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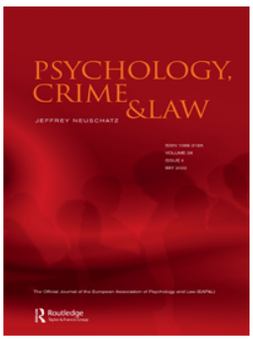

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Emotional, cognitive and behavioral self-regulation in forensic psychiatric patients: changes over time and associations with childhood trauma, identity and personality pathology

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ABSTRACT

The construct of self-regulation is of particular interest to the forensic psychiatric practice due to its associations with both clinical and criminal outcomes, as well as recidivism. However, research on different components of self-regulation within forensic psychiatric practice is rare. The current study aimed to gain knowledge on the construct of self-regulation in a sample of forensic psychiatric patients ($N = 94$). Firstly, by investigating change of emotional, behavioral and cognitive self-regulation over the course of 12 months in state-mandated care in a treatment facility. Secondly, by looking at the associations between these three elements of self-regulation and childhood trauma, identity dysfunction and personality pathology. Repeated measures ANOVA showed little to no difference in average self-regulation over time (only for behavioral regulation), and rank-order stability was relatively high in most cases. Path analysis showed that: emotion regulation was associated with all outcomes; behavioral regulation with all except childhood trauma and detachment; and cognitive regulation only with antagonism and negative affectivity. Findings suggest short-term changes are unlikely and indicate relative importance of emotional, and to some extent behavioral regulation for clinical practice. However, due to sample size restrictions, interpretations should be made with caution.

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Self-regulation; self-control; childhood trauma; identity; personality

Introduction

Forensic psychiatric patients can be described as individuals who have committed a crime and at the same time suffer from some form of psychopathology. In addition, often there is a relationship between the crime committed and the disorder. The combination of a

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crime and a disorder entails the risk of recidivism, which can harm society. Therefore, the risk of recidivism is periodically estimated and personalized treatment goals are formulated to ensure a safe reintegration into society (Bogaerts et al., 2018). Although usually not explicitly mentioned, self-regulation and self-control are important for both risk assessment and for treatment because of their importance in predicting criminal behavior (Pratt & Cullen, 2000; Vazsonyi et al., 2017). Self-regulation is a patient's ability to regulate their thoughts, emotions and behaviors (e.g. Vohs & Baumeister, 2004). This is reflected in clinical risk factors based on risk assessment, such as impulsivity (behavioral regulation) or emotion regulation in the form of coping skills (e.g. Spreen et al., 2014). In many forms of treatment, self-regulation is implicitly important (e.g. aggressive patients are trained to regulate intense emotions by using breathing techniques or other strategies).

We can also find the importance of self-regulation in several rehabilitation-oriented approaches in forensic care. For example, in the Risk Need Responsivity (RNR) model, aspects of self-regulation (and self-control) are seen as dynamic criminogenic needs and treatment targets (Andrews & Bonta, 2010). Criminogenic needs in the RNR model are targeted as a way to decrease criminal behavior, for example by strengthening self-regulation skills. When looking at the Good Lives Model, self-regulation can be seen as the basis of the secondary goods (skills) needed to achieve a primary good or goal (Ward et al., 1998). These primary goods can vary depending on the identity and goals of the individual (e.g. being wealthy or maintaining friendships). The lack of self-regulation capacity can be an obstacle in achieving those goals and increasing self-regulation can be a way to help individuals secure their primary goods (e.g. get a better job).

Previous research has shown that self-regulation skills can be parsed in three broad domains pertaining to emotional, behavioral and cognitive self-regulation (Billen et al., 2021). Emotion regulation is the ability of a person to recognize as well as modulate strong emotions to suit the situation (Gratz & Roemer, 2004). Behavior regulation is the adaptation of certain actions depending on the specific situation, and can include aspects of impulsivity and risk taking. Cognitive regulation revolves around managing thoughts and executive functions (e.g. attention, goal setting). Theories on the development and manifestation of criminal behavior throughout the lifespan have often looked at self-regulation as a general construct or one of the three derivatives as an explanatory factor for criminal behavior (e.g. Agnew et al., 2002; DeLisi & Vaughn, 2014; Gottfredson & Hirschi, 1990). Much research has supported a strong positive correlation between self-regulation and criminal or deviant behavior (see Vazsonyi et al., 2017).

In particular, poor self-regulation is not only a predictor of crime but also predictive of mental health problems (e.g. Moffitt et al., 2011; Tangney et al., 2004), such as substance use problems (e.g. Malouf et al., 2014; Verdejo-García et al., 2007), alcohol use (e.g. Adams et al., 2012) and antisocial personality disorders (e.g. Gilbert & Daffern, 2013; Turner et al., 2017). Because of its relevance to both criminal behavior and psychopathology, research on self-regulation within a forensic psychiatric environment is particularly important, and a more salient presence in risk assessment might be useful.

The present study, therefore, aims to investigate self-regulation within a forensic sample with two main goals. First, we examine the degree of stability and change of three self-regulatory components (behavioral, cognitive, and emotional) during mandatory admission to a forensic facility (patients are not necessarily attending treatment sessions, but are in a treatment facility). Second, we want to advance knowledge about the

nomological network of self-regulatory components by investigating their associations with childhood trauma, identity and personality dysfunctions. Each of these aims is presented in more detail in the sections that follow.

Stability and change in self-regulation

The stability of self-regulation over time is often debated. Theoretically, self-regulation develops during childhood and remains relatively stable into adulthood (e.g. Gottfredson & Hirschi, 1990; Hoyle, 2006). Longitudinal research has shown that a person with lower self-regulation than their peers will always have lower self-regulation compared to their peers (e.g. Hay & Forrest, 2006; Higgins et al., 2009; Ray et al., 2013). However, many studies also find changes in self-regulation over time (e.g. Burt et al., 2014; Hay et al., 2018; Höing et al., 2015). Especially in individuals with low self-regulation, more change and less stability of self-regulation is found, while those who start with high levels of self-regulation show a stable pattern, which may indicate a ceiling effect as high self-regulation offers little room for further improvement (Ray et al., 2013). Offenders may have a vulnerability to lower levels of self-regulation, and therefore more chances to improve. Indeed, some studies show change in juvenile offenders (Hay et al., 2018; Turner & Piquero, 2002), even showing that offenders improve more than non-offenders.

Few studies have investigated changes in three aspects of self-regulation, namely behavioral, cognitive and emotional self-regulation. Behavioral regulation has been found to change over a period of 20 years (e.g. Forrest et al., 2019). Retrospective research on stability of self-regulation in forensic psychiatric patients showed different patterns of change during treatment in general (Billen et al., 2019). In this study, it was shown that patients (more often than not) improved their risk of impulsivity (behavioral regulation) and coping skills (more related to emotion regulation) during treatment (up to 16 years). Studies looking at cognitive self-regulation have found relative stability, but with a potential for fluctuation based on environmental (as opposed to genetic) influence (e.g. Biederman et al., 2007; Friedman et al., 2016). Emotion regulation in inmates following a cognitive–behavioral treatment program also showed improvement, even after a 12-month follow-up (Brazão et al., 2018). Furthermore, it improved in sex offenders after a 12-month community-based support intervention (Höing et al., 2015). Also, a study on (non-forensic) addiction treatment did find improvement over the course of four weeks of treatment in both emotional and cognitive elements of self-regulation (Littlefield et al., 2015).

Taken together, previous findings suggest that individual levels of self-regulation may change even in adulthood and be more pronounced in criminal and forensic psychiatric samples because of their lower starting level of self-regulation. This is consistent with judicial offender rehabilitation approaches, where self-regulation can be seen as a dynamic risk factor or a treatment goal (Andrews & Bonta, 2010). Specifically, self-regulation is central to dialectical behavior therapy (e.g. Bianchini et al., 2019; Evershed et al., 2003), and aggression control therapy (e.g. Hornsveld et al., 2008), which are often provided in forensic psychiatric settings. Although treatment effects may vary from study to study and depend on the type of treatment and setting, improving an offender's ability to regulate emotions, thoughts and behaviors is an important aspect of treatment and rehabilitation in providing offenders with tools to reintegrate safely into society.

More research is needed on how changes in self-regulation occur in patients in forensic settings. That is, many studies measure the effects of treatment targeting self-regulation by looking at improvements in aggression and hostility, but without measuring self-regulation in particular (e.g. Evershed et al., 2003; Hornsveld et al., 2008). Other studies focus only on youth (e.g. Hay et al., 2018), or only cover some aspects of self-regulation (e.g. Littlefield et al., 2015). Although there is some evidence of change over long time intervals (e.g. Billen et al., 2019), research on short-term changes is still missing. These short-term changes can be interesting for evaluating the progress of treatment goals and assessing risk of recidivism in a continuous manner. Therefore, this study aims to investigate potential changes in behavioral, cognitive and emotional self-regulation in adult male forensic psychiatric patients during one year of mandatory stay in a forensic setting with patients following different, individualized paths of treatment.

Correlates of self-regulatory components

The second aim of the study was to investigate the associations that self-regulatory components (i.e. behavioral, cognitive and emotional) have with constructs relevant to forensic mental health care, which may be targets for treatment, either dynamic or developmental. Specifically, the study took into account: childhood trauma, identity and personality dysfunction. This would advance current knowledge in two ways: first, by examining possible differential associations between self-regulatory components and clinically relevant factors; second, by examining these associations in a forensic psychiatric sample, given that often inferences on this population are made based on studies in general population samples. In this section, we briefly review the state of the art on each of these constructs, their relevance in the forensic psychiatric population and their association with each of the aspects of self-regulation (cognitive, emotional and behavioral).

Childhood trauma and self-regulation

Childhood trauma (i.e. the experience of psychical, emotional or sexual traumatic events in the early years of life) has been shown to have a wide variety of negative consequences. This includes an increased risk of psychiatric disorders and impaired psychosocial functioning (Copeland et al., 2018; Polusny & Follette, 1995), risk and aggressive behavior (Banducci et al., 2014) and substance abuse (Khoury et al., 2010; Min et al., 2007). In addition, childhood trauma has been associated with an increased risk of offending (Fox et al., 2015) and is highly prevalent in offenders and forensic psychiatric patients (e.g. Jankovic et al., 2021; Moore et al., 2013; Spitzer et al., 2006). Not surprisingly, trauma-informed treatments are common in forensic settings (e.g. Keulen-de Vos et al., 2016).

Childhood trauma can also contribute negatively to self-regulation because theoretically, self-regulatory development is related to parenting behavior. Responsive and supportive parenting is associated with good self-regulation, while harsh or authoritarian parenting is associated with deficits in self-regulation (see Eisenberg et al., 2011).

Research also shows that childhood trauma is significantly associated with poor self-regulation in general (Walters, 2018; Xie et al., 2020), as well as with poor emotion regulation (Banducci et al., 2014; Gagnon et al., 2013) and impulsivity more specifically (i.e.

behavioral regulation; Carli et al., 2014; Ramakrishnan et al., 2019). Of the different components of self-regulation, previous research seems to suggest that emotion regulation is more strongly associated with childhood trauma (Banducci et al., 2014; Gagnon et al., 2013) while cognitive regulation is less strongly associated (e.g. Gagnon et al., 2013; Nikulina & Widom, 2013), though research in forensic samples is scarce.

Identity and self-regulation

The recently developed identity value model (Berkman et al., 2017), states that self-regulation is identity driven. More specifically, our identity determines the subjective value we attach to choices and goals, which motivates a person to regulate their behavior (Berkman et al., 2017). In recent years, there has been an increasing interest in the role of identity and its association with psychopathology (e.g. Klimstra & Denissen, 2017), as evidenced by the inclusion of identity in the DSM-5 alternative model for personality disorders (American Psychiatric Association, 2013). Here, some aspects of self-regulation (i.e. emotion regulation) are even considered indicators of identity functioning. Identity and self-direction (which contains other aspects related to self-regulation, such as pursuing meaningful goals, having prosocial standards for behavior and self-reflection), in turn, represent the core components of self-functioning that, along with dysfunctional trait domains, shape the conceptualization of personality pathology. Although both theoretical models propose conceptual links between identity and self-regulation, it is still unclear how and to what extent the two constructs of self-regulation and identity are empirically connected.

Research on self-regulation and identity has mainly been performed in adolescents and has focused on developmental or motivational aspects of identity (e.g. Hofer et al., 2011; Oyserman et al., 2017), and not on identity dysfunctions (American Psychiatric Association, 2013), which are of clinical importance to the assessment and treatment of adult forensic psychiatric patients. However, there is some research showing identity dysfunction is associated with a lack of emotion regulation (Kaufman et al., 2016; Peters et al., 2012), as well as problems with a lack of perseverance (i.e. cognitive regulation; Tragesser & Robinson, 2009). One study showed that when different aspects of self-regulation were taken into account, only emotion regulation was associated with identity dysfunction (Peters et al., 2012). Given these initial indications, we aimed to further investigate this association in a forensic population where identity dysfunction is more common than in the general population and may be clinically relevant. Furthermore, no research into this topic could be found in a forensic psychiatric population.

Personality dysfunction and self-regulation

As mentioned before, self-regulatory functions are essential for good personality functioning, in the form of self-direction (i.e. cognitive), emotion regulation (as part of self-functioning) and disinhibition (i.e. behavior; American Psychiatric Association, 2013). Deficiencies in personality functioning and pathological traits are very common in a forensic psychiatric setting, and many patients in these settings are diagnosed with personality disorders (e.g. Garofalo et al., 2018). Beyond discrete and somewhat arbitrary categories of specific personality disorders, an emerging literature is focusing on the

alternative model of personality disorders proposed in the DSM-5 which may be more useful to capture the dimensional and complex nature of personality pathology (American Psychiatric Association, 2013). Specifically, this alternative model for personality pathology distinguishes five domains of maladaptive personality functioning.

The domain of antagonism includes manipulative, callous, deceitful, grandiose and hostile traits. Negative affectivity includes aspects of anxiousness, emotional lability, depressivity and separation insecurity. The detachment domain contains elements of introversion, withdrawal, anhedonia, restricted affectivity and intimacy avoidance. Finally, psychoticism is characterized by perceptual dysregulation, eccentricity and unusual thoughts or beliefs (American Psychiatric Association, 2013; Krueger et al., 2012). A fifth domain concerns disinhibition, which was not included in the present study as it conceptually overlaps with behavioral self-regulation and therefore would create concerns in terms of conceptual reasoning and criterion contamination.

Associations between the three specific components of self-regulation and the different pathological personality domains have not been comprehensively examined to date, though some indirect evidence can be drawn from studies that looked at conceptually related constructs. In fact, previous studies showed a clear link between antagonistic traits and behavioral regulation in the form of low constraint (Anderson et al., 2013), disinhibition (de Vries et al., 2009) and thrill-seeking (Gullone & Moore, 2000). A link with emotional and cognitive regulation has also been reported (Moraleda-Barreno et al., 2018; Pollock et al., 2016). Theoretically, behavioral aspects of self-regulation, such as impulsivity are expected to have the strongest association (Fossati et al., 2016).

Detachment and negative affectivity traits are mainly associated with difficulties in emotion regulation (Fossati et al., 2016; Pollock et al., 2016). With regard to behavioral aspects of self-regulation, some research shows that negative affectivity (in the form of high emotionality) and detachment (in the form of introversion) might actually be negatively associated with sensation seeking (de Vries et al., 2009), although other research shows small positive associations with sensation seeking and impulsivity (Fossati et al., 2016; Moraleda-Barreno et al., 2018). Small associations with cognitive aspects of self-regulation have also been reported, but to a lesser extent than emotion regulation aspects (Fossati et al., 2016; Moraleda-Barreno et al., 2018).

Of all the domains of the alternative model for personality disorders, psychoticism may be less studied in relation to self-regulation and for which the theoretical associations are similarly less clear. Research does show an association between psychotic traits and a lack of constraint or impulsivity (Anderson et al., 2013; Fossati et al., 2016). Associations have also been found with different aspects of emotion regulation (Pollock et al., 2016). However, the associations with cognitive elements of self-regulation seem to be weaker or disappear completely when other aspects of self-regulation are taken into account (Fossati et al., 2016; Moraleda-Barreno et al., 2018) despite the fact that perception and beliefs are a cognitive element of psychoticism.

The current study

The current study consists of two parts, first, a longitudinal part investigates the stability or change of self-regulation in a forensic psychiatric sample during 12 months in a high to medium security psychiatric center. Second, a cross-sectional part investigates the

associations of self-regulation in this sample by focusing on emotional, behavioral and cognitive aspects of the broader self-regulation construct.

With regard to the longitudinal part of the study, although there is some evidence that self-regulation of forensic patients may change (i.e. improve) over time, the aim is to investigate whether a change can be observed over a relatively short period of 12 months. Observing change at 12 months is important as clinicians want to assess patient's progress in the shorter term. This can be particular useful in assessing the effects of treatment on the risk of recidivism and can help adjust treatment goals.

The cross-sectional part of the study aims to investigate cross-sectional associations between the three aspects of self-regulation (behavioral, cognitive and emotional) and potentially relevant clinical variables. Childhood trauma, identity and personality dysfunction are common in forensic patients and could be good treatment goals. The nature of this study with regard to the associations between these constructs is largely exploratory, since there has not been sufficient research using the three aspects of self-regulation as predictors of clinical correlates, and none in a forensic population. However, with regard to behavioral regulation, we tentatively expected a stronger association with the antagonistic domain of personality, as this domain includes aspects that are mainly focused on outward behavior. Furthermore, we expected emotion regulation to be more strongly associated with childhood trauma and identity dysfunction due to the fact that these might disturb underlying emotion regulation processes. We also expected a stronger association with both the negative affectivity and detachment domain of personality dysfunction, as these both require emotion regulation capacity.

Methods

Data

The data used in the current study were collected as part of a larger longitudinal study on change in forensic psychiatric patients in Belgium and the Netherlands. Three waves of data were collected at the time of writing, at baseline, 6 and 12 months. Unfortunately, in one of the three participating centers, collection of the third wave of data was not possible because the researchers were not allowed to enter the institution due to restrictions imposed in response to the Covid-19 crisis. Data for the longitudinal section of the analyses, therefore, concerns only forensic psychiatric center (FPC) de Kijvelanden (Netherlands) and FPC Gent (Belgium) whereas data for the cross-sectional section pertains to all three centers (wave 1).

Registration

The concept and preferred method of analysis for this study were registered on the Open Science Framework (https://osf.io/u5w7f/?view_only=2ca0e75d5e2a4ac58fe1029946ff7a6f) after the data collection was completed. Steps taken before the registration was submitted are described therein. Due to the nature of the data and the particularly small sample size, we were not able to adhere fully to our plans as mentioned in the registration (although this was somewhat anticipated in the registration itself). Deviations from the pre-registered analysis plan are summarized here and more details can be found in Online Supplement 1.

Participants

Forensic psychiatric patients from three different high security FPCs in Belgium (Gent and Antwerpen) and the Netherlands (de Kijvelanden) were recruited to participate in the study. In total, 96 patients participated, of which two were women. The current study only focuses on the male population ($N = 94$). For the longitudinal analyses data from FPC Gent and FPC de Kijvelanden for the first wave (W1, $N = 64$), the second wave at six months (W2, $N = 44$) and the third wave at 12 months (W3, $N = 36$) were used. Data for all three waves were available for 31 patients, missing data handling is discussed in the statistical analyses section.

All participants were required to have good control of the Dutch language and most participants had the Belgian (69.1%), or Dutch (23.4%) nationality. Participant age at the first point of data collection ranged from 25 to 66 ($M = 42.67$, $SD = 10.46$). Most participants had a high-school level education (77.4%), a relatively large number only finished elementary school (19.4%) and a small percentage finished some form of higher education (3.2%). Most participants were single at the time of data collection (76.9%), others were divorced (16.5%), in a serious relationship (5.5%) or married (1%).

In terms of index crime, 24.5% of participants committed at least one non-violent crime (e.g. drug crime, theft) and 28.7% at least one medium-violent crime as an index crime (e.g. possession of weapons, robbery with violence). Furthermore, 13.8% committed severe violence, 14.9% a sex offence, 31.9% a sex offence with a minor, 16.0% homicide, 7.4% arson and 12.8% premeditated murder as an index crime. Common diagnoses were personality disorder (31.9%), substance use disorder (26.6%), paraphilic disorder (13.8%), psychotic disorder (8.5%) and developmental disorders (8.5%). Other disorders diagnosed included mood disorders, disruptive disorders, neurocognitive impairment and more (17.1%). Patients were recruited regardless of actively receiving treatment at the time of the data collection or not. The length of stay of the patients in the treatment facility was unknown. The length of stay from the imposition of the most recent juridical measure at the start of the research varied between 1.81 and 369.58 months (30.8 years; $M = 88.41$). The data for three patients was invalid. Not the full period was necessarily spent in a treatment facility, as Dutch law allows for combined sentences (starting with imprisonment) and Belgian high-security treatment facilities only opened in 2014. Furthermore, patients may have spent time in treatment prior to their current juridical measure. Based on the data from patient files, at least 52 patients (55.3%) were following some type of treatment around the start of the study[1] (treatment type varied, with 24.5% following occupational or creative therapy, 13.8% cognitive behavioral therapy, 5.3% getting psycho education and 4.2% aggression therapy). A large group of patients (37.2%) followed one or more other forms of treatment, such as social skills training or risk management training. Treatment data for six patients were not accessible because they had left the clinic before this information was collected.

Procedure

Participants were recruited with the help of clinical staff and by researchers going door to door to explain the research. They were given an information letter and were further informed by either researchers or clinical staff when needed. They were given an informed consent form to sign prior to the start of the study. The informed consent made clear that their participation was voluntary and could be stopped at any time, without any negative

consequences nor the need for an explanation. It also indicated that coded information would be used for scientific research, and participants were asked for their consent to collect data from their (electronic) patient file. The study was approved by the ethics review board of Tilburg University.

Data collection was scheduled around participant availability, within a period of one to five consecutive weeks for each center at each wave. A researcher was always present in case participants had any questions. Most participants (80.6% - 95.5% depending on the wave) filled out questionnaires on a laptop that was provided by the researcher and got access to the questionnaire that was implemented online using Qualtrics (www.qualtrics.com). Although most data collection was computerized, some participants filled out questionnaires on paper due to difficulties using computers, or in case of technical issues (4.5% - 19.4% depending on the wave). To limit the burden on participants, the number of administered questionnaires differed per time point. The first wave was the most comprehensive, as it included few unchangeable variables such as childhood trauma, that were only measured once. Participants were encouraged to take breaks and ask questions. Data collection generally took between one and three hours depending on the wave and participant. On rare occasions when participants were not able to finish in one session, they were asked to either come back or given paper questionnaires to complete at their convenience ($N_{W1} = 2$; $N_{W2} = 1$; $N_{W3} = 5$).

Participant attrition was 31.3% at W2 and 43.8% by W3. This was mainly due to participants leaving the FPC (65% of participants that did not participate during W2, and an additional 40% of those that did not participate in W3). Two participants of FPC Gent started later and were not able to complete certain waves for this reason (5% of W2, 13.3% of W3). However, some participants (30% of W2 and 46.7% of W3) either chose to drop out or were unable to make an appointment with the researcher due to personal circumstances or matters outside of their direct control (e.g. being in isolation or having unexpected cell checks at the time of the appointment). These participants were not excluded from participating in future waves of the data collection. Whenever possible, a second appointment was made with participants in the case that they were not able to complete data collection at the first opportunity.

Measures

In the longitudinal section of the study, the 20-item UPPS-P impulsivity scales (Cyders et al., 2014; Lynam et al., 2007; Whiteside & Lynam, 2001), the 16-item Difficulties in Emotion Regulation Scale (DERS-16; Bjureberg et al., 2016; Gratz & Roemer, 2004) and the 13-item Brief Self-Control Scale (BSCS; Tangney et al., 2004) were used to measure the three aspects of self-regulation (emotional, behavioral and cognitive). Each scale was scored in a way that higher scores represent lower self-regulation. Confirmatory factor analyses were done with subsets of items (chosen based on theory) for each of the three aspects. The composition of each aspect of self-regulation (rather than each questionnaire) is described below. After this, the measures used for the cross-sectional analysis (wave 1) are described.

Emotion regulation

Emotion regulation was measured by all the scales of the DERS-16 (Bjureberg et al., 2016) as well as four items of the negative urgency scale of the 20-item UPPS-P (Cyders et al.,

2014; Lynam et al., 2007; Whiteside & Lynam, 2001). The DERS-16 contains five scales measuring the non-acceptance of negative emotions (referred to as non-acceptance), a lack of goal directed behavior when distressed (i.e. goals), impulsive behavior when distressed (i.e. impulse), a lack of emotion regulation strategies (i.e. strategies) and lack of emotional clarity (i.e. clarity). Items are scored on a scale from 1 (almost never) to 5 (almost always). The DERS-16 has been reported to have a good internal consistency in previous studies ($\alpha = .92$ to .94; Bjureberg et al., 2016). The UPPS-P is scored on a scale from 1 (totally disagree) to 4 (totally agree) and negative urgency has an acceptable internal consistency according to prior research ($\alpha = 0.78$; Cyders et al., 2014). Emotion regulation, therefore, was measured with a total item pool of 20 items.

Behavioral regulation

Items of both the BSCS (Tangney et al., 2004) and the UPPS-P (Cyders et al., 2014) were used as indicators of behavioral regulation. With regard to the BSCS this concerned three items that were found to load on one of two sub-constructs, namely disinhibition. This two-factor model had a good fit in several samples used in a prior study (including the current one), but the internal consistency for disinhibition in the forensic sample was poor ($\alpha = .52$), however, good model fit was preferred over good internal consistency (Billen et al., 2021). Items on the BSCS are scored on a scale from 1 (totally not like me) to 5 (totally like me). With regard to the UPPS-P, four items of the positive urgency and four of the sensation seeking scale were used as indicators for behavioral self-regulation. The internal consistency of the scales was good ($\alpha = .85$) and acceptable ($\alpha = .74$) respectively (Cyders et al., 2014). Behavior regulation had a total item pool of 11 items.

Cognitive regulation

Items from the BSCS as well as the UPPS-P were used as indicators for cognitive regulation. With regard to the BSCS it concerned five items pertaining to (a lack of) discipline. This was the second factor found in the previously mentioned factor analysis and had a poor internal consistency ($\alpha = .58$) but fit the model well (Billen et al., 2021). Four items were used of both the (lack of) perseverance and (lack of) premeditation scale, which have shown a moderate ($\alpha = 0.79$) to good ($\alpha = 0.85$) internal consistency in previous research (Cyders et al., 2014).

Personality dysfunction

The four remaining domains (excluding disinhibition) of the Personality Inventory for DSM-5 (PID-5) 100-item version (Krueger et al., 2012; Maples et al., 2015; See et al., 2020) were used to measure personality dysfunction. Items are scored on a scale from 0 (not at all true) to 3 (completely true) where higher scores reflect a higher degree of dysfunction. These domains are Antagonism (24 items), Detachment (20 items), Negative Affect (24 items) and Psychoticism (12 items). Each domain consists of several facets containing four items each. The domain Antagonism contains the facets attention seeking, callousness, deceitfulness, grandiosity, hostility and manipulativeness. The Detachment domain is comprised of the facets anhedonia, depressivity, intimacy avoidance, restricted affectivity and withdrawal. Negative Affect contains anxiousness, emotional lability, perseveration, separation insecurity, submissiveness and suspiciousness. The suspiciousness scale of negative affectivity can be seen as theoretically dubious and might be more in

line with psychoticism (e.g. Kremen et al., 1998) as also found occasionally in studies (e.g. Somma et al., 2018). Lastly, the Psychoticism domain is made up of the facets eccentricity, perceptual dysregulation and unusual beliefs. Higher scores on the PID-5 domains indicate higher levels of personality dysfunction. The internal consistency of the different scales of each domain was found to be acceptable to good in the Dutch 100-item version of the PID-5 ($\alpha = .60$ to .84; See et al., 2020).

Childhood trauma

The Childhood Trauma Questionnaire (CTQ; Bernstein et al., 2003) measured trauma in the patients' younger years. The questionnaire consists of 28 items scored on a scale from 1 (never true) to 5 (very often true), with higher scores representing a higher degree of trauma. The questions tap into five domains: physical, emotional and sexual abuse, and physical and emotional neglect. In the current study, we consider overall trauma (e.g. an overall sum-score based on all items contained in the questionnaire) and do not investigate separate domains. The internal consistency for each of the scales is considered acceptable to excellent ($\alpha = .61$ to .94; Bernstein et al., 2003).

Identity disturbance

We used the Self-Concept and Identity Measure (SCIM; Kaufman et al., 2015) to assess clinical identity disturbance. The SCIM contains 27 items, that are rated on a scale from 1 (totally disagree) to 7 (totally agree), with an 'I don't know' option (scored as missing). The measure contains the scales consolidated identity, disturbed identity and a lack of identity. Scores were coded such that higher scores indicated lower levels of identity disturbance. Research on the SCIM shows good reliability ($\alpha = .89$; Kaufman et al., 2015).

Statistical analyses

P-values were regarded as significant at $\alpha < .05$, and 95% confidence intervals were given whenever possible. Statistical analyses were done in R (R Core Team, 2019). Factor analyses and structural equation models (SEM) were run using Lavaan (Rosseel, 2012). Statistical analyses were done with both sum-scores and factor scores of constructs.

Missing data

Few data were missing for patients present at testing due to the use of computerized testing. However, some patients used paper questionnaires, or indicated being unable or unwilling to fill out certain questions (e.g. items about driving while never having had a license, sensitive questions about childhood events). Little's MCAR test (Little, 1988) indicated that data were missing completely at random in both W1 ($\chi^2 = .000$, df = 5964, $p = 1$), and in W3 ($\chi^2 = 27.711$, df = 42, $p = .956$) and there was no missing data in W2. Missing data were handled automatically by Lavaan (Rosseel, 2012) using full information maximum likelihood (FIML) estimation.

Outliers

In this study, we defined an outlier as any value above or below the first quartile minus 1.5 times the Inter Quartile Range (IQR). Scale level outlier data were inspected to see if there is a response style bias (e.g. a clear response pattern). Most outlier data did not show a

clear response style and were therefore interpreted as normal variation in the sample and kept for data analysis. In the longitudinal analyses, for the composite cognitive score (e.g. sum-score based on all items), six total score data points (two in each wave) and four-factor score data points were removed (two in the first wave, one in each other), due to the sensitivity of ANOVA to potential outliers. For behavioral regulation one data point (in W2) was removed from both the total and factor scores prior to the repeated measures ANOVA. In the cross-sectional analyses only one participant was found to be an outlier in almost all PID-5 scales. This individual answered with variety, but only used the extremes (1 or 4) of the scale and was left in the analyses as part of regular variation.

Assumptions

Skewness and kurtosis were between −2 and +2 for all variables in the study. Kolmogorov–Smirnov Tests were done to check if data were normally distributed. This was combined with a visual inspection of the data. Both for the longitudinal and cross-sectional analyses, data were considered being normally distributed.

Multicollinearity was determined by correlations higher than .80 between the different constructs. There was no multicollinearity found between the constructs cross-sectionally. There was a high correlation between W1 and W2 of emotion regulation, however this was not considered to be an issue since it reflects the same construct. Longitudinal correlations can be found in Table 1. Cross-sectional correlations can be found in Table 2.

Longitudinal analyses

These analyses were conducted using the data of patients from two centers across the three waves. The third center was excluded from this analysis, as the data point cannot be considered randomly missing and therefore cannot be estimated without potential bias.

Confirmatory factor analyses (CFAs) were used to find three factors of self-regulation, emotion regulation, behavioral regulation and cognitive regulation. The mean scores only were used in a repeated measures ANOVA in order to determine change between different time points. In the case that main effects were significant, we implied post-hoc Tukey tests to inspect specific differences between waves. Furthermore, Spearman's rank order correlations were calculated for both mean and factor scores to get an idea of stability of self-regulation over the course of six months. Assumptions of these approaches were checked prior to running analyses.

Table 1. Spearman's correlations between waves.

	Emotion regulation			Behavioral regulation			Cognitive regulation		
Total scores	W1	W2	W3	W1	W2	W3	W1	W2	W3
W1		44	36		43	35		40	34
W2	.86		31	.59		30	.72		29
W3	.79	.74		.70	.71		.53	.72	
Factor scores	W1	W2	W3	W1	W2	W3	W1	W2	W3
W1		44	36		43	36		42	34
W2	.81		31	0.53		30	.71		30
W3	.78	.75		0.64	0.67		.52	.79	

Notes: *N* can be found above the diagonal, correlations below. All correlations were significant at $\alpha > .05$.

Table 2. Cross-sectional correlations between variables for mean and factor scores.

	1	2	3	4	5	6	7	8	9
1. Emotion regulation	1	**0.51**	**0.34**	**0.27**	**−0.55**	**0.60**	**0.54**	**0.73**	**0.62**
2. Behavior regulation	**0.54**	1	**0.24**	0.12	**−0.50**	**0.64**	**0.23**	**0.57**	**0.52**
3. Cognitive regulation	**0.42**	**0.34**	1	−0.03	**−0.30**	**0.31**	0.18	**0.38**	0.18
4. Trauma	**0.29**	0.16	−0.09	1	−0.03	0.02	0.18	0.14	0.13
5. Identity	**−0.55**	**−0.59**	**−0.27**	−0.10	1	**−0.57**	**−0.46**	**−0.58**	**−0.66**
6. Antagonism	**0.57**	**0.63**	**0.41**	−0.03	**−0.57**	1	**0.59**	**0.77**	**0.74**
7. Detachment	**0.44**	**0.28**	0.12	0.19	**−0.40**	**0.48**	1	**0.63**	**0.68**
8. Negative Affect	**0.71**	**0.51**	**0.43**	0.12	**−0.59**	**0.71**	**0.51**	1	**0.78**
9. Psychoticism	**0.58**	**0.52**	**0.26**	0.12	**−0.67**	**0.73**	**0.60**	**0.77**	1

Notes: Factor score correlations can be found above the diagonal, mean score correlations can be found below the diagonal.

Cross-sectional analyses

A SEM path analysis was done using (1) sum scores and (2) factor scores to measure the constructs. Results are mentioned for both models in this order. Prior to the path analysis CFAs were used both to determine the best composition of each construct within the forensic group and to retrieve the factor scores on every construct for every respondent.

In the sum-score approach, we used the total scores of the variables (e.g. total scale scores calculated based on the internal structure as found in the CFA). In the factor score approach, we used factor scores that resulted from the CFAs. In the path analyses (for both approaches), the three self-regulation constructs, emotion regulation, behavioral regulation and cognitive regulation were used as exogenous variables, since they are predictors of the endogenous variables, childhood trauma, identity dysfunction, antagonism, detachment, negative affectivity and psychoticism. Both a model without any restrictions as well as additional models that implied further restrictions (based on plausible expectations) were estimated in a stepwise manner. Covariation between the endogenous variables based on the PID-5 was set to be equal as these were expected to be similar. Furthermore, as the relationship between behavioral regulation and detachment and negative affectivity, and cognitive regulation and psychoticism was expected to be negligibly weak the respective regression equations were removed in case they were not significant. Models were then compared based on commonly used fit indices (see below for more detail) in order to choose the model that fitted the data best while at the same time being the most parsimonious.

Model fit

In the current study, we interpreted a good fit if two of the following four indices with their respective cut-off: the Tucker Lewis Index (TLI) and Comparative Fit Index (CFI) > .90, Root Mean Square Error of Approximation (RMSEA) and Standard Root Mean Square Residual (SRMR) <.08. Models with restrictions were compared using Akaike information criterion (AIC) and Bayesian information criterion (BIC), where lower AIC and BIC indicate a better fitting model, and BIC is slightly more aimed at parsimony.

Results

Longitudinal analyses

Descriptive statistics for the longitudinal total mean and factor scores can be found in Table 3. Spearman's rank order correlations for each of the constructs over time (for

Table 3. Descriptive statistics of cross-sectional and longitudinal (waves 1–3) total mean and factor scores.

	Total mean scores					Factor scores				
	N	*M*	*SD*	Min	Max	*N*	*M*	*SD*	Min	Max
Longitudinal										
Wave 1										
Emotion regulation	63	2.20	0.87	1	4.27	64	0	0.55	−0.73	1.46
Behavioral regulation	63	2.25	0.63	1.22	3.78	64	0	0.26	−0.39	0.55
Cognitive regulation	61	1.89	0.54	1	3.14	62	−0.03	0.33	−0.39	0.79
Wave 2										
Emotion regulation	44	2.19	0.89	1	4.36	44	0	0.86	−1.05	2.08
Behavioral regulation	43	2.10	0.59	1	3.33	43	−0.04	0.52	−0.86	1.16
Cognitive regulation	42	1.90	0.53	1	3.29	43	−0.03	0.36	−0.52	0.92
Wave 3										
Emotion regulation	36	2.08	0.92	1	4.00	36	0	0.74	−1.85	1.50
Behavioral regulation	35	2.09	0.61	1	3.44	36	0	0.3	−0.42	0.70
Cognitive regulation	34	1.68	0.43	1	2.57	35	−0.03	0.27	−0.35	0.62
Cross-sectional										
Emotion regulation	93	20.14	5.42	11	34	94	0	0.56	−0.76	1.31
Behavioral regulation	93	13.31	4.03	7	24	94	0	0.36	−0.5	0.79
Cognitive regulation	93	23.83	9.16	11	47	94	0	0.31	−0.4	0.82
Trauma	90	45.17	18.28	18	88	93	0	1	−1.36	2.41
Identity	77	77.95	15.04	37	105	93	0	0.77	−1.91	1.16
Antagonism	92	26.18	8.36	14	56	94	0	0.58	−0.8	2.03
Detachment	91	21.7	6.58	12	44	94	0	0.36	−0.47	1.21
Negative affect	94	37.35	11.26	18	72	94	0	0.75	−1.22	2.19
Psychoticism	93	27.95	8.56	15	54	94	0	0.31	−0.41	0.98

both total and factor scores) can be found in Table 1. Detailed information on the confirmatory factor analyses can be found in Online Supplement 2. Post-hoc power calculations showed that the power for the repeated measures ANOVA was very low for emotion regulation (.28) and for cognitive regulation (.55), although acceptable for behavioral regulation (.81), careful interpretation is warranted.

Emotion regulation

CFA. Due to sample size restrictions, the UPPS-P negative urgency items were not included in the CFA. Furthermore, the results of the CFA indicated that all three items of the non-acceptance scale, one item of the impulse scale and one item of the strategies scale did not fit the model well (e.g. low factor loadings, high residual correlations). The internal consistency of the final 11-item scale was good ($\alpha > .93$). There was no significant difference between models checking for configural, weak and strong measurement invariance. Spearman's correlations between factor scores and total scores were $r = .98$ to .99 (depending on the wave).

Repeated Measures ANOVA. The results of the ANOVA were not significant, indicating no substantial change in emotion regulation over each of the six-month periods, $F(2, 78) = 1.125$, $p = .33$.

Behavioral regulation

CFA. Based on both item correlations as well as the results of an initial CFA, it was decided to remove two sensation-seeking items from the scale. Cronbach's alpha of the final nine-item scale in each wave was between .77 and .84. In terms of measurement invariance, no significant difference in fit was found between the configural, weak and strong invariance

and fit continued to be sufficient. Spearman's correlations between factor scores and total scores were $r = .93$ to .95.

Repeated measures ANOVA. The results of the ANOVA were significant, $F(2, 75) = 4.264$, $p = .02$. A post-hoc Turkey test showed a significant difference between wave 1 and wave 2 ($p = .02$) but not between wave 2 and wave 3 ($p = .84$).

Cognitive regulation

CFA. Based on low item-total correlation and factor loadings (<.30), four BSCS items and two items of the UPPS-P lack of perseverance scale were removed. Cronbach's alpha for the 7-item scale was .72 to .83 for our data. In terms of measurement invariance there were no significant differences between configural, weak and strong invariance models, and the fit continued to be sufficient. Spearman's correlations between factor scores and total scores were $r = .88$ to .96.

Repeated measures ANOVA. There were two outliers in each wave of data and in total six data points were removed before further analysis. The data were normally distributed. The ANOVA was not significant, meaning there was no difference in cognitive regulation over time, $F(2, 72) = 2.320$, $p = .11$.

Cross-sectional analyses

Confirmatory factor analyses

A detailed description of the factor analyses can be found in Online Supplement 2. CFA fit indices can be found in Table 4. Childhood trauma was included in the analyses without the sexual abuse scale (5 items) and two items of physical neglect as this resulted in the best interpretable factor structure. Cronbach's alpha for the final remaining 18 item scale was .93. The correlation between the estimated factor scores and the sum scores was .99.

For identity dysfunction, the consolidated identity scale, which is a more positive construction of identity and might be less related to psychopathology (e.g. Bogaerts et al., 2018) along with one item of the lack of identity scale were left out due to poor fit with the model. Cronbach's alpha for the new 15-item identity scale was .87. The correlation between the factor score and sum score was .96.

The scale used to measure the construct of antagonism was slightly modified as it was found that removing items of grandiosity and attention seeking (based on low factor loadings, as well as difference in content with other items) significantly improved the fit of the model. Two items of callousness were also excluded. The final scale consisted of 14 items and had a Cronbach's alpha of .91. Correlations between factor and sum scores were .99.

Detachment was likewise reduced to contain mostly items representing depressive moods. Removing the items of intimacy avoidance and restricted affectivity improved model fit significantly. The final model included 12 items and had a Cronbach's alpha of .86. The factor scores and sum scores had a correlation of .98.

The suspiciousness scale of negative affectivity can be seen as theoretically ambiguous and might be more representative of the construct psychoticism (e.g. Kremen et al., 1998) as found in earlier studies (e.g. Somma et al., 2018). Model fit improved significantly when leaving suspiciousness out of the negative affectivity construct. Two items of the submissiveness scale were also excluded since they showed very low factor loadings. The final

Table 4. Robust fit indices for the confirmatory factor analyses.

	CFI	TLI	RSMEA (CI)	SRMR
Longitudinal				
Wave 1				
Emotion regulation	**0.925**	0.899	0.115 (0.065–0.161)	**0.051**
Behavioral regulation	**0.956**	**0.940**	**0.053** (0.000 - 0.120)	**0.065**
Cognitive regulation	**0.976**	**0.961**	**0.048** (0.000 - 0.137)	**0.057**
Wave 2				
Emotion regulation	**0.944**	**0.924**	0.108 (0.032 - 0.165)	**0.063**
Behavioral regulation	**0.973**	**0.960**	**0.051** (0.000 - 0.140)	0.082
Cognitive regulation	**1.000**	**1.119**	**0.000** (0.000 - 0.095)	**0.054**
Wave 3				
Emotion regulation	**0.926**	0.898	0.134 (0.064 - 0.195)	**0.056**
Behavioral regulation	**0.958**	**0.939**	**0.074** (0.000 - 0.160)	**0.061**
Cognitive regulation	**1.000**	**1.044**	**0.000** (0.000 - 0.130)	**0.059**
Cross-sectional				
Childhood trauma	**0.918**	**0.913**	**0.080** (0.058 - 0.100)	0.086
Identity dysfunction	**0.928**	**0.928**	**0.063** (0.026 - 0.092)	**0.068**
Antagonism	**0.900**	0.871	0.100 (0.072 - 0.128)	**0.073**
Detachment	**0.928**	**0.905**	**0.075** (0.034 - 0.110)	**0.069**
Negative affectivity	**0.910**	**0.895**	**0.078** (0.053 - 0.100)	**0.067**
Psychoticism	**0.923**	**0.909**	**0.065** (0.026 - 0.094)	**0.070**
Emotion regulation	**0.927**	**0.903**	0.108 (0.069 - 0.146)	**0.061**
Behavioral regulation	**0.940**	**0.914**	**0.064** (0.000 - 0.112)	**0.056**
Cognitive regulation	**0.937**	**0.905**	**0.068** (0.000 - 0.136)	**0.057**

Notes: Fit indices in bold meet the predetermined cut-off criteria. CFI = Comparative Fit Index, TLI = Tucker-Lewis Index, RSMEA = Root Mean Square Error of Approximation, CI = Confidence Interval, SRMS = Standardized Root Mean Square.

scale contained 18 items, with a Cronbach's alpha of .92. The sum and factor scores correlated .99.

Based on previously mentioned theoretical premises (Kremen et al., 1998), the suspiciousness scale was added to the PID-5 psychoticism domain. All items fit well in this CFA. The final construct contained 16 items with a Cronbach's alpha of .90. Sum and factor score correlation was .98.

The same three self-regulation scales (emotional, behavioral and cognitive) as in the longitudinal analyses were retested with the full ($N = 94$) sample and fit well, a description of the scales can be found above.

Structural equation modeling

As expected, the residual correlations of the PID-5 scales could be set equal (all were significant and similar in size). Furthermore, no or only a very weak connection was found between psychoticism and cognitive regulation and detachment and behavioral regulation (as expected). To arrive at a more parsimonious model, it was therefore decided to drop the connection between these constructs in the SEM model. The association between behavioral regulation and negative affectivity was significant and therefore kept in the model. With these restrictions, the final model had seven degrees of freedom. The changes made to arrive at a more parsimonious (and theoretically more plausible) model did not result in a significant change in model fit, but did result in an improvement in AIC and BIC. This was the case for the sum score model χ^2 change ($7, N = 93$) = 7.95, $p = 0.34$ (base AIC = 3579.2, BIC = 3692.2; adjusted AIC = 3575.0, BIC = 3670.4), as well as for the factor score model χ^2 ($7, N = 93$) = 8.06, $p = .33$ (base AIC = 576.07, BIC = 690.52; adjusted AIC = 571.38, BIC = 668.02). The model fit was very good in both the factor score and total score model, the

model fit indices, Z-values, regression weights and significance levels for the regressions can be found in Table 5. The results show that emotion regulation was significantly associated with all outcomes in the expected directions. Behavioral regulation was significantly associated with all outcomes except childhood trauma and detachment. Cognitive regulation, on the other hand, was only significantly associated with antagonism and negative affectivity.

The raw data and scripts used in this study are available on request from the corresponding author, [initials]. The data are not publicly available due to their containing information that could compromise the privacy of research participants.

Next to our regressions residual correlations were found between several of our outcome variables, significance was the same in both sum score and factor models, although the effect sizes differed. Most notably, and as expected were the significant positive covariations between all PID-5 domains ($r = .27$ to .54), which were thereafter restricted to be equal. Furthermore, we found significant negative residual correlations between identity dysfunction and psychoticism ($r = -.40$; $r = -.42$). These associations were all in the expected direction, but there was also a significant negative association between childhood trauma and antagonism ($r = -.34$), suggesting that more traumatic experiences were associated with less antagonistic behavior.

Discussion

The current study had a dual aim; the first was to investigate changes in the different aspects of self-regulation (emotional, behavioral, cognitive) in forensic psychiatric patients over a period of one year, the second was to examine if these aspects show differential associations with correlates of clinical relevance, such as childhood trauma, identity and maladaptive personality traits.

Table 5. Regression results for the cross-sectional path analyses (factor and sum score models).

		Factor scores				Sum scores			
		CFI 0.981	TLI 0.911	RSMEA 0.109	SRMR 0.033	CFI 0.995	TLI 0.979	RSMEA 0.053	SRMR 0.036
		Z-value	Standardized regression coefficient	*P*-value		Z-value	Standardized regression coefficient	*P*-value	
Childhood trauma	E	**2.642**	**0.333**	**0.008**		**2.341**	**0.302**	**0.019**	
	B	−0.262	−0.029	0.794		0.382	0.046	0.702	
	C	−1.451	−0.137	0.147		−1.272	−0.131	0.203	
Identity dysfunction	E	**−3.132**	**−0.355**	**0.002**		**−3.097**	**−0.362**	**0.002**	
	B	**−2.995**	**−0.288**	**0.003**		**−3.948**	**−0.385**	**0**	
	C	*−1.664*	*−0.132*	*0.096*		−0.623	−0.056	0.533	
Antagonism	E	**3.407**	**0.37**	**0.001**		**3.322**	**0.318**	**0.001**	
	B	**4.694**	**0.422**	**0.000**		**4.987**	**0.419**	**0**	
	C	**1.983**	**0.123**	**0.047**		**2.124**	**0.117**	**0.034**	
Detachment	E	**4.774**	**0.518**	**0.000**		**4.594**	**0.458**	**0**	
	C	0.605	0.04	0.545		0.347	0.023	0.728	
Negative Affectivity	E	**6.467**	**0.585**	**0.000**		**7.013**	**0.601**	**0**	
	B	**2.798**	**0.245**	**0.005**		*1.941*	*0.174*	*0.052*	
	C	**2.563**	**0.155**	**0.010**		**2.572**	**0.13**	**0.01**	
Psychoticism	E	**4.519**	**0.467**	**0.000**		**5.193**	**0.518**	**0**	
	B	**3.874**	**0.278**	**0.000**		**2.938**	**0.244**	**0.003**	

Notes: Values in bold were significant. Values in italics approached significance. CFI = Comparative Fit Index, TLI = Tucker-Lewis Index, RSMEA = Root Mean Square Error of Approximation, CI = Confidence Interval, SRMS = Standardized Root Mean Square. E = Emotion regulation, B = Behavioral regulation, C = Cognitive regulation.

Because previous research on changes in self-regulation focused on non-forensic populations (e.g. Hay et al., 2018), or longer periods of time (e.g. Billen et al., 2019), there were no clear expectations on potential change over a one year period. Due to the small sample size for the longitudinal section of the study, the results regarding changes over time must be interpreted with caution. Results on rank-order stability (correlation) showed different amounts of stability for each of the aspects of self-regulation. Emotion regulation had the highest level of stability over each six-month period, as well as over the 12 months. Cognitive regulation showed a similar level of stability over six months, but less stability over the one-year period. Behavioral regulation was relatively less stable, especially over the first six-month period. This was also shown in the mean-level change over time, with none of the mean scores showing significant changes over time, except for behavioral regulation over the first six months. Since patients were recruited independent of prior treatment length, it does not seem that this is simply an effect of the first period of clinical care, but at the same time it is not certain what the effect of prior treatment may be. Furthermore, missing data analyses also showed that data was randomly missing, and thus did not depend on specific qualities of those who dropped out. Therefore, the change in stability can also not be due to selective drop-out (i.e. those who would have lower scores leaving first).[2]

Although no clear pattern of change over time was found, we can still draw some conclusions regarding the change and stability of self-regulatory aspects over time. Firstly, emotion regulation and cognitive regulation seem to be relatively (although not absolutely) stable over time, and there does not seem to be a mean-level change for these aspects. We do need to take into account that there was also a lack of power which may have led to not finding small effects. Cognitive regulation might be more prone to change over a longer period of time (12 months) than emotion regulation, but this needs to be investigated further. Behavioral regulation seems to be less stable over time in general, both in terms of rank-order and mean level, but this potential for change might not be consistent over time. It might be the case that behavioral regulation is more dependent on situational factors and can therefore fluctuate over time.

These changes in behavioral regulation might reflect patients learning to adapt their behavior either in treatment or by simply being exposed to the clinical environment. Due to the nature of the current study, it is unclear whether these changes in behavioral regulation only reflect a larger focus of the forensic setting on behavior, or if behavioral regulation is simply more easily influenced by treatment or setting. In practice, it might be useful to measure changes in behavioral regulation more accurately as treatment progresses. In this way, environmental factors that may influence these changes can be taken into account, and treatment plans can be adjusted based on these changes and trigger factors. This may be relevant for risk assessment, where treatment-based changes would result in a reduction in clinical risk, whereas environmental influences might implicate the need for more structural changes (e.g. assisted living, network involvement) to help reduce risk.

The second aim of the study was to investigate the associations of the three self-regulatory components with clinically relevant constructs. We will briefly summarize the results with regard to emotional, behavioral and cognitive aspects of self-regulation, and highlight the most interesting overarching findings and conclusions.

Emotion regulation was the most influential of the three self-regulatory constructs, having a significant effect on all outcome variables in the expected direction (e.g.

Fossati et al., 2016; Kaufman et al., 2016; Ramakrishnan et al., 2019). Furthermore, for childhood trauma and detachment, emotion regulation was the only significant predictor, and for all outcomes except antagonism, it was the strongest predictor. This shows the importance of the emotional aspect of self-regulation when it comes to clinical outcomes relevant in the forensic setting.

Behavioral regulation significantly predicted all outcomes except childhood trauma and detachment. Based on prior research this outcome was somewhat expected for detachment (e.g. Fossati et al., 2016; Moraleda-Barreno et al., 2018), but not for childhood trauma (e.g. Carli et al., 2014; Ramakrishnan et al., 2019). With regard to the latter, this can be in part due to prior research not taking into account emotion regulation (Carli et al., 2014), or due to differences in population group (e.g. mostly female students; Ramakrishnan et al., 2019). With regard to negative affectivity, no clear result was expected, as previous research was ambiguous on potential associations (de Vries et al., 2009; Moraleda-Barreno et al., 2018), but a small positive effect was found, indicating that, at least within our forensic psychiatric sample, a lack of behavioral self-regulation was associated with negative affectivity. Overall, behavioral regulation seemed to be of reasonable importance for clinical outcomes in forensic psychiatric patients, especially so for antagonism, where it had the largest effect of the three variables.

Cognitive regulation was only associated with antagonism and negative affectivity, which is generally in line with expectations, as cognitive regulation was expected to be associated with these constructs, although to some extent also with trauma and identity, and to a lesser extent with detachment. For identity dysfunction and detachment there were small correlational effects, but these were likely due to some shared variance with emotional and/or behavioral regulation, in line with other studies of identity disturbance (Peters et al., 2012; Tragesser & Robinson, 2009) where effects dissipated after controlling for other elements of self-regulation. In terms of detachment, prior research found a stronger association with elements of the cognitive element perseverance (Fossati et al., 2016; Moraleda-Barreno et al., 2018), which was partially taken out of the current construct of cognitive regulation. Childhood trauma, however, did not correlate with cognitive regulation and it seems that this association, although present in previous studies with different populations (Ramakrishnan et al., 2019), may not hold up in the forensic psychiatric population.

Taken together, childhood trauma and detachment were only predicted by emotion regulation. Identity dysfunction and psychoticism were predicted by emotional and behavioral regulation. Finally, antagonism and negative affectivity were predicted by emotional, behavioral and cognitive regulation.

Implications

The results of the current study have both clinical and research implications. Firstly, although it might be of interest to further investigate the stability of the three aspects of self-regulation separately, it seems unlikely to expect noticeable change in a patient's self-regulatory behavior over 12 months of mandatory stay in a forensic facility. Since behavioral regulation seems to be more likely to fluctuate, potentially due to situational factors, it might be more interesting to investigate even shorter-term changes.

Furthermore, predictors of both long- and short-term change could be important for clinical practice since this can aid in setting treatment goals for those low in a certain type of regulation. The general lack of change may simply be due to slow progress of patients in the forensic setting, as previous studies did show long-term change (Billen et al., 2019). Another reason could be patients' lack of insight into personal change, especially for the more internal emotional and cognitive regulation, which may be resolved by using a multi-informant and multi-method (e.g. including tasks) set-up. Moreover, it is important to take into account the fact that we did not control for patients' active participation in evidence-based treatment, or the phase of treatment a patient was in.

Furthermore, the cross-sectional results show the importance of measuring and taking into account different aspects of self-regulation in forensic samples. That is, when controlling for the overlap among the different components of self-regulation, emotion regulation clearly plays a bigger role in clinical outcomes than behavioral regulation, which in turn plays a bigger role than cognitive regulation. When only investigating a single aspect of self-regulation, or folding the construct into an overarching variable, we may miss interesting associations, or overestimate the importance of certain aspects (e.g. the role of cognitive regulation for identity dysfunction). The results are to some extent in line with the principles of the biosocial theory of personality functioning, which indicates that individuals with personality pathology, and in particular borderline personality disorder, primarily have problems with emotion regulation. These problems with emotion regulation can lead to unrealistic goals and an inability to achieve these goals, as well as cause changes in cognitive processes (Linehan, 1993). From the current research it may appear that this is not only the case for borderline personality disorder, but more generally for pathological personality traits. Dialectical behavioral therapy, which is based on the biosocial theory of personality and focuses on self-regulation (mainly emotion regulation), is also widely used in correctional settings to help treat people with a personality disorder more generally, not only for borderline personality disorder (Berzins & Trestman, 2004).

While all three aspects should probably be incorporated in treatment plans to assure long-term success, it may be more important to focus on emotion regulation capabilities in order to improve clinical functioning. A focus on behavioral regulation however, might be especially important with more antagonistic patients, such as those with high levels of psychopathic traits or problems with aggression management. Cognitive regulation seems to be less important in terms of clinical functioning and might be incorporated more in treatment of patients with antagonistic or anxious personalities. Treatment of specific or general trauma might also be important to help improve emotion regulation, which may be done through for example Eye Movement Desensitization and Reprocessing, schema-focused therapy or dialectical behavior therapy. Although some of these treatments, or elements of them, are already used in patient treatment plans, patients might benefit substantially if they were more readily available within the clinics.

Limitations

Although this study has contributed to a better understanding of the concept of self-regulation and its three different aspects, there are also some limitations. Firstly, the 12-month

time-limit of the current study may be insufficient to see changes in a population that usually undergoes longer treatment. Furthermore, patients could be at different stages of treatment, and since participation in the study was voluntary, the sample may be biased toward the more conscientious patients. Patients were also not always actively in treatment and different treatments were provided depending on the patient. Further bias may have arisen from the use of self-report, excluding patients with lower cognitive abilities. Self-report questionnaires were chosen for practical reasons, but a lack of insight, social desirability and patients not taking the study seriously can also influence the results. Moreover, the sample size, although relatively large for this population, might be insufficient to detect smaller effects, especially longitudinally, and there were insufficient female patients to conduct any analyses. In terms of statistics, this led to issues with estimating full latent variable models, and sum and factor scores were used instead. Although we used factor analysis to make this as reliable as possible, this approach may still lead to bias. Furthermore, when running the factor analyses some items or groups of items were excluded (e.g. sexual abuse, grandiosity). This means that it might be more difficult to compare results with studies where no changes were made to the constructs, though at the same time ensures that the present findings are based on solid measurement models. We do not believe that the core of any of the measured constructs was significantly different from other studies, but nevertheless it might make a difference in expression since the content coverage of some of our measures was reduced to a more coherent, but narrower, set of components. It is unclear if the lack of fit for certain items or certain scales was due to actual poor fit within this sample, or influenced by our restricted sample size.

However, considering the importance of self-regulation for these clinical factors, as well as for criminal factors (e.g. Gottfredson & Hirschi, 1990; Vazsonyi et al., 2017) we are convinced that changes in self-regulatory abilities are necessary to ensure a safe return to society. This implies that long-term longitudinal studies, with regular measurements of the three aspects of self-regulation, are necessary to be able to observe these changes over time. However, this type of intensive research requires time and resources to conduct within a forensic psychiatric population that is typically small, difficult to reach and difficult to motivate to participate in research. Furthermore, ideally, patients from several types of forensic psychiatric institutions should be included (e.g. low-high security, inpatient/outpatient), and patients should be monitored as they move through the forensic system. To set up a large-scale longitudinal study, collaboration and coordination between researchers and different institutions are necessary.

Conclusion

In conclusion, the different aspects of self-regulation (behavioral, cognitive, emotional) do not show a great potential for change in forensic psychiatric patients over the course of 12 months of mandatory admission to a forensic facility. Change was seen over one, but not both periods of six months, but only for behavioral regulation, and only with a small effect size. Next to this, cross-sectionally, the associations of these three aspects with clinically relevant outcomes differ. Emotion regulation is comparatively more strongly associated with all outcomes (i.e. childhood trauma, identity and personality dysfunction). Behavioral

regulation is more strongly associated with antagonism, but also with the majority of outcomes (excluding trauma and detachment). Cognitive regulation seems to be less relevant for clinical functioning, and was only weakly associated with antagonism and negative affectivity in forensic psychiatric patients. Although there are still many questions to be answered regarding self-regulation within the forensic psychiatric population, we believe this study gives a first glance into the potential importance of each of the three subcomponents of self-regulation and how they relate to other variables and might evolve over time.

Notes

1. Although data was gathered from files as meticulously as possible, both the filing systems and the tendency for therapists and other workers to correctly log a patient's therapy might have resulted in inaccuracies in the exact number of patients in treatment, or the timing of the treatment.
2. We considered that those who dropped out between W2 and W3 might have been a group with a higher rate of change (between W1 and W2) than those who stayed, but a comparison of change scores showed no difference between those who showed up, and those who permanently dropped out or the full group of absentees.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability statement

The data that support the findings of this study are available on reasonable request from the corresponding author, EB. The data are not publicly available due to the sensitive nature of patient data.

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