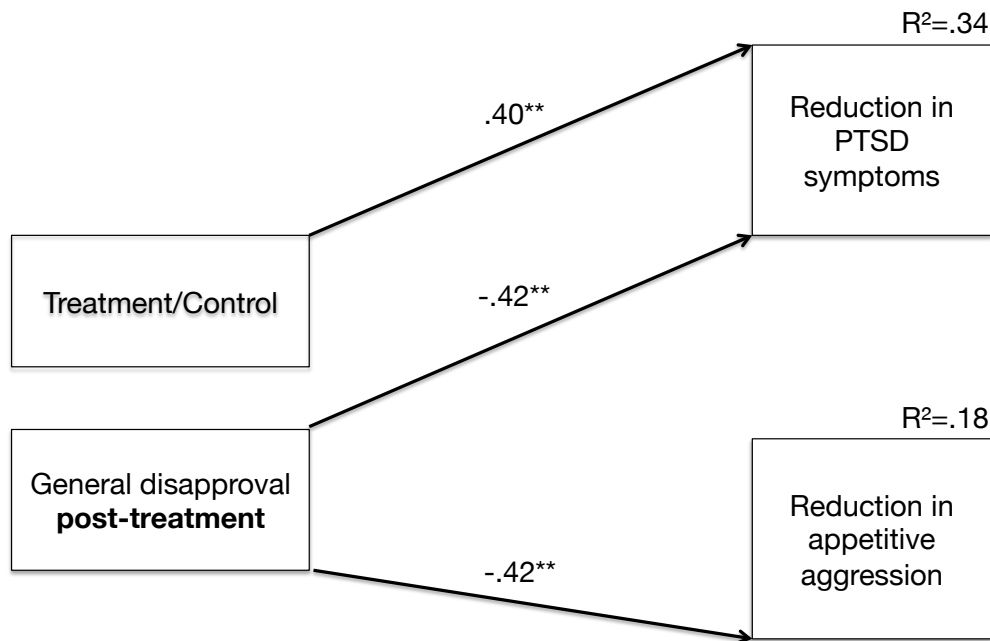
Variable	Mean (SD) [range]	PSS-I change score	AAS change score
Intermediate			
traumatic event types	11.71 (6.09) [0 – 27]	-.41*	-.13
offense types	8.08 (4.90) [1 – 16]	-.23	-.35*
SAQ recognition	1.69 (.69) [0 – 3]	-.31	-.29
SAQ general disapproval	8.62 (3.69) [0 – 15]	-.48**	-.47**
SAQ family disapproval	6.85 (3.91) [0 – 14]	-.24	-.38*
Treatment/Control <sup>1</sup>	-	.38*	-.09
PSS-I change score	5.54 (13.88) [21 – 29]	1	.33*
AAS change score	3.72 (13.88) [33 – 39]	.33*	1

*Note.* PSS-I = PTSD Symptom Scale-Interview, AAS = Appetitive Aggression Scale, SAQ = Social Acknowledgment Questionnaire. Change scores resulted from subtracting the post- from the pre-treatment score, such that a positive score represents symptom reduction. \* $p < .05$ , \*\* $p < .01$  (two-tailed), <sup>1</sup>Point-Biserial Correlation Coefficient

#### 7.4.2 Path analyses

Fit statistics for our hypothesized model were adequate:  $\chi^2(2, N=54) = 2.67, p = .263, CFI = .978, RMSEA = .080$  (90% confidence interval [CI] = .000-.296). Paths from traumatic events to changes in PTSD and appetitive aggression, from offenses to changes in appetitive aggression, and from recognition to changes in PTSD were non-significant. The path from age to changes in appetitive aggression showed a negative trend ( $p = .054$ ). Non-significant paths and the remaining non-significant inter-correlation between treatment and general disapproval were excluded. The revised model is shown in figure 7.1.

Adding family disapproval as another control variable did not significantly increase the explained variance, neither in the full model nor in the final model. For validation purposes, the hypothesized model was also calculated for the 39 participants with complete data, resulting in the same paths as described in the final model, with nearly identical fit values:  $\chi^2(3, N=39) = 2.78, p = .426, CFI = 1.000, RMSEA = .000$  (90% CI = .000-.266).



**Figure 7.1.** Path model of relationships between general disapproval post-treatment, treatment (1) vs. control (0), and changes in PTSD symptom severity and appetitive aggression. Paths with one arrowhead indicate directed associations. Standardized regression weights are shown. \*\* $p < .01$ .

The final model accounted for 34% of the variance in reduction in PTSD and 18% for appetitive aggression. Considering the norms of a good-fitting model (Hu & Bentler, 1999) fit statistics were excellent:  $\chi^2(3, N=54) = 2.80, p = .423, CFI = 1.000, RMSEA = .000$  (90% CI = .000-.226). The treatment condition exhibited greater changes in PTSD than the control condition ( $b = 11.08$ ). General disapproval was negatively related to changes in both PTSD ( $b = -1.61$ ) and appetitive aggression ( $b = -1.59$ ).

Raw scores for PTSD severity ranged from 8 to 37 pre-treatment ( $M = 18.96, SD = 7.83$ ) and from 0 to 39 post-treatment ( $M = 14.62, SD = 12.46$ ), and those of appetitive aggression from 9 to 52 pre-treatment ( $M = 25.78, SD = 11.83$ ) and from 0 to 47 post-treatment ( $M = 24.00, SD = 15.17$ ). Consequently, the final model's results indicate that although the means of both outcomes decreased after treatment, general disapproval impeded changes in PTSD and appetitive aggression.

## 7.5 Discussion

This study investigated potential associations between changes in PTSD and appetitive aggression and intermediate traumatic events, offenses, general disapproval, recognition, and treatment condition from pre-treatment to post-treatment in high-risk individuals from poor communities in Cape Town. Consistent with results from Sommer et al. (2016), general disapproval was not only related to more severe PTSD symptoms (Forstmeier, Kuwert, Spitzer, Freyberger, & Maercker, 2009) but also negatively related to changes in PTSD after treatment and over time. This is in line with findings by W. Xu et al. (2015) indicating that a positive change in social acknowledgment is associated with reduced PTSD after treatment. Similarly, Nietlisbach and Maercker (2009a) conclude that PTSD patients exhibit stronger negative responses to social exclusion than healthy individuals, which is linked to the exacerbation of mental impairments.

General disapproval was also negatively associated with changes in appetitive aggression, which may indicate that feeling excluded from society could impede a possible reduction in appetitive aggression. Ex-gang members may experience rejection for their previous offenses; because such social exclusion could discourage them about the chances of making positive changes in their lives (Dorkins & Adshead, 2011), the environment of ex-offenders may influence their ability to abstain from violence (Serin & Lloyd, 2009).

The treatment condition exhibited greater changes in PTSD than the control condition ( $b = 11.08$ ), indicating that trauma- and aggression-focused treatment can significantly reduce PTSD in South African victim-offender populations. With regard to changes in appetitive aggression, no significant relationship with treatment was found. This may be an age effect (participants in the treatment condition were older than those in the control condition), as changes in appetitive aggression were negatively correlated with age. However, including the interaction between treatment and age as a predictor of change in appetitive aggression did not significantly increase the explained variance in the final model.

Recognition from one's environment was not significantly related to changes in PTSD. This is in line with research indicating that positive social reactions are not as influential as negative ones Jones et al. (2006). Although intermediate traumatic events were negatively related to changes in PTSD in the correlation analysis, this relationship was non-significant in the overall model. The same holds true for the path from intermediate offenses to changes in



appetitive aggression. One explanation for these findings could be that our data provided too little power; it is also possible that general disapproval ruled out other intervening variables.

The path from changes in PTSD to changes in appetitive aggression indicated a positive trend ( $p = .091$ ), but a non-significant one. This result suggests that the alleviation of PTSD symptoms may not necessarily reduce the drive for appetitive aggression, which is promoted when moral inhibitions collapse, as may occur under extremely violent conditions (Elbert et al., 2010). If these moral inhibitions cannot be resurrected due to factors such as general disapproval – implying exclusion from society and thus an obstacle to reconnecting with its values (Dorkins & Adshead, 2011) – the restored psychosocial functioning may even lead to more violence perpetration.

A larger sample size might have allowed more complex mapping in the proposed statistical models and thus greater statistical power. Tracking participants within South African victim-offender populations is challenging, as participants may be homeless, frequently intoxicated or in hiding due to gang-fights and thus inaccessible for follow-ups. Furthermore, the Social Acknowledgment Questionnaire measures subjective perceptions, which may differ to some extent from objective social interactions (Maercker & Müller, 2004) as PTSD symptoms may potentially bias a person's perception of social support (Charuvastra & Cloitre, 2008). Because this measure only assesses three domains of social acknowledgment, it may not capture all the cultural nuances of this construct. Finally, as correlation does not imply causation, causal inferences should be drawn with caution.

### **7.5.1 Conclusions**

With respect to intervention approaches, a focus only on the individual and only on the trauma can neglect external factors that may influence treatment outcomes, contributing to the limited effectiveness of individual psychotherapeutic approaches for PTSD (Maercker & Hecker, 2016). Social influences should thus be considered when treating PTSD (Maercker & Horn, 2013), and effective community-wide interventions are needed to improve social support (Kaniasty & Norris, 2008), which has been shown to be essential in the successful reduction of appetitive aggression in combination with interventions like FORNET (Hermenau, Hecker, Schaal, et al., 2013). Conversely, the lack of social support may contribute to environments that promote reoffending (Payne, Tewksbury, & Mustaine, 2010).

Acknowledging ex-offenders instead of excluding them from society may lower appetitive aggression. Narratives in which offenders try to integrate their victimization and perpetration into a complete picture (Dorkins & Adshead, 2011), may represent one approach intended to promote understanding when shared with the community.

In the attempt to ensure sustainable psychological intervention effects in offender populations, it should be stressed that social acknowledgment – in particular, societal disapproval related to past violent experiences as both perpetrator and victim – may represent an important social factor that must be addressed in the treatment of PTSD and appetitive aggression. In addition to individual therapeutic interventions, the affected community should be targeted in the holistic management of offenders.

## **7.6 Acknowledgments**

Thanks to the participants, REALISTIC, our local interpreters, counselors, therapists, and our research colleagues Veronika Wieshammer, Noah Lorenz, Sarah Wilker, Anselm Crombach, Nicole Brunnemann, Maggie Schauer, and Elisabeth Schauer.

## **8 General Discussion**

The aim of the current thesis was to gain insights into the interplay between traumatic stress and aggression focusing on factors, groups and settings, which have not been investigated so far. The following sections will discuss the results according to the research questions as outlined in chapter 2.

### **8.1 Consequences of warfare for mental health and aggressive behavior in females**

Our results derived from the first study indicate that proximity to combat is associated with both a high level of exposure to traumatic events, and perpetration of aggression. This is in line with research on mental health impairment in war-affected regions (Annan et al., 2011; Bogic et al., 2015; Fazel et al., 2005; Karunakara et al., 2004; Steel et al., 2002). Moreover, they demonstrate the building block effect for PTSD (Dohrenwend et al., 2006; Neuner et al., 2004; Schauer et al., 2003).

Concerning experiences of child maltreatment independent of group membership, our results align with previous studies showing that the risk for abusive child-rearing practices is not limited to growing up in armed groups, but arises among families living in war and conflict zones (Catani et al., 2008; Saile et al., 2014). Additionally, we found evidence for an inter-generational transmission of violence (Crombach & Bambonye, 2015; Rieder & Elbert, 2013; Saile et al., 2014): Recent aggressive behavior was best predicted by participants' own experiences of child maltreatment, together with appetitive aggression. Since in our study, the overall majority of women had children, it is possible that they may have borne the brunt of a significant number of reported acts of aggression. Our study shed light on the cycle of violence by demonstrating that childhood maltreatment outperformed the impact of PTSD in predicting recent aggressive acts. This is in favor of the assumption that timing of adverse experiences is very important (Enlow et al., 2013; McLaughlin et al., 2010; Teicher & Samson, 2013). It is possible that both experiences during childhood and adulthood tap into the same neuronal pathways responsible for regulatory behavioral competences (Kolassa & Elbert, 2007); failures in its accurate development or execution result in increased aggression (Davidson, 2000; DeWall et al., 2007). Lastly, we found high levels of appetitive aggression, particularly in those females with combat experience, thus being consistent with the first pilot

study about the emergence of female appetitive aggression (Meyer-Parlapanis et al., 2016). The current study points to the elevated risk of ongoing violence perpetrated by females in countries in transition from war to peace, further fueling instability. The need for support with respect to high traumatic load and pronounced symptoms of PTSD and aggression is thus all the more urgent, not only for individual mental health, but also for broader social stability.

## **8.2 Sex and appetitive aggression**

In accordance with the literature, both exposure to traumatic events as well as experiences of childhood maltreatment fuel the development of an attraction to violence in males (Hinsberger, Sommer, et al., 2016; Nandi, Bambonye, et al., 2015; Nandi, Crombach, Bambonye, et al., 2015; Sommer et al., 2017), whereas in females these associations were negative or completely unrelated. With respect to lifetime perpetrated acts, a positive association was found in both sexes, with a steeper slope for females. Accordingly, the perpetration of violent acts seems to serve as the groundwork for the development of appetitive aggression to a greater extent in females than in males. Campbell (2013b) has suggested that females mostly prefer low-risk strategies when carrying out aggression, in order to reduce the risk of mortality of their offspring, as this is dependent to a greater extent on maternal than on paternal survival. She concluded that fear is more present in females and restrains physical aggression to a significantly greater extent in females than in males (Campbell, 2006, 2013a; Cross & Campbell, 2011). Though this association has never been tested with respect to appetitive aggression, a similar mechanism might apply: Starting with the hypothesis that initial barriers for a female onset of appetitive aggression are higher, we propose a delayed threshold shift in the perception of violence from fearful to appealing in females compared to males. Initial female responses towards violence might be fear-driven and avoidant due to the mechanism outlined above. But when being caught in conflict without having the opportunity to escape, overcoming the fear reaction and developing an intrinsically rewarding approach motivation is also vital for females in the context of ongoing conflict, in order to maintain functionality and survival. This would also fit the assumption that in reality appetitive and reactive types of aggression are likely to co-occur. Immediate reactions to threat might be of a defensive nature, but with time and experience, will transition into appetitive aggression. As a result, the perpetration of violence serves as the most important predictor of appetitive aggression in females, being reflected by the more

positive association shown in the data. Fitting with this assumption, similar specific perpetrated event types elicited appetitive aggression in males and females, suggesting that specific cues inherent in the perpetration of violence are processed in a similar manner in both sexes. Most probably, these cues trigger the incorporation into the hunting network (Köbach, Nandi, et al., 2015; Köbach, Schaal, & Elbert, 2015).

Beyond this evolutionary perspective, we cannot fully exclude the possible impact of gender stereotypes. A body of research has demonstrated that identification with femininity is inappropriate with respect to the perpetration of physical aggression (Reidy et al., 2009; Richardson & Hammock, 2007; Wyckoff & Kirkpatrick, 2016). This also goes along with research indicating that female fighters face greater social stigmatization after demobilization than males (Tonheim, 2012), potentially arising from gender role conflicts. However, further research is required to fully answer this question.

### **8.3 Impact of impulsivity facets**

In the third study with displaced individuals, both childhood maltreatment and PTSD were related to lower premeditation and perseverance, and childhood maltreatment was also positively associated with urgency. This is in line with research indicating alterations in behavioral competencies due to exposure to adverse events (e.g., Braquehais et al., 2010; Cicchetti & Toth, 2005; Enlow et al., 2013; Thibodeau et al., 2015; Tull et al., 2007; Weiss et al., 2012). However, our study differed with respect to specific impulsivity dimensions (Contractor et al., 2016; Weiss et al., 2013), which is likely attributable to the high PTSD load in our sample. Childhood maltreatment was predictive of both reactive and appetitive types of aggression, being consistent with previous research from post-conflict settings (Nandi, Bambonye, et al., 2015), and also with the cycle of violence hypothesis (Widom, 1989). Moreover, this finding adds further support to the timing hypothesis that early adverse experiences result in long-lasting detrimental consequences (Enlow et al., 2013). Also in accordance with the literature was the reported link between symptoms of PTSD and reactive types of aggression (Hecker, Fetz, et al., 2015; Marsee, 2008; Stimmel et al., 2014). With respect to impulsivity dimensions, only sensation seeking significantly contributed to the emergence of appetitive aggression, and marginally to reactive aggression. This finding implies that when assessing impulsive tendencies antecedent to aggression, exposure to adverse events and symptoms of PTSD need to be taken into account in high-risk populations

for psychological trauma. This fact is also likely to explain divergent results from other studies with the normal population (e.g., Hecht & Latzman, 2015; Latzman & Vaidya, 2013; J. D. Miller et al., 2012). Moreover, these results fit well to the conceptualization of appetitive aggression as hunting for internally rewarding thrills and excitement when perpetrating violence (Elbert et al., 2017; Elbert et al., 2010), and provide further evidence that appetitive aggression is distinct from traditional concepts of proactive aggression carried out in an unemotional manner (Hoeve et al., 2015).

Lastly, studies have indicated that PTSD-related symptoms of hyperarousal accounted for enhanced reactive aggression (Stimmel et al., 2014). This has been interpreted to align with regulatory problems when trying to control distressing emotions such as anger (Marsee, 2008; Orth & Wieland, 2006; Weiss et al., 2012). However, because we did not find an impact of impulsivity in the path from psychological trauma to reactive aggression, impeded regulatory competencies cannot explain our findings in traumatized populations. Taking into account the fact that emotional states of anger or irritability mediate the pathway from PTSD to reactive aggression (Hoeve et al., 2015), we suggest that within states of PTSD-related high arousal and continuous alertness, environmental cues might be processed as potentially threatening, thus resulting in increased reactive aggression. Accordingly, it is not behavioral regulation difficulties but rather dysfunctional cognitive appraisal that seems to account for enhanced reactive aggression. Living in a continuous war or conflict region, this biased interpretation might provide an essential benefit for survival. However, it becomes maladaptive in non-stress situations after migration or when peace has been established, further accounting for aggressive behavior in traumatized populations.

## **8.4 Alterations in risk-taking behavior**

The most prominent finding in the fourth study was that exposure to organized violence such as war or torture was related to lower risk-taking behavior measured with the BART, whereas exposure to non-organized traumatic events was associated with higher risk-taking behavior. Thus, our findings suggest that the type of traumatic experiences is of vital importance in predicting risk-taking behavior in the BART.

There is evidence that anxiety and fear are related to a decrease in adjusted pumps in the BART (e.g., Heilman et al., 2010; Maner et al., 2007), which can be traced back to a

decision-making bias in the evaluation of a potential threat (Aue & Okon-Singer, 2015; Maner et al., 2007). Accordingly, a speculative explanation for the differential impact of types of events on performance in the BART is that the expectancy of gains and losses is evaluated differentially following experiences of non-organized violence in contrast to being exposed to conditions of war and torture and that this might be related to differences in intensity, duration or type of peri- and posttraumatic fear reactions. Nevertheless, this hypothesis cannot fully explain the complex pattern between types of traumatic experiences and risk-taking behavior in the BART.

With respect to the well-established link between exposure to traumatic events and increased risk-taking behavior as a coping strategy in order to overcome negative affect (Ben-Zur & Zeidner, 2009; Rheingold et al., 2004), the question arises of what aspect of risk-taking behavior does the BART actually capture? The task may be valuable in measuring the elemental components of decisions antecedent to risky activities but not involvement in risk-taking behavior per se (see Sujana et al., 2014). Nevertheless, the findings show that the BART is able to capture differential effects related to types of events, making it a helpful tool to assess changes in general risk propensity in clinical populations.

Finally, the model failed to predict the extremes of high and low scores of risk-taking behavior, which leads to the assumption that other variables not taken into account might additionally be relevant. This is also supported by the sufficient but still low predictive performance of the training model compared to the generally high predictive performance capabilities of machine learning models.

## **8.5 Outlook: Effects of Social Acknowledgment**

Lastly, we investigated whether perceived social acknowledgment had an impact on the reduction of PTSD and appetitive aggression following FORNET treatment in traumatized high risk adolescents. It was revealed that post-treatment *general disapproval* but not *family disapproval* and *recognition*, was negatively related to both a reduction of appetitive aggression and a reduction of PTSD symptoms. This is in accordance with the relevant PTSD literature, indicating that social factors have a major impact on the development of PTSD (Forstmeier et al., 2009; Maercker et al., 2009; J. Mueller et al., 2009; Nietlisbach & Maercker, 2009b; Sharp et al., 2012), as well predicting treatment success (TARRIER et al.,

2000; W. Xu et al., 2015). Findings regarding appetitive aggression are consistent with previous research about social factors influencing pathways to enhanced aggression after being victimized (Benhorin & McMahon, 2008; Scarpa & Haden, 2006). Mechanisms for appetitive aggression might be similar: Feeling rejected by the people around you - friends, neighbors or teachers - is likely to fuel a cycle of violence. Perpetrating violence remains a functional adaptation (Crombach & Elbert, 2014; Weierstall, Hinsberger, et al., 2013) and is experienced by the individual to be a helpful strategy for overcoming not only individual feelings of weakness and helplessness arising from social rejection, but also to restore justice by one's own means (Mendes, Mari, Singer, Barros, & Mello, 2009). The end result is a never-ending cycle of revenge and violence. Again, it is likely that initial aggression occurs as reaction to a perceived insult and only later shifts into appetitive aggression, as appealing and self-rewarding aspects start to develop. Taken together, social factors must be addressed when intervening in the cycle of violence.



## 9 Implications

Several implications can be derived from the above-discussed findings. They are grouped into implications regarding further research and implications for practitioners. Lastly, an overall conclusion follows.

### 9.1 Future research

In the first study, we demonstrated that females within armed groups are especially vulnerable with respect to the development of mental health impairment such as PTSD and appetitive aggression. Nevertheless, sound epidemiological data regarding proportions of female involvement, extrinsic and intrinsic motivators for joining armed groups, as well as mental health consequences is scarce. In light of increasing numbers of female agents in warfare and terrorism (Bloom, 2011; Laster & Erez, 2015), future research should not only investigate these issues, but also focus on societal obstacles and after-effects when being demobilized, in order to evaluate the support that these females need during and after transition to a civilian life.

Our second study revealed sex-specific pathways for appetitive aggression. Nevertheless, it only focused on previously established risk factors, such as experiences of trauma during childhood and lifetime, as well as perpetrated event types. An extension of research to other risk factors, for instance a sex-specific lack of social acknowledgment, might be beneficial in further understanding these pathways. This is because forced marriages or sexual abuse with children originating from rape are likely to put a greater burden on females than on males with respect to societal stigmatization (e.g., Tonheim, 2012). Moreover, the paths described here should be investigated outside the East African context in order to test the robustness of findings.

Linking exposure to violence and reactive and appetitive aggression in study three, we proposed alterations in information processing as a reason for reacting aggressively. Since a meta-analysis has confirmed the impact of a hostile attributional bias being related to different types of aggression (Chen, Coccaro, & Jacobson, 2012), this likely powerful explanation should be investigated further, with a focus on high-risk populations for both trauma and violence. Additionally, the third study has revealed that antecedents of reactive and appetitive types of aggression differ, further supporting etiologically distinct categories.

Nevertheless, an immediate consequence of high levels of both types of aggression seems to be the high risk of committing violence, as outlined in study one. Accordingly, research should also focus on how reactive and appetitive types of aggression differentially contribute to the actual involvement in violent acts, and investigate what conditions determine the transition from reactive to appetitive modes of aggression, as discussed in study two. This could be approached by means of assessing both valence of emotions and physiological reactivity after having experimentally induced appetitive or reactive aggressive attitudes, following the implementation of Moran et al. (2014).

With respect to the fourth study, further research should unravel the relation between involvements in domain specific risky behavior, such as excessive substance abuse and alterations in general risk propensities or basic decision making, as operationalized by the BART. There are a few studies that have already addressed this issue (e.g., Sujan et al., 2014), but none has focused on highly traumatized populations such as displaced individuals. Moreover, the hypothesized impact of fear on performance in the BART in these high-risk populations should be evaluated.

With regard to overcoming appetitive aggression, as studied in the fifth study, social disapproval was a driving factor for the perpetuation of appetitive aggressive attributes after treatment. Research has found that a hostile cognitive bias, like that suggested in study three, can account for increased aggression after social rejection (DeWall, Twenge, Gitter, & Baumeister, 2009). Accordingly, it might be interesting to test the hypothesis of a hostile attributional style with respect to the pattern of increased appetitive aggression after being both victimized and socially neglected. This might not only provide further insights into the cycle of violence, but to also have the potential to derive cognitive-based interventions and be able to diminish the propensity towards aggression.

A problem that arises with respect to all cross-sectional data is that proving causal directions or pathways is not possible, and the direction of causality is a matter of theoretical speculation. The implementation of experimental studies assessing pathways between traumatization and aggression is not only difficult in war-torn regions, but also limited due to ethical considerations when investigating effects of traumatic stress. Nevertheless, approaching these questions with experimental methods in an ethically appropriate way is necessary in order to validate the findings derived from these mostly retrospective and correlational field research. Moran et al. (2014) have described a promising method for the

induction of appetitive and reactive aggression in a student sample by means of auditory scripts. Together with the induction of social exclusion for modeling social disapproval (see Twenge et al., 2001) or a psychosocial stress paradigm (see Heim, Newport, Mletzko, Miller, & Nemeroff, 2008), this design could serve as a model to investigate behavioral antecedents and consequences of aggression following an approximation of traumatic stress in the laboratory.

Taken together, the results derived from all studies indicate that associations and effects are far more complex than assumed. This requires an extension of research on specific types and timing of traumatic experiences. New methodological approaches such as machine-learning procedures like those employed in study two and four might provide fruitful insights (see Breiman, 2001b). Though these methods are not able to capture reciprocal associations or to test mediation models, they provide the opportunity to assess complex non-linear associations beyond simple dose-dependent effects with comparably small sample sizes – and thus might reflect real-world situations more accurately.

Lastly, research regarding appetitive aggression has thus far almost exclusively focused on societal or behavioral aspects. Recently, research has started to take into account biological correlates such as epigenetic variations and has revealed common functional polymorphisms underlying both risk-taking behavior in the BART (Crisan et al., 2009), the prediction of PTSD after exposure to traumatic events and childhood adversities (Xie et al., 2009), and amygdala reactivity, which is known to mediate increased sensitivity to perceived threat and fear in individuals with PTSD (Murrough et al., 2011). Additionally, epigenetic determinants for types of aggression have been reported (Mendes et al., 2009; Waltes, Chiocchetti, & Freitag, 2016). At this stage, these findings are not yet conclusive, and effects are small but complex. But they point to the importance of further elaborating biological correlates and might provide an additional framework for understanding trajectories into the cycle of violence.

## **9.2 Clinical and practical implications**

Considering the tremendous impact of child maltreatment on impulsive and aggressive tendencies, it becomes evident that in the long term, the cycle of violence can only be halted if interventions or rather prevention takes place as early as possible in order to create a

beneficial environment for children when growing up. This not only includes awareness-raising for the detrimental consequences of childhood maltreatment, but also support with needs-based training and parenting programs in order to promote culturally appropriate beneficial parenting styles. Some first promising results have been found in an East African sample with a training program for the prevention of child maltreatment in child institutional care (Hermenau, Kaltenbach, Mkinga, & Hecker, 2015). In Germany, a system of early support for caretakers has been implemented for the sake of child protection in cooperation with the youth welfare office (Eickhorst et al., 2016). However, very often, the assistance provided is not sufficient or neglects the actual needs of caregiver or children (Eickhorst et al., 2016). Accordingly, a development and extension of the early support system is required. Moreover, this support needs to be accessible for individuals with uncertain residence status, and those who are still going through their asylum procedure in Germany. Since many of these displaced individuals present a history of psychological trauma, their offspring are especially vulnerable to becoming tomorrow's perpetrators through the trans-generational cycle of violence (Catani, 2010; Saile et al., 2014).

Regarding adult individuals with a trauma background, interventions should address both individual trauma histories and aggression. The official demobilization, disarmament and reintegration (DDR) programs in post-conflict regions have very often failed to adequately include mental health issues and provide effective counseling (Banholzer, 2014; Maedl et al., 2010). Moreover, considering studies with female members of armed groups, a gendered approach needs to be implemented. In the past females involved as active agents in warfare have often been overlooked by the international community, resulting in only irregular access of female combatants to DDR programs (McKay & Mazurana, 2004; World Bank, 2009). Addressing gendered needs is of utmost importance not only with respect to the sex-specific trajectories of appetitive aggression but also to prevent future generations becoming victims of violence, in the light of greater female involvement in raising children in very often traditional African societies. Across all contexts, there seems to be a simple but effective mechanism for helping victims overcome trauma and reduce appetitive aggression besides providing individual treatment: social acknowledgment by the community. Raising awareness and applying community intervention programs is a low-cost strategy and thus also suitable for low resource countries. Veale, McKay, Worthen, and Wessells (2013) evaluated a reintegration program of former female combatants by means of drama and poetry, giving them a voice on the one hand and enabling them to come into contact with the

community. This intervention was highly effective in helping these young women transition from their combatant role into the active participation in civilian life by being acknowledged by the community. An intervention combining community work with individual support might provide a beneficial way of integrating not only for former combatants in post-conflict regions, but also to counteract stigmatization and prevent aggression in Western societies with a view at the current refugee situation.

### **9.3 Conclusion**

Following the announcement of violence as a public health problem (Krug et al., 2002) and in light of a massive increase of armed conflict worldwide (UNHCR, 2016) the current thesis supports the notion that appetitive aggression is an omnipresent phenomenon in human beings, developing in response to conflict, irrespective of sex, culture or context. It also emerges to a minor extent in civilian populations, making it a powerful force driving human conflict. Referring to the initial question of the association between mental health problems and committing violence, we could show in all studies, that experiences of victimization fuel an ongoing cycle of violence. This was the case in post-conflict regions such as Burundi, in continuous stress situations such as in South Africa, and in individuals from war-affected regions seeking refuge in Germany. Of great predictive importance was prior child maltreatment. It also became evident that exposure to traumatic events had a detrimental impact beyond reactive or appetitive aggression, namely increased risk-taking behavior. This was differentially related to types of trauma and maltreatment experiences. Finally, we revealed evidence that general disapproval hindered successful recovery from PTSD and reductions in appetitive aggressive tendencies after treatment.

From the current thesis it can be seen that a one-fits-all-approach to addressing violence arising from victimization is not appropriate (Widom, 2014). We have shown that complex associations connect the pathway from trauma to violence. In order to halt the recurring perpetration of aggression, prevention programs should aim to focus on parenting programs as well as to provide early support for caretakers in need. Moreover, the thesis has demonstrated the necessity of regularly including female ex-combatants in DDR programs and to apply gender-informed interventions within these settings. In order to tackle the societal burden of violence as a global health crisis, the finding of the impact of social acknowledgment provides a useful starting-point for targeting appetitive aggression and

PTSD, by counteracting stigmatization. This may well be useful not only in conditions under continuous stress such as in South Africa, but also with respect to the reintegration of former combatants, and with a view to the current refugee situation in Germany. With respect to the public's fear of displaced individuals acting violently, ironically it is exactly this fear that could inhibit societal acknowledgment of the suffering of traumatized individuals, thus further fueling the cycle of violence. Consequently, interventions must reach beyond the affected individuals, and address the overall society in order to overcome this fear.

## 10 References

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## Appendices

## Appendix A

### Additional information for chapter 4.2: Hunter or prey: Predicting appetitive aggression and PTSD by event types. A study with women from a post-conflict region.

**Table A1.** 36-item checklist suggested by Brandt et al. (2014) when replicating results following the first replication study (Köbach, Nandi, et al., 2015).

<b>The Nature of the Effect</b>	
1. Verbal description of the effect I am trying to replicate:	Differential impact of specific types of perpetrated, self-experienced, and witnessed events as well as potentially traumatic events during childhood on appetitive aggression and posttraumatic stress disorder
2. It is important to replicate this effect because:	The associations have never been tested in a female sample
3. The effect size of the effect I am trying to replicate is:	<i>n/a</i> – a machine learning procedure has been applied which does not produce effect sizes
4. The confidence interval of the original effect is:	<i>n/a</i> – a machine learning procedure has been applied which does not produce effect sizes
5. The sample size of the original effect is:	<i>N</i> = 392
6. Where was the original study conducted? (e.g., lab, in the field, online)	Field study
7. What country/region was the original study conducted in?	Burundi, Bujumbura
8. What kind of sample did the original study use? (e.g., student, Mturk, representative)	Male ex-combatants
9. Was the original study conducted with paper-and-pencil surveys, on a computer, or something else?	iPad-based assessment and data storage
<b>Designing the Replication Study</b>	
10. Are the original materials for the study available from the author?	Yes, on demand.
11. I know that assumptions (e.g., about the meaning of the stimuli) in the original study will also hold in my replication	A previous study has investigated the occurrence of appetitive aggression in females.

- because:
12. Location of the experimenter during data collection: On site.
  13. Experimenter knowledge of participant experimental condition: *n/a*
  14. Experimenter knowledge of overall hypotheses: Interviewers did not know the hypotheses.
  15. My target sample size is: *n/a*
  16. The rationale for my sample size is: Feasibility of data collection in fragile regions and availability of former female members of armed groups

**Documenting Differences between the Original and Replication Study**

17. The similarities/differences in the instructions are: [Exact | Close | Different]
18. The similarities/differences in the measures are: [Exact | Close | Different]
19. The similarities/differences in the stimuli are: *n/a*
20. The similarities/differences in the procedure are: [Exact | Close | Different]  
Similar procedure and setting, but data assessment via Ipad in the original study and paper-pencil in the replication study.
21. The similarities/differences in the location (e.g., lab vs. online; alone vs. in groups) are: [Exact | Close | Different]  
Different locations for data collection but under similar conditions (semi-structured interviews with private atmosphere)
22. The similarities/differences in remuneration are: [Exact | Close | Different]  
Participants got transport money in both studies and an additional compensation in the replication study.
23. The similarities/differences between participant populations are: [Exact | Close | Different]  
Different sex and different involvement in warfare.
24. What differences between the original study and your study might be expected to influence the size and/or direction of the effect? [Exact | Close | Different]  
Sex - Males (ex-combatants and active soldiers) versus females (ex-combatants and civilians) and accordingly sex-based specific experiences
25. I have taken the following steps to test whether the differences listed in #24 will influence the outcome of my replication attempt: Impact of specific types of events as research question

**Analysis and Replication Evaluation**

- |   |   |
|---|---|
| 26. My exclusion criteria are (e.g., handling outliers, removing participants from analysis): | Participants with missings as well as invalid answers were removed from the analysis.   |
| 27. My analysis plan is (justify differences from the original):                              | Same analysis as in the original study but with split between training and test set, because this is the state of the art application for machine learning procedures |
| 28. A successful replication is defined as:   | Similar impact of specific types of events on the emergence of appetitive aggression and PTSD   |

**Registering the Replication Attempt**

- |  |            |
|--|------------|
| 29. The finalized materials, procedures, analysis plan etc of the replication are registered here: | <i>n/a</i> |
|--|------------|

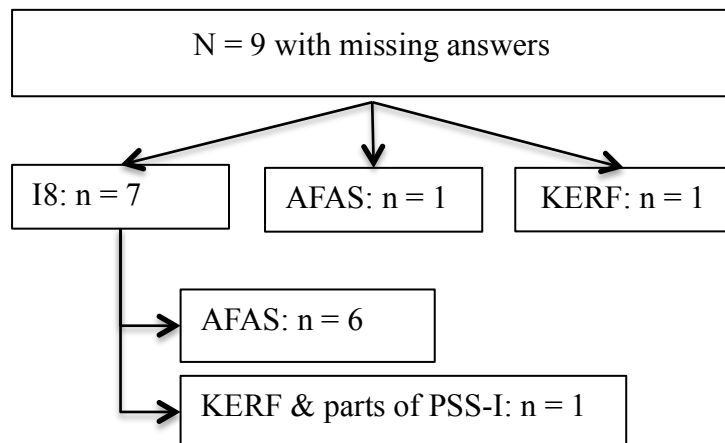
**Reporting the Replication**

- |  |  |
|--|--|
| 30. The effect size of the replication is:   | <i>n/a</i> – see above (question no. 3).   |
| 31. The confidence interval of the replication effect size is:   | <i>n/a</i> – see above (question no. 4).   |
| 32. The replication effect size [is/is not] (circle one) significantly different from the original effect size?                                      | <i>n/a</i> – see above (question no. 3/4).   |
| 33. I judge the replication to be a [ <u>partial success/informative failure to replicate/practical failure to replicate/inconclusive</u> ] because: | A similar pattern has been revealed with respect to the impact of perpetrated event types in the prediction of appetitive aggression. However, the model could not be replicated for symptoms of PTSD because the model fit was very insufficient. |
| 34. Interested experts can obtain my data and syntax here:   | Via e-mail from the authors  |
| 35. The limitations of my replication study are:   | Cross-sectional design, very small sample size, failure to predict symptoms of PTSD  |
| 36. All of the analyses were reported in the report or are available here:   | Dissertation / via e-mail from the authors   |

*Note: n/a = not applicable.*

## Appendix B

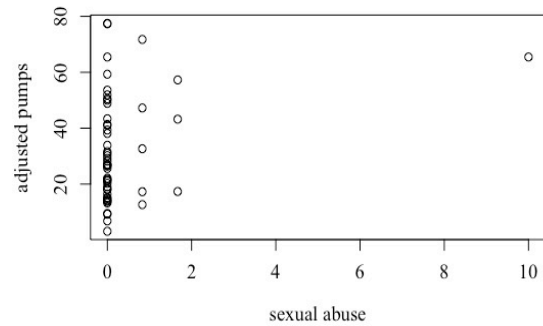
**Additional information for chapter 5: relations between traumatic stress, dimensions of impulsivity, and reactive and appetitive aggression in individuals with refugee status.**



**Figure B1.** Missing answers sorted by questionnaires. Seven participants missed the I8. Of these, six also missed the AFAS, and one missed the KERF and parts of the PSS-I. Besides, another participant missed the AFAS but no other data and one missed the KERF but no other data.

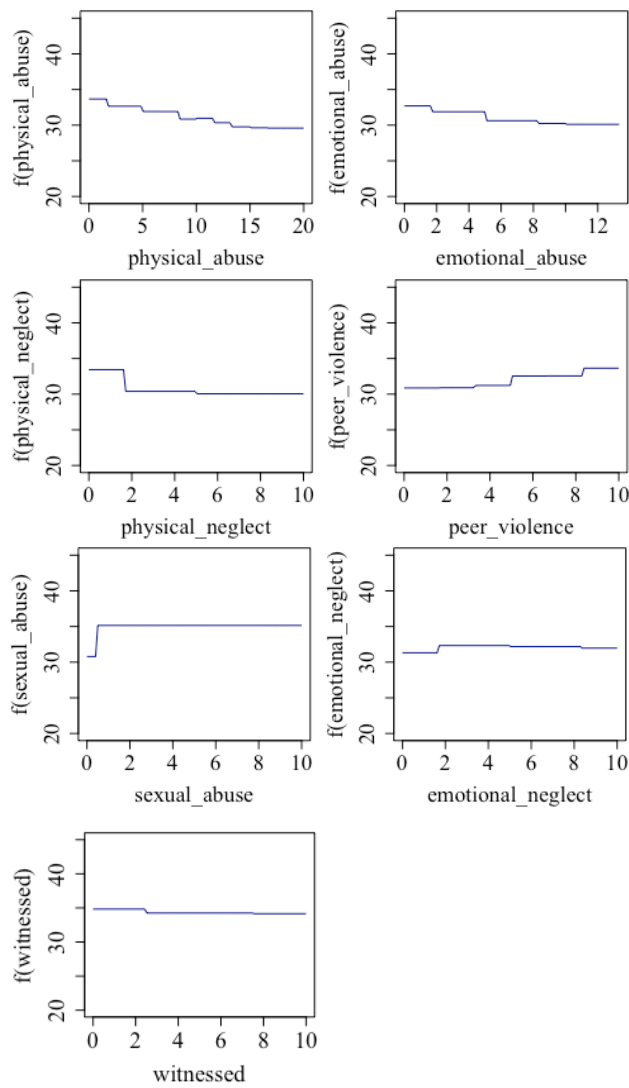
## Appendix C

**Additional information for chapter 6: When do traumatic experiences alter risk-taking behavior? A machine learning analysis of reports from refugees.**



**Figure C1.** Correlation pattern between adjusted pumps (ordinate) and sexual abuse (abscissa) indicating one outlier.





**Figure C2.** Partial dependency plots for the seven less important variables. For each predictor variable (displayed on the abscissas) the number of adjusted pumps (displayed on the ordinate) is shown as a function of the former.