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Published in:
Transnational Criminology Manual, Volume 2 (Crime)

Publication date:
2010

[Link to publication in Tilburg University Research Portal](#)

Citation for published version (APA):
Brouwers, R. C., Appelo, M., & Oei, T. I. (2010). Mental illness and crime: Impulsive violent behaviour: Factors and forms. In M. Herzog-Evans (Ed.), *Transnational Criminology Manual, Volume 2 (Crime)* (pp. 489-505). Wolf Legal Publishers (WLP).

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2.1. Mental illness and Crime

Impulsive violent behaviour: factors and forms

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Abstract

Impulsive violent behaviour (IVB) is a frequently occurring phenomenon in our society and is also a characteristic of a range of psychiatric diagnoses. What neurobiological, cognitive-affective and social psychological factors are related to IVB? A literature survey of the last fifty years was conducted on the neurobiological, cognitive-affective and social psychological aspects of IVB. Following popular search programs key search terms were violence, aggression and impulsiveness. These words were combined with terms pertaining to the areas of arousal, cognition and hostility.

Neurobiological risk factors are an increased cortisol production in aversive stimulation or provocation and reduced serotonin activity (both possibly related to alcohol or cocaine use). In addition, personal characteristics such as a strongly positive, though unstable self-image, impulsivity, problematic self-control, and difficulty with verbal expression, a low self-disclosure and hostility seem to increase the risk. Being in a violent group and having a weapon at hand are apparently social psychological factors that increase the chance of IVB. All factors were familiar but only found to be associated with the subject, none proved to be discriminative and no research integrated them all. There are indications that IVB, as a reaction to a provocation, can be regarded as a separate psychopathological syndrome and should be subdivided in two basic forms. One based on reward-delay impulsivity and second based on rapid-response impulsivity, both different for accountability. Further research should integrate all factors and focus on the differentiation of impulsive violent subtypes and how the associated biological, cognitive and psychosocial factors relate to it.

Résumé

Le comportement violent impulsif (IVB) est un phenomena d'occurrence fréquente dans notre société qui renvoie à une variété de diagnostics psychiatriques. Quels sont les facteurs d'ordre neurobiologiques, cognitifs-affectifs, sociaux et psychologiques qui peuvent être reliés à l'IVB ? Une revue de la recherche de ces cinquante dernières années a été menée relativement aux dimensions neurobiologiques, cognitives-affectives, sociales et

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psychologiques de l'IVB. Nous nous sommes appuyés sur des mots clefs comme violence, agression et impulsivité, que nous avons entrés dans les programmes de recherche les plus connus. Ces mots clefs ont été combinés avec d'autres, relatifs à des domaines comme l'excitation sexuelle, la cognition et l'hostilité.

Des facteurs de risque neurobiologiques tiennent à une production augmentée de cortisol dans des situations de stimulations négatives ou de provocation, ainsi qu'à une activité réduite de la sérotonine (les deux pouvant être corrélés à une consommation d'alcool ou de cocaïne). De plus, des caractéristiques personnelles comme une image de soi fortement positive, mais instable, de l'impulsivité, un self-control insuffisant et des difficultés d'expression verbale, une faible capacité à se dévoiler et de l'hostilité, semblent accroître encore le risque. Appartenir à un groupe violent et avoir une arme à sa portée sont apparemment des facteurs psycho-sociaux qui accroissent encore le risque d'IVB. Ces facteurs sont certes tous familiers, mais ont seulement été liés au sujet ; aucun n'a été démontré comme étant déterminant à lui seul, de même qu'aucune recherche ne les a tous intégrés. Il existe des raisons de penser que l'IVB, en tant que réaction à une provocation, peut être considéré comme un syndrome psychopathologique spécifique et qu'il pourrait de plus se subdiviser en deux principaux sous-groupes. Le premier renvoie à une impulsivité liée à un retard à l'obtention de la récompense, tandis que le second renvoie à une réponse rapide impulsive. De nouvelles recherches devraient intégrer tous les facteurs et se focaliser sur la différenciation de sous-types de violents impulsifs ainsi que sur les facteurs associés de type biologique, cognitif et psychologique.

2.1.1. Introduction

Most of us know that violence can be used to achieve a certain goal. Usually it concerns moderate and restrained violent behaviour as in giving the door an extra push when it's jammed. Generally we know when to stop before reaching the point of overstepping the critical line. Deliberations are made whether it pays to exert the amount of violence and assessing whether the violent act is suited to the situation and remains within the boundaries of the law. Apart from limited and restrained violence there are also many instances of impulsive, instinctive and exaggerated violence that are often the focus of media attention.

The situation, in which this violence takes place, occurs instantly. Persons use the words as "I blew my top" and "I wasn't myself". In imitation of Jaspers this behaviour is referred to as "impulsive" because the person acts without having made a decision about it beforehand. Impulsive violent behaviour occurs in both healthy and sick people in a range of diagnoses. The violence is often limited to minor incidents but in cases of more severe violence the sentence may involve detention in a custody centre. How can a person get into a state of impulsive violent behaviour (IVB)? Can it happen to anyone or are there certain conditions?

Although we are familiar with factors associated with impulsive violence, we want to know all the factors that are associated with this topic. This study focuses on identifying the neurological, cognitive-emotional and social psychological factors in the literature related to IVB and examining whether these factors are discrimination and have a predictive value. It is estimated that sixty to ninety percent of violent crimes are impulsive in nature (Stanford, et al., 2002, Kockler, et al., 2006) although there is considerable correlation between instrumental and impulsive violence. Impulsivity and violence are factors in diagnoses like borderline personality disorder, psychopathy or antisocial personality disorder but not essential. Does this situation always involve a violent act or do people get into such a state like this without demonstrating violent behaviour? Are we dealing with an affliction, a separate psychopathological entity, as suggested by Plutchick and Van Praag (1998).

A key understanding is that the violent act is excessive, disproportionate to the extent of provocation, if provocation takes place at all. Sudden alterations in the situation can promote unexpected results Sashin (1986) and it is hypothesized that a changed state of mind is a result of a sudden elevation in arousal (Brown, et al., 2006, Meyer-Lindenberg, et al., 2006, Pressman, 2007). IVB with no provocation or aversive stimulation occurs from the context are patients who experiences attacks of uncontrolled impulsive aggression without prior threat from other persons. This type of IVB is related to electro physiological disorders to the temporal cortex and subcortical structures including the hypothalamus, thalamus, hippocampus and amygdale (Devinsky & Bear, 1984, Tonkonogy, 1991), and involves a neurological affliction with discriminating deviations in the electro-encephalogram.

This article describes the results of our literature survey of the last fifty years on the issues raised above. As suggested by Raine and Scerbo (1991) it was decided to combine the various factors. Our literature survey on IVB was conducted from neurobiological, cognitive (meaning thoughts and emotion) and social-psychological perspective and the results are summarized in the following sections.

The literature survey on neurobiological, cognitive and social psychological aspects of IVB was conducted in Pub med, medline, Psycinfo, Online Contents, Winspirls and the Cochrane database. Key search terms were applied such as "violence", "aggression" and "impulsiveness". These were subsequently combined with terms pertaining to three sub-areas. No further restrictions were made to the search tasks, starting from 1945 to 2005. The first search term was "review". For the neurobiological section additional terms were used as "hostility" and "arousal". A total number of 117 articles were eventually found that had to do with the subject. The search terms violence, cognition and review were selected as search terms for the cognitive section. However, no articles were found. The term review was eliminated and the terms aggression and impulsiveness were added as well as self-esteem, personality, self-evaluation, cognitive dissonance and attribution. This led to a selection of 20 articles. The search terms impulsive violence and group, culture, family, school, mass media, environmental factors and senseless violence were added to the social-psychological section. No data limit was imposed due to insufficient response, which resulted in a selection of 12 articles.

2.1.2. Neurobiological aspects

There is an overwhelming amount of literature on the neurobiological aspects of (impulsive) aggression. It is therefore we present the broad and consequently less detailed outlines.

The amygdale attaches meaning to new sensory information. Violence involves aversive-danger (LeDoux , 1996). This primary meaning is subsequently enhanced from the nucleus accumbens by dopamine and converted to a primary impulse, attack in this case (Erp van, et al., 2000, Ferrari, et al., 2003). The primary impulse is transmitted to the upper brain areas. This is where the tendency to attack is cognitively weighed ("is that the sensible thing to do", or "the goal justifies all means") and evaluated from the memory ("what happened last time, what was the outcome for others who reacted in the same way before"). In doing so, a secondary meaning is attached by placing the plan of attack in the context of the situation.

The result is a secondary impulse, which is a compromise between the primary impulse and the secondary meaning attached to it. The neurotransmitter serotonin plays an important in this process in which the primary impulse is basically delayed. Various parts of the brain are involved in this process (Rolls, et al., 1994, Jürgens, 2002) the orbital frontal cortex (respect for other person), the anterior cingulated (love for other person), the medial prefrontal cortex (extinction) and the right parietal lobe (verbal abuse)

In other words; the primary impulse can weaken due to the secondary meaning for instance when the perpetrator feels love and respect for the potential victim. Extinction can also occur or verbal aggression can replace physical aggression. As a consequence the violent act will not take place or if it does, in a more controlled manner.

Broadly speaking there are three different causes of inappropriate, excessive or impulsive violence. Firstly, in stressed persons the initial stimulus is attended with a high cortisol production (Goldstein, 1995). Traumatic events in childhood may be the underlying cause of this. The excessive cortisol production weakens the functioning of the upper brain areas, resulting in less or no matching between the primary impulse and the context.

The secondary meaning can also be weakened as a result of a serotonin deficit. Thirdly, the primary impulse can be excessively strong when the primary meaning from the lower part of the brain is controlled by too much dopamine. In the literature on neurotransmitters and violence it is generally accepted that increased levels of dopamine as well as decreased serotonin production are important factors (Kavoussi, et al., 1997, Coccaro, 1998, Davidson, et al., 2000, Ryan, 2000, Miczek, et al., 2002). As to the diminished serotonin production correlations with a traumatic history and borderline personality were frequently found, of which impulsivity is a characteristic symptom (Soloff, et al., 2000). In addition, there is also a relationship between a decreased serotonin production and cocaine intake (Koob, et al., 1987, Heidbreder, et al., 1999). In turn, the use of these substances concurs with an increased risk of exerting violence (Giancola, 2000, Volovka, 2002).

Evidence confirms that selective serotonin reuptake inhibitors commonly cause or exacerbate a stimulant profile ranging akathisia, mild agitation, manic psychosis, agitated depression and obsessive preoccupations that are alien or uncharacteristic of the individual (Breggin, 2003). The factors that were found are summarized in Table 1.

Table 1: Summary literature survey IVB

Neurobiological factors	Weakened secondary meaning as a result of: - high cortisol level following aversion or provocation - reduced serotonin activity - facilitating factor: traumatic history
	Enhanced primary impulse as a result of: - increased dopamine activity - facilitating factor: alcohol and drug intake
Cognitive factors	- High positive unstable self-image - Impulsivity - Problematic self-control - Limited ability of verbal expression - Low self-disclosure

	-Hostility -Anger
Social psychological factors	-Violent group - Presence of weapon

First, it is hypothesized that a combination of these factors can trigger IVB. Due to the high level of dopamine the primary impulse becomes very strong. In addition no or limited secondary meaning occurs on account of the presence of the high level of cortisol and/or little serotonin. A second hypothesis is that these errors will result in a risk profile, and not necessarily in IVB, which partly depends on the cognitive and psychosocial factors that may increase or reduce the risk of IVB.

2.1.3. *Cognitive aspects*

Cognition, in the sense of “considering” and secondary meaning are more or less synonymous. The violence inhibiting function of cognition is the key issue in the general theories on cognition and aggression. Geen (1990) and Berkowitz (1974) emphasize that a physiological condition that easily leads to violent behaviour (for instance highly elevated arousal or a primary violent impulse) can be converted to alternative, non violent behaviour through mediation by cognitive factors.

We hypothesize that IVB involves a strongly reduced or absent secondary meaning. Consequently, it would be impossible for a person to make a conscious decision on demonstrating IVB. It is therefore not surprising that hardly any literature has been found on the relation between cognition and IVB. Indeed, the articles that were found on this subject are more concerned with personality traits rather than states. Baumeister, Smart and Boden (1996) presented an overview of the literature on aggression and self-image. It emerged that there was a strong relation between IVB and a high positive, unstable self-image. It concerns people who think highly of themselves but who find it very difficult to cope with criticism. In a psychodynamic sense we see a striking resemblance to narcissistic personality (disorder). Criticism or threat is perceived as a confirmation of “underlying” insecurity and as an attack against the highly valued self-image. For this reason the person may react with an act of blind rage. Two other IVB-related personality characteristics are the experience of control problems and impulsivity. People who describe themselves as having less ability to control themselves demonstrate impulsive violence more frequently than persons do without any complaints on control issues (Capara, et al., 1985, Barrat, et al., 1999). The same goes for persons who characterize themselves as highly impulsive (Barrat & Slaughter, 1998). The remarkable thing about this is that the relationship between impulsivity and physical aggression is stronger than that between impulsivity and verbal aggression.

Persons who find it difficult to express their emotions verbally, react relatively more often with IVB when facing stressful conditions (Harmon-Jones, et al., 1997, Shoham, et al., 1989, Moeller, et al., 2001). In addition, it also appears that nonaggressive youths find it more helpful to talk about their problems than aggressive youths do (Yuzawa & Yuzawa, 2001). Finally, a low self-disclosure proves to be related to the limited ability to express one self verbally and impulsive violence. Anger is correlated with aggression and impulsivity (Buss & Perry, 1992, Barratt et al., 1999).

Basquil, et al. (2004) investigated a group of men with low intelligence (70 on the WAIS) with and without violent behaviour. His findings were that both groups were equal in perceiving hostility in situations where hostility was indeed present but that aggressive men were found to make more mistakes in identifying hostile intentions where no hostility was present. The same group was also less capable of finding solutions in hostile situations apart from violence. Troisi, et al. (2003) investigated men in a psychiatric ward and found that hostility was associated with verbal aggression whereas other cognitive disorders had more to do with physical violence.

Hostility is the psychological term for an attitude to life characterized by cynicism, suspicion and always expecting the worst from others (Barefoot, 1992). According to Zillmann (1979) hostility also means the willingness to harm other people. People with a high degree of hostility experience more stress in interpersonal contacts and tend to create more stressors for themselves (Smith, 1994). This can largely be explained by the hostile interpretation of the behaviour and intentions of other persons, which in turn evokes a hostile reaction, so that the so-called "hostility loop" is reinforced again. In addition, the concept of "hostility" distinguishes between "covert hostility", whereby a person's behaviour is considered irritating and disturbing and "overt hostility", meaning that a person shows physically violent behaviour (Bendig, 1962). Another term for IVB is "hostile aggression" (Ramirez & Andreu, 2006). This is confusing since it concerns the concept of IVB relative to instrumental violent behaviour and not the factor hostility. In normal people "hostile aggression" is positively correlated with impulsivity (non-planning impulsiveness) but not with instrumental violent behaviour.

Consequently, a relationship has now been found between IVB and a high positive unstable self-image, impulsivity, poor verbal expression, a low self-disclosure and hostility. It should be noted that non of these concern causal relationships. The cognitive factors found do not necessarily involve IVB since there are also persons with IVB without deviating scores on the factors above.

2.1.4. *Social psychological aspects*

The literature on social psychological factors relative to violence is abundant. Relationships with IVB were found for groups, environmental factors and senseless violence. When people find themselves in a group functioning in a highly unstructured manner - as in a crowd trying to escape- there is, theoretically, an increased risk of IVB (Reicher, 1984). Higher cognitive

functions, as self-evaluation are supposed to operate less adequately in these circumstances. When a person is in an IVB sensitive situation, that person will demonstrate this violent behaviour more quickly if there is a weapon at hand (Berkowitz & LePage, 1967). This applies more to men rather than women.

There are often no reasons for senseless violence and the reasons mentioned are disproportionate to the extent of violence exerted. It often concerns a physical confrontation without involving weapons, perpetrators are most likely men between the age of 18 and 24 and the violence is more severe when it concerns violent group behaviour. The violent usually occurs during daytime on the public road.

The individuation theory (Zimbardo, 1996) has been moderately supported by empirical evidence. Postmes and Spears (1998) performed a meta-analysis of sixty different studies in which the implications were studied of the individuation theory. It was concluded that there is little support for the occurrence of deindividualised behaviour (opposed to accepted norms) or the existence of a deindividualised state. It is more likely that group behaviour is more influenced by group norms that may emerge spontaneously in certain situations (Turner & Killian, 1972). Moreover, many groups that demonstrate excessive violent behaviour are often well structured. Hooligans, for instance, are generally well organized and coherent and the group structure changes relatively little over time (Sullivan, 2001).

2.1.5. Integration and discussion

The factors in the literature were studied that occur in impulsive violent behaviour were grouped under neurobiological, cognitive and social psychological risk factors. Neurobiological risk factors are an increased cortisol production in aversive stimulation or provocation and reduced serotonin activity (both possibly related to alcohol or cocaine use). In addition, personal characteristics such as a strongly positive, though unstable self-image, impulsivity, problematic self-control, and difficulty with verbal expression, a low self-disclosure and hostility seem to increase the risk. Being in a violent group and having a weapon at hand are apparently social psychological factors that increase the chance of IVB.

The striking thing is that none of the factors found proves to have a discriminative value. Even impulsivity is not significant enough to predict impulsive violent behaviour. It is not known if the factors mentioned here are decisive for the occurrence of IVB. Further research is needed to establish this. To what extent are these factors present or necessary in persons who were proven to have demonstrated impulsive violent behaviour? It can indeed not be ruled out that protective factors may prevent the actual manifestation of IVB, despite the risk factors, as can also be seen in 'normal' 'violent crimes'. The absence of a risk factor is not necessarily the same as the presence of a protective factor. Can we learn more about how and why a person can immediately resort to violence, rather than the violent act itself. To what extent are normally cognitive functions are blocked in that process from provocation to violence? Future research should include all these factors.

Apart from these factors this survey provided other facts. Impulsive violent behaviour (affective defence) is distinguished from instrumental violent behaviour (predatory attack) (Weinschenker & Siegel, 2002). The literature shows that there are different views on impulsivity (Swann, et al., 2002, Evenden, 1999). On the one hand, it is consistently argued that impulsivity can be related to the inability to delay a certain response (reward-delay impulsivity). On the other hand, according to the antecedent viewpoint the key issue is that the context is not involved in determining the response. For a better understanding differentiation of impulsive violence is welcome and can be split up in two separate forms. The first type (based on reward-delay) is related to personality traits and functions as a diagnostic criterion for periodical explosive disorder (inability to resist aggressive impulses). Consequently, a second type can be considered a separate psychopathological entity on the basis of rapid response impulsivity, Table 2.

Table 2: Time impulsive violent behavior (type-T) and Context impulsive violent behaviour (type-C).

	Type-T	Type-C
	To much and to quick violence in comparison with provocation	To much and to quick violence in comparison with provocation, more violent
Evenden, 1999	Reward-delay impulsivity	Rapid-response impulsivity
Swann, et al., 2002		Lifetime axis-I
Best, Williams and Coccaro, 2002	Intermittent Explosive Disorder?	
Nelson, Reuter-Lorenz, Sylvester, Jonides and Smith, 2003	Response processing Anterior cingulated cortex	Preceding level of processing Inferior frontal gyros
Dougherty, Mathias, Marsh and Jagar, 2005	Monetary reward paradigm TC, SKIP	Response inhibition paradigm IMT/DMT, Go Stop
Van den Bergh, 2006 Serotonin 5HT _{1A/1B} agonist	Improves	Deteriorates
Brown et al., 2006		Arousability
Brouwers, 2007	Periodic Stays in touch with situation	Incidental Loosing contact with context of the situation

IVB type-C can be distinguished form periodical explosive disorder (PED) wherein type-C the perpetrator makes no inner deliberations (it concerns rapid response impulsivity). In PED the person is incapable of delaying (reward-delay

impulsivity). What the two have in common is the extent of excessive violence; the extent of violence is disproportionate to the nature and intensity of the provocation.

If this is true, to what extent do these types differ in pathophysiology? For instance, IVB is also attended by an increase in arousal, which can be seen as a biological factor. Excessive release of dopamine leads to an over activated amygdala, which in turn, produces extreme alertness that is no longer tuned to the actual situation. The executive functions for secondary meaning can also be weakened due to excessive cortisol and serotonin activity. Especially people that are susceptible to stress with traumatic childhood experiences are particularly vulnerable in this area.

Arousal is the extent of alertness and level of awareness, which can be measured in a number ways, e.g. by skin conduction and electroencephalogram. Arousal can be subdivided into energetic and tension arousal (Schimmack & Reizenzein, 2002, Thayer, Newman & McClain, 1994). Energetic arousal has to do with sleep, being awake, fatigue and feeling rested. It varies over a period of 24 hours on account of the sleep-waking cycle, physical activity and nutrition. A person will experience more energetic arousal during daytime than late at night and physical exertion can trigger an increase in energetic arousal. Low levels of energetic arousal go together with fatigue and high levels with movement and activity.

IVB involves a state of high tense arousal. This arousal will incite a person to jump into action, in relation to real or alleged danger. The detection of danger produces an increase in tense arousal, preparing the person to deal with the threat ("fight or flight"). The person experiences stress, tension, anxiety and fear. In contrast, low levels of tense arousal will make a person feel calm and quiet.

Energetic and tense arousals are mutually related and influence each other reciprocally.

An increased tense arousal (stress) reduces the level of energetic arousal and vice versa. A low level of energetic arousal can generate increased vulnerability to tension and this tension will in turn decrease as a result of increased energetic arousal, such as physical exertion. In the middle of a violent act a person may reconsider his actions due to physical exertion and think about what he is actually doing. Changes in the energetic arousal levels during the day go together with a variation in vulnerability, which may explain why people find it harder to cope with tension in the evening than during daytime. Do these different levels of energetic and tense arousal have a different effect on the proposed two forms of impulsive violent behaviour?

Another finding is the fact that reward delay and rapid response impulsivity are independent paradigms but research by rats has shown that after they received a serotonin agonist, reward delay impulsivity improved but rapid response impulsivity deteriorated (Van den Bergh, 2006). Is impulsive violence based on rapid-response impulsivity linked to impulsive violence based on reward-delay impulsivity? In other words, is a longer delay dependent of declining information processing? If this is the case in humans, than it could be

that type-T impulsive violence is improving as a result of the intervention with a serotonin agonist but type-C impulsive violence is deteriorating. Is a better tolerance, a longer delay to use violence achieved at the cost of a worsening of information processing and a greater chance of rapid response based impulsive violence (type-C)? Is this the case in serotonin reuptake inhibitor related violence?

Rapid response and reward delay impulsivity can be measured in a laboratory setting with the immediate and delayed memory task, the go-stop impulsivity paradigm, the single key impulsivity paradigm and the two choice impulsivity paradigm (Dougherty, Mathias, Marsh & Jagar, 2005). With these tests further research is possible to see if a person with IVB is more vulnerable for one or the other type of impulsivity.

2.1.6. Conclusion

In sum, bold conclusions for future research and interventions are: 1. sixty to ninety percent of violent crimes are impulsive in nature, 2. none of the factors found proves to have a discriminative value, 3. future research should include all the factors found, 4. the factor arousal has two forms, energetic and tension, 5. the factor impulsivity has two forms, reward delay and rapid response, 6. violence is divided in instrumental and impulsive forms, and the impulsive form can be split up in separate types of impulsive violent behaviour, based on reward delay and rapid response impulsivity.

Research is needed to investigate to what extent the factors concerned are present in persons who have been shown to demonstrate impulsive violent behaviour. As it seems that we are dealing with risk profiles it is also necessary to investigate the extent of all these factors in persons who have not been violent or less violent but who have indeed felt a sudden occurring impulse to act violently. This will contribute to establishing a risk assessment.

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