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ORIGINAL ARTICLE

Exploring the Relationships of Crime Victimization with Depression, Anxiety, and Loneliness in Twin Families

B.M.A. Gonggrijp[1,2] · S.G.A. van de Weijer[1] · J. van Dongen[2,3] · E.M.A. Slob[4,5,6] · C.C.J.H. Bijleveld[1,7] · D.I. Boomsma[2,3]

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Abstract

Crime victimization is associated with a more unfavorable health profile. We examined associations of victimization of property, violence, and sexual crime with mental health indices for depression, anxiety, and loneliness and explore their etiology in Dutch twin families. The data were collected from adult twins, their parents, siblings, spouses, and offspring participating in longitudinal survey studies of the Netherlands Twin Register ($N = 19{,}867$). First, we tested if there is an association between victimization and loneliness, anxiety, and depression at the population level. Second, discordant twin pairs were identified, where one twin was a crime victim and the cotwin was not. This design allows controlling for confounding by shared environment and genetic factors. Third, a longitudinal comparison was made of pre- and post-victimization data in victims, their family members, and unrelated individuals. At the population level, victimization was associated with increased depression, anxiety, and loneliness, except for property crime, which was not associated with depression and anxiety. The associations were strongest for violent and sexual crimes. Within discordant twin pairs, no significant differences were found between the victimized and non-victimized twins. These results confirm that crime victimization is associated with adverse mental health outcomes and loneliness, with the strength of this association differing per type of crime. There is no strong evidence that the relationship between victimization and mental health or loneliness follows a simple causal model, as the relationship can be partly explained by genetic and shared environmental confounding. These results also suggest that victims of sexual and violent crimes may already experience more mental health problems before victimization than non-victims, and that individuals with more mental health problems and loneliness are at increased risk of becoming a victim.

Keywords Mental health · Discordant twins · Confounding · Longitudinal

Extended author information available on the last page of the article

Introduction

Crime is a prevalent societal problem and is reported to have a significant impact on the well-being and health of victims. In 2021, 17.1% of the population in the Netherlands, the country on which the current study focuses, became a victim of one or more crimes. This comprised violent crimes (4.1%), sexual crimes (1.1%), property crimes (9.0%), or vandalism (6.0%) (Statistic Netherlands, 2022). Victimization has been associated with less favorable outcomes across multiple life domains, such as relationship formation, employment, criminal offending, and a wide range of mental health outcomes (e.g., Beckley et al., 2018; Dworking et al., 2017; Hanson et al., 2010; Jennings et al., 2012; Krumm et al., 2018; Maniglio, 2008; Swanberg & Logan, 2005; De Jong, 2022). Victims of crime also have an elevated risk for a wide range of adverse physical health outcomes, and this has been linked to poor functioning of the brain and nervous system, cardiovascular-, gastrointestinal-, musculoskeletal-, reproductive, immune, and endocrine systems (e.g., Britt, 2001; Breiding et al., 2008; Chrisler & Ferguson, 2006; Coker et al., 2000; Kramer et al., 2004; Murray-Close et al., 2014).

Research on victimization and mental health problems has often focused on childhood or adolescent victimization, and often only one type of victimization is included (e.g., only sexual victimization or violent victimization). Becoming a victim during childhood or adolescence, both sensitive developmental periods, is associated with an increased likelihood of various negative outcomes such as depression, anxiety, loneliness, and post-traumatic stress disorder (PTSD) (e.g., Boney-McCoy & Finkelhor, 1995; Jackson & Deye, 2015; Kilpatrick & Acierno, 2003; Kimmel, 2014; McKay et al., 2021; Turner et al., 2006; de Venter et al., 2013). In addition, it can lead to several negative outcomes in adulthood, such as bipolar disorder, substance abuse, decrease in self-esteem, anxiety, and depression (e.g., Isaacs et al., 2008; Macmillan, 2001; Turanovic & Pratt, 2015). It is, however, important to note that previous life-course criminological literature suggests that victimization profiles are heterogeneous over time (DeCamp & Zaykowski, 2015; Kong & Easton, 2019; Tillyer, 2014). Semenza et al. (2021), for example, found that individuals who were violently victimized during the transition to adulthood showed the most mental and physical health problems. Research based on adult violent victimization has been more limited and has often focused on specific types of crimes (i.e., domestic violence, sexual crimes, or property crimes). Still, previous research has found that adult victimization, including violent, sexual, and property crime, correlates with numerous psychological and mental health problems (e.g., Britt, 2001; Campbell & Wasco, 2005; Krahé & Berger, 2017; Kimmel, 2014; Kunst & Koster, 2017; Ruback & Thompson, 2001). For example, Choudhary et al. (2012) examined the association of sexual violence victimization with depression and anxiety symptoms. Of the victims of sexual violence, 18.82% reported being diagnosed with depression, 8.37% reported an anxiety disorder, and 28.28% reported being diagnosed with both depression and disorder. This was significantly higher compared to the non-victims (respectively, 7.39%, 3.75%, and 6%). Porcerelli et al. (2003) found, in a cross-sectional study of

1024 family practice patients, that the women and men who were a victim of violence showed more depressive symptoms compared to non-victims.

While the results of these studies reveal an association between victimization and mental health, the question is whether victimization causes mental health problems, as confounding could be present. Confounding may arise when third factors influence both the risk of victimization and mental health issues. One specific type of confounding is genetic confounding which occurs when genetic factors influence both the risk of victimization and outcomes such as mental health problems. It has been established that mental health problems are influenced by genetic factors. Genetic contributions to variation in anxiety were estimated at 45% (Lamb et al., 2010) and roughly 30 to 50% for depression (Boomsma et al., 2000; Polderman et al., 2015; Kendler et al., 2000; Sullivan et al., 2000). Even though victimization might seem a chance occurrence, it does not happen at random and heritable traits have been identified that are associated with an increased risk of victimization (Beckly et al., 2018; Veldkamp et al., 2019). For example, Beaver et al. (2011) found that violent victimization in adults is heritable, and chronic victimization has an even higher estimate of heritability. It is crucial to emphasize that when we describe victimization as heritable, we are not implying that there are specific genes that directly cause people to victimize others, but that research suggests that genetic factors influence an individual's characteristics (such as behavior or personality traits) that increase their chance of victimization. Previous research showed evidence of a shared genetic vulnerability for victimization and mental health problems, such as anxiety (Guimond et al., 2015), paranoid symptoms (Shakoor et al., 2015), and MDD (Kavish et al., 2019).

One approach to studying the etiology of an association between exposure and an outcome, such as victimization and mental health problems, is by within-family designs (McGue et al., 2010). When siblings or twins within a family are discordant for the exposure, their degree of discordance for the outcome can inform on different mechanisms underlying the association. Twins and siblings share all or part of, their genetic makeup. Monozygotic twins (MZ) share 100% of their genes, whereas dizygotic twins (DZ) and non-twin siblings share on average 50% of their segregating genes. By making comparisons within twin pairs, we thus automatically control for genetic confounding, either partly (DZ twins) or completely (MZ twins). Siblings and twins also share many (familial) environmental exposures, which for twins also include prenatal exposures. Therefore, by comparing twins, we automatically control for a wide variety of possible confounding factors that have been found to be related to both victimization and mental health, such as age, sex, SES, household income (Willitts et al., 2004), and SES (e.g., Hastings & Hamberger, 1997; Straus & Gelles, 1986).

Figure 1 shows the expected patterns of analyses in a general population and discordant twins under different mechanisms of causality and confounding. If there is a causal pathway between victimization and mental health, analyses in all groups (i.e., population analysis, same-sex DZ twin pairs, and MZ twin pairs) are expected to reveal effect sizes larger than zero, and they will be similar in all groups (left set of bars in Fig. 1). Under the noncausal hypothesis, where genetic factors completely explain the

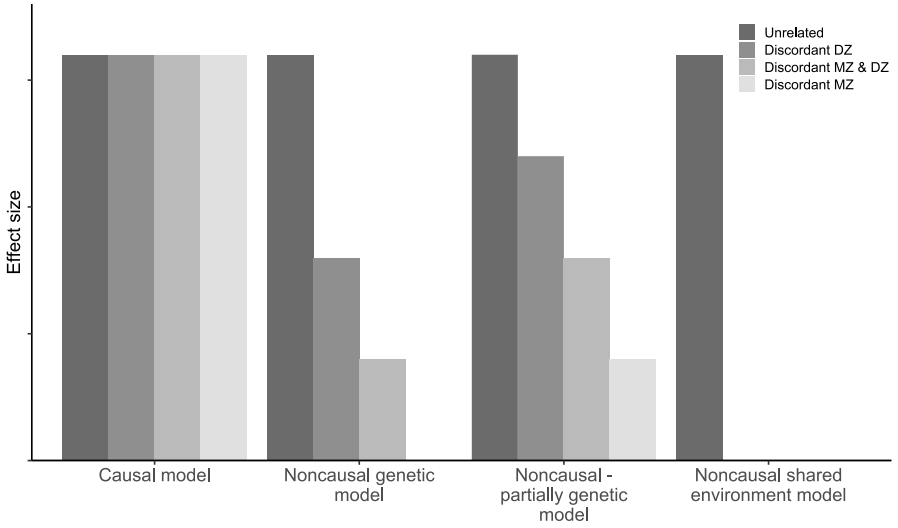

Fig. 1 Expected patterns of population and discordant monozygotic (MZ) and dizygotic (DZ) twin analyses under the causal and noncausal hypothesis

association (2nd set of bars in Fig. 1), discordant MZ twins are expected to have an effect size of zero because they are genetically identical and are thus exposed to the same genetic risk factors. The DZ twins show an intermediate pattern. If the model is only partially explained by genetic factors, we expect a similar pattern, but the effect size of the MZ twins will be above zero (3rd set of bars in Fig. 1). Finally, if the association is noncausal but completely explained by shared environmental factors, all discordant twins are expected to have an effect size of zero (4th set of bars in Fig. 1), as twins have been raised in the same family, and in these analyses, we automatically control for all shared environmental factors (Lichtenstein et al., 2002; Slob et al., 2020).

Studies of twin pairs discordant for victimization exposure have reported an increased risk of emotional or behavioral problems in the victimized twin (e.g., Arseneault et al., 2008; Connolly et al., 2021; Kendler et al., 2000; Silberg et al., 2016), while other studies reported little to no effect (Berenz et al., 2013; Bornovalova et al., 2013; Dinwiddie et al., 2000). It is important to note that these twin-based studies are difficult to compare as they often looked at different types of victimization and different mental health disorders in various populations at different ages. A substantial number of these discordant twin analyses have focused on child or adolescent victimization (e.g., Dinkler et al., 2017; Donahue et al., 2017; Kendler et al., 2000). Schaefer et al. (2018) analyzed 625 MZ and 491 DZ UK twin pairs discordant for the exposure to domestic violence between the mother and her partner, frequent bullying by peers, physical maltreatment by an adult, sexual abuse, emotional abuse, and neglect, or physical neglect. Results showed that both childhood and adolescent victimization increased the risk of mental health problems (such as depression, anxiety, PTSD, and substance abuse) independent of family background and genetic risk. In contrast, Dinwiddie et al. (2000) looked at childhood sexual abuse (CSA) and the prevalence of psychiatric disorders. In the full sample ($N = 5995$ Australian twins),

CSA was associated with major depression, conduct disorder, panic disorder, and alcoholism, and participants were more likely to report suicidal ideation and a history of a suicide attempt. However, no differences were found when comparisons were restricted to discordant twin pairs ($N = 64$ MZ and 112 DZ twin pairs).

To the best of our knowledge, only one previous discordant twin-pair study has examined adult victimization and mental health (Connolly et al., 2021). They found that twins who experienced more intimate partner victimization reported more symptoms of depression than their co-twin ($N = 471$ American twin pairs). Because most discordant twin studies have concentrated on childhood or adolescent victimization, our knowledge regarding the impact of adult victimization over the life course of various crimes remains limited. It is often seen that siblings regularly share experiences of victimization in childhood, especially twins (Jaffee et al., 2004). Thus, with the limited number of discordant twins or siblings, it can be difficult to determine whether certain outcomes are caused by victimization using a discordant twin design in children or adolescents. In contrast, as twins age, they share fewer experiences and therefore also fewer experiences of victimization, making this analytical approach in adults more feasible.

In this study, we investigated the association between victimization, mental health problems, and loneliness in adults. We focused on depression, anxiety, and loneliness as outcome measures and looked at three different types of victimization, namely violent, sexual, and property crimes. This enabled us to take into account possible heterogeneous associations with different types of crime, which may impact in different ways on victims. We first compared victims and non-victims on these outcomes at a population level in a large sample of participants unselected for exposure or outcome. The participants are included in longitudinal survey studies and were assessed because they are twins or family members of twins. This offered the unique possibility to also apply a discordant twin design to address questions regarding confounding. Lastly, we investigated whether an association between victimization and mental health problems exists prior to victimization.

Methods

Participants

The data were collected from adult twins, their parents, siblings, spouses, and offspring who take part in studies with the Netherlands Twin Register (NTR). Recruitment of twins and their family members is via several routes, e.g., through city councils in the Netherlands, the yearly NTR newsletter *Twinfo*, the NTR website, and national events organized by, for example, the Dutch Twin Society. Twins who are registered by their parents after birth are invited to take part in self-report surveys after adolescence. Respondents fill out surveys on health and lifestyle every 2 to 4 years since 1991. Detailed information on the data collection procedures in the NTR, including the number of registered participants by role and age group and response rate, have been reported in detail (e.g., Ligthart et al., 2019; Middeldorp

et al., 2008; Vink et al., 2004; Vink & Boomsma, 2008), showing, for example, good representatives for data collected on health, personality, and lifestyle.

The present study is based on data from the four surveys collected in 2000, 2002, 2004, and 2009, which asked about exposure to life events, including crime victimization. The surveys from 2004 and 2009 assessed loneliness; the surveys from 2000 and 2002 assessed anxiety, and the surveys from 2000, 2004, and 2009 assessed depression. The data were combined across surveys to create the largest possible dataset for the three outcome measures. If participants filled out multiple surveys that contained the outcome variable of interest (e.g., 2000 and 2002 for anxiety), we selected the most recent survey for that specific variable and the victimization data from the same survey. If a participant belonged to a twin pair, preference was given to the most recent survey to which both twins had responded (2.267 twin pairs within the same survey, 69.37%). The selection of participants for each different analysis is detailed in Fig. 2.

Twin zygosity was determined by genotyping or by self- and parental reports concerning the physical resemblance of the twins or confusion by other family members and peers, showing excellent agreement (Ligthart et al., 2019). We selected all participants aged at least 25 years with complete data for victimization. The total sample consisted of $N = 19{,}867$ participants (see Table 1). Twins whose zygosity was unknown were excluded from the discordant twin analyses ($N_{\text{loneliness}} = 2$, $N_{\text{anxiety}} = 2$, and $N_{\text{depression}} = 4$). Data from participants who had filled in multiple surveys showed high consistency when looking at sexual or violent victimization; only 2.43% of the participants who reported sexual victimization did not report their sexual victimization again in later surveys, this was 3.20% for violent crimes. Reporting of property crime was more inconsistent, with 12.67% of the participants who had reported property crime in an earlier survey, not reporting this in a later survey.

Exposure

Victimization

In all four surveys, a Dutch life event scale (*the Schokverwerkings Inventarisatie Lijst*; Van der Velden et al., 1992) with a Cronbach's alpha of 0.73 was included. This scale asked, "What events have happened to you in your life?" The scale includes a variety of life events, such as the death of a spouse, serious illness, or divorce. However, the present study focused on victimization and therefore included all the available victimization items, which were property crime (theft, burglary, and vandalism), violent crime (robbery and physical assault), and sexual offense (rape and sexual assault). Response categories for the surveys in 2000 and 2002 were "never experienced," "0–6 months ago," "6–12 months ago," "1–5 years ago," and "more than 5 years ago." In the surveys in 2004 and 2009, the response categories did not include "0–6 months ago" and "6–12 months ago," but instead "less than a year ago" was used. To have uniform response categories across surveys, the response categories from the surveys in 2000 and 2002, "0–6 months ago" and "6–12 months ago", were combined to "less than a year ago." When more than one

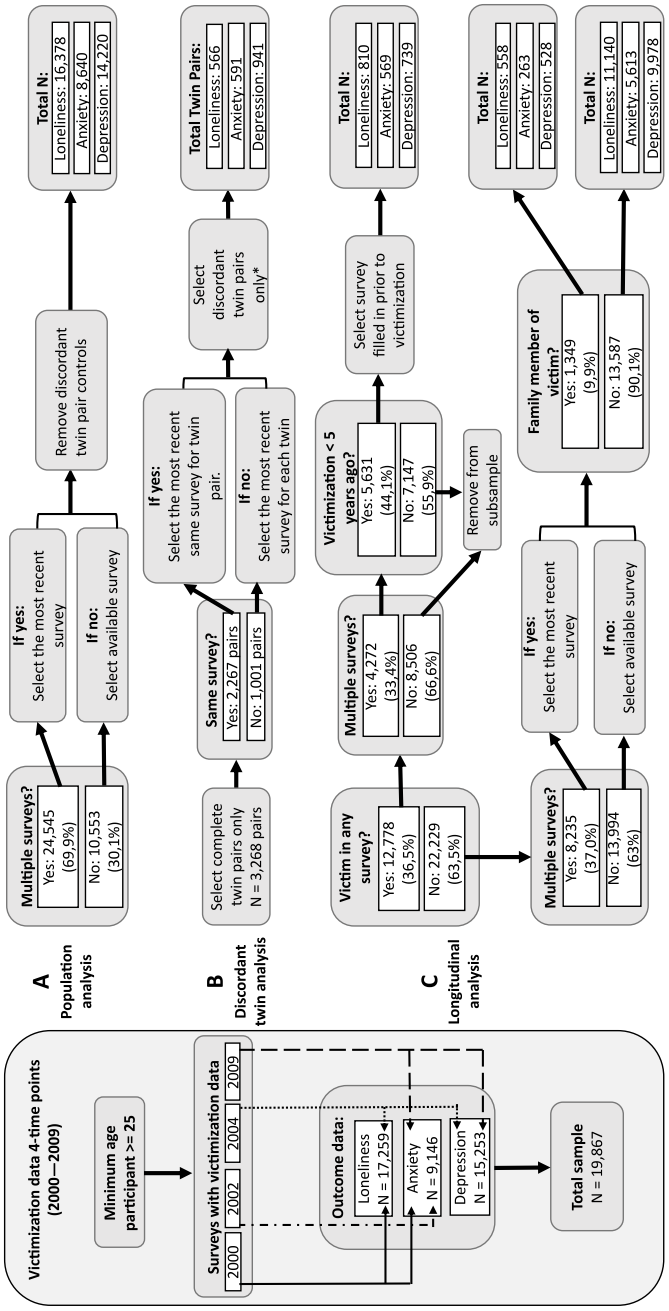

Fig. 2 Flowchart of the selection procedure in each analysis. Each row (**A–C**) illustrates the available data and selection criteria for the particular analysis

Table 1 Sample distribution for loneliness, anxiety, and depression analyses, and for the total sample combined

	Twins	Siblings	Parents	Others*	Total	Males	Females
Loneliness	7036	1868	6863	1492	17,259	6587	10,672
Anxiety	4115	1444	2189	1398	9146	3817	5229
Depression	6005	1791	5827	1630	15,253	6014	9239
Total sample	4118	6005	2322	7422	19,867	7899	11,967

*That is, partners, offspring of twins

victimization of the same type of crime was reported by a participant, we selected the most recently reported crime. Although considerable numbers of respondents indicated to have ever been victimized by any type of crime (victimization prevalence, see Table 2), the number of twins who had been victimized in each separate time frame was relatively small. Therefore, the original response categories that incorporated time of victimization were collapsed into a single binary variable (ever victimized yes/no) for both the population analysis and the discordant twin analyses.

Outcomes

Loneliness

Loneliness was measured in 2004 and 2009 with the Three-Item Loneliness Scale, which has a Cronbach's alpha of 0.81. Specifically, the items "how often do you feel that you lack companionship," "how often do you feel left out," and "how often do you feel isolated from others" were used. The items are rated on a 3-point scale: 1 = hardly ever; 2 = some of the time; 3 = often.

Anxiety

Trait anxiety (i.e., the tendency to experience negative emotions across many situations; Gidron 2013) was measured in 2000 and 2002 with the Spielberger Trait-Anxiety Inventory (STAI), which is a self-report questionnaire measuring how anxious people feel across situations on a daily basis (Spielberger, 1983; Boomsma et al., 2000). It comprises 20 items such as "I worry too much about something that really does not matter," "I am content," and "I am a steady person." Participants can respond on a 4-point Likert scale ("almost never," "sometimes," "often," and "almost always"), and some items are reverse-scored. The STAI has a Cronbach's alpha of 0.75.

Depression

Depression was measured by the Adult Self Report (ASR), which has a Cronbach's alpha of 0.91. In the ASR, participants report their behavior, thoughts, and feelings of the previous 6 months by rating how applicable the items are. Each item is rated from 0 = not true, 1 = somewhat true, and 2 = very true. Two example items are

Table 2 Descriptive statistics of ever being victimized, mean age, and mean IRT scores for loneliness, anxiety, and depression of the overall sample

	All		Men		Women		Twins		Non-twins	
Victimization	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Violent	4.6	95.4	6.1	93.9	3.7	96.3	4.3	95.7	4.3	95.7
Sexual crime	4.9	95.1	0.8	99.2	7.5	92.5	4.6	95.4	4.7	95.3
Theft	22.3	77.7	24.2	75.8	21.1	78.9	25.7	74.3	25.8	74.2
	Mean (Min–max)	**SD**	**Mean (Min–max)**	**SD**	**Mean (Min–max)**	**SD**	**Mean (Min–max)**	**SD**	**Mean (Min–max)**	**SD**
Loneliness	− 0.023 (− 0.73 to 2.67)	0.789	− 0.132 (− 0.73 to 2.67)	− 0.738	0.044 (− 0.73 to 2.67)	0.813	0.008 (− 0.73 to 2.67)	0.804	− 0.045 (− 0.73 to 2.67)	0.778
Anxiety	− 0.029 (− 2.19 to 3.75)	0.962	− 0.195 (− 2.19 to 3.10)	0.941	0.094 (− 2.19 to 3.75)	0.959	− 0.019 (− 2.19 to 3.75)	0.981	− 0.071 (− 2.19 to 2.81)	0.945
Depression	− 0.066 (− 1.57 to 3.84)	0.803	− 0.312 (− 1.57 to 3.84)	0.854	0.094 (− 1.57 to 3.84)	0.895	− 0.011 (− 1.57 to 3.84)	0.926	− 0.104 (− 1.57 to 3.36)	0.877
Age	46.01 (25–97)	12.68	48.81 (25–89)	12.976	46.01 (25–97)	12.383	41.63 (25–97)	12.339	50.88 (25–91)	11.459

"I feel confused or in a fog" and "I feel worthless or inferior." The 2009 survey included all 18 items from the ASR scale. The 2000 survey included 17 items and the 2004 survey 15. Aseba (2023) shows all 18 items from the ASR scale.

IRT Scoring

All outcome variables were defined by item-response theory (IRT; Embretson & Reise, 2013) and calculated with the Generalized Partial Credit Model (GPCM) in R with the *mirt* package (Chalmers, 2012). GPCM is an item response theory model developed to analyze polytomous data. The benefit of an IRT score over a simple sum score is that it appropriately weights the relative contributions of individual items to a scale with a more favorable distribution and takes into account missing data. Scores for each participant are relative to all other participants in that wave of data collection, as a separate model is fitted for each wave of data collection. Therefore, potential "wave" or data collection effects are filtered out, and the mean IRT score of each wave is zero.

Study Design and Analyses

To examine whether victimization was associated with loneliness, anxiety, and depression, we proceeded in three steps (Lichtenstein et al., 2002). First, a population analysis was conducted to assess if there is an association between victimization and loneliness, anxiety, and depression at the population level. All family members were included except for the controls from the discordant twin pairs (i.e., non-victimized twin; controls removed; $N_{\text{loneliness}} = 1066$, $N_{\text{anxiety}} = 749$, and $N_{\text{depression}} = 941$). See Fig. 2A for an illustration of the data selection. For the population analysis, we used generalized estimating equation (GEE) linear regression models to account for familial clustering, with victimization as the exposure and anxiety, loneliness, and depression as the outcome variables, controlling for age and sex. Analyses were performed in SPSS version 24.

Second, a co-twin-matched analysis in all same-sex discordant twin pairs was performed. Twin pairs are discordant if one of them had ever been a victim of a crime and the other had not. This approach corrects for shared environment and for shared genetic variants, as data from dizygotic (DZ) and monozygotic (MZ) twin pairs were included in one analysis. Next, we conducted a matched co-twin analysis separately in DZ and MZ twin pairs discordant for victimization. In the MZ pairs, we now control for all shared genetic and environmental factors. See Fig. 2B for an illustration of the data selection. Fixed effect regression analyses were conducted within twin pairs discordant for victimization in Stata statistical software, release 16 (StataCorp, 2019).

To determine if an association between victimization and mental health already exists prior to victimization, we conducted additional GEE analyses where pre- and post-victimization scores on loneliness, anxiety, and depression of victims were compared with non-victims. To look at both the pre- and post-victimization scores,

only participants who had filled in multiple surveys could be included. If a participant indicated that their victimization had taken place more than 5 years ago, they were excluded from these longitudinal analyses, as we then could not determine when exactly victimization took place and if the available measurements of mental health or loneliness were collected prior to the victimization. As a consequence, only information on mental health and loneliness was available after victimization occurred, and therefore we could not make a comparison between pre- and post-victimization for this specific group. If the victimization was 1–5 years ago or less than 1 year ago, we would select the most recent data available prior to victimization. For the participants who had not been a victim of any survey, all surveys could be included. If they filled out multiple surveys that contained the mental health questions of interest (e.g., 2000 and 2002 for anxiety), we selected the most recent survey for that specific mental health variable. See Fig. 2C for an illustration of the data selection. The sample distribution for the longitudinal analyses can be found in Supplementary Table 5. It was not possible to examine the discordant twin pairs' mental health before victimization as the sample sizes for these data were very low. Therefore, we compared victims to non-victims, who were divided into two groups, namely: their family members (parents, brothers, and sisters) and unrelated individuals.

To account for multiple testing, *q*-values were computed for all *p*-values using the false discovery rate (FDR) correction with the R package *q*-value. A *q*-value is an estimate of the proportion of false discoveries among all significant *p*-values (Benjamini & Hochberg, 1995). The *q*-value threshold for declaring significance was 0.05 (that is, the top 5% of the significant findings are, on average, allowed to be false discoveries).

Results

Descriptive Statistics

We first describe the prevalence of victimization, for all participants, as well as separately for twins, men, and women. Table 2 shows the frequencies of victimization in the entire sample and the descriptive statistics for loneliness, anxiety, depression, and age of the sample. The percentage of men who had been victimized by a violent crime (6.1%) or a property crime (24.2%) was higher than the percentages of women (respectively, 3.7 and 21.1%). Women more often reported sexual assault victimization (7.5% against 0.8%). Loneliness, anxiety, and depression mean scores were higher for women than for men. Descriptive statistics were also obtained for each survey separately (see Supplementary Table 1). Overall, the mean scores of the outcome variables were comparable for the different surveys. The mean age, percentage of men and women, and victimization rates differed somewhat between the surveys as participants age over time and the invitation policy of the NTR was not always the same, but no major differences were found between the surveys. Looking at the differences between twins and non-twins, Table 2 indicates that victimization rates, as

well as mean scores on loneliness, anxiety, and depression, are similar to non-twins. To test for significance, twin singletons were compared to their singleton siblings. No significant differences were found for loneliness ($t(211) - 0.668$, $q = 0.505$), anxiety ($t(689)$ 1.064, $q = 0.288$), and depression ($t(143) = -0.029$, $q = 0.977$), nor for any of the victimization variables (violent crime ($X^2(5, N = 1243) = 1.531$, $q = 0.909$), sexual crime ($X^2(4, N = 1243) = 2.596$, $q = 0.627$), and property crime ($X^2(6, N = 1258) = 9.164$, $q = 0.165$)).

Table 3 shows the discordance and concordance rates for the victimization of twins split by sex and zygosity group. The concordance (both twins victimized) rates for sexual and violent crime are higher for MZ twins than for DZ twins. The same was found when looking at property crime in the female twins. However, in the male twins, the concordance rate for property crime was higher in the DZ twins compared to the MZ twins, which suggests that genetic factors have a limited influence on property crime victimization.

Figure 3 shows the mean IRT scores of loneliness, anxiety, and depression separately for victims and non-victims. Higher mean scores of loneliness, anxiety, and depression were found for victims compared to non-victims. Differences were most pronounced for victims of sexual and violent crimes. Looking at loneliness, the highest mean score was found for sexual crime victims more than 5 years ago ($\text{mean}_{\text{loneliness}}$ 0.354, SD 0.957). For anxiety and depression, the highest mean scores were seen for victims of a sexual crime 1–5 years ago ($\text{mean}_{\text{anxiety}}$ 0.486, SD 1.18; $\text{mean}_{\text{depression}}$ 0.456, SD 1.061).

Population Analysis

Results from the population analysis are given in Table 4. The population analyses showed significant positive associations between loneliness and victimization of a sexual crime ($B = 0.294$, $q < 0.001$), a violent crime ($B = 0.203$, $q < 0.001$), and property crime ($B = 0.04$, $q = 0.004$). The population analyses also showed significant associations between victimization of a sexual or violent crime and higher scores on anxiety ($B = 0.345$, $q < 0.001$ and $B = 0.205$, $q < 0.001$, respectively). Similarly, victimization of a violent ($B = 0.372$, $q < 0.001$) and sexual crime ($B = 0.238$, $q < .001$) were significantly related to depression. Victimization of property crime was not significantly associated with anxiety ($B = 0.008$; $q = 0.885$) or depression scores ($B = 0.035$; $q = 0.064$). A clear effect for sex was found for all mental health variables: women had higher scores on loneliness ($B = 0.153$, $q < .001$), anxiety ($B = 0.255$, $q < 0.001$), and depression ($B = 0.366$, $q < 0.001$) compared to men. Lastly, a small age effect was found as older respondents had lower scores of depression ($B = -0.002$, $q = 0.002$). No age effects were found for experiencing loneliness or anxiety.

Results from the analyses with victimization split by the period of occurrence (i.e., less than 1 year ago, 1–5 years ago, longer than 5 years ago) can be found in Supplementary Table 2. The analyses presented in Table 4 were repeated for each survey. The results from these additional analyses generally showed associations in the same direction as presented in Table 4 (see Supplementary Table 3).

Table 3 Number and percentages of discordant and concordant twin pairs for violent, sexual, and theft victimization on data from MZ and DZ complete twin pairs, divided per outcome variable

	Violent crime						Sexual crime						Theft					
	Discordant		Concordant no victimization		Concordant victimization		Discordant		Concordant no victimization		Concordant victimization		Discordant		Concordant no victimization		Concordant victimization	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
Monozygotic male twin pairs																		
Loneliness	311	84%	48	13%	10	3%	361	98%	7	2%	1	0%	161	44%	148	40%	60	16%
Anxiety	167	43%	25	7%	192	50%	194	99%	1	1%	1	1%	105	54%	73	37%	18	9%
Depression	253	84%	42	14%	7	2%	296	98%	6	2%	-		139	46%	117	39%	46	15%
Monozygotic female twin pairs																		
Loneliness	934	88%	112	11%	13	1%	894	85%	130	12%	33	3%	555	52%	374	35%	130	12%
Anxiety	524	89%	53	9%	10	2%	481	82%	89	15%	18	3%	294	50%	226	38%	69	12%
Depression	767	88%	96	11%	12	1%	719	82%	127	15%	27	3%	445	51%	322,5	37%	103	12%
Dizygotic male twin pairs																		
Loneliness	145	78%	20	11%	22	12%	163	98%	3	2%	1	1%	83	50%	54	32%	30	18%
Anxiety	95	46%	9	4%	104	50%	102	96%	4	4%	-		47	44%	44	42%	15	14%
Depression	116	87%	15	11%	2	2%	128	96%	5	4%	-		66	50%	44	33%	23	17%
Dizygotic female twin pairs																		
Loneliness	402	90%	42	9%	5	1%	369	82%	72	16%	8	2%	221	49%	192	43%	36	8%
Anxiety	256	89%	26	9%	5	2%	247	86%	34	12%	5	2%	162	57%	101	35%	23	8%
Depression	347	90%	33	9%	5	1%	320	83%	59	15%	6	2%	187	49%	166	43%	31	8%
Dizygotic opposite sex twin pairs																		
Loneliness	359	87%	51	12%	2	0%	366	89%	45	11%	1	0%	220	53%	150	36%	42	10%
Anxiety	236	86%	30	11%	7	3%	248	91%	23	8%	2	1%	152	56%	101	37%	20	7%
Depression	309	87%	45	13%	3	1%	318	89%	35	10%	4	1%	182	51%	138	39%	37	10%

Table 3 (continued)

	Violent crime						Sexual crime						Theft					
	Discordant		Concordant no victimization		Concordant victimization		Discordant		Concordant no victimization		Concordant victimization		Discordant		Concordant no victimization		Concordant victimization	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
All twins																		
Loneliness	2156	88%	274	11%	32	1%	1707	85%	258	13%	45	2%	1244	51%	919	37%	299	12%
Anxiety	1279	88%	143	10%	28	2%	1273	88%	151	10%	26	2%	760	52%	546	38%	145	10%
Depression	1794	87%	232	11%	29	1%	1784	87%	232	11%	37	2%	1022	50%	792	39%	240	12%

- No concordant exposed pairs

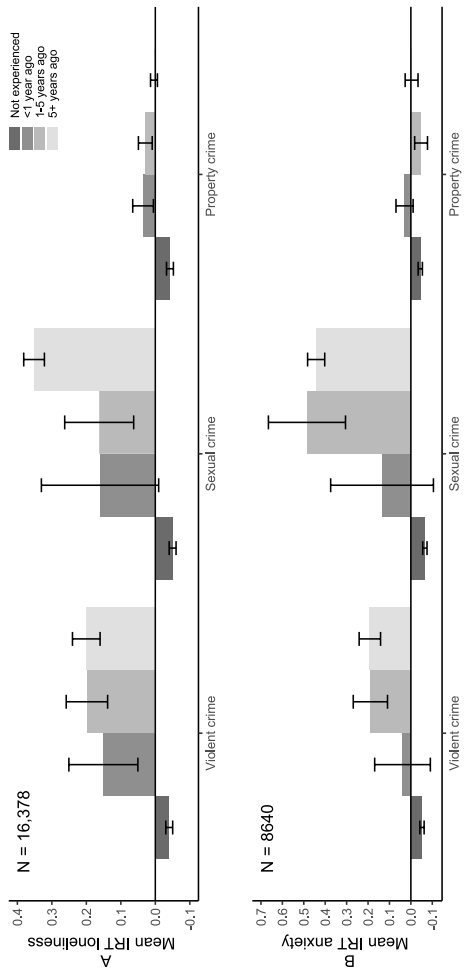

Fig. 3 Mean IRT scores of loneliness (**A**), anxiety (**B**), and depression (**C**) for non-victims and victims of violent, sexual and, property crimes

Table 4 Population analyses showing the association between victimization and loneliness, anxiety, and depression

	Loneliness			Anxiety			Depression		
	B	95% CI (LL–UL)	*q*	*B*	95% CI (LL–UL)	*q*	*B*	95% CI (LL–UL)	*q*
Violent crime victimization	0.294	(0.233–0.355)	< 0.001	0.345	(0.250–0.442)	< 0.001	0.372	(0.302–0.441)	< 0.001
Sexual crime	0.203	(0.142–0.263)	< 0.001	0.204	(0.117–0.292)	< 0.001	0.238	(0.17–0.306)	< 0.001
Theft crime	0.04	(0.013–0.067)	0.004	0.08	(− 0.038–0.054)	0.801	0.035	(0.003–0.067)	0.063
Sex (ref = male)	0.153	(0.129–0.177)	< 0.001	0.255	(0.215–0.296)	< 0.001	0.366	(0.338–0.395)	< 0.001
Age (years)	0.001	(0–0.002)	0.301	− 0.001	(− 0.003–0)	0.138	− 0.002	(− 0.003 to − 0.001)	0.002

Discordant Twin Analyses

Figure 4 summarizes the results from the population analyses and the discordant twin pair analyses for loneliness, anxiety, and depression. The full results of the discordant twin analyses, as well as the exact sample sizes, can be found in Supplementary Table 4. While we found significant results in the population analyses, none of the discordant twin pair analyses indicated significant differences between victims and non-victims within pairs, suggesting that the association between victimization and mental health is confounded by genetic and/or shared environmental risk factors.

Mental Health Prior to Victimization

To determine if an association between victimization and mental health existed prior to victimization, we compared the pre- and post-victimization scores between victims and non-victims (both related and unrelated to the victim). The mean scores on loneliness, anxiety, and depression prior to and after victimization is summarized for victims, their family members, and unrelated controls in Fig. 5. Unrelated controls had significantly lower scores on loneliness compared to victims of sexual crime prior to victimization and violent crime victims prior to their victimization ($B = -0.724$, $q = 0.015$ and $B = -0.296$, $q = 0.015$, respectively). Victims of property crime showed no significant associations between depression, anxiety, and property crime prior to the victimization, but unrelated controls did have lower scores on loneliness when compared to the victims of property crime after victimization ($B = -0.087$, $q = 0.023$). Lastly, associations between related and unrelated control groups were tested. No significant differences were found, with the exception of the related control group for sexual crime reporting higher scores on depression compared to the unrelated control group ($B = 0.340$, $q = 0.021$). Supplementary Table 5 gives the mean scores and results from the population analyses of loneliness, anxiety, and depression pre- and post-victimization.

Looking at the overall trend of the mean scores pre- and post-victimization, victims showed a higher mean score on mental health both pre- and post-victimization compared to the non-victims irrespective of the type of victimization. The victims of sexual and violent crimes are closer in scores to their non-victimized family members, who consistently score lower than the victims but higher than the unrelated controls. Victims of property crime on average score slightly higher than the non-victims, but are not always closer in scores to their family members. Interestingly enough, there also seems to be a decrease in experiencing anxiety, depression, and loneliness post-victimization; however, this decrease was not significant. These results indicate clearly that there are genetic and shared environmental factors that confound the association between (sexual and violent) victimization and mental health.

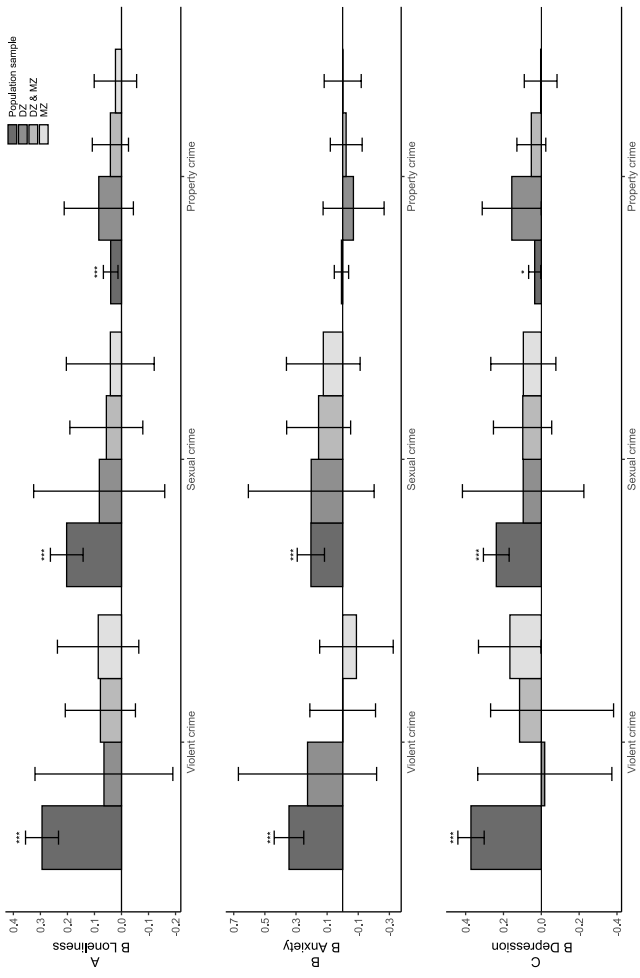

Fig. 4 Comparison between the population analyses and analyses in the same-sex discordant twin pairs for loneliness (**A**), anxiety (**B**), and depression (**C**), separately for violent, sexual, and property crime

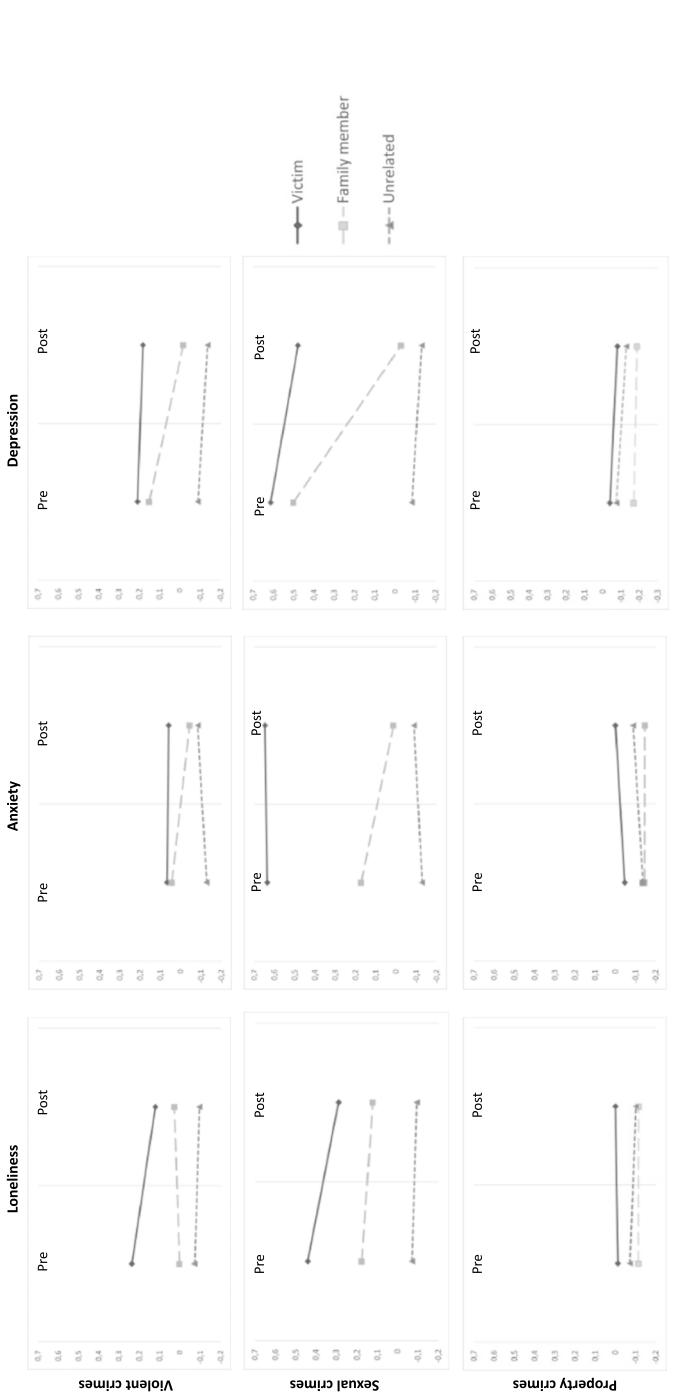

Fig. 5 Average IRT scores on loneliness (left), anxiety (middle), and depression (right) pre- and post-victimization for violent, sexual, and property crime victims compared to related and unrelated controls

Discussion

This study aimed to investigate the association of victimization of various types of crime with loneliness, anxiety, and depression using a population analysis and discordant twin design. We found clear associations in the population analyses between victimization and experiencing loneliness, anxiety, and depression. These findings were in line with previous research that showed a correlation between victimization and mental health problems (Britt, 2001; Campbell & Wasco, 2005; Kunst & Koster, 2017). Our results furthermore indicated that women have a significantly higher chance of experiencing loneliness, anxiety, or depression compared to men, a finding also in line with previous research (Kessler, 2003; Zender & Olshansky, 2009).

Our study expressly distinguished between victimization of property and violent and sexual crimes. This is an important contribution to the literature as research that compares the health consequences of various forms of victimization is sparse. Some focused on property crime specifically (e.g., Cook & Fox, 2011; Gale & Coupe, 2005; Kilpatrick et al., 1985), but the majority focused on the consequences of specific forms of violent crime, such as sexual assault and bullying, or combined violent, sexual, and property crime victimization in one measure (e.g., Kilpatrick & Acierno, 2003; Morrall et al., 2010; van der Velden et al., 2021). Our findings underline the importance of disaggregating by type of crime, showing that the health effects varied by crime type. The analyses showed that victimization by violent and sexual crimes was clearly associated with more mental health problems and loneliness, as compared to property crime, with the association between property crime and mental health problems much weaker or even absent. As the current study focused only on anxiety, depression, and loneliness, future research is needed to focus on other types of mental health problems (i.e., PTST, sleeping disorders, and suicidality) to assess the scope of the impact of various types of criminal victimization.

The positive associations found in our population analyses do not necessarily imply causal effects. Discordant twin analyses were therefore conducted to investigate whether victimization and mental health in adulthood are confounded with shared environmental and/or genetic factors. In discordant twin pair analyses, no differences were found between victims and non-victims, which shows that victims of property, violent, or sexual crimes do not experience more mental health problems than their non-victimized twin. This finding is in line with most previous discordant twin studies of child victimization (Berenz et al., 2013; Bornovalova et al., 2013; Dinwiddie et al., 2000; Shakoor et al., 2015), with only one previous study finding that twins who experienced more intimate partner victimization reported more symptoms of depression than their co-twin (Connolly et al., 2021).

Several explanations can be put forward to explain our finding that a cross-sectional association between victimization and mental health was found, but no differences between victims and non-victims within families. The first of these is simply that victimization does not have a causal impact on mental health and that the association at the population level is explained completely by confounding of shared environmental and genetic factors. This does appear counterintuitive and not in line with many victims' lived experiences.

A second possible explanation is in a sense, the opposite of the previous one, as it posits that victimization has such a pervasive effect that not only the victimized person but also his or her twin is affected. This explanation has previously been coined as a "spill-over" effect, i.e., when a family member is victimized, the victimization also affects non-victimized family members (De Jong, 2022). Our sample size did not permit us to study changes in the mental health of non-victimized twins from before to after victimization for the victimized twin. However, when comparing changes in mental health from before to after victimization for victims and their other family members, we found no evidence of a spill-over effect. Both victims and their family members showed no increase in mental health problems after the victimization had taken place.

Another explanation might be that offenders specifically target vulnerable victims. To investigate this, we also looked at mental health pre-victimization. Our results showed that victims already had higher scores on mental health problems before victimization, especially victims of sexual and, to a lesser extent, violent crimes. This finding is in line with the extensive amount of previous research that has found patients with severe mental illness at substantially increased risk of victimization compared to other community members (e.g., Latalova et al., 2014; Khalifeh et al., 2015; Monahan et al., 2017; Rossa-Roccor et al., 2020; Krahé and Berger, 2017). For example, Middeldorp et al. (2008) found that adverse life events are associated with higher levels of anxious depression and scores on neuroticism. In turn, higher scores on neuroticism and anxious depression are associated with an elevated risk of exposure to adverse life events. Rossa-Roccor et al. (2020) conducted a cross-sectional study and found an increased risk for theft, physical violence, and sexual harassment among people with severe mental illness. This finding concurs with rational choice and economic theory that posit that perpetrators will attempt to minimize their costs (amongst which risk of detection and punishment) by targeting vulnerable persons (Becker, 1968; Cornish & Clarke, 1987). The current study suggests that mental health problems symptoms may in fact be a warning sign for victimization risk, which could have important implications for clinical practice. To reduce victimization and its consequences, effective prevention and intervention programs might more effectively target high-risk groups (i.e., those who experience mental health problems). In addition, as victims are a high-risk group for mental health issues, it is important that organizations that support victims pay attention to this in their assistance to the victims, regardless of whether these mental health issues are caused by the victimization or not.

Aside from the finding that victims had higher scores on mental health problems and loneliness before victimization, results also indicated that the victims resembled their non-victimized family members more than unrelated individuals. This finding is in line with the first explanation: the association between victimization and mental health problem can be explained by shared environmental and genetic factors, as it points to confounding familial factors that influence mental health as well as the risk of victimization. This is furthermore underscored by the result that most of the concordant (both twins have been a victim) rates for MZ twins were higher compared to the DZ twins when looking at sexual and violent crime, which suggests that these

types of victimization are also associated with genetic factors and that some people are simply more at risk of victimization than others.

Lastly, with regard to the discordant twin pair analyses, there can be important, but for statistical purposes small, differences between victims and non-victims that were not detected due to a lack of power. The current study employed a large dataset with over 17,000 participants, but the sample for the discordant twins was still relatively small, which could have led to the non-significant findings in the discordant twin analyses.

This study has several limitations that should be taken into account when interpreting the results. First, we analyzed self-report data from survey studies, and it is known that not all victims report victimization, for example, because they are ashamed of what happened to them, they do not remember their victimization, or they give socially desirable answers. Upon inspection, it turned out, however, that participants were fairly consistent in their self-report of sexual and violent victimization. Of the participants who filled out multiple surveys, only 2.43% indicated that they had not been a victim of a sexual crime, while they had reported being a victim in an earlier survey. For violent crimes, the inconsistency was 3.20%. However, for property crime, 12.67% of the participants gave conflicting answers. Possibly, many people might consider property crime to be a relatively regular event, which may lead to forgetting about the event in later surveys or not reporting it anymore because it has been forgotten, leading to inconsistency. Indeed, Averdijk and Elffers (2012) reported that when comparing results from a victimization questionnaire to police records, in 48% of the cases, a respondent did not mention a victimization event that had been registered in police records. Such discrepancy might of course be due to how the survey question is interpreted, or because police reports have been filed wrongly, nevertheless, it is clear that some events are simply not reported.

Second, our measures of victimization likely comprise a range of victimization events that vary in intensity (i.e., the theft of a bicycle versus a home burglary). If the less severe types of victimization are more common, this could mask the true effect of (more severe) victimization on mental health.

Third, we could not distinguish between participants who had been victimized multiple times (repeat victimization) and participants for whom the victimization was a single occurrence, nor do we know who the perpetrator was. Literature shows that victimization rarely occurs as a stand-alone, and it is possible that the effect of repeat or poly-victimization is stronger in comparison to a single event (e.g., Finklehor et al., 2006; Pears et al., 2008). In addition, previous research found that the victim-offender relationship is important for the association between victimization and mental health problems. More symptoms regarding mental health problems are usually found if the offender is a known or trusted person (De Jong, 2022) or known to the victim (Demaris & Kaukinen 2005; Lawyer et al., 2006). In this research, it was not known what the relationship between the victim and the offender was, and thus we could not take this effect into account.

Fourth, although the current study focused on adult victimization, we cannot rule out that some victims were victimized in their childhood as participants could report that the crime had occurred more than 5 years ago, and it is likely that for some the victimization was during childhood or adolescence. Previous research found that the chances of becoming a victim, especially of violent crimes, are

highest during childhood and adolescence, and that victimization during these sensitive developmental periods can lead to mental health problems in adulthood (Macmillan, 2001). As the current research cannot completely rule out victimization during childhood and adolescence, we were unable to fully disentangle the effects of childhood or adolescent victimization from adult victimization.

Lastly, current research used the discordant twin design, a strong design in the sense that it controls for genetic and shared environmental confounders (and thus familial confounding). However, this design is not without limitations (Mcgue et al., 2010, Duffy & Martin, 1994). Firstly, even though the design corrects for shared environmental factors, non-shared environmental factors can still be present and influence the association. Measured non-shared environmental factors can be included as covariates, but many important non-shared environmental factors are difficult or not possible to measure, and thus these can still influence the association. Nevertheless, as basically all human behavior and traits are to some extent heritable (Polderman et al., 2015), we still expect to at least partly control for these non-shared environmental factors by comparing within twins. Second, the discordant twin design may fail to detect a within-pair association due to measurement error. It is expected that the within-pair attenuation will be greater for MZ than for DZ pairs. This may lead to the underestimation of causal effect or failure to observe significant within-pair association, even when there is a large enough sample and a causal association is present between the exposure and outcome (Mcgue et al., 2010, Duffy & Martin, 1994).

In conclusion, our results confirm associations between victimization and loneliness, and mental health problems. These associations differ depending on the type of crime, as it is stronger for violent and sexual crimes and much weaker for property crimes. Furthermore, we show that individuals who are more lonely, anxious, or depressed are at increased risk of victimization. Lastly, our discordant twin and longitudinal analyses indicated that the association is at least partly explained by genetic and shared environmental confounding, with some people seeming to be more at risk of becoming a victim than others. Future, particularly longitudinal or even life-span, research is essential to further examine the relationship between victimization and mental health and to better study additional explanations for our findings such as the proposed "spill-over effect," and disaggregating by the seriousness of crime and relationship with the perpetrator. Gaining a better understanding of the relationship between victimization and mental health is not only important for theory but pivotal for policy and prevention.

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Declarations

Conflict of Interest The authors declare no competing interests.

References

Arseneault, L., Milne, B. J., Taylor, A., Adams, F., Delgado, K., Caspi, A., & Moffitt, T. E. (2008). Being bullied as an environmentally mediated contributing factor to children's internalizing problems: A study of twins discordant for victimization. *Archives of Pediatrics & Adolescent Medicine, 162*(2), 145–150.

Aseba (2023). *Adults (ABCL, ASR)*. https://aseba.org/adults/

Averdijk, M., & Elffers, H. (2012). The discrepancy between survey-based victim accounts and police reports revisited. *International Review of Victimology, 18*(2), 91–107.

Beaver, K. M., Mancini, C., DeLisi, M., & Vaughn, M. G. (2011). Resiliency to victimization: The role of genetic factors. *Journal of Interpersonal Violence, 26*(5), 874–898.

Becker, G. (1968). Crime and punishment: An economic approach. *The Journal of Political Economy., 76*(2), 169–217.

Beckley, A. L., Caspi, A., Arseneault, L., Barnes, J. C., Fisher, H. L., Harrington, H., et al. (2018). The developmental nature of the victim-offender overlap. *Journal of Developmental and Life-Course Criminology, 4*, 24–49.

Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society: Series B (Methodological), 57*, 289–300.

Berenz, E. C., Amstadter, A. B., Aggen, S. H., Knudsen, G. P., Reichborn-Kjennerud, T., Gardner, C. O., & Kendler, K. S. (2013). Childhood trauma and personality disorder criterion counts: A co-twin control analysis. *Journal of Abnormal Psychology, 122*(4), 1070–1076.

Boney-McCoy, S., & Finkelhor, D. (1995). Psychosocial sequelae of violent victimization in a national youth sample. *Journal of Consulting and Clinical Psychology, 63*(5), 726.

Boomsma, D. I., Beem, A. L., Van den Berg, M., Dolan, C. V., Koopmans, J. R., Vink, J. M., et al. (2000). Netherlands twin family study of anxious depression (NETSAD). *Twin Research and Human Genetics, 3*(4), 323–334.

Bornovalova, M. A., Huibregtse, B. M., Hicks, B. M., Keyes, M., McGue, M., & Iacono, W. (2013). Tests of a direct effect of childhood abuse on adult borderline personality disorder traits: A longitudinal discordant twin design. *Journal of Abnormal Psychology, 122*(1), 180–194.

Breiding, M. J., Black, M. C., & Ryan, G. W. (2008). Chronic disease and health risk behaviors associated with intimate partner violence—18 US states/territories, 2005. *Annals of Epidemiology, 18*(7), 538–544.

Britt, C. L. (2001). Health consequences of criminal victimization. *International Review of Victimology, 8*(1), 63–73.

Campbell, R., & Wasco, S. M. (2005). Understanding rape and sexual assault: 20 years of progress and future directions. *Journal of Interpersonal Violence, 20*(1), 127–131.

Chalmers, R. P. (2012). mirt: A multidimensional item response theory package for the R environment. *Journal of Statistical Software, 48*, 1–29.

Choudhary, E., Smith, M., & Bossarte, R. M. (2012). Depression, anxiety, and symptom profiles among female and male victims of sexual violence. *American Journal of Men's Health, 6*(1), 28–36.

Chrisler, J. C., & Ferguson, S. (2006). Violence against women as a public health issue. *Annals of the New York Academy of Sciences, 1087*(1), 235–249.
Coker, A. L., Smith, P. H., Bethea, L., King, M. R., & McKeown, R. E. (2000). Physical health consequences of physical and psychological intimate partner violence. *Archives of Family Medicine, 9*(5), 451.
Cook, C. L., & Fox, K. A. (2011). Fear of property crime: Examining the effects of victimization, vicarious victimization, and perceived risk. *Violence and Victims, 26*(5), 684–700.
Cornish, D. B., & Clarke, R. V. (1987). Understanding crime displacement: An application of rational choice theory. *Criminology, 25*(4), 933–948.
Connolly, E. J., Hayes, B. E., Boisvert, D. L., & Cooke, E. M. (2021). Intimate partner victimization and depressive symptoms: Approaching causal inference using a longitudinal twin design. *Journal of Quantitative Criminology*, 1–19.
De Jong, R. (2022). *Long-term consequences of child sexual abuse: Adult role fulfillment of child sexual abuse victims.*
De Venter, M., Demyttenaere, K., & Bruffaerts, R. (2013). Het verband tussen traumatische gebeurtenissen in de kindertijd en angst, depressie en middelenmisbruik in de volwassenheid; een systematisch literatuuroverzicht [The relationship between adverse childhood experiences and mental health in adulthood. A systematic literature review]. *Tijdschrift voor Psychiatrie, 55*(4), 259–268.
DeCamp, W., & Zaykowski, H. (2015). Developmental victimology: Estimating group victimization trajectories in the age–victimization curve. *International Review of Victimology, 21*(3), 255–272.
Demaris, A., & Kaukinen, C. (2005). Violent victimization and women's mental and physical health: Evidence from a national sample. *Journal of Research in Crime and Delinquency, 42*(4), 384–411.
Dinkler, L., Lundström, S., Gajwani, R., Lichtenstein, P., Gillberg, C., & Minnis, H. (2017). Maltreatment-associated neurodevelopmental disorders: A co-twin control analysis. *Journal of Child Psychology and Psychiatry, 58*(6), 691–701.
Dinwiddie, S., Heath, A. C., Dunne, M. P., Bucholz, K. K., Madden, P. A., Slutske, W. S., Bierut, L. J., Statham, D. B., & Martin, N. G. (2000). Early sexual abuse and lifetime psychopathology: A co-twin-control study. *Psychological Medicine, 30*(1), 41–52.
Donahue, K., Långström, N., Lundström, S., Lichtenstein, P., & Forsman, M. (2017). Familial factors, victimization, and psychological health among sexual minority adolescents in Sweden. *American Journal of Public Health, 107*(2), 322–328.
Duffy, D., & Martin, G. (1994). Inferring the direction of causation in cross-sectional twin data: Theoretical and empirical considerations. *Genetic Epidemiology, 11*, 483–502.
Dworkin, E. R., Menon, S. V., Bystrynski, J., & Allen, N. E. (2017). Sexual assault victimization and psychopathology: A review and meta-analysis. *Clinical Psychology Review, 56*, 65–81.
Embretson, S. E., & Reise, S. P. (2013). *Item response theory*. *Psychology Press*.
Gale, J.-A., & Coupe, T. (2005). The behavioural, emotional and psychological effects of street robbery on victims. *International Review of Victimology, 12*(1), 1–22.
Gidron, Y. (2013). Trait anxiety. In M. D. Gellman & J. R. Turner (Eds.), *Encyclopedia of Behavioral Medicine*.
Guimond, F. A., Brendgen, M., Vitaro, F., Dionne, G., & Boivin, M. (2015). Peer victimization and anxiety in genetically vulnerable youth: The protective roles of teachers' self-efficacy and anti-bullying classroom rules. *Journal of Abnormal Child Psychology, 43*, 1095–1106.
Hanson, R. F., Sawyer, G. K., Begle, A. M., & Hubel, G. S. (2010). The impact of crime victimization on quality of life. *Journal of Traumatic Stress, 23*(2), 189–197.
Hastings, J. E., & Hamberger, L. K. (1997). Sociodemographic predictors of violence. *Psychiatric Clinics of North America, 20*(2), 323–335.
Isaacs, J., Hodges, E. V., & Salmivalli, C. (2008). Long-term consequences of victimization by peers: A follow-up from adolescence to young adulthood. *International Journal of Developmental Science, 2*(4), 387–397.
Jackson, A. M., & Deye, K. (2015). Aspects of abuse: Consequences of childhood victimization. *Current Problems in Pediatric and Adolescent Health Care, 45*(3), 86–93.
Jaffee, S. R., Caspi, A., Moffitt, T. E., Polo-Tomas, M., Price, T. S., & Taylor, A. (2004). The limits of child effects: Evidence for genetically mediated child effects on corporal punishment but not on physical maltreatment. *Developmental Psychology, 40*(6), 1047–1058. https://doi.org/10.1037/0012-1649.40.6.1047
Jennings, W. G., Piquero, A. R., & Reingle, J. M. (2012). On the overlap between victimization and offending: A review of the literature. *Aggression and Violent Behavior, 17*(1), 16–26.

Kavish, N., Connolly, E. J., & Boutwell, B. B. (2019). Genetic and environmental contributions to the association between violent victimization and major depressive disorder. *Personality and Individual Differences, 140*, 103–110.

Kendler, K. S., Bulik, C. M., Silberg, J., Hettema, J. M., Myers, J., & Prescott, C. A. (2000). Childhood sexual abuse and adult psychiatric and substance use disorders in women: An epidemiological and cotwin control analysis. *Archives of General Psychiatry, 57*(10), 953–959.

Kessler, R. C. (2003). Epidemiology of women and depression. *Journal of Affective Disorders, 74*(1), 5–13.

Khalifeh, H., Moran, P., Borschmann, R., Dean, K., Hart, C., Hogg, J., et al. (2015). Domestic and sexual violence against patients with severe mental illness. *Psychological Medicine, 45*(4), 875–886.

Kilpatrick, D. G., & Acierno, R. (2003). Mental health needs of crime victims: Epidemiology and outcomes. *Journal of Traumatic Stress: Official Publication of The International Society for Traumatic Stress Studies, 16*(2), 119–132.

Kilpatrick, D. G., Best, C. L., Veronen, L. J., Amick, A. E., Villeponteaux, L. A., & Ruff, G. A. (1985). Mental health correlates of criminal victimization: A random community survey. *Journal of Consulting and Clinical Psychology, 53*(6), 866.

Kimmel, D. M. (2014). Effects of adolescent violent victimization on adult depression: Testing heterogeneity for men and women. *Society and Mental Health, 4*(3), 179–196.

Kong, J., & Easton, S. D. (2019). Re-experiencing violence across the life course: Histories of childhood maltreatment and elder abuse victimization. *The Journals of Gerontology: Series B, 74*(5), 853–857.

Krahé, B., & Berger, A. (2017). Longitudinal pathways of sexual victimization, sexual self-esteem, and depression in women and men. *Psychological Trauma: Theory, Research, Practice, and Policy, 9*(2), 147.

Kramer, A., Lorenzon, D., & Mueller, G. (2004). Prevalence of intimate partner violence and health implicatioslobns for women using emergency departments and primary care clinics. *Women's Health Issues, 14*(1), 19–29.

Krumm, S., Checchia, C., Kilian, R., & Becker, T. (2018). Viktimisierung im Erwachsenenalter von Personen mit Psychiatrieerfahrung [Adult Victimization of Mental Health Service Users - A Review of Prevalences, Risk Factors, and Disclosure]. *Psychiatrische Praxis, 45*(2), 66–77.

Kunst, M. J. J., & Koster, N. N. (2017). Psychological distress following crime victimization: An exploratory study from an agency perspective. *Stress and Health, 33*(4), 405–414.

Lamb, D. J., Middeldorp, C. M., van Beijsterveldt, C. E., Bartels, M., van der Aa, N., Polderman, T. J., & Boomsma, D. I. (2010). Heritability of anxious-depressive and withdrawn behavior: Age-related changes during adolescence. *Journal of the American Academy of Child & Adolescent Psychiatry, 49*(3), 248–255.

Latalova, K., Kamaradova, D., & Prasko, J. (2014). Violent victimization of adult patients with severe mental illness: A systematic review. *Neuropsychiatric Disease and Treatment, 10*, 1925–1939.

Lawyer, S. R., Ruggiero, K. J., Resnick, H. S., Kilpatrick, D. G., & Saunders, B. E. (2006). Mental health correlates of the victim-perpetrator relationship among interpersonally victimized adolescents. *Journal of Interpersonal Violence, 21*(10), 1333–1353.

Lichtenstein, P., De Faire, U., Floderus, B., Svartengren, M., Svedberg, P., & Pedersen, N. L. (2002). The Swedish Twin Registry: A unique resource for clinical, epidemiological and genetic studies. *Journal of Internal Medicine, 252*(3), 184–205.

Ligthart, L., van Beijsterveldt, C. E. M., Kevenaar, S. T., De Zeeuw, E., van Bergen, E., Bruins, S., Pool, R., Helmer, Q., van Dongen, J., Hottenga, J. J., van't Ent, D., Dolan, C. V., Davies, G. E., Ehli, E. A., Bartels, M., Willemsen, G., de Geus, E. J. C., & Boomsma, D. I. (2019). The Netherlands Twin Register: Longitudinal research based on twin and twin-family designs. *Twin Research and Human Genetics, 22*, 623–636.

Macmillan, R. (2001). Violence and the life course: The consequences of victimization for personal and social development. *Annual Review of Sociology, 27*(1), 1–22.

Maniglio, R. (2008). Severe mental illness and criminal victimization: A systematic review. *Acta Psychiatrica Scandinavica, 119*(3), 180–191.

McGue, M., Osler, M., & Christensen, K. (2010). Causal inference and observational research: The utility of twins. *Perspectives on Psychological Science, 5*(5), 546–556.

McKay, M. T., Cannon, M., Chambers, D., Conroy, R. M., Coughlan, H., Dodd, P., Healy, C., O'Donnell, L., & Clarke, M. C. (2021). Childhood trauma and adult mental disorder: A systematic review and meta-analysis of longitudinal cohort studies. *Acta Psychiatrica Scandinavica, 143*(3), 189–205. https://doi.org/10.1111/acps.13268 Epub 2021 Jan 18.

Middeldorp, C. M., Cath, D. C., Beem, A. L., Willemsen, G., & Boomsma, D. I. (2008). Life events, anxious depression and personality: a prospective and genetic study. *Psychological Medicine, 38*(11), 1557–1565.

Monahan, J., Vesselinov, R., Robbins, P. C., & Appelbaum, P. S. (2017). Violence to others, violent self-victimization, and violent victimization by others among persons with a mental illness. *Psychiatric Services, 68*(5), 516–519.

Morrall, P., Marshall, P., Pattison, S., & Macdonald, G. (2010). Crime and health: A preliminary study into the effects of crime on the mental health of UK university students. *Journal of Psychiatric and Mental Health Nursing, 17*(9), 821–828.

Murray-Close, D., Crick, N., Tseng, W., Lafko, N., Burrows, C., Pitula, C., & Ralston, P. (2014). Physiological stress reactivity and physical and relational aggression: The moderating roles of victimization, type of stressor, and child gender. *Development and Psychopathology, 26*(3), 589–603. https://doi.org/10.1017/S095457941400025X

Pears, K. C., Kim, H. K., & Fisher, P. A. (2008). Psychosocial and cognitive functioning of children with specific profiles of maltreatment. *Child abuse & neglect, 32*(10), 958–971.

Polderman, T. J., Benyamin, B., De Leeuw, C. A., Sullivan, P. F., Van Bochoven, A., Visscher, P. M., & Posthuma, D. (2015). Meta-analysis of the heritability of human traits based on fifty years of twin studies. *Nature genetics, 47*(7), 702–709.

Porcerelli, J. H., Cogan, R., West, P. P., Rose, E. A., Lambrecht, D., Wilson, K. E., et al. (2003). Violent victimization of women and men: Physical and psychiatric symptoms. *The Journal of the American Board of Family Practice, 16*(1), 32–39.

Rossa-Roccor, V., Schmid, P., & Steinert, T. (2020). Victimization of people with severe mental illness outside and within the mental health care system: Results on prevalence and risk factors from a multicenter study. *Frontiers in Psychiatry, 932*.

Ruback, R. B., & Thompson, M. P. (2001). *Social and psychological consequences of violent victimization*. *Sage*.

Schaefer, J. D., Moffitt, T. E., Arseneault, L., Danese, A., Fisher, H. L., Houts, R., et al. (2018). Adolescent victimization and early-adult psychopathology: approaching causal inference using a longitudinal twin study to rule out noncausal explanations. *Clinical Psychological Science, 6*(3), 352–371.

Semenza, D. C., Testa, A., Turanovic, J. J. (2021). Trajectories of violent victimization over the life course: Implications for mental and physical health. *Advances in Life Course Research, 50*, 100436. https://doi.org/10.1016/j.alcr.2021.100436

Shakoor, S., McGuire, P., Cardno, A. G., Freeman, D., Plomin, R., & Ronald, A. (2015). A shared genetic propensity underlies experiences of bullying victimization in late childhood and self-rated paranoid thinking in adolescence. *Schizophrenia bulletin, 41*(3), 754–763.

Silberg, J. L., Copeland, W., Linker, J., Moore, A. A., Roberson-Nay, R., & York, T. P. (2016). Psychiatric outcomes of bullying victimization: a study of discordant monozygotic twins. *Psychological Medicine, 46*(9), 1875–1883.

Slob, E. M., Brew, B. K., Vijverberg, S. J., Kats, C. J., Longo, C., Pijnenburg, M. W., et al. (2020). Early-life antibiotic use and risk of asthma and eczema: Results of a discordant twin study. *European Respiratory Journal, 55*(4), 1902021.

Spielberger, C. D. 1983. *State-trait anxiety inventory for adults*.

StataCorp. (2019). *Stata Statistical Software: Release 16*. *StataCorp LLC*.

Statistic Netherlands (CBS) (2022). *Slachtoffermonitor 2021*. Retrieved from https://www.cbs.nl/nl-nl/longread/rapportages/2022/veiligheidsmonitor-2021

Straus, M. A., & Gelles, R. J. (1986). Societal change and change in family violence from 1975 to 1985 as revealed by two national surveys. *Journal of Marriage and the Family, 48*, 465–479.

Sullivan, P. F., Neale, M. C., & Kendler, K. S. (2000). Genetic epidemiology of major depression: Review and meta-analysis. *American Journal of Psychiatry, 157*(10), 1552–1562.

Swanberg, J. E., & Logan, T. K. (2005). Domestic violence and employment: A qualitative study. *Journal of Occupational Health Psychology, 10*(1), 3–17. https://doi.org/10.1037/1076-8998.10.1.3

Tillyer, M. S. (2014). Violent victimization across the life course: Moving a "victim careers" agenda forward. *Criminal Justice and Behavior, 41*(5), 593–612.

Turanovic, J. J., & Pratt, T. C. (2015). Longitudinal effects of violent victimization during adolescence on adverse outcomes in adulthood: A focus on prosocial attachments. *The Journal of Pediatrics, 166*(4), 1062–1069.

Turner, H. A., Finkelhor, D., & Ormrod, R. (2006). The effect of lifetime victimization on the mental health of children and adolescents. *Social Science & Medicine, 62*(1), 13–27.
Van der Velden, PG, Van der Burg, S, Steinmetz, CHD, Van den Bout, J (1992). Slachtoffers van bankovervallen [Victims of bank bobberies]. Bohn Stafleu Van Loghum: Houten, The Netherlands
Van der Velden, P. G., Contino, C., van de Ven, P., & Das, M. (2021). The use of professional help and predictors of unmet needs for dealing with mental health to legal problems among victims of violence, accidents, theft and threat, and nonvictims in the general population. *PLoS One, 16*(11), e0259346.
Veldkamp, S. A., Boomsma, D. I., de Zeeuw, E. L., van Beijsterveldt, C. E., Bartels, M., Dolan, C. V., & van Bergen, E. (2019). Genetic and environmental influences on different forms of bullying perpetration, bullying victimization, and their co-occurrence. *Behavior Genetics, 49*(5), 432–443.
Vink, J. M., & Boomsma, D. I. (2008). A comparison of early and late respondents in a twin–family survey study. *Twin Research and Human Genetics, 11*(2), 165–173.
Vink, J. M., Willemsen, G., Stubbe, J. H., Middeldorp, C. M., Ligthart, R. S., Baas, K. D., et al. (2004). Estimating non-response bias in family studies: Application to mental health and lifestyle. *European Journal of Epidemiology, 19*, 623–630.
Willitts, M., Benzeval, M., & Stansfeld, S. (2004). Partnership history and mental health over time. *Journal of Epidemiology and Community Health, 58*(1), 53–58.
Zender, R., & Olshansky, E. (2009). Women's mental health: Depression and anxiety. *Nursing Clinics, 44*(3), 355–364.

Authors and Affiliations

B.M.A. Gonggrijp[1,2] · S.G.A. van de Weijer[1] · J. van Dongen[2,3] · E.M.A. Slob[4,5,6] · C.C.J.H. Bijleveld[1,7] · D.I. Boomsma[2,3]

✉ B.M.A. Gonggrijp
b.m.a.gonggrijp@vu.nl

1 Netherlands Institute for the Study of Crime and Law Enforcement (NSCR), Amsterdam, The Netherlands

2 Department of Biological Psychology, Vrije Universiteit Amsterdam, Amsterdam, The Netherlands

3 Amsterdam Public Health Research Institute, Vrije Universiteit Amsterdam, Amsterdam, The Netherlands

4 Department of Clinical Pharmacy and Toxicology, Leiden University Medical Center, Leiden, The Netherlands

5 Department of Respiratory Medicine, Amsterdam University Medical Centers, University of Amsterdam, Amsterdam, The Netherlands

6 Department of Clinical Pharmacy, Haaglanden Medical Center, The Hague, The Netherlands

7 Department of Criminal Law and Criminology, VU University Amsterdam, Amsterdam, The Netherlands