

# Violent crimes in men and its causes: A literature review combining environmental, psychological and genetic factors of violent criminal behavior

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**Abstract.** In this extended project, I consider a variety of causes for violent criminality, and show how genetic, environmental and psychological elements converge to contribute to an individual's likelihood of offending. This review covered some fundamental genetic markers (i.e., XYY syndrome, the MAOA gene variant), with those carried on by environmental influences in the form of own characteristics and immediate factors (i.e. socioeconomic status, familial dynamics) to personal psychological qualities as psychopathy. The results show that genetic influences on a disposition to engage in criminal behavior do not lie dormant but act together outside the confining space of bare biology. In reality, many environmentally and psychologically trigger the actual act of criminal activities. This is not to say that any one of these factors determines whether violent criminal behavior will develop, but rather, that criminal behavior emerges from the interaction of all the elements discussed in this review. Such a nuanced perspective is important for our legal systems, as it emphasises the need of seeing every individual separately and assessing an individual on several levels while also implementing measures that take into consideration some reference to genetic predisposition, surroundings and psychological profile. Further longitudinal and interdisciplinary studies are needed to better understand the relationships between these factors as well as to develop prevention and intervention strategies in the future.

**Keywords:** Criminal behavior, MAOA-gene, XYY syndrome, Exposure to violence, 16-personality.

## 1. Introduction

For centuries crime has been a hallmark issue of study and debate, with an array of researches and theories concerning its origins deduced from various facets. Criminal behavior is influenced by a wide range of biological, psychological and sociological factors. Of these, genetic risk factors have been the most researched, especially prospective target genes related to aggression and impulsivity. For example, a specific genotype of the MAOA gene was discovered to predispose male carriers to commit violent crime [1](Caspi et al., 2002), and so too has research on being born with an additional Y chromosome, XYY syndrome been found to have a higher rate of violent behavior. It is believed that these biological traits interact with environmental and psychological components to determine an individual's likelihood of committing crimes.

In doing so, it is inescapable that the interplay of these factors and also a host of environmental elements such as socioeconomic status, family dynamics and peer influences are two sides to understanding criminal behavior. The theory of Sutherland that is recognised as the Differential Association Theory states that criminal behavior is learned through social interactions in relation to intimate personal groups, e.g. family and friends. This perspective suggests values, attitudes and behaviours favourable to crime are learned through such social groups, and thus, an individual's likelihood of being a criminal is predetermined.

In addition to the above, I find that psychological factors, especially personality traits and mental health conditions, serve as fundamental triggers for violence. Impulsivity, lack of empathy, and antisocial behaviour find their home in the characteristics of psychopathy are also well anchored to violent crime.

We are looking to answer the question “Are genetic factors the most dominant factor in predicting violent criminal behavior in men?” This study contributes to a broad understanding of the sources and manifestation of criminal behavior by using evidence from genetic explanations, such as XYY and MAOA gene variant and well replicated environmental predictors of criminal behavior. It also discusses the interplay of these factors with a recent paper by Estrada et al.[2], providing evidence of how all these components collectively play a role in determining criminality.

This project will not only add to the body of literature regarding the predispositions towards offending, but it also strives to inform interventions. In realizing the interplay of genetics, environment and psychology, we take one step forward towards learning how to suppress criminal behaviour using early intervention strategies. This delineated approach emphasises the need to take into account the multidimensionality of influence when tackling causes and prevention of crime.

Genetics is the study of genes and the variation of characteristics that are influenced by genes--including physical and psychological characteristics. Genetic factors, therefore, refer to the hereditary components and variations in an individual's DNA that influence their physical traits and behaviours. In the context of criminal behaviour, genetic factors imply specific genes and genetic mutations that may predispose individuals to certain behaviours, such as aggression or impulsivity. Criminal behaviour refers to an offender's conduct that leads to the commission of an unlawful act. Criminologists commonly group crimes into several major categories: Violent crimes, property crimes, white-collar crimes, organised crimes and consensual or victimless crimes. Violent crimes can include homicide, aggravated and simple assault, while property crimes include burglary, larceny, motor vehicle theft, and arson. Psychological factors are the elements of an individual's mental and emotional state that influence their behaviours and decisions. Environmental factors are the external conditions or circumstances that impact human behaviour and decision-making. These factors include physical, social, cultural, and economic factors, as well as broader structural conditions such as political systems, institutional arrangements, and historical legacies.

## **2. Literature review**

### *2.1. Genetic Underpinnings of Criminal Behaviour: Exploring XYY Syndrome and MAOA Variants*

#### *2.1.1. XYY syndrome*

XYY syndrome is a genetic condition that occurs when a male has an extra copy of the Y chromosome in each of their cells (XYY). Symptoms of XYY syndrome includes an autism diagnosis, attention difficulties, delayed motor skill development, delayed or difficult speech, emotional or behavioural issues, hand trembling or involuntary muscle movements, hypotonia (weak muscle tone), learning disabilities and taller-than-average height. This syndrome has also been associated with aggressive and criminal behaviour. Given these symptoms, researchers have investigated the potential link between XYY syndrome and criminal behavior.

In 1965, Jacobs et al. [3] published their findings from a chromosome survey conducted at a maximum-security hospital, The State Hospital, Lanarkshire, Scotland. In the 342 patients surveyed, 9

individuals had an additional Y chromosome. This means that 3.5% of the population of sub-normal male patients with dangerous, violent or criminal propensities had the XYY gene. In 1967, Price et al. [8] conducted a comprehensive study of 9 XYY males at The State Hospital, which was divided into East (203 mentally subnormal patients) and West (139 patients with mental illness) wings. They compared these males with 18 randomly selected patients with severe personality disorders (17 with XY chromosomes). Their findings revealed that XYY males were less likely to commit violent crimes against people, with only 8.7% of their 92 convictions being for such offenses, and more likely to convict crimes against property (88%). They also had a younger average age at first conviction (13.1 years) compared to controls (18 years). Additionally, crime incidence among siblings of XYY patients was significantly lower than that of the control group's siblings. Only one conviction is recorded among the 31 siblings of the XYY patients whereas around 139 convictions were recorded for 12 of 63 siblings of the control patients.

On top of that, the detailed assessment of nine male XYY patients revealed significant behavioural and psychological abnormalities. These men were mostly identified as mentally subnormal not through standard educational or health services, but rather through interactions with legal authorities. Their behaviours showcased broad developmental issues and lack of control over aggressive impulses and emotional responses, which contributed directly to their criminal activities. Interestingly, these behaviours manifested independently of any adverse family environments and persisted despite numerous rehabilitation efforts. This study suggests that the extra Y chromosome may lead to a disordered personality predisposing these individuals to legal conflicts, but also cautions that these findings might not apply universally to all XYY individuals, indicating the potential for less severe manifestations in different environments.

However, the study by Raznahan et al. (2023) [9] provides a contemporary perspective on the behavioral and psychiatric characteristics associated with XYY syndrome, which contrasts with historical findings such as those by Jacobs et al. (1965) and Price et al. (1967). Raznahan et al. performed a detailed phenotypic evaluation of XYY individuals, ultimately invalidating prior reports linking the extra Y chromosome to violent behavior and criminality. To the contrary, the study suggests a markedly high prevalence of neurodevelopmental comorbidities with ADHD and ASD in XYY individuals having severe psychiatric morbidity burden, and is determined by more environmental factors and sociodemographic environment than by genetic predisposition. This holistic approach demonstrates that although XYY syndrome is a risk factor for mental illness, this does not translate directly into violent predisposition, and the net effect of an extra Y chromosome is multifaceted and context-dependent.

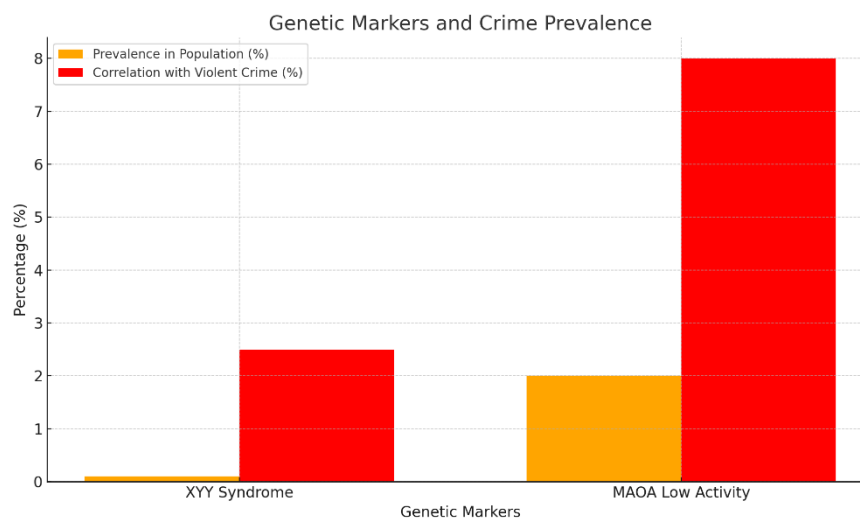
So, although initial studies pointed to a very clear association between XYY syndrome and violent tendencies, it is now accepted that the link is nuanced and influenced by other factors. Raznahan et al. conducted comprehensive research relevant to the present study and take a critical view that questions whether the genetic factors such as the additional Y chromosome in XYY syndromes are really overwhelmingly important compared with the complex influences of genes and environment. And recall that – even controlling for Price and Jacob, too – while property crimes were most likely in XYY patients, they are part of another etiology versus violent crimes. This implies that XYY syndrome perhaps predisposes for the commission of property, not violent crimes.

### *2.1.2. MAOA variant*

The MAOA gene provides instructions for making an enzyme called monoamine oxidase A. This enzyme is part of a family of enzymes that break down molecules called monoamines through a chemical reaction known as oxidation. Among the monoamines broken down by monoamine oxidase A are certain chemicals that act as neurotransmitters, transmitting signals between brain nerve cells. Neurotransmitters are broken down when signaling is no longer needed. Specifically, monoamine oxidase A is involved in the breakdown of the neurotransmitters serotonin, epinephrine, norepinephrine, and dopamine. Signals transmitted by serotonin regulate mood, emotion, sleep, and appetite. Epinephrine and norepinephrine control the body's response to stress. Dopamine transmits signals within the brain to produce smooth physical movements.

Highly interesting is the Swedish study of Tiihonen et al., titled “Genetic background of extreme violent behavior”. [10] (2014) are the first to show that severe recidivistic violent behaviour is related to MAOA genotype and such that this association has robustly displayed interaction with an adverse psychosocial environment. Whereas prior work obtained evidence suggesting that MAOA is a vulnerability gene for violence in the context of childhood maltreatment, this study revealed a direct main effect of the low-activity MAOA genotype on violent offending, with no indirect effects via maltreatment. In addition, the researchers suggest that alcohol and amphetamine intoxication, which raises brain dopamine levels, could increase aggression in people with low-activity MAOA genotypes. The study also confirmed that crimes of violence are likely committed under the influence of alcohol or other amphetamines together with increasing brain dopamine levels, a neurotransmitter type associated with increased aggression depending on the presence or absence of MAOA high/low activity genotypes. Increases in impulsive aggression were also observed with alterations in serotonin metabolism and signaling within the corticolimbic circuitry. The authors estimated that about 9% of severe violent crimes in Finland could be accounted for by the low-activity MAOA genotype.

Contrastingly, Ouellet-Morin et al. (2016) [7] emphasized the importance of the interplay between environmental stressors and dispositional factors. The study “Effects of the MAOA gene and levels of exposure to violence on antisocial outcomes” by Ouellet-Morin et al. (2016) explored how the interaction between the MAOA gene and exposure to violence impacts antisocial behavior in a population-based sample of 327 males. The researchers aimed to determine whether the MAOA gene moderates the impact of violence across the full distribution of exposure or only at higher levels. The study found non-linear interactions between the MAOA gene and violence exposure, suggesting that the genetic moderation of antisocial behavior becomes significant only at higher levels of violence exposure. This finding aligns with the diathesis-stress model, indicating that genetic vulnerabilities are more likely to be expressed under adverse conditions. Additionally, Higher exposure to violence was associated with more symptoms of conduct disorder in adolescence and antisocial personality in adulthood, as well as a higher likelihood of arrest and partner violence. However, property-violent crimes did not show a clear association with violence exposure. Low-activity MAOA allele carriers exhibited more conduct disorder and antisocial personality symptoms and reported higher instances of partner violence compared to high-frequency allele carriers when exposed to higher levels of violence. These results suggest that the MAOA gene's effect on antisocial behavior is conditional on the level of violence exposure. The findings highlight the importance of considering the level of environmental stressors, such as violence exposure, in understanding the genetic moderation of antisocial behavior. The study suggests that preventive interventions for antisocial behavior should account for both genetic predispositions and the severity of environmental adversities.



**Figure 1.** Genetic markers and crime prevalence.

This bar chart compares the prevalence of genetic markers (XYY Syndrome and MAOA Low Activity) in the population with their correlation to violent crime. It shows that while these genetic markers are relatively rare, they have a significant correlation with violent behavior.

## 2.2. *Environmental factors of criminal behaviour*

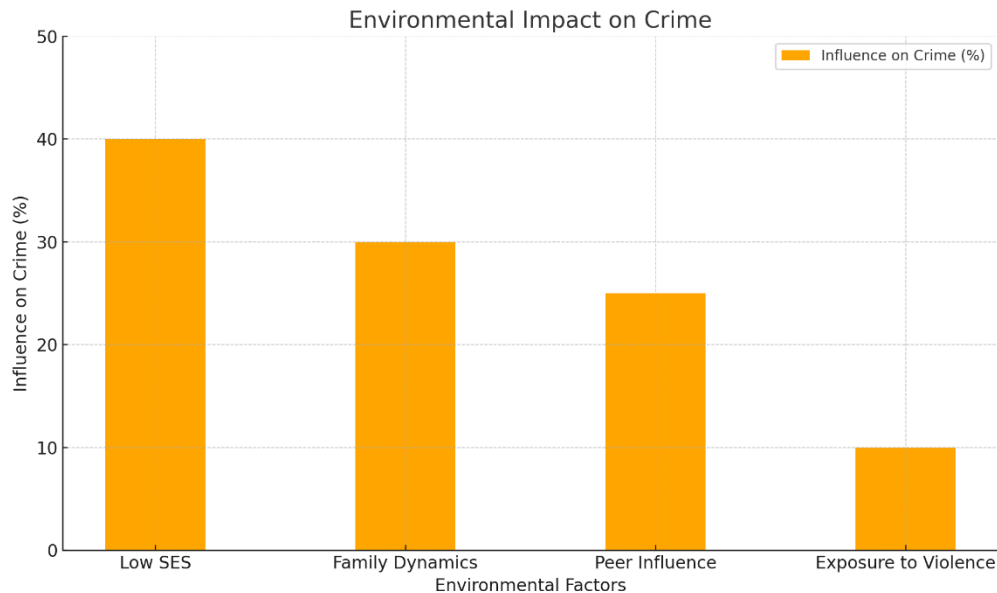
Environmental factors are integral to understanding and addressing criminal behavior. By recognizing the influence of social learning, socioeconomic conditions, family dynamics, community characteristics, peer influence, exposure to violence, educational opportunities, and cultural norms, we can develop more effective strategies to prevent crime and promote pro-social behavior. Interventions that focus on improving environmental conditions and providing support systems can significantly reduce the likelihood of individuals engaging in criminal activities.

Kendler (2014) examined how the environment contributes to violent criminal behavior by taking a look at over 12.5 million individuals with siblings in a study entitled "Environmental Transmission of Violent Criminal Behavior in Siblings: A Swedish National Study. In data from Swedish national registers, the authors identified 2.3 times more violent crime in people related to someone with a violence conviction than otherwise, even for siblings separated at birth and raised in different families (Kendler et al, 2014). [4]The effect of environmental factors was greater in full-siblings than half-siblings, indicating that the degree of shared environment also influences the probability of violent behavior transmission. Meanwhile, full siblings, who share more of their environment, were more concordant for violent criminal behavior than half-siblings, who share less of their environment. Age and gender were other influential moderators of the environmental pathways to violent behavior. Among males, the transmission was even stronger and focused among younger siblings, who were more influenced by the criminal acts of their older siblings. This study sheds light upon the influence of socioeconomic status (SES) on the perpetuation of violence as an environmental phenomenon. Lower SES was a risk factor for - having siblings who were violent criminals (sib-sib transmission), suggesting that familial transmission of violence could be particularly pronounced among individuals exposed to socioeconomic deprivation. Interventions that improve family environments and tackle socioeconomic inequalities might prevent violent criminal behaviour, the findings indicate. In addition, policy supports for families in low SES brackets and early prevention programs for at-risk youth could be very impactful. This research is consistent with Sutherland's Differential Association Theory that contends criminal behavior is learnt through interaction with others, especially within intimate personal groups, like family. This result provides supporting evidence for the social transmission of violent behavior, or at least for shared environments.

Klevens and Roca (1999) [5] examine the determinants of resilience and vulnerability among high-risk young men in Colombia, one of the most violent countries worldwide. The study examines 46 life stories of young men who differ in offending behavior (offending, resilient). In the light of these observations, this study differs from Kendler et al. in that it suggests resilience to be independent from environmental stressors, with a clear causative path through stress-exposure leading to violent behavior; but underlines that individual factors of resilience such as exposure to severe life events or social support within the family and a perception of personal control are central in preventing violent behavior even in a high-risk environment. This indicates that environmental factors are not the sole determinants of violent behaviour and that personal and familial protective factors may act to insulate an individual from the influence of a violent society. More importantly, this research indicates that violent behavior is determined not just by exposure to adverse environments but also by a person's ability to cope with adversity. Resilient individuals living in high-risk environments were exposed to less severe life stress, suggesting that reduced stress exposure appears to be an important determinant of resilience against violent behavior.

The study by Klevens and Roca (1999) provides critical insights into the role of individual and familial resilience factors that mitigate the influence of environmental factors on violent behavior. While Kendler et al. (2014) emphasize the role of environmental transmission within families, Klevens and Roca (1999) highlight the importance of personal agency, family support, and resilience in overcoming

adverse environments. Therefore, environmental factors alone do not determine violent behavior, as individual resilience and supportive family dynamics play crucial roles in preventing criminal outcomes. This nuanced understanding challenges the notion that environmental factors are the sole determinants of violent behavior, emphasizing the need to consider personal and familial protective factors in interventions and prevention strategies.



**Figure 2.** Environmental impact on crime.

This bar chart illustrates the influence of various environmental factors (Low SES, Family Dynamics, Peer Influence, and Exposure to Violence) on criminal behavior. It highlights that low socioeconomic status and family dynamics are major contributors to criminal behavior.

### 2.3. Psychological factors that impact criminal behaviour

Psychological factors are critical components in understanding criminal behavior, as they provide insights into the mental and emotional processes that drive individuals towards unlawful activities. These factors encompass a wide range of mental health conditions, personality traits, and emotional states that influence behavior and decision-making. Among the most studied psychological traits in the context of criminal behavior is psychopathy, which is characterized by a combination of impulsivity, lack of empathy, and antisocial behavior. Individuals with high levels of psychopathy are often found to have a greater propensity for engaging in violent and criminal activities.

Estrada, Cinguina & Baskin-Sommers (2020) investigate the mediation of psychopathic personality disorder on the relationship between exposure to violence and perpetration of violent crime in their study “The Role of Exposure to Violence and Psychopathy on Violent Crime Perpetration.” The study analysed 2 samples of adults in community and prison settings to explore the influence of psychopathy’s different faces (e.g., impulsive-antisocial traits, primary/secondary subtypes) on this path. Psychopathy has a significant moderating effect on the association between exposure to violence and violent behaviour. The study found that individuals with higher levels of psychopathy, particularly those with impulsive-antisocial traits and secondary (high-anxious) psychopathy, were more likely to engage in violent behavior following exposure to violence. In the community sample, the indirect effect of psychopathy on the relationship between exposure to violence and violent behavior was 0.03, while in the prison sample, it was 0.14, indicating a stronger mediating effect in the prison population. Specifically, the impulsive-antisocial traits of psychopathy were more strongly related to violent behavior than other psychopathic traits. This suggests that impulsivity and antisocial behavior are critical

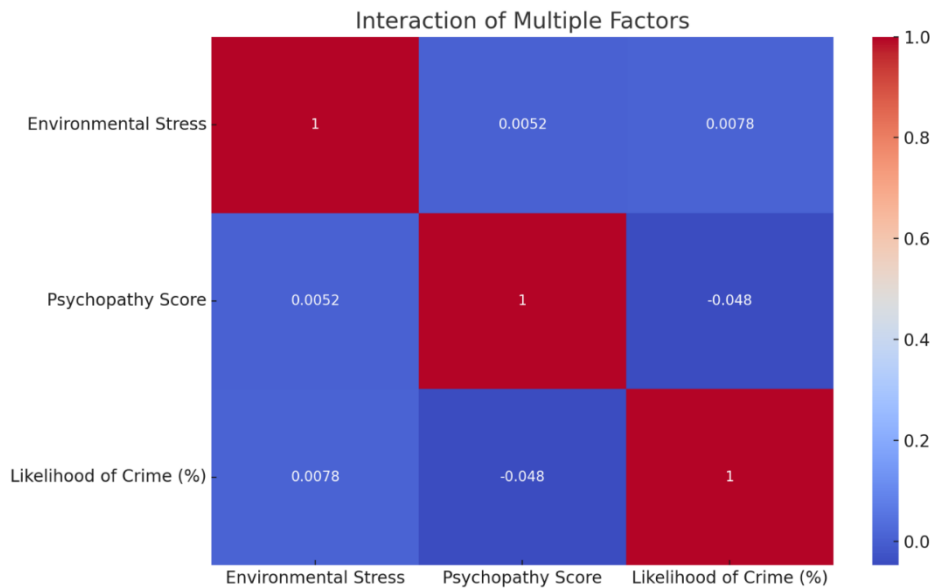
factors in the development of violence in individuals exposed to violence. The secondary subtype of psychopathy, characterized by high anxiety, also showed a significant mediation effect, highlighting the importance of emotional and psychological distress in the pathway from exposure to violence to violent behavior.

The study “A Study of Homicide: The Validity of Predictive Test Factors” by McDonald and Paitich [6] (1981) investigates the validity of various psychological test factors in predicting violent behavior among different groups, including murderers, assaulters, perpetrators of theft, and non-criminal controls. The study aimed to determine if individual psychological factors could reliably predict violent behavior. The study found that psychological test factors did not effectively discriminate between violent and non-violent individuals. The psychological tests used, such as the Elizur Hostility Scale, the DeVos Hostility Scale, and Megargee’s Overcontrolled-Hostility Scale, were unable to distinguish between groups of murderers, assaulters, and non-criminal controls. The 16 Personality-Factor Questionnaire rated all groups, including murderers, assaulters, and non-criminal controls, as having above-average emotional stability. This suggests that these personality factors were not reliable indicators of violent behavior. The findings suggest that reliance on psychological test scores alone is insufficient for understanding or predicting violent actions. This challenges the assumption that psychological traits are primary determinants of violent behavior, emphasizing the need for a broader approach that considers other factors, such as environmental influences and situational contexts. From a Freudian perspective, this could be interpreted as an indication that violent behavior is more deeply rooted in unconscious conflicts and drives than can be captured by standard psychological assessments. Freud’s emphasis on the unconscious suggests that surface-level personality traits may not fully reveal the underlying causes of violent behavior. Freud may also suggest that examining an individual’s early childhood experiences and unresolved conflicts to understand their violent behavior. Standard psychological tests might overlook these formative experiences and the unconscious conflicts they generate.

#### *2.4. Interactions between psychological, biological and environmental factors*

The study “The Role of Exposure to Violence and Psychopathy on Violent Crime Perpetration” by Estrada, Cinguina, and Baskin-Sommers (2020) explores how psychopathy mediates the relationship between exposure to violence and violent behavior. The study involved two samples: community members (N = 232) and incarcerated individuals (N = 313). It aimed to assess the impact of environmental exposure to violence, psychopathy, and their interaction on violent criminal behavior. Exposure to violence (ETV) is a strong predictor of violent behavior, but not all individuals exposed to violence engage in violent acts. Approximately 30% of individuals in the U.S. experience violent acts in their communities, with higher rates in poor urban areas. ETV is associated with adverse outcomes like mental health issues, poor academic achievement, and increased risk of engaging in violent behavior. Psychopathy significantly affects the relationship between ETV and violent behavior. The indirect effect of psychopathy on the ETV-violent behavior relationship was found in both the community (indirect effect = 0.03, SE = 0.02, 95% CI = 0.004, 0.07) and prison samples (indirect effect = 0.14, SE = 0.05, 95% CI = 0.05, 0.25). Impulsive-antisocial traits of psychopathy (Factor2) and the secondary (high-anxious) subtype were particularly influential. ETV was more strongly related to Factor2 traits (impulsivity and antisocial behavior) than to Factor1 traits (interpersonal and affective deficits). Factor2 traits mediated the relationship between ETV and violent crime in both samples. The relationship between psychopathy and violent behavior was moderated by anxiety levels, with higher anxiety levels strengthening the mediation effect of psychopathy on violent behavior.

This study shows without a web of risk factors in the environment (exposure to violence) and person (psychopathy and anxiety), it is difficult to understand who will commit violent criminal behavior. More specifically, it was discovered that psychopathy, predominately its impulsive-antisocial facets, serves as a mediator of ETV and violent behaviors; inferring that individual differences in personality shape the manner in which environmental experiences are processed and actualized. Together, then, these findings demonstrate the importance of interventions and studies to address dimensions that are not only external (the environmental factor) but also internal (qualifying that classic equation for violence).



**Figure 3.** Interaction of multiple factors.

This heat map illustrates the correlation between genetic factors, environmental stress, psychopathy scores, and the likelihood of committing a crime. It shows that the interaction of these factors is complex and multifaceted.

### 3. Conclusion

By exploring genetic, environmental, and psychological factors, the research highlights the complexity of criminal behavior and the interplay between these various influences. The investigation into XYY syndrome and the MAOA gene variant provided insights into the genetic predispositions that may contribute to violent behavior. However, the findings also indicated that these genetic factors are not solely determinative. Environmental influences, such as socioeconomic status and familial dynamics, and psychological factors, such as psychopathy, play crucial roles in shaping an individual's propensity for criminal behavior.

Key studies like Tiihonen et al. (2014) and Kendler et al. (2014) emphasize the significant impact of both genetic and environmental factors, while the comprehensive analysis by Estrada et al. (2020) integrates these aspects with psychological traits to offer a well-rounded understanding of violent behavior. Furthermore, research by Klevens and Roca (1999) underscores the importance of resilience and personal agency in overcoming adverse environmental conditions, suggesting that individual factors can significantly mitigate the impact of a high-risk environment. Studies by Beaver et al. (2010) and McDermott et al. (2009) also highlight the role of genetic predispositions in conjunction with environmental stressors in predicting violent behavior, indicating that the relationship between genetics and crime is far from straightforward.

The research collectively suggests that criminal behavior results from a complex interaction of genetic predispositions, environmental contexts, and psychological traits, challenging the dominance of genetic determinism. This is supported by findings from meta-analyses and longitudinal studies that reveal how environmental and psychological factors can either exacerbate or mitigate genetic risks (Caspi et al., 2002; Fergusson et al., 2011).

These findings regarding genetic, environmental and psychological factors in criminal behavior pose important legal and research implications. The potential implications of these findings for legal systems are that offenders should be evaluated based on a comprehensive understanding of their genetic predispositions, environmental background, and psychological make-up before they are convicted or sentenced to certain rehabilitative programs beyond individual determinants, more comprehensive



assessments might in turn trigger a wide variety of more targeted and correspondingly more effective interventions, ultimately lowering re-offending rates by addressing the root causes of crime. For example, combining genetic profiles with psychological evaluations and a social history might represent a more sensitive fingerprint of those individuals at risk for violence behavior (Moffitt 2005).

Moreover, longitudinal research studies that examines the interaction of these factors over time and across different populations ought to be conducted in future so as to gain a deeper understanding of criminal behaviour. In addition, it is critical to explore interdisciplinary models incorporating genetics, psychology and environmental science to generate preventive and intervention techniques as a whole. Research should also attempt to identify possible critical biomarkers and environmental triggers that might be modifiable using early intervention programs, thereby providing much more accurate and individualised approaches to crime prevention and rehabilitation (Raine 2013).

The current literature review serves as an important first step in understanding the vast range of antecedents of antisocial behaviors, but it also has a number of limitations that need to be recognized. The literature search that a systematic review is built on can be biased in that it may not cover all relevant studies, which makes conclusions about the factors that contribute to offending incomplete. Also, the findings are based on previous studies requiring larger understandings and thus different capabilities of various methodological quality and scope. Third, the current study is constrained in that it largely focuses on specific populations and may be less generalizable to a wider or other demographic groups. The other issue with these factors is that they are related to one another, making it difficult to extract separate effects. Finally, the advancing field of genetic research also offers an evolving narrative regarding the genetic landscape of crime that could reshape the existing understanding in this area and thereby continues demand for updates in the literature. These limitations call for more well-designed, diverse and comprehensive studies in future research.

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