

Potential Implications of Research on Genetic or Heritable Contributions to Pedophilia for the Objectives of Criminal Law

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Abstract: In recent years, there has been increasing scientific research on possible genetic or heritable influences to the etiology of pedophilia, driven by national and public concerns about better understanding the disorder in order to reduce children's vulnerabilities to pedophilic and child sex offenders. This research has corresponded to growing academic dialogue on how advances in genetic research, especially concerning the causes and development of particular mental disorders or behaviors, may affect traditional practices of criminal law and how the justice system views, manages, and adjudicates different types of criminal behavior and offenders. This paper strives to supplement this dialogue by exploring several of the many possible effects and implications of research surrounding genetic or heritable contributions to pedophilia for the five widely accepted objectives that enforce and regulate the punishment of criminal law. These include *retribution*, *incapacitation*, *deterrence*, *rehabilitation*, and *restoration*. Although still currently in early stages, genetic and heritability research on the etiology of pedophilia may have the potential moving forward to influence the current and established punitive methods and strategies of how the justice system perceives, adjudicates, regulates, and punishes pedophilic and sex offenders, as well as how to best prevent sexual offending against children by pedophilic offenders in the future.

Keywords: Adjudication, criminal law, deterrence, DNA, genetics, genomics, heritability, incapacitation, judiciary, jury, paraphilia, pedophilia, punishment, rehabilitation, restoration, retribution, sex offender.

INTRODUCTION

Since the late 1980s, increased media coverage regarding high-profile sex crimes against children, child sex abuse scandals, and television shows namely *Dateline NBC: To Catch a Predator* have inflamed national concerns and panic surrounding the exposure and defenselessness of children to sexual predators. This exposure has also created the utmost focus on establishing retributive and punitive sex offender policies in order to protect children from what have been described as "modern day monsters" [1-3]. Media attention has led to a considerable increase of interest and concern by the general public surrounding pedophilia in particular [3-5], often shaped by the stigmatization and incorrect belief that the word "pedophilia" conveys the perpetration of child sex abuse instead of a clinically diagnosed psychiatric disorder [6, 7]. Researchers stress that these beliefs should be discouraged, as not all individuals who sexually abuse children meet the psychiatric and clinical diagnostic standards for pedophilia and not all individuals diagnosed with pedophilia have committed sexual acts upon children [3, 6, 7].

Pedophilia, or pedophilic disorder, is a paraphilic disorder and diagnosis defined by a persistent sexual attraction to children aged 13 and younger. The most recent *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) defines

the disorder as one where "adults or adolescents 16 years of age or older have intense and recurrent sexual urges towards and fantasies about prepubescent children that they have either acted on or which cause them distress or interpersonal difficulty" [8]. Although the prevalence of pedophilia in the general population is not known, it is thought to be around 3% to 5% and has been reported to be much more common among males [9]. It is not known or agreed upon what percentage of child sex offenders meet the clinical diagnosis for pedophilia¹ [3, 9], but some estimate these individuals make up about 20% of all sex offenders [10].

Little scientific inquiry has been done concerning pedophilia until recently. Over the last few decades, heightened media attention and concerns of the general public about the prevalence of pedophilic offenders and vulnerabilities of children to them have led to a surge of scientific studies on the biological causes or facets of the disorder [3, 11]. Much of this research has focused on understanding the disorder as a neurodevelopmental or medical condition, its physiological characteristics, etiology and causes, and corresponding treatments or therapeutic interventions. Although in its early

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¹ To emphasize the distinction between an individual who meets the clinical diagnosis for pedophilia, an individual who meets the clinical diagnosis for pedophilia and sexually offends against children, and an individual who does not meet the clinical diagnosis for pedophilia and sexually offends against children, this paper will use the terms "pedophile," "pedophilic offender" and "child sex offender" respectively.

stages, this has also included research into potential genetic or heritable contributions to the causes, development and presence of pedophilia.

In general, there has been a longstanding history of research surrounding genetics and potential causes of criminality, including research on the connection of men with XYY Syndrome to criminal behavior and overrepresentations in prison populations in the 1960s [12] and on the relationship between the presence of the MAOA gene and aggressive or criminal behavior in humans in the 1990s [13]. Recent decades have been especially marked by a growth of academic dialogue on the relationship between genetics and criminal law, including discussions on how increased scientific understandings of genetic contributions, underpinnings or predispositions to mental disorders, specific behaviors or types of criminality may complicate or alter traditional approaches to criminal adjudication, crime prevention and views on legal responsibility, punishment and justice [ex. 14-18]. The use or presentation of behavioral genetics evidence has also increasingly appeared in court as a method of explaining or contextualizing criminal behavior of offenders, often in an attempt to mitigate responsibility and corresponding punishment for criminal actions [14, 15]. Thus, it is reasonable to assume that advances in genetic and heritability research could in the future produce similar discussions and possible implications for criminal law and the legal evaluation of offenders diagnosed with pedophilia, as it has with other genetically influenced mental disorders [17, 19-21]. Additionally, taking into account the existing fears and negative perceptions surrounding child sex offending and the justice system's historical focus on punitive strategies, policies and punishments for pedophilic and child sex offenders [2], suggested genetic influences on pedophilic behavior could also potentially affect how the legal system traditionally approaches the management, adjudication, and punishment of pedophilic offenders.

Therefore, although it is conceivable that criminal law could be influenced by this research in many areas, this paper specifically focuses on some of the possible implications of research surrounding genetic or heritable contributions to pedophilia for each of the five widely accepted objectives that enforce and regulate the punishment of criminal law in the United States [22]. These objectives include the following: (1) Retribution; (2) Incapacitation; (3) Deterrence; (4) Rehabilitation; and (5) Restoration. I will first review the available research that has explored the potential genetic or heritable contributions to the causes, development and presence of pedophilia. Then, within each of the aforementioned objectives, I will consider how genetic and heritability research fits within existing literature on both contemporary criminal justice practices and perceptions of the management, adjudication, and punishment of sex offenders, and genetics and criminal law. I will also discuss several implications and future issues that may arise in these areas due to genetic research.

Finally, it is important to briefly acknowledge that although this paper primarily focuses on the U.S. legal system, 90 countries between 1945 and 2005 revised or augmented laws and practices increasing the protection of children against sexual abuse and offending, showing there is an in-

ternational focus on these issues [23]. However, these laws vary significantly in their interpretation of what constitutes sexual offending against children, as well as methods and practices that provide safety for children and hold offenders accountable. There is also a large degree of variability in confidentiality and reporting laws in different countries, and there are huge differences concerning the age of sexual consent [23]. Thus, although some of the discussion in this paper may be relevant or useful to other jurisdictions, the impact of this research on other countries should be separately considered, as pedophilic offending and modes to address or prevent it are complex, multifaceted legal, social, psychological, economic, and medical issues that vary significantly from country to country [23].

REVIEW OF GENETIC RESEARCH ON PEDOPHILIA

The etiology of pedophilia remains largely unknown, but the disorder is thought to be caused by an undetermined distribution of psychological, sociological, and biological factors [24]. To fully understand and survey the origins of the disorder, researchers have cautioned that attention should be paid to all of these factors [25]. Even though the biological facets of the disorder are still not principally determined and very few researchers study the causes of pedophilia [26], most scientists now consider the disorder as a complex deep-rooted predisposition and, over the last few decades, have correspondingly begun to study possible biological associations to the etiology and presence of the disorder, such as abnormal brain structure and function [26-31], irregular hormone levels [32-34], biological vulnerabilities to environmental factors [35, 36], and as I will discuss in this paper, genetic influences. Although there is overall very little genetic research in this area and literature is limited, several studies in the preceding decades have begun to preliminarily explore and implicate potential contributing genetic influences to the development of pedophilia, and research is ongoing. In addition to the following discussion, a summary of the six main studies explicitly suggesting genetic contributions to pedophilia and their findings can be found in Table 1.

One such area of exploration concerns the possible heritability or familial transmission of pedophilia. Literature has speculated that sexual interest in children may be heritable [37, 38] and researchers believe establishing the presence or absence of a familial pattern of occurrence is an important preliminary step in identifying the etiology of a disorder [34]. Three studies and one case report, to my knowledge, have been undertaken in this area for pedophilia. The first of its kind, a small study in 1984 by Gaffney *et al.* [39] surveyed the family history of 33 pedophilic patients and found 10.3% of pedophilic patients had male first-degree relatives with pedophilia. The researchers concluded this shows a level of familial transmission and that the presence of pedophilia in one member of a family increases the chance of pedophilia in other members of a family [39].

The results of a 2012 pilot study, involving the construction of genograms over multiple generations of five different families, supported the familial transmission of homosexual and heterosexual pedophilia [24]. Unfortunately, the results of this study were unable to differentiate if results were due

Table 1. Summary of key research suggesting genetic contributions to pedophilia.

Study	Methods	Genetic or Heritability Findings for Pedophilia	Conclusions
Gaffney <i>et al.</i> 1984 ²	A double-blind study at Johns Hopkins Hospital in Baltimore, MD comparing family records of 33 patients with pedophilia and 21 patients with non-pedophilic paraphilia (vs. psychiatric controls) for histories of sexual deviance in first-degree relatives.	Results found 10.3% of pedophilic patients had male first-degree relatives with pedophilia. This compared to 0% of a psychiatric control group who had male first-degree relatives with pedophilia.	Gaffney <i>et al.</i> conclude that the data suggest that pedophilia is familial, and the presence of pedophilia in one member of a family increases the chance of pedophilia in other members of a family.
Comings 1994 ³	A large survey on sexual behavior of patients with Tourette's Syndrome or Attention Hyperactivity Disorder (or relatives of patients) treated at the City of Hope National Medical in Duarte, CA.	Results found a highly significant positive correlation to the presence of <i>Gts</i> genes in pedophilic patients; 18.5% of pedophilic patients admitted to having another pedophile in the family, compared to 3% of a psychiatric control group.	In addition to the involvement of <i>Gts</i> genes in pedophilic behavior and possible heritability of the disorder, Comings also suggests the development of sexual behavior, including pedophilia, is related to serotonin (5-HT) receptors and dopamine-related candidate genes.
Rainero <i>et al.</i> 2011 ⁴	An Italian case study about a 49-year-old male patient with a yearlong history of sexual attraction to his nine-year-old daughter who later developed frontotemporal dementia.	During genetic sequencing of the patient, the authors identified a point mutation (R177H) in the PGRN gene and in silico analyses suggested the damaging role of this mutation in prefrontal function and sexual behavior	Rainero <i>et al.</i> suggest a link between PRGN gene abnormalities and pedophilic behavior, especially concerning effects of this mutation for frontal functioning. Rainero <i>et al.</i> suggests this relates to past findings concluding that pedophiles have poor prefrontal networks.
Labelle <i>et al.</i> 2012 ⁵	A study at the Sexual Behaviors Clinic at the Royal Ottawa Mental Health Care Centre that constructed genograms for five different families by standardized family histories of sexual deviance. Families were identified by having at least two first or second degree relatives previously diagnosed with a sexual paraphilic disorder.	Results found considerably higher rates of paraphilia and specifically pedophilia in families compared to rates based on population prevalence data. However, the results of this study were unable to differentiate if results were due the effects of a shared environment or to genetics.	Labelle <i>et al.</i> conclude results suggest the familial transmission of homosexual and heterosexual pedophilia.
Alanko <i>et al.</i> 2013 ⁶	A study in Finland employed an extended family design within behavioral genetic modeling and sampled almost 4,000 Finnish twins and male siblings to estimate the role of heritability and genetic influences in shaping pedophilia.	The incidence of pedophilia was higher for monozygotic twins compared to dizygotic twins; the genetic variance attributable to heritability for pedophilia was estimated at 14.6%.	Alanko <i>et al.</i> conclude the results present preliminary evidence that genetic influences and heritability contribute to pedophilia amongst adult men.
Shim <i>et al.</i> 2014 ⁷	A Korean case study on monozygotic male twins with pedophilia.	Findings showed both twins had extensive histories of sexual deviance and pedophilia. Twins had some differing experiences with environmental factors, including sexual abuse.	Shim <i>et al.</i> suggest genetic influences and related genetic vulnerabilities appear to be more important to the causes and development of pedophilia than environmental factors, including childhood abuse.

² [39], ³ [48], ⁴ [45], ⁵ [24], ⁶ [40], ⁷ [41]

the effects of a shared environment or to genetics. The authors therefore recommended that further research on familial inheritance surrounding pedophilia should utilize twin or adoption studies that can effectively recognize if familial transmission is due to genetic or environmental influences [24].

A 2013 Finnish study employed an extended family design within behavioral genetic modeling and sampled almost 4,000 Finnish twins and male siblings to estimate the role of heritability and genetic influences in shaping pedophilia. Alanko *et al.* [40] concluded the incidence of sexual interest in children were higher for monozygotic twins compared to dizygotic twins, and the genetic variance attributable to heri-

tability was estimated at 14.6%. The study concluded that these results present preliminary evidence that genetic influences may contribute to sexual interest toward children, at least amongst adult men, and is one of the first studies of its kind to empirically demonstrate heritable factors in the development of pedophilia [40].

Although only a case study, a 2014 Korean report on monozygotic twins with pedophilia concluded genetic influences and related genetic vulnerabilities appeared to be more important to the causes and development of pedophilia than environmental factors, including childhood abuse [41]. Alternatively, other research has reported the potential heritability of pedophilia may be due to differences in genetically

determined susceptibility to environmental factors during development, including adverse childhood experiences or sexual interactions, rather than familial transmission [35, 42-44].

Recent research has also explored pedophilia's association to specific genes. An Italian case study in 2011 by Rainero *et al.* [45] related a patient's late-onset heterosexual pedophilia to a genetic screening showing the R177H mutation in the Progranulin (PGRN) gene. The PGRN gene is traditionally expressed in neurons in the cerebral cortex, hippocampus, and cerebellum, and has been implicated in several processes including neurodegeneration and neural development. After weeks of treatment with anti-psychotic and antidepressant medications, the patient ceased having pedophilic urges or behaviors [45]. The authors of that research connected their results to those of previous experimental animal studies, which have suggested the PGRN gene plays a major role in establishing sexual dimorphic behavior in both developing and adult brains. For example, male rats with targeted disruption of the PGRN gene have in the past displayed abnormalities in sexual behavior [46, 47].

In 1994, a study by Comings [48] reported a significant positive correlation to the presence of *Gts* genes, connected to the inheritance of Tourette Syndrome (TS), in the development of sexual behaviors and expressions, including a highly significant correlation with the presence of pedophilia. Further, 18.5% of pedophilic patients in this study admitted to having another pedophile in the family, compared to 3% of a psychiatric control group [48]. As the development of TS has been connected to genetic changes in serotonin and dopamine metabolism, Comings [48] also suggested the development of sexual behavior is connected to genes related to the development of serotonin (5-HT) receptors and dopamine-related candidate genes. This was supported by the findings of Miller *et al.* [49] in 1999, which linked an individual's dopamine D2 and D1 receptor alleles and the age at first sexual intercourse. Miller *et al.* [49] concluded the importance of dopaminergic receptors in the development and stabilization of expressions of normal and abnormal male sexual behavior. Several studies have also reported at least some successful treatment of the urges or compulsions associated with paraphilias, including pedophilia, with selective serotonin reuptake inhibitors (SSRIs), specifically sertraline, fluoxetine, and fluvoxamine, which increase the serotonin availability for 5-HT receptors [50-54].

In 2004, Tost *et al.* [38] interpreted past findings surrounding dopamine and the development of sexual behavior as possible evidence that pedophilia may be a phenotypical expression of 'reward deficiency syndrome,' a spectrum of addictive, impulsive or compulsive disorders caused by genetic deficiency in the dopamine D2 receptor. As pedophilia is characterized by "compelling urges, mental preoccupation and loss of behavioral control" surrounding sexual interest in children, paired with its potential connection to genetic abnormalities related to dopamine, Tost *et al.* [38] suggested pedophilia has the potential to be defined and treated as a impulsive-compulsive disorder.

Finally, other research on the biological underpinnings of pedophilia has also related findings to genetic influences.

Seto [53] argued that in some ways pedophilia could be compared to the development of sexual orientation, including similar ages of sexual onset, the stability of sexual preference over time, and at least some support for neurodevelopmental influences, including genetics, on the development of both pedophilia and sexual orientation [54]. There has also been research focused on linking the disorder to a series of human traits that have traditionally thought to be at least partially genetically influenced, including IQ [55], height [56], and hand dominance [57]. The literature reports studied pedophiles have increased rates of lower IQs [58-60], shorter physical height [61-63], and non-right-handedness [54, 58, 60, 64, 65].

IMPLICATIONS FOR THE OBJECTIVES OF CRIMINAL LAW

In the following three sections, I will discuss several possible implications of research suggesting genetic or heritable contributions to pedophilia for the five traditional purposes of criminal punishment [22]: (1) Retribution and Incapacitation; (2) Deterrence; and (3) Rehabilitation and Restoration. This paper and its content are by no means exhaustive in exploring all possible manners in which this type of research could affect the legal system and its handling, adjudication, and punishment of pedophilic offenders. It does, however, provide a foundation for discussion and may indicate areas where future study or dialogue are needed.

Retribution and Incapacitation

Retribution is often designated as the primary objective of modern-day American criminal law. It relies on the idea that for justice to be rendered, an offender deserves to be punished in such a manner that is proportionate to the severity of the committed criminal action. Punishments of retributive justice range in gravity and type based upon the crime perpetrated, ranging from minor indiscretions, such as a monetary fine for a traffic violation, to extremely violent crimes, such as a death penalty sentence for a murder conviction [66]. For pedophilic and child sex offenders, who are often labeled as "modern day monsters" [1] and have created tremendous societal panic and fear [2, 67, 68], rendered punishments by the courts have been retributive and harsh in nature over the last several decades [2] – instead of focusing on rehabilitation or treatment, justice is achieved by punishment solely to manage, control, and contain dangerous sexual predators from the general public. Specifically, sex offenders have been subject to severe sentencing laws aimed at incapacitation [69]. Incapacitation, another objective of criminal law, aims to remove offenders from society in order to protect the general public from future unlawful behavior and is one of the most common forms of punishment utilized by the U.S. legal system [70].

Compared to other offenders, pedophilic and child sex offenders have been particularly subject to harsh treatment from both society and the courts, including judges and juries [69]. Judges and members of the public have previously described pedophilic and child sex offenders as "the worst of the worst" and inevitable recidivists [71]. A 2005 public poll indicated almost two-thirds of respondents believed that child molesters could not be rehabilitated, and a 1991 Star

Tribune National poll showed 87% of respondents indicated they believed there is no existing punishment that could prevent sex offenders from reoffending if released back into society [71]. A recent study of judicial perceptions of sex offenders, focusing especially on child sex offenders, noted that surveyed judges viewed these offenders just as negatively as the general public, and labeled them as more depraved than any other type of offender [72]. The judges also indicated that they sentence and punish offenders according to these views [72]. A judicial survey on sex offenders revealed heavy support for traditional retributive sex offender punishments, including prison and civil commitment; of the 42 judges surveyed in that study, only seven percent indicated they thought the legal system is too tough on sex offenders [73]. New York Supreme Court Judge Richard L. Buchter, presiding over the sentencing of a pedophilic offender convicted of child pornography and molestation charges in April 2014 said, "In 27 years on the bench, I have not seen a more repulsive case. Justice is a poor replacement...The lengthy prison sentence I propose will not restore the sweet innocence of the [victimized] child" [74]. Overall, the opinions of the justice system and public have showed intense support for the use of retributive and incapacitory practices for sex offenders, especially those who sexually offend against children.

Moving forward, research on the genetic contributions to pedophilia could potentially affect traditional retributivist and incapacitory views and practices regarding pedophilic offenders. Although still uncommon, defendants have increasingly presented genetic research in recent decades as evidence in court in an attempt to explain or contextualize their behavior as caused or influenced by their genetics. These include arguments such as genetic predisposition to specific types of criminal behavior, issues with behavioral or impulse control due to genetic susceptibility, or a familial history of criminal behavior, all with hopes of negating or mitigating responsibility for their crimes [14, 15, 75]. Previous literature has shown the use of genetics evidence in past cases has described as a "double edged sword" – meaning either a mitigator or aggravator – in court for judges and juries concerning sentence type or severity; either the offender is more dangerous because his genes are unchangeable, or the offender is less responsible for his actions because he did not "choose" his genetic makeup [14-17]. Depending on the views of the judge or jury in a case, research on genetic or heritable influences to pedophilia could similarly produce these divergent perceptions during the adjudication and sentencing of pedophilic offenders.

As an aggravator, genetic research might exacerbate existing retributive views on pedophilic and sex offender dangerousness of legal actors who are responsible for the responsibility determination or sentencing of a pedophilic offender and lead to increased calls for containment, harsh sentencing, and incapacitation of those offenders. Courts have been shown to be very interested in hearing evidence associated with an offender's problems with behavioral control and likelihood for future threatening behavior in sentencing proceedings [17]. In some cases, the court has viewed genetic evidence as an indicator of an offender's inherent dangerousness or incurability [16]. This interpretation of genetic evidence is of especially relevant use to the prosecu-

tion in an attempt to affect the perceptions of judges and juries [15]. Prosecutors may play on the concerns of legal actors and use this information to heighten judges' or juries' views that an offender is highly dangerous, likely to reoffend, and in need of long-term incapacitation and harsher punishment than normal [14, 18]. Lawyers or expert witnesses for the prosecution may suggest an individual's genetics are unchangeable and, therefore, anything but incapacitation is pointless because the offender cannot be rehabilitated [14, 76].

In court, the portrayal of an offenders' inherent dangerousness or incurability due to genetic factors may be an especially effective argument concerning pedophilic offenders. Current views of juries and judges surrounding pedophilic and child sex offenders, describing these individuals as inevitable recidivists, unlikely to be rehabilitated and necessitating incapacitation to prevent reoffending [67-69], are similar to how juries and judges have described defendants in trials where genetic evidence has been seen as an aggravating factor [14, 16, 18, 76]. Indeed, Farahany and Bernet [15] argued that future research on specific gene-environment interactions possibly correlated to sexual disorders, such as pedophilia, could in the future be used in court by experts to portray offenders with these factors as unlikely to be rehabilitated and more likely to recidivate. This could be an especially effective strategy for the prosecution, as there has been past concern that judges and juries, who often do not have scientific expertise or background, may misjudge or overestimate the level of influence an individual's genetic makeup has over his behavior when making decisions about offenders in court [75, 77].

Additionally, the heritability of behaviors has also been presented in court to insinuate likely recidivism [15]. For example, when addressing the jury in *Johnston v. Love* [78] in 1996, a prosecutor referred to an offender's family history, citing generations of criminal behavior, as a possible aggravating factor in an attempt to demonstrate that the defendant was a member of a "family of crime." Heritability or familial transmission research on pedophilia could likely be used to portray pedophilic offenders in the same aggravating manner.

Conversely, as a mitigator, genetic research on pedophilia could also reduce court judgments of blameworthiness and, therefore, mitigate punishment if it is believed the offender's free will or control over his actions was somehow compromised due to his genetic makeup [15]. This could consequentially alleviate some of the negative opinions of the criminal justice system and public concerning pedophilic and sex offenders, as well as the severity of traditional retributive or incapacitory sex offender sentences. Research or evidence on how genetic influences compromise behavior can often be seen as a scapegoat or offer an explanation to frustrated victims, the media, or courts who are searching for reasons why an act of violence has occurred [14, 79]. This was seen most recently in 2012 after the Sandy Hook School Shooting, where geneticists were asked to search for answers of "why" by studying Adam Lanza's DNA [80, 81].

Overall courts have been skeptical of behavioral genetic evidence in an attempt to mitigate responsibility or sentenc-

ing [16], but past research and particular cases have indicated that some judges and juries are open to hearing and considering defenses and mitigating scientific evidence surrounding biological or genetic compulsions, predispositions, or risk factors [17, 81-84]. Depending on the nature of the genetic evidence or experts presented, and their receptivity to it, jurors could be influenced or sympathetic to genetic evidence as an explanation or influence on behavior, as they were for murder in *State of Tennessee v. Davis Bradley Waldroup Jr.* [84], in cases involving pedophilic offending. Indeed, several studies have shown that jurors are at times overly trusting of the opinions of expert witnesses, who may have impressive credentials or degrees, and their presented testimony or interpretation of the facts of the case, especially when it comes to scientific evidence [85-87]. There have been similar discussions about judges potentially being unable to effectively determine the soundness and relevance of expert testimony and scientific evidence, including in sex offender cases specifically [88].

Thus, depending on what genetic evidence is presented, the receptivity of judges and juries, and how criminal justice actors understand the evidence, its significance and how it affects the facts of the case, it is possible that certain courts might view genetic evidence as a palpable mitigating factor in cases involving pedophilic offenders, as certain courts have for select other cases [82, 84]. As hypothetical examples, an expert could offer up research to judges or juries suggesting pedophilia be viewed as a genetic obsessive-compulsive disorder, as put forth by Tost *et al.* [38], or as a type of congenital medical disability or impairment in an attempt to explain the offender's behavior as genetically caused compulsions, out of his direct control, and therefore mitigate responsibility or punishment for behavior. In fact, issues of reduced impulse control and culpability surrounding other obsessive-compulsive disorders, such as TS, have been discussed in the context of allayed punishment and legal liability in the past [89-91]. Further, Greece recognized pedophilia as a state-recognized medically defined disability in 2009 [92]. If an expert presented scientific evidence or testimony of this nature in court, it is possible that a receptive judge or jury could consequently view a pedophilic offender as less blameworthy for his actions.

Deterrence

The function of legal policies and practices focusing on criminal deterrence is to disincentivize the future committal of crimes in a cost-benefit model. The threat or fear of specific punishments or criminal sanctions, such as incarceration, fines or other measures, are to outweigh an individual's motivation to commit an unlawful act. Thus, the "benefits" of breaking the law are inadequate compared to the "costs" of potential legal, social or other consequences [66]. National sex offender policy has utilized two well-known deterrent strategies to prevent sex offenders from re-offending: the registration of convicted sex offenders on statewide sex offender registries and community notification systems notifying the public of convicted sex offenders living or working in their neighborhoods. These policies function under the reasoning that online public sex offender registries and community notification will unmask the threat to the community and minimize the possibility of reoffending, both

through public exposure and the shaming of the offender; this is especially true concerning pedophilic and child sex offenders [69, 93].

However, research has generally demonstrated that registries and community notification are ineffective deterrents and provide little or no reduction in pedophilic and sex offender recidivism and crimes [93]. Studies have found average pedophilic offender recidivism rates between 10% and 50%, although several of these studies include reconviction for any type of crime (for a review of these studies, see [3]). One longitudinal study found 25% of heterosexual pedophilic offenders and 50% of homosexual or bisexual pedophilic offenders were reconvicted for a crime against a child [94].

Although traditional sex offender policies have been shown to be ineffective in deterring pedophilic and sex offender recidivism, research has demonstrated that deterrent strategies aimed at other criminal populations have been successful [95]. Specifically, when an offender perceives that the threat of punishment or aftereffect holds a reasonable level of severity, deterrence is likely to occur [96, 97]. Literature has noted that sex offenders themselves perceive sanctions and consequences of current deterrent policies, especially of registries, as inefficient and ineffective methods of deterrence and reducing recidivism [93]. Therefore, for sex offender policies aimed to function as deterrents to be successful, it is possible that the threat of punishment, sanction or consequence held by those policies may need to be perceived by offenders as more sufficient or severe than that of current strategies.

Research concerning the genetic or heritable contributions to pedophilia, paired with the use of forensic DNA databases and existing concerns on genetic privacy in the criminal justice system, may present a new and possibly more effective deterrent strategy to first time and repeat pedophilic offenders. Historically, criminal deterrence has been one of the many goals surrounding the criminal justice system's use of forensic DNA databases [98]. The government has argued that the forensic collection and storage of DNA serves a compelling interest in reducing recidivism because repeat offenders know their DNA is stored in the system and will assume they will be caught if they reoffend [99, 100].

Yet there have been also several ethical concerns surrounding forensic DNA databases, including from offenders themselves, concerning violations of genetic privacy, potential misuses of stored genetic information, and the creation and regulation of laws establishing these databases [101-103]. One of the main criticisms is that many state laws, such as those in Massachusetts and Alabama, do not provide statutory limits on the use of the database information outside of forensic purposes, allowing personal genetic information in the databanks to be hypothetically used in academic, medical or other types of research without consent of the individuals [104]. This has caused concern surrounding the genetic privacy of offenders [18, 104]. Although unproven in practice, literature has reported that databases in the future may serve to deter repeat offenders, as well as individuals with no past criminal history, from committing criminal acts because they fear their genetic information will be misused and their genetic privacy will be violated [98]. Concerns

about the presence, storage and potential use of their genetic data stored in forensic databases may “internalize a reduced quantum of privacy” enough to prevent future criminal actions [98].

Considering current and future research concerning the genetic or heritable contributions to pedophilia, fears about violations of genetic privacy and misuses of genetic samples included in DNA databases could possibly act as a deterrent to the future offending of pedophilic offenders. As it currently stands, pedophilic and other sex offenders are not deterred by public exposure of basic identifying information, such as name, photograph, birthdate, address or criminal history, included in registries or community notification [93]. Yet these offenders might be deterred instead by the inclusion of their genetic samples in DNA databases, perceived violations of genetic privacy and the possible exposure of their DNA [98], especially since many database laws do not regulate or limit the number or type of individuals who might handle or have access to an offender’s DNA [104].

DNA has been considered the *ultimate identifier* [105] and far more powerful and potentially invasive than other measures of identification in the criminal justice system, even fingerprints [106]. When an individual’s genetic sample is deposited in a forensic database, the genetic profiles of that person’s siblings, parents, and families are also indirectly deposited, as an individual’s DNA profile contains genetic, medical, and identifying information about every close relative to that person [98]. DNA has been described as an inherent property of the individual, as a part of a person’s identity or “self,” an indicator of disease or immutable characteristics such as intelligence or sexual orientation, a predictor of behavior, and a source of potential discrimination, stigmatization, or class distinction [106-109]. DNA not only provides an individual’s name and personal information, but also exposes family members, personal and family health history, and amid continuing genetic research on the etiology of pedophilia, could indicate and expose the presence of genetic contributions to the disorder for an individual or an entire family. This exposure could lead to both personal and familial stigmatization and discrimination [110], especially regarding research on familial transmission or heritability of pedophilia. Therefore, it is possible that some first time and repeat pedophilic offenders could perceive the inclusion of their samples in DNA database, potential violations of genetic privacy, and exposure or identification of their and their family’s genetic information as more serious consequences than the current consequences of sex offender registries or community notification, and correspondingly, may be deterred from offending based on these concerns.

Fears surrounding the use of one’s DNA for potential research without the consent or knowledge of the individual [101-103] could also be perceived as a deterrent for pedophilic offenders. Amid offenders with pedophilia, continuing genetic etiological research on the disorder could plausibly lead to the use of genetic profiles included in databases in behavioral or genetic research without the individuals’ knowledge [104], such as the inclusion of their samples in databases specifically aimed at those convicted of sex crimes against children. This idea is not a new one; in 2007, an un-

successful Congressional bill [111] was introduced that proposed the creation of a separate DNA database only containing samples of violent and sexual predators convicted of sex crimes against children. Thus, there is obvious interest in creating databases of specific populations of offenders for research purposes, especially child sex offenders [18]. Literature has noted that databases like these could create a wealth of genetic information for researchers on specific genetic associations to particular behaviors and could in the future lead to the identification, classification and surveillance of individuals by their “genetic propensity” to specific behaviors or crimes [112-114], including pedophilia. Although these practices do not currently exist, ethical concerns and fears from offenders, and society as a whole, that they could in the future do exist [112, 113] and particular offenders, including some pedophilic offenders, may perceive the likeliness or use of these practices in the future as possible deterrents to offending.

Rehabilitation and Restoration

Rehabilitation, often seen as a contrast to retribution, seeks ways to actively reform an offender’s behavior so that an individual will not reoffend. Rehabilitative sentences are often viewed as a treatment, rather than solely a punishment, and depending on the offender’s needs, can take many forms such as therapy, medication, substance abuse programs, vocational training, and education [68]. Most recently, problem-solving courts have been established in many jurisdictions as a rehabilitative alternative or addition to traditional corrections or jailing. Specifically they have been created to meet the needs and facilitate the rehabilitation of specific populations of offenders who have been identified by the courts as those unlikely to benefit from conventional sentences [115]. By providing some type of treatment or other assistance to these offenders in order to reduce recidivism, these courts attempt to find ways to address the underlying issues of their offending, such as addiction or mental health problems. The most famous examples of these types of courts are drug courts, mental health courts, and community courts [115].

The main goals of problem-solving courts are rehabilitation and, the final objective of criminal law, restoration. Popularized in the 1990s and often viewed as a progressive alternative to retribution, restoration emphasizes the achievement of justice through reconciliation between offenders, victims, and often the community, rather than focusing solely on punishment [116-120]. Restorative justice addresses the individual needs of and engages both offenders, holding them accountable, preventing their recidivism through reintegration and rehabilitation, and helping them fully acknowledge and appreciate the consequences of their committed actions, and victims, empowering them to confront the offender, vocalize the effects of the committed actions, and realize justice on their own terms [119, 120].

Instead of rehabilitative or restorative practices, retributive practices have dominated sex offender policy in recent decades. As previously mentioned, the general public and the justice system overwhelmingly view this population as unable to rehabilitated; further, criminal justice actors sentence and punish offenders according to these views, often leading

to lengthy jail sentences [69, 71-73]. Even so, rehabilitative practices for sex offenders are sometimes used in prison and through other programs, usually consisting of cognitive-behavioral therapy, psycho-educational therapy, and pharmacological therapy to prevent reoffending [121]. As for pedophilic offenders specifically, rehabilitative treatment has focused on teaching an individual to control his attraction to children, rather altering the individual's attraction to children [3]. Strategies have included traditional sex offender treatments, testosterone lowering medications, and modes of castration [3, 121]. Findings indicate that although some pedophilic offenders can learn to control their sexual arousal to children and that may motivate them to refrain from sexually offending, research shows the underlying sexual preferences or attractions of pedophiles will not change with treatment [9, 25]. Although some studies have reported varied levels of success, the literature demonstrates there is little empirical support for the overall effectiveness, reliability and success of current treatment options for sex offenders [122-127], as well as interventions or treatments aimed at pedophilic offenders specifically [9, 127].

Thus, researchers argue that investing in studies and research on better understanding the etiology of pedophilia, rather than ways to "cure" it, is critical in order to establish successful treatments and strategies that attempt to prevent recidivism and potentially rehabilitate pedophilic offenders [9]. Etiological research suggesting genetic contributions to pedophilia may be one such area that could be fundamental to the effectual rehabilitation of pedophilic offenders. Here I will explore two examples of potential rehabilitative and restorative treatments and practices for pedophilic offending that could be furthered by genetic research on the disorder.

First, etiological genetic research on pedophilia might help identify effective rehabilitative treatments for convicted pedophilic offenders to replace or augment existing treatment practices. Specifically, previously mentioned genetic research on pedophilia and serotonin and dopamine dysfunction [38, 48-52] may help focus further attention on pharmacological treatments of pedophilic offenders by SSRIs or other medications that act on 5-HT receptors as a way to inhibit and manage the sexual desires and behaviors associated with pedophilia [128]. In the future, post-conviction rehabilitation may be the most beneficial stage of the legal process where genetic research on particular conditions or behaviors could be used in order to develop more effectual and preventative policies and programs for diagnosed offenders, as well as effectively address issues associated with offending and their genetic condition [100]. Seto [53] argues rehabilitation and treatment of pedophilic offenders are much more likely to be effective if programs and treatments focus on self-regulation and impulse control skills to control pedophilic urges, thoughts, and actions, than on trying to change sexual preferences.

Some existing studies (see [129] for a review of these studies) suggest SSRIs have successfully controlled the urges and ruminations associated with several paraphilias, including pedophilia [50-52, 129], by reducing compulsive behaviors and helping to regulate impulse control of diagnosed individuals [3, 9, 26, 129]. SSRIs have also been reported to diminish sexual thoughts, urges and significantly

mitigate sex drive in pedophiles [128, 129]. This is a common side effect of SSRIs. Although it is usually perceived as an adverse effect for most patients, it may be advantageous for pedophiles [3, 129]. Additionally, genetic research has also suggested pedophilia may be related to obsessive-compulsive and impulse disorders, which are thought to be at least partially genetically influenced and are often treated with SSRIs [3, 26, 38, 130, 131]. SSRIs could be a valuable supplement to current treatment regimens for pedophilic tendencies because they address sexual thoughts and urges, as well as compulsions and impulse control [3, 9, 26, 129].

Although suggesting the use of SSRIs to treat behaviors associated with pedophilia is not a novel approach, there has been little research done in this area; it has only been studied and shown effective in case reports and open-label trials [3, 50-52]. The overall number of studies completed in this area is small and no randomized, placebo-controlled studies have been reported [129]. Additionally, researchers are still unclear how SSRIs work in relation to the treatment of pedophilia [128]. Thus, there is necessity for further research and increased studies on the effectiveness of SSRIs on regulating the impulse control and inhibiting the sexual ruminations and compulsions of pedophilic offenders [128]. If genetic research could assist in connecting or identifying the concrete relationship between the development of pedophilia and serotonin and dopamine abnormalities, it is reasonable to think there might be more opportunities, support, funding and resources for research and studies focused on the use of pharmacological treatments like SSRIs or other medications that act on 5-HT receptors as possible treatments for pedophilic offenders. Thus, etiological research on the possible genetic influences of pedophilia could be an integral factor in identifying effective treatments for the symptoms of pedophilic offenders in the future.

Second, genetic research concerning pedophilia could potentially help establish a successful restorative justice model or "problem-solving court" for pedophilic offenders, focusing on these individuals as both sex offenders and as offenders with a genetically influenced condition. Currently, restorative practices for sex offenders are very limited, as those who do support restorative justice strategies are not sure if its use should be extended to violent or serious crimes, such as sexual offending [132]. Many fear it may belittle the magnitude of sex crimes, particularly against children, and may fail to properly hold offenders accountable [119]. Yet a few restorative justice programs for sex offenders do exist in the United Kingdom, Canada and the U.S. One example is "Circles of Support and Accountability," a program that targets high risk sex offenders being released from prison and establishes a dialogue of treatment and support between the offender and the community in which the offender is being released [133-136]. Available research has suggested that these programs have been shown to many times reduce the recidivism of its high-risk sex offender participants [136].

Additionally, although sex offender problem-solving courts do not currently exist, paradigms have been previously proposed in literature [137, 138] and by at least one non-profit community criminal justice organization [139] as additions, rather than replacements or complete alternatives,

to current regulatory practices for sex offenders. For example, the community organization *Justice Action* [140] and Bazemore and Griffiths [137] have described similar models of sex offense problem-solving courts, as versions of existing community-courts, to be used post-conviction and as a supplement to existing punitive sentences. While protecting the privacy of both victims and offenders, victims and the community could be empowered by confronting offenders and conveying the effects of the abuse within a "victim support scheme." Offenders could, in turn, confront their past actions without the fear of being stigmatized or ostracized by their family or community [137, 139]. Offenders could also be provided with treatment options. Furthermore, the community and victims could be "empowered" and satisfied by this process by better understanding the mindset and reasons for the actions of these offenders [137]. This process would aid communities in eliminating the stereotypes and myths about the nature and complexities of sexual offending that can often make communities susceptible to this type of offending [137]. Salter [140] writes the only way for communities to successfully tackle issues surrounding sex offenders is to possess and utilize accurate facts about the nature of sexual offending. Communicating with offenders on why they have offended is one way to achieve that and create effective practices to prevent recidivism [137, 140].

La Fond and Winick [138] have also proposed sex offender reentry courts for sex offenders to be utilized as offenders are to be released from prison. The offender's involvement in the court would begin at sentencing, and the court would be able to manage and monitor the offender's compliance and progress with treatment in prison. When an offender is to be released, the court would involve the community, the offender's family, and other support networks to help the offender develop successful strategies and motivations to effectively deal with their issues and prevent recidivism. This system would continue to monitor their treatment after they returned to the community [138].

Although no current restorative justice programs exist for pedophilic or child sex offenders specifically, recently there have been discussions about creating these types of programs for cases involving child sexual abuse and offending [141]. There is increasing acknowledgement that existing retributive and punitive approaches alone are not adequate strategies to prevent sex offenses against children and can often impede the successful rehabilitation and reintegration of pedophilic and child sex offenders [141]. Although the incapacitation of pedophilic offenders allows for the safety of the public while they are imprisoned, it single-handedly does not prevent an offender from reoffending upon his release [142, 143]. Thus, there is real need to explore alternative forms of justice for pedophilic offending, such as restorative justice models, to augment existing ones [119]. Alternative approaches to handling, rehabilitating and reintegrating sex offenders may ultimately protect and address the concerns of the public more effectively than traditional practices [119].

As genetic research of pedophilia progresses, problem-solving courts tailored specifically to pedophilic offenders, as both sex offenders and as offenders with a specific genetic condition, represent one possible alternative approach that could be integrated into existing retributive models of han-

dling pedophilic offending. Lewis [96] has written about the potential creation of genetic "problem-solving courts," arguing that advances in genetic research could help establish specialized rehabilitative and restorative court programs fitted to handle, treat and manage offenders with specific genetic conditions. It is reasonable to imagine proposed models of sex offender courts [118, 138, 139], integrated with tailored practices to handle, treat, and manage the offender's specific genetic condition [100], as conceivable exemplars for problem-solving courts for pedophilic offending. Genetic research leading to more effective rehabilitative treatments for pedophilic offenders, such as the use of SSRIs, could be utilized to create more effective treatment regimens or strategies included in these described models in both prison and after the offenders are released into the community. These measures could help inhibit urges and regulate impulses to offend in the future.

Further, research suggesting genetic influences on the etiology or development of pedophilia may aid victims and communities to better comprehend the nature or behaviors associated with pedophilic offending, as well as motivations or reasons for individuals' actions, during the restorative justice process. Enhanced understanding of the underlying reasons and motivations for the offender's behavior, especially through the inclusion and discussion of research or information on the complex biological and genetic predispositions and associations of pedophilia [26-65], could in turn lead to a more satisfying experience for victims and communities [137]. For offenders, learning about the nature, behaviors and other facets associated with their disorder and corresponding behaviors through these types of research, as well as communication with victims and communities, may help individuals better recognize and confront their issues, the consequences of their actions, and ways to control their offending.

It would be also be valuable for communities to be exposed to this genetic research to rid common misconceptions about pedophilia and to alleviate some of the stigmatization surrounding disorder [137, 140]. As current practices are not effective on their own, utilizing this research to clarify the underlying nature of pedophilic offending, and what potential treatments or strategies might be best to prevent it, could possibly make communities less vulnerable to these offenders in the future [137] and lead to the development and integration of other practices or strategies tailored specifically to help these offenders reintegrate, rehabilitate and not recidivate based on this knowledge.

CONCLUSION

In conclusion, intensified concerns and awareness of the general public and media in recent years surrounding pedophilia and the prevention of sex crimes against children have fueled a growth of scientific studies and research seeking to better understand the causes, development, and characteristics of the disorder from a biological and genetic perspective. The progression of research suggesting genetic or heritable influences on pedophilia has corresponded to increasing academic dialogue on the potential ways in which genetic research on mental disorders, specific behaviors, and antisocial conduct could affect traditional views and practices

regarding the management, adjudication, and punishment of criminal behavior within the criminal justice and legal systems. This paper seeks to add to this existing dialogue, specifically serving to discuss various possible future implications of research surrounding genetic or heritable contributions to pedophilia for the objectives of criminal law, in addition to current practices and strategies, concerning pedophilic sex offenders. Many of these potential implications supplement previous discussions in literature on genetics and criminal law, as well as on current sex offender policies and practices.

It is of course important to remember that current genetic research on pedophilia is still in its early stages, and the extent to which genetic or heritable contributions impact the development and presence of the disorder is still unknown. In terms of breadth, there is still very little genetic research on pedophilia. Even so, the amount of genetic and biological research on the etiology of pedophilia continues to grow, fueled by continuous societal interest and concern on fully understanding, addressing, and preventing pedophilic offending in order to better protect our children from “modern day monsters.” Thus, although preliminary, it is important that an active discussion exists concerning the ways in which genetic research may be influential, relevant or useful to society’s and the justice system’s approaches on managing, treating, and punishing pedophilic offenders early in the research process. The considerations put forth in this paper, which are by no means exhaustive, should act as that abstract foundation for a larger discourse on these issues, including how this research may benefit or affect society away from the courtroom. For example, this research could be significant in identifying and implementing strategies to preemptively predict, prevent or reduce pedophilic urges or behaviors before they are expressed criminally. It is my opinion that it would be valuable for researchers, academics, and those individuals involved in the criminal justice system to survey other potential ways in which genetic research on this disorder may affect sex offender policy, practices and adjudication, as well as criminal law and conceptions of crime prevention, prediction, and punishment on a broader scale.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflicts of interest.

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