What determines violent behavior in men? Predicting physical, psychological, and sexual violent offending based on classification and regression tree analysis

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Abstract

Despite compelling evidence that victimization and offending co-occur, it remains unclear what types of victimization are linked to specific forms of perpetration. Here we examined the relationship between physical, psychological, and sexual violence with respect to influencing variables including mental health, risk-taking behaviors, and coping strategies. Data from 5385 men were collected as part of an epidemiological study on violence experience. A classification and regression tree analysis identified the main predictors of violence perpetration and classified violent offending into high- and low-risk groups. Results indicate that violence is best predicted by previous exposure to violence and polyvictimization. Physical violence is best predicted by prior exposure to physical violence and this is further influenced by the frequency of and the age at which violence was experienced. Drug use was a strong predictor of physical and psychological violence. The latter is best predicted by a history of polyvictimization, the severity and the originator of violence. Sexual violence is strongly predicted by one’s sexual violence experience. Other factors such as demographic characteristics are less predictive. Our results may contribute to the development of early prevention and intervention approaches that account for different risk factors. The significance of violence exposure suggest that intervention measures must focus on victims of early and prolonged experience of violence. On the strength of the link between drug use and violence, exposure to violence should be considered in drug prevention and intervention and vice versa.

KEYWORDS

classification and regression tree analysis, exposure to violence, perpetration, polyvictimization, risk factors, violent offending

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1 | INTRODUCTION

In 2019 alone the number of violent crimes reported in Germany was 181,054 of which 135,575 were physical and 9426 were sexual crimes (Bundesministerium des Innern, 2019). In the United States, an estimated 1,203,808 violent crimes occurred with aggravated assaults accounting for 68.2% and rape for 8.2% of violent crimes (U.S. Department of Justice, 2019). These numbers, however, only account for official crime reports including physical violence (i.e., murder, manslaughter, and physical injury), sexual violence (i.e., sexual assault and rape), and robbery. Psychological violence is not included in these reports despite often having similarly severe consequences (Habel et al., 2016). Research on violence is challenging due to the heterogeneity of violence definitions and cross-cultural differences in the perception of violence. The world report on violence and health defines violence as “the intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment, or deprivation” (p.5, Hoffman, 2003). The intention to harm someone is common to most definitions of violence. In this study, we define violence as an extreme form of aggression that includes every type of behavior, not only physical force, that is intended and has the potential to cause harm to another.

Understanding the causes and risk-factors associated with violent behavior is of utmost importance in reducing and preventing violence.

The development of violent offending relies on a dynamic matrix of situational (i.e., the presence of a suitable target, the absence of guardianship, or unstructured socializing with peers; L. Cohen & Felson, 1979; Hindelang et al., 1978; Osgood et al., 1996), individual (i.e., low self-control, negative emotions, and lack of coping capacity (Agnew et al., 2006; Agnew, 1992; Gottfredson & Hirschi, 1990)), and environmental factors (i.e., role of culture and neighborhood [A. Cohen, 1955]). These factors, however, cannot entirely explain the development of violent behavior. As such, a general aggression model has been established to provide an integrative framework combining those existing theories to address three main aspects: (1) person and situational inputs, (2) cognitive, affective, and arousal routes, and (3) outcomes of aggression (Anderson & Bushman, 2002).

Personal and situational inputs increasing the probability of aggression include demographic characteristics, tendencies to risk-taking behaviors and previous experience with violence. For instance, couples with lower socioeconomic status have a higher susceptibility to violence (Reichel, 2017). These results, however, vary due to different indicators of socioeconomic status. Low income, education levels, and employment problems in particular correlate with higher levels of violence and victimization (Reichel, 2017). While socioeconomic status may also predict health outcomes and violence, its role remains open to debate.

Risk-taking is associated with increased violent behaviors. For instance, substance use, including alcohol (Bushman & Cooper, 1990; De Sousa Fernandes Perna et al., 2016; Exum, 2006) or methamphetamines (McKetin et al., 2014) increase the likelihood of violent behaviors. Further risk-taking behaviors associated with violence, particularly sexual violence, include having multiple sexual partners and impersonal sex or casual attitudes toward sex (Tharp et al., 2012). Similarly, internalizing behaviors, such as self-injurious acts are also associated with violence. For example, Richmond-Rakerd et al. (2019) showed that the odds of committing violent crimes are 3.5 times greater for self-harming adolescents than for those who do not injure themselves.

Beside demographic characteristics and risk-taking behaviors, past experience also plays a major role in the occurrence of aggressive behaviors. Thus, victimization constitutes an environmental modifier that increases the probability of developing aggressive behaviors. Exposure to violence is an important factor with negative consequences for social interactions and mental health, leading to depression, anger, and to increased delinquency (Hagan & Foster, 2001; Hay & Evans, 2006). Moreover, exposure to violence is strongly associated with long-term and short-term violent behavior, with long-term effects involving complex processes of observational learning and emotional desensitization (Huesmann & Kirwil, 2007; Huesmann, 1998; for a review of the evidence supporting an overlap between victimization and offending, see Jennings et al., 2012). Theories of violence and crime differ in their explanations of the suggested overlap between violent offending and violent victimization. While some argue victimization and offending are independent consequences of common characteristics, others assume a causal relationship between victimization and offending despite clear directional causality (Turanovic & Pratt, 2013).

These risk factors may also occur as direct or indirect consequences of experienced violence and play moderating or mediating roles in developing aggressive behavior. Furthermore, violence does not result from single risk factors, but likely from a dynamic interplay of different factors and/or an accumulation of predisposing factors. Despite the ongoing debate on the causes of violence and the relationship between victimization and offending, there is ample evidence that the personal consequences of violence are massive. Previous research has shown that participants exposed to violence are more likely to suffer from psychiatric problems including depression, anxiety, self-harm, and alcohol/cannabis dependence (Newbury et al., 2018). Furthermore, psychosomatic complaints and somatic health problems have also been found to be linked to violent behavior, with violent offenders having a higher risk of being diagnosed with a chronic disease diagnosis (Reingle et al., 2014). It is therefore essential to further investigate the causes of violence and the complex interaction between multiple risk factors. The aim of this study, therefore, is to reveal the pathways of numerous risk factors for violent offending. Although there is a strong relationship between offenders and victims as well as for the risk and protective factors that explain the affiliation to this overlap group, these links are far from being clear since previous studies have frequently neglected the interrelationships between different types of violence (Jennings et al., 2012). In this study, we collected detailed information on violence experiences, such as age at which violence was
experienced, originator and target as well as frequency and perceived severity of different types of violence. Additional factors such as psychosomatic and physiological complaints, risk-taking behavior such as drug use, self-harming behavior, multiple sexual partners, help-seeking behavior in male victims and perpetrators of violence were also taken into account.

1.1 The current study

Although violence is generally well-investigated, little is known about violence experience specifically in men and the role of victimization in the prediction of violent offending. Therefore, the primary objective of this study was to determine the risk factors that best predict physical, psychological, and sexual violent offending in male individuals. The data-driven Classification and Regression Tree (C&RT) approach, which allows the identification of low- and high-risk groups of violent offending, was used on data from 5385 adult males to identify and assess risk factors.

Since we used a data-driven hypothesis-free method aimed at uncovering relationships within the data structure and identifying clusters, we formulated three research questions instead of specific hypotheses:

1. Does one's own experience of violence predict subsequent violent behavior? If so, does the experience of one specific type of victimization lead to a particular form of offending?
2. If exposure to violence predicts offending, do age, context, frequency, severity, and the relationship to the perpetrator play important roles in prediction?
3. Are demographics, social support, help-seeking behavior, psychosomatic/physiological complaints, and risk-taking behavior important predictors of violence perpetration?

2 METHODS

The data for this analysis originate from a large-cohort survey on violence and health of the University hospital RWTH Aachen, Germany. The study was approved by the Ethics Committee of the Medical Faculty of RWTH Aachen University, all participants gave oral informed consent.

2.1 Participants

Male in- and outpatients from general and psychiatric hospitals aged 18 years or older were included in this study. All patients who were physically and mentally able to fill out the questionnaire on their own were asked to participate in the survey. A total of 1609 men refused to participate before handing out the questionnaire and 1397 returned envelopes containing blank questionnaires. A total of 5385 patient questionnaires were acquired and analyzed, resulting in a response rate of 64.2%. The participants had a mean age of 56.1 years (SD = 17.6) with an average of 11 years of education (SD = 2.6). The majority of 82.8% of the participants were born in Germany. Other countries of birth were Poland, the Netherlands, Turkey, and Belgium. A tabular overview of demographic data is provided in the Table S1 (Supporting Information Appendix A).

2.2 Procedure

The questionnaires were handed out in seven hospitals in North Rhine-Westphalia and later collected in unlabeled, sealed envelopes to ensure data protection and anonymity. The sealed envelopes ensured that the participants could refuse to take part in the study even if they had not directly refused to fill in a questionnaire. Study participation was not remunerated. To achieve high-quality standards, all investigators were given specific instructions regarding the ways in which the patients were to be approached and informed about the study. Participants were provided with two flyers, one including the study details and the other including the contact details of a counseling service provided by the investigators. Counseling was offered by a psychotherapist to those in need of support due to negative consequences of victimization or perpetration experiences.

2.3 Questionnaire

The demographic data, health-related complaints, risk-taking and help-seeking behaviors, convictions, and violence experiences (including violence exposure and violent offending behavior) were assessed in 5385 men via a self-administered, anonymous questionnaire. The present study distinguishes between physical, psychological, and sexual forms of violence. Participants were instructed to report all experiences of physical, psychological, or sexual acts, which they either exerted themselves or were exposed to, that were intentional and caused, or had the potential to cause harm. The development of the questionnaire was based on one used for a previous German prevalence survey on violence (Habel et al., 2016) and was extended to include additional risk factors. The questionnaire surveys prevalence’s of the exposure to physical, psychological, and sexual violence. For the present study, the questionnaire was extended by also asking for perpetrating these forms of violence. The recommendations of the manual on violence research by Schröttle were also followed (Schröttle, 2016). The first version of the questionnaire was piloted and made available for evaluation by 106 male patients who were asked to provide ratings on the comprehensibility of the questionnaire. Based on the participants’ feedback, some of which was related to the extensive scope of the questionnaire, the category “economic violence” was removed in the first revision of the questionnaire. During the second revision, we included a question assessing past convictions following violent crimes. The questionnaire was distributed to randomly selected patients and was administered in the same way as after the pilot phase.
Violence-related items included information about violence exposed to and perpetrated as well as the age at which the exposure to violence occurred, the severity of the exposure (rated on a scale between 0 and 10), by/against whom the violence was directed at, and the frequency of this exposure. Distinctions were made between physical, psychological, and sexual violence. Participants were instructed to report all experiences of violent acts, which were intentional and caused harm or had the potential to cause harm. For each type of violence, examples were listed as shown in Figure S1 (Supporting Information Appendix B).

The demographic data included participants’ age, number of children (if any), highest level of education, marital status, occupation, gross income per year, country of birth, and religious confession. Additionally, data on help-seeking behaviors, psychosomatic/physiological complaints, and risk-taking behaviors were collected. The questionnaire was provided in five languages (German, English, French, Dutch, and Turkish) and the translations were completed using the back-translation method. By distributing and collecting the questionnaire in patient wards, we were able to reach a large number of German- and non-German-speaking men who would otherwise not be able to participate in such studies due to age- or health-related restrictions. Overall, we collected and analyzed data from a heterogeneous sample, largely corresponding to the socioeconomic heterogeneity in the general German male population. The final version of the questionnaire consisted of 52 items, including (half) open-ended, multiple choice responses and rating scales.

2.4 | Statistical analysis

We used the Classification and Regression Trees (C&RT) algorithm (C&RT, Breiman et al., 1984) which is a tree-based method that employs binary partitioning of the data and satisfies the minimization of a splitting criterion. The method seeks out associations in the data that best predicts an outcome variable (i.e., becoming a perpetrator) based on input variables. C&RT identifies subgroups of individuals with different probabilities of perpetrated violence (high-risk vs. low-risk groups) and optimizes the discrimination between violent and non-violent individuals by sequentially identifying the predictor variables that best differentiate groups along the outcome variable. In this analysis, we used the Gini impurity function as splitting criterion. The minimum value of Gini improvement could not be smaller than 0.001, wherein a higher mean decrease Gini value represents a higher variable importance. As stopping criterion we used a minimum number (50) of individuals in the nodes. The C&RT analysis can include nominal, ordinal, and interval data as independent variables. We conducted a 10-fold cross-validation to train the data set. Before generating the regression trees, the missing data were imputed using multiple imputations (Rubin, 1988). With all participants (N=5385) and 186 variables taken into account, it resulted in a total of 1,001,610 values (186 × 5385), 10.8% of which was missing with no identifiable patterns. Next, three independent regression trees were generated, one each for the prediction of physical, psychological, and sexual violence. The classes are dichotomous variables, which include lifetime perpetration of the three types of violence. In total, 186 predictor variables were included in each analysis: 8 variables containing demographic information, 41 variables related to health and risk-taking behaviors, 96 variables related to experienced violence (32 for each type of violence), and 41 related to help-seeking behaviors. For a detailed overview of the included variables, see Table S2 (Supporting Information Appendix C). We considered all possible predictors in the analysis and generated an extensive model of risk assessment. Given that a variable can be considered highly important even if it never appears as a node splitter, since the algorithm identifies the next best predictor within every child node, the relevance of all predictor variables was checked separately.

3 | RESULTS

3.1 | Sample characteristics and demographic data

Just over half (51.6%) of the participants reported to have no experiences of violence, either in terms of perpetration or victimization, with 18.6% being only victims of violence, 4.8% being only perpetrators, and 25.0% reporting to have experiences in both victimization and perpetration. This breakdown shows that a relatively small group of individuals became perpetrators without being victims. Almost a third of the male patients were victims of physical violence (31.3%) while a smaller percentage (27.8%) perpetrated physical violence during their lifetime. Although 30.3% of the men became victims of psychological violence, roughly one-tenth reported to use psychological violence (13.1%). Sexual violence was found to be the least frequently reported type of violence, with 4.6% having been exposed to sexual violence relative to 1.6% who have perpetrated it. 48.9% of all victims were exposed to multiple types of violence (polyvictimization) and 29.5% of all perpetrators committed multiple types of violence (polyperturbation). These prevalence estimates refer to the raw data of all completed questionnaires (with the missing data omitted). For the analysis of the main findings, the missing data were imputed using multiple imputations enabling the inclusion of every questionnaire despite the missing data.

3.2 | Main findings

3.2.1 | Physical violence

The parent node included 5385 individuals with a 33.1% prevalence of perpetrated physical violence (Figure 1). This analysis generated a model with a depth of three levels and six terminal nodes, with individuals perpetrating physical violence ranging from 14.7% (low-risk group) to 67.5% (high-risk group). The parent node split into two child nodes according to the variable “frequency of exposure to physical violence,” with a lower risk to become physically violent ascribed to individuals who were never exposed to physical violence (Gini improvement = 0.074). Among those who were never exposed
to physical violence, the frequency of exposure to sexual violence provided the most important split (Gini improvement = 0.013). For individuals without any sexually violent experience, the tree generated a child node according to the variable "psychological violence experienced over a period of x years" with a threshold value of 5.1 (Gini improvement = 0.003). None of these groups was split further (terminal nodes 3 and 4). Individuals who were exposed to psychological violence for less than 5.1 years and never experienced sexual or physical violence (terminal node 3), had a 14.7% risk of becoming physically violent, and thus represented the low-risk group.

Among those who were exposed to physical violence (split 1), the question whether or not this exposure took place between the ages 13 and 20 provided the most significant split, with a Gini improvement of 0.003. If the experience of physical violence occurred between 13 and 20, the risk of committing physical violence was higher than if violence was experienced at the other age categories. The model generated no further split for this group (terminal node 2). Thus, individuals who were exposed to physical violence between the ages 13 and 20 constituted the high-risk group with a 67.5% risk of becoming physically violent. For those who were under 13 and above
Information Appendix D). The Figure S2 (Supporting Information) most important variables is presented in Table S3 (Supporting Information). The set of 10 best predictor within the group of every child node, we then checked never appears as a node splitter since the algorithm identifies the total of 11.2% of all individuals who never used physical violence. Appendix E) reveals a plot of the importance of predictor variables. The distribution of 0.003. The model generated a threshold value of 4, with those who consumed more than four different drugs having a higher risk of using physical violence. Neither of these groups was split further according to the predictor variables.

Table 2 shows the risk of misclassification in this model. Overall, 15.1% of cases were not predicted correctly on the basis of this model. The importance of all predictor variables for psychological violence is shown in Table S4 (Supporting Information Appendix F) where we list the 10 most important predictor variables. Similar to the results for physical violence, the list shows that frequent exposure to violence is the best predictor. Figure S3 (Supporting Information Appendix G) shows a plot of the importance of the variables for predicting psychological violence. The distribution of the graph highlights that the model includes an equal distribution of good, medium, and poor predictor variables.

3.2.2 | Psychological violence

The analysis generated a tree containing eight terminal nodes with a 4-level depth (Figure 2). The percentage of people who reported psychologically abusing someone ranged from 5.1% (low-risk group) to 72.0% (high-risk group) within these eight groups. The parent node included 5385 participants with an overall percentage of 16.6% having committed psychological violence. As shown in Figure 2, the first splitting variable represented multiple types of violence experiences with a lower risk of psychological perpetration for those without polyvictimization (Gini improvement = 0.052). Those who were exposed to two or more types of violence were further differentiated by the variable “number of drugs” with a Gini improvement of 0.003. The model generated a threshold value of 4, with those who consumed more than four drugs having a higher risk of committing psychological violence (terminal node 3). Among those who did not consume more than four different drugs during their lifetime, the next important variable was the period of time during which violence was experienced. This separated those who were exposed to violence less than 30 years from those who were exposed to psychological violence for more than 30 years (Gini improvement = 0.002). Thus, individuals who were exposed to multiple types of violence over a long period of time constituted the high-risk group with a 72.0% risk of becoming psychologically violent. Among those who were not exposed to psychological violence for more than 30 years, the next important split was whether or not they were exposed to psychological violence by a friend, with those who were having a 61.0% risk of becoming psychologically offensive.

If no violence or only one type of violence was experienced (split 1), the severity of the experienced psychological violence provided the most important split (Gini improvement = 0.008). Those who rated the severity of experienced psychological violence less than 2 on a Likert scale, ranging from 1 (“not severe at all”) to 10 (“very severe”), had a lower risk of using psychological violence themselves. The last important variable in this model was “at least one experience of violence.” Neither of these groups was split further according to the predictor variables.

3.2.3 | Sexual violence

For the parent node, the percentage of participants who ever used sexual violence was 11.3%. The analysis generated a tree with only two splits and three terminal nodes as shown in Figure 3. The percentage of individuals who ever perpetrated sexual violence ranged from 6.7% to 38.5%. When testing the predictor variables using a C&RT analysis, the factor with the largest impact on becoming sexually abusive was the frequency of one’s own exposure to sexual violence (Gini improvement = 0.016). Node 1 could not be subdivided and constituted the low-risk group. For those who were never exposed to sexual violence, the risk of becoming sexually violent was 6.7% (terminal node 1). Individuals who were exposed to at least one sexual offense had a 36.3% risk of committing sexual violence themselves later in life (terminal node 2). This shows that one’s own exposure to sexual violence causes an almost sevenfold increase (from 5.3% to 36.3%) in one’s risk of becoming sexually violent. The last split in this group referred to the experience of sexual violence perpetrated by a stranger. Specifically, those who experienced this type of violence committed by a known or close person had the highest risk of becoming sexually offensive themselves. The predictive value and the explanatory power, however, are limited due to the small proportion of individuals exposed to sexual violence.
The risk of misclassification amounts to 0.113, which implies that this model makes correct predictions in 88.7% of the cases. While the results provide important insights, they should be interpreted with caution. Because the group of individuals who ever used sexual violence is relatively small, the model predicts correctly in 88.7% of the cases when categorizing all participants as non-violent (Table 3). The relevance of the predictor variables for sexual violence indicates that only the first three variables have an improvement of at
least 0.01. Of these variables, only one was selected for splitting in our model (see Table S5, Supporting Information Appendix H). Furthermore, only seven variables show an improvement of at least 0.001. We determined that the minimum value of Gini improvement should not be smaller than 0.001 as a stopping criterion for the tree. Figure S4 (Supporting Information Appendix I) demonstrates the relevance of the predictor variables for sexual violence. The graphic representation of the relevance of the predictor variables also shows that many variables where either poor or did not predict sexual violence at all. These results suggest that the information we collected and the variables we analyzed are much less important with respect to the prediction of sexual violence compared to the two other types of violence.

### 4 | DISCUSSION

We aimed to explore the relationship between physical, psychological, and sexual violence with respect to influencing variables including mental health. For the latter, we recorded items related to injuries, impairments of the motor system, chronic pain, gastrointestinal diseases, skin disease, sleep disorder, depression, anxiety, heart problems, suicidal thoughts, posttraumatic stress, sexually
transmitted diseases. For risk-taking behaviors we surveyed history of drug use, risky sexual behavior, self-inflicted injuries, and gambling. Last, for coping strategies we surveyed variables focusing on friends, sports, family, psychological advice, counseling, religious institution, therapist. We found that all three types of violence were best predicted by prior exposure to violence. Physical and sexual violence were best predicted by the respective type of violence, whereas psychological violence was best predicted by polyvictimization rather than exposure to one specific type of violence. Furthermore, physical violence was predicted by the frequency of, and the age at which violence was experienced but also by drug use. Sexual violence was best predicted by the frequency and the originator of one’s own exposure to sexual violence. Besides a history of polyvictimization, the severity, the originator of violence and drug use were strong predictors of psychological violence.

First, we investigated whether the specific types of experienced violence are related to specific forms of violent behavior. Investigating violence risk factors has often been done in the context of general offending (mostly delinquency or official convictions) or has been limited to a particular type of violence. Here, we used a classification and regression tree algorithm to identify and investigate patterns that might explain the factors leading to three different types of violent behavior, namely, physical, psychological, and sexual violence. We found that previous exposure to violence and polyvictimization increase one’s risk of becoming a perpetrator. Our results show that perpetration of physical and sexual violence is best predicted by one’s own exposure to the respective type of violence. Polyvictimization was the best predictor of psychological violence. Other studies have also provided evidence of victimization as a risk factor for delinquent behavior (Chang et al., 2003; Daday et al., 2005). With respect to physical and psychological violence in particular, our results confirm that each of the three violence experiences promote violent behavior. Contrary to some earlier findings according to which the link between childhood experience of physical abuse and violence in adulthood do not survive robustness checks (Myers et al., 2018), we found that frequent exposure to physical violence was a strong predictor of physically violent behavior. Myers et al. (2018) on the other hand, showed that childhood neglect (instead of physical abuse) was the most robust predictor of adult violence (Myers et al., 2018). Nevertheless, our results are in line with previous findings showing an association between one’s own experience of and the perpetration of physical violence thereof (Dodge et al., 1990; Widom & Maxfield, 2001).

Regarding sexual violence, our findings provide some support for the “sexually abused—sexual abuser hypothesis” (Glasser et al., 2001). This hypothesis states that sexual offenders are more likely to have been sexually abused than nonsexual offenders. That is, individuals who experienced sexual coercion were more likely to engage in sexually coercive behavior (Seto et al., 2010). A review by Tharp et al. (2012) showed an increased tendency toward sexual violence following emotional, physical, and sexual abuse (Fineran & Bolen, 2006; Zakireh et al., 2008). Our results, however, only identified exposure to sexual violence as a risk factor for perpetrating sexual violence. Although we found that the frequency of one’s own exposure to sexual violence increases the risk of sexual offending up to 38.5%, it should be kept in mind that the majority of the sexual violence victims do not end up perpetrating sexual offenses. Thus, the assumption that today’s victims are tomorrow’s offenders should be interpreted with caution.

In general, we only found a small number of perpetrators without having experienced any prior victimization. Many studies reveal an overlap between violent victimization and offending, with those who were victims of violence being the most likely to engage in such behavior themselves later in life (Broidy et al., 2006; Flexon et al., 2016; Jennings et al., 2010, 2014).

Second, we further explored the impact of circumstances and the context of violence experiences on violent behavior. The age at which violence was experienced was the best relevant predictor of physical violence with individuals exposed to physical violence between the ages of 13 and 20 having the higher risk of offending. These results suggest that exposure to violence in adolescence is more relevant to the likelihood of violent behavior emergence. One explanation for this could be the functional and structural brain organization taking place during adolescence and young adulthood (Giedd & Blumenthal, 1999; Sisk & Foster, 2004; Sisk & Zehr, 2005). Adolescents, therefore, show a unique sensitivity that challenges the less mature cognitive control systems, resulting in patterns of behavior that can lead to riskier or suboptimal choices (Somerville & Casey, 2010).

Our findings are in line with previous evidence showing that the severity of time period, and the nature of the relationship between perpetrator and victim are important factors in the emergence and development of psychological offending. Additionally, our results show that sexual violence is also best explained by the frequency and the originator of one’s own exposure to sexual violence. The experience of violence committed by a person of trust seems to have a special influence. The literature suggests that offending tends to be concentrated in families and fostered from one generation to the next and that there may be intergenerational continuities in the exposure to multiple risk factors (Farrington et al., 2001). Our observations corroborate the findings and indicate that the experience of sexual violence perpetrated by a close person or relative increases one’s risk of becoming sexually offensive. Jespersen et al. (2009) propose learning, sexual development, and genetic transmission as possible explanations for the emergence of sexually violent behavior. Accordingly, there is a larger genetic contribution to sexually violent behavior than to the other types of violent offending (Långström et al., 2015). However, the environmental factors remain unclear in most studies addressing the genetic mechanisms of sexually violent behavior.

Third, besides victimization history, we also examined socio-demographic factors, help-seeking behaviors, health-related complaints, and risk-taking behaviors. Risk-taking behavior was only represented by the number of drugs in the model for physical and psychological violence. Drug use was linked to an increased risk of violent offending, while other risk-taking behaviors as well as risk
factors such as demographic information, help-seeking behavior, and health status were less predictive of violent behavior. Regular poly drug use was a good predictor of the increased risk of becoming physically or psychologically violent. These results match previous findings showing significant direct and indirect effects of alcohol on violence perpetration (Parrott & Zeichner, 2002; Sprunger et al., 2015). Overall, the results show that it is the number of consumed drugs rather than one specific drug that plays an important role in the development of violent behavior. The direction of influence, however, remains unclear. It is plausible, nevertheless, that drug use follows or ensues from the experience of violence and may serve as a coping strategy. Conversely, chronic drug use can lead to drug-related crime and violence potentially mediated by impulsivity.

4.1 Limitations

Our findings should be considered in light of a few limitations. First, we were unable to establish clear causal relationships between risk variables (i.e., drug use) and violent outcomes given the data are not temporally ordered. Longitudinal and prospective designs would be better suited to determine whether risk-taking behavior is caused or followed by the experience of violence. Further research is needed to verify whether the correlates and associations we report above predict violent behavior or are a consequence thereof.

Second, the length of the questionnaire lead to some missing data at random. The reason for developing this comprehensive survey was to gather detailed information on various types of violence including those that are often underexplored (e.g., stalking, isolation, or social withdrawal, which we included in psychological violence), taking into account the severity of violence exposure, which is often ignored. Nonetheless, we used multiple imputations to reduce attrition and overcome the problems related to missing data. In addition to the items’ missing, the general rejection rate of the questionnaire should be noted. Even though the mean response rate for written surveys on sensitive topics such as violence exposure is 57.03% (Klingwort, 2017) and we achieve an acceptable response rate of 64.2%, results should be interpreted with caution as we cannot rule out selection bias. This issue is particularly relevant for sensitive topics and future studies should address different means to improve the rate of responding beyond reassuring full-anonymity.

Third, the experience and perpetration of violence was measured via self-report questionnaires which could have been influenced by social desirability responding or memory recall. Since the vast majority of offenses are not officially reported and recorded, including self-reported measures was the best solution to avoid significant information loss (Dubow et al., 2014). Although there is a high level of correspondence between self-reports and official arrest reports (Gomes et al., 2018), self-reports overestimate the number of offences and lower the age of onset (Farrington et al., 2014). The use of self-reports, therefore, allows an early identification of individuals at risk of violent behavior (Gomes et al., 2018) and provides an opportunity for early intervention (Farrington et al., 2014).

Fourth, the age categories may not be optimal with respect to the assessment of age. With the age category 13–20 including the transition from childhood to adolescence, it is possible that qualitatively different types of victimization were captured in this age range, rendering it difficult to separate child abuse from physical assault.

Last, the algorithm yielded a 25.4% risk of misclassification for the first, 15.1% risk for the second and 11.3% risk for the third model. It must be noted that the risk of misclassification for the classification tree of sexual violence has a very poor predictive value and explanatory power. The sample size of individuals who reported to have used sexual violence is smaller compared with the other violence groups. The model predicts correctly in 88.7% of the cases when categorizing all participants as nonviolent, which can be seen as another shortcoming of the present study. Due to the rather small number of sexually violent men in our sample, the model did not accurately discriminate between sexually offensive and nonoffensive men. We used the Gini impurity function to differentiate between groups and found the first and only split of the parent node to have a very poor Gini improvement (0.016). These findings were validated by separately analyzing the relevance of all predictors which indicated that the model was less predictive of sexual violence compared with physical and psychological violence. Other factors not included in these analyses may be more important with respect to the prediction and explanation of sexual violence. Nevertheless, these preliminary findings provide valuable information and may be further explored in future studies.

While we cannot use the C&RT analysis to establish causal associations, the method has several advantages and is now being increasingly applied to epidemiological data to assess potential risk factors. A clear advantage is its appropriate handling of complex data and interpretability of complex results involving interactions with the aid of tree graphics (De Ath & Fabricius, 2000). The ability to use different scale levels of variables in one analysis is another strength of this method (De Ath & Fabricius, 2000).

Since men are still more often stereotyped as perpetrators of violence than as victims of violence, and since the experiences of violence are likely to differ between men and women, it is of utmost importance to survey men’s experiences of violence in detail. Mention should be made, however, that our results are primarily applicable to the general German male population. Future investigations on whether the findings are applicable to women and/or other cultural backgrounds are warranted to ensure the robustness of the predictors irrespective of gender or socio-cultural background. The results must be cautiously interpreted considering cross-cultural and geographic differences.

4.2 Practical and research implications

Research on the determinants of violence not only detects the risk factors but also possible protective factors, which should also be integrated in prevention programs. For psychological violence, it is often difficult to implement research findings into practice since psychological violence rarely leads to obvious violation and convictions. Regardless of its type,
violence continues to be a major problem in all societies. Since the development of violent behavior is a complex and long process, there is need for relevant longitudinal research, especially with respect to the potential determinants of sexually violent offending. Additional possible biopsychosocial influencing factors, such as biological (genes, hormones) and social-environmental influences, should also be taken into account. Although we show that most perpetrators of violence likely have experienced violence themselves, there are also violent men who claim to have never been victims of violence. Our results indicate that treating and dealing with victims of violence also necessitates addressing the potential later or concurrent execution of violence and hence has to be tackled actively in prevention and treatment programs.

Identifying the risk factors and their pathways with respect to this group of violent men may constitute a promising direction for future research. To conclude, we identified a strong association between one's own experience of victimization and violent behavior. For future research, it would therefore be interesting to explore one's own histories of violence in relation to the use of violence in more detail and more specific. Our findings indicate a potential link between the use of drugs and physical and psychological violence. The link between drug-use and violence suggests that treatment should also focus on identifying drug-use and its causes, developing alternative courses of action and withdrawal. This classification is not only relevant for the health-care sector but also for prevention programs given that a significant portion of the costs of violence originates from the impact of violence on health status but also for designing reoffending intervention programs. Since exposure to violence increases the risk of becoming a perpetrator, prevention policies, therapy, and counseling programs for individuals who have been exposed to violence are of particular importance with respect to primary prevention. Further, our results indicate that additional red flags that should lead to actions are male gender, information on the number of victimizations, drug use and the sensitive age range during which those experiences occurred. We would suggest using our and other’s findings to establish prognostic scales assessing risk factors, that should be acknowledged and initiate preventive actions and stepwise processes when a certain number of risk factors is fulfilled. Regarding secondary prevention, individuals who have already become violent may benefit from holistic programs accounting for one's own exposure to violence as well as for specific circumstantial factors precipitating violence to construct adequate coping strategies aimed at dealing with own violence experiences. The current findings suggest that trauma-informed care, may be beneficial for men when implemented in the course of a reoffending prevention program for convicted criminal offenders. It is necessary to detect violence as early as possible to prevent its health and social consequences, but also its detrimental effect on violence perpetration. As adolescence is a particularly vulnerable period, interventions at this stage of life may be highly effective in preventing future perpetration of violence.

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DATA AVAILABILITY STATEMENT
Data sharing is prevented by ethical, privacy, or confidentiality matters. We do not have the ethical approval to share the data.

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