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Neurobiological Factors as Predictors of Prisoners' Response to a Cognitive Skills Training

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ABSTRACT

Purpose: The current study investigates the predictive value of neurobiological factors in relation to detainees' treatment outcome, in order to better understand why some individuals respond favorably to treatment while others do not. It was hypothesized that low levels of heart rate activity are associated with poor treatment outcome and that weak neurocognitive functioning is predictive of more benefit from therapy.
Methods: Background characteristics, behavioral measures, neurocognitive functioning and heart rate activity of 121 male detainees selected for cognitive skills training were assessed. Outcome measures included program completion, evaluations by trainers and ward staff, and detainees' self-reported motivation and treatment evaluation.
Results: Concentration performance, a neurocognitive skill, significantly predicted treatment dropout over and above background and behavioral measures, including self-reported motivation. In addition, high selfreported 'meanness', a psychopathic feature, was associated with low treatment motivation and an expectation bias seemed to be present among highly motivated detainees. These results did not confirm the hypotheses.
Conclusions: Offenders who are characterized by a decreased concentration performance, low motivation and increased meanness, are less likely to benefit from treatment. The results have the potential to improve the current treatment assessment procedures in order to reduce dropout rates and, eventually, recidivism rates.

Introduction

Throughout the world, more than ten million people are confined in penal institutions (Walmsley, 2013). Incarcerating people with criminal behavior is the most widely used strategy to protect society against crime, but the recidivism rate after confinement is high. For this reason, several rehabilitation models have been introduced to develop effective interventions aimed to reduce antisocial behavior and, eventually, to reduce recidivism rate. Of these models, the Risk-Need-Responsivity (RNR) model is currently most prominent for treating offenders (e.g. Andrews, Bonta, & Wormith, 2011; Ward, Melser, & Yates, 2007).

The RNR model was developed in the 1980s and is primarily based on personality and socio-psychological perspectives on human behavior (Andrews & Bonta, 2010). According to this model, the assessment and treatment of offenders should be based on three principles. The *risk* principle proposes that the level of treatment intensity should correspond to the offender's risk level; the *need* principle determines which specific criminogenic needs should be targeted in treatment; and the *responsivity* principle suggests that cognitive/behavioral interventions work best for offenders and prescribes that the intervention should be tailored to the offender's learning style, motivation, abilities and strengths.

There is strong meta-analytic evidence suggesting that current behavioral, cognitive-behavioral and multimodal intervention strategies are successful in influencing factors that are known to predict recidivism (e.g. Andrews & Bonta, 2010; Genoves, Morales, & Sanchez-Meca, 2006; Lipsey & Cullen, 2007; Pearson, Lipton, Cleland, & Yee, 2002). For instance, cognitive-behavioral therapy (CBT) aims to ameliorate dysfunctional (i.e. antisocial) thinking processes by improving specific cognitive skills such as empathy, moral reasoning, planning and problem solving (McDougall, Perry, Clarbour, Bowles, & Worthy, 2009; Sadlier, 2010; Vaske, Galyean, & Cullen, 2011). Examples of well-known CBT programs are Reasoning and Rehabilitation (Ross & Hilborn, 2008), Aggression Replacement Training (Goldstein, Glick, & Gibb, 1998) and Enhanced Thinking Skills therapy (Clark, 2000).

Nevertheless, response rates of these intervention programs vary widely between different effect studies. For example, the effectiveness

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of CBT varies between less than 10% up to almost a 50% reduction of criminal recidivism (Lipsey & Cullen, 2007; Lipsey, Landenberger, & Wilson, 2007; McDougall et al., 2009). Additionally, the rates of treatment non-completion range from 20% to 40% (Hollin et al., 2008; Olver, Stockdale, & Wormith, 2011; Polaschek, 2010). These high percentages are concerning, especially since 'non-completers' are six to eight times more likely to reoffend compared to treatment 'completers' (e.g. Dowden & Serin, 2001; Hollin et al., 2008; Seager, Jellicoe, & Dhaliwal, 2004). This implies that non-completers may represent the harder-to-treat cases that are especially in need of treatment (Wormith & Olver, 2002).

According to the RNR model, several factors are assumed to affect treatment outcome: gender, ethnicity, age, clinical status, verbal intelligence, motivation and personality (Andrews & Dowden, 2007). In addition, factors such as treatment integrity, program setting, and different offender's characteristics, such as a prior offense history and drug abuse, have been suggested as explanations for the wide variability in treatment outcome (Lipsey et al., 2007; Serin & Kennedy, 1997; Sterling-Turner, Watson, & Moore, 2002). Nevertheless, it remains unclear which mechanisms exactly underlie a wide treatment response variety and which factors can 'predict' whether the offender is likely to adhere to and complete therapy. According to Lipsey and Cullen (2007), "(…) there are many questions about the sources of variability in the effects of rehabilitation treatments that have not been adequately addressed by the research available to date" (p. 313). This indicates the need to better understand why some individuals respond well to correctional treatment and others do not, for both the eventual improvement of treatment selection and success, and the reduction of recidivism rates.

In recent years, more attention has been paid to a neurobiological view on antisocial behavior, which has become a valuable additional perspective for its understanding (Glenn & Raine, 2014). The increasing neurocriminological knowledge has led to the suggestion that specific impairments in neurobiological systems, such as poor frontal brain functioning, may disrupt the types of cognitive or emotional processing that usually play a prominent role in therapeutic interventions (Fishbein et al., 2006; Van Goozen & Fairchild, 2008). In addition, Vaske et al. (2011) argue that CBT is effective in reducing antisocial behavior because it targets specific cognitive deficits and corresponding brain areas associated with these cognitive deficits. Therefore, information about underlying neurobiological mechanisms related to effective CBT is what eventually may improve our understanding of why some offenders benefit from CBT while others do not.

To illustrate, cognitive and emotional empathy are central concepts to CBT and to criminology in general (Jolliffe & Farrington, 2004; Van Langen, Wissink, Van Vugt, Van der Stouwe, & Stams, 2014). In addition, neuropsychological studies have shown that both types of empathy are associated with activation in specific brain regions, such as the medial prefrontal cortex, temporo-parietal junction and cingulate cortex[1] (Vaske et al., 2011). It is likely that effective CBT does not only change behavioral aspects of empathy, but also changes frontal brain functioning associated with cognitive and emotional empathy. In addition, not only might CBT change brain functioning, but it is also very likely that a reciprocal relationship exists between the outcome of CBT on behavior and brain functioning (CBT ← → brain functioning) (Vaske et al., 2011). In other words, individual differences in brain functioning may moderate the effectiveness of CBT. This raises the question whether brain functioning, and perhaps other neurobiological factors, may present a responsivity concern to correctional therapy.

In a recent literature review, we have studied what is known about the association between neurobiological factors and different types of behavioral treatment for individuals with antisocial behavior (Cornet, De Kogel, Nijman, Raine & Van der Laan, 2014). Although only ten relevant studies were found, it appears that specific neurobiological factors actually can predict treatment outcome. Especially low levels of physiological arousal, such as a low resting heart rate and low cortisol levels, were predictive of poor treatment outcome. None of the included studies provided a full explanation for this relationship. Yet, one possible reason is that individuals with antisocial behavior and low arousal levels are often characterized by callous, unemotional or psychopathic traits (Cima, Smeets, & Jelicic, 2008). It is known that individuals with high levels of psychopathic traits display several impaired learning processes, such as social learning and error learning, which probably impairs their ability to benefit from behavioral treatment (Blair, Mitchell, & Blair, 2005; Von Borries et al., 2010).

Results from this literature review show that a neurobiological perspective on the treatment outcome of individuals with antisocial behavior may provide additional exploratory value to the current psychological and sociological perspectives central to the RNR model. However, several limitations exist with regard to the studies included in the review. For example, the majority of the studies included a sample of children, while the included studies also differed substantially with regard to antisocial behavior problems, the content of the treatment programs, and treatment outcome measures. Given the newness of this line of research and the limited number of studies, more research is needed.

Therefore, the aim of the present study is to further explore the predictive value of specific neurobiological factors in relation to a cognitive skills training in a sample of convicted adult offenders. Based on the literature review, it was hypothesized that: 1) low levels of heart rate activity are associated with poor treatment outcome and 2) weak neurocognitive functioning, as measured with a variety of neuropsychological tasks, is associated with more benefit from treatment, since there is greater potential for improvement.

Method

Participants

The current sample consisted of 121 male detainees with a mean age of 28.79 ($SD = 8.57$), who had been selected by the Probation Service to take part in a cognitive skills training aimed at reducing cognitive deficits (see the Cognitive Skills Training Section). Participants were recruited in several prisons in the Netherlands between 2011 and 2013. The only reason for exclusion from participation in the study was an unstable psychological or physical condition at the time of measurement. The study was approved by the Medical Ethics Committee of the VU University Medical Center Amsterdam (NL36062.029.11), while informed consent to participate in this study was sought from the detainees.

The mean intelligence level of the sample was 81.24 ($SD = 9.71$).[2] Almost 60% was born in the Netherlands, 11.6% in the Netherlands Antilles, 10% in Surinam, 6% in Morocco, 2.5% in Turkey and 10.7% in other Western or non-Western countries. Compared to the total Dutch prison population (CBS, 2014), there were slightly more Dutch (7%), Antillean (5%) and Surinamese (4%) participants in the current study. The majority (78%) had been convicted for a violent offense and 22% for a non-violent offense (e.g. drug trafficking).

Cognitive skills training

Participants in this study took part in a cognitive skills training called 'CoVa' (Cognitieve Vaardigheden, i.e. cognitive skills) training, which is an adapted and translated version of the English 'Enhanced Thinking Skills' (ETS) program (Clark, 2000). This type of cognitive behavioral treatment is provided by the Probation Service and consists of twenty sessions, made up of two two-hour sessions per week. The training takes place in prison (Van Poppel, Tackoen, Verhaeghe, & Bogaerts, 2004). Different cognitive skills are central to the treatment; inhibition, problem solving, critical and moral reasoning/thinking, and perspective taking. In research conducted in the UK, it has been shown that the ETS program can actually reduce impulsive behavior and reconviction rates among offenders (McDougall et al., 2009; Sadlier, 2010). For detainees,