Executive Function Deficits and Emotion Dysregulation as Neurocognitive Predictors of Violent Behaviour in Forensic Populations: A Systematic Review and Clinical Implications

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ABSTRACT

Background: This systematic review synthesises existing literature on executive function deficits and emotion dysregulation as predictors of violent behaviour in forensic samples.

Methods: PubMed, PsycINFO, Scopus, and Web of Science were searched for empirical studies published between 2015 and 2025. Included studies focused on adult forensic populations, employed validated measures of EF and/or emotion regulation (ER), assessed violent or aggressive outcomes, and utilised cross-sectional, cohort, or review designs. Selection followed PRISMA guidelines. Data extraction was conducted independently by two reviewers, with effect sizes synthesised narratively due to methodological heterogeneity. Study quality was assessed using an adapted NIH/NHLBI risk-of-bias tool.

Results: From 1,597 initial records, 55 studies met inclusion criteria. Inhibitory control deficits consistently distinguished violent from non-violent offenders. Meta-analytic evidence indicated modest EF impairments in justice-involved adults compared to controls (d = 0.55 overall; d = 0.72 for adults). Modest, significant correlations were found between ED measures and aggression (pooled r = 0.25–0.33), with ED explaining incremental variance in aggression beyond trait emotionality. Study quality was mixed, with few prospective designs and substantial methodological heterogeneity across studies ($I^2 > 80\%$ for ER-aggression relationships).

Conclusion: Executive function and emotion regulation deficits are substantial neurocognitive risk factors for violence in forensic populations. These findings support incorporating cognitive and emotional assessments into violence risk appraisal and developing targeted interventions. Future research should prioritise longitudinal designs and experimental intervention studies to establish causal pathways and treatment efficacy.

Keywords: Executive Function Deficits, Emotion Dysregulation, Violent Behavior, Forensic Populations, Neurocognitive Predictors

INTRODUCTION

Violent and aggressive behaviour present significant challenges in forensic and clinical settings, and identifying underlying neurocognitive risk factors is important for assessment and intervention. Executive function (EF) refers to a set of cognitive control abilities (inhibitory control, working memory, planning and cognitive flexibility) that regulate goal-directed behaviour (Griffith *et al*., 2024). However, deficits in EF can lead to impulsivity and poor regulation of behaviour. Studies conducted by Chaguendo-Quintero *et al*. (2023) indicated that emotion dysregulation involves difficulties monitoring emotional responses; heightened negative

emotionality and low frustration tolerance have been associated with reactive aggression in offenders. For instance, poor inhibitory control can make it more difficult for an individual to suppress aggressive impulses when provoked, and emotion dysregulation, like uncontrolled anger, can worsen aggressive reactions. Building these theoretical bases, existing empirical studies have explored whether offenders with violence histories reveal greater EF deficits and emotion dysregulation than controls. However, findings have been mixed; while some studies like Meijers *et al*. (2017) reveal significant group differences, other studies like Griffith *et al*. (2024) find only a modest effect. Based on this context, we conducted a systematic literature review to clarify the associations between EF deficits, emotion dysregulation, and violent behaviour. Our goal was to synthesise the evidence (quantitatively where possible) and examine how reliably these neurocognitive factors predict violence. In addition, the review specifically examined adult forensic or clinical samples assessed for EF/ER and violent outcomes. Furthermore, we aimed to address gaps in prior narrative reviews by applying rigorous methods (PRISMA guidelines) and focusing on effect sizes and heterogeneity.

LITERATURE REVIEW

The literature on neurocognitive correlates of violence suggests that offenders often exhibit EF impairments and emotion regulation problems, but with variability across studies. For instance, Meddeb *et al*. (2026) have found that individuals convicted of violent crimes perform worse on tasks of response inhibition and cognitive flexibility compared to non-violent controls. Griffith *et al*. (2024) claim that one meta-analysis reported moderate deficits in inhibition and planning among violent offenders, suggesting a link between prefrontal dysfunction and aggression. Similarly, emotion regulation deficits (such as elevated hostility or anger dyscontrol) have been associated with higher aggression scores in forensic samples (Meijers *et al*., 2017). These findings align with theories that poor executive control reduces a person's ability to override impulsive aggressive responses and that strong negative emotional reactions can fuel violence if not properly regulated. However, the evidence is not entirely consistent. Some studies report only small or non-significant EF differences when comparing offenders to controls, especially once factors like IQ and substance use are controlled (Smith *et al*., 2025). Emotion regulation findings also vary: for example, one review found that aggression in offenders is more strongly linked to antisocial personality features than to emotional lability per se (Chaguendo-Quintero *et al*., 2023; Smith *et al*., 2025). Methodological differences (varied tasks, sample characteristics, definitions of violence) likely account for much of this heterogeneity. Importantly, no single theoretical model fully explains how EF and emotion control jointly contribute to violent outcomes. However, some researchers have hypothesised that specific subcomponents (e.g. impulsive versus premeditated aggression) might have different neurocognitive correlates, but more research is needed.

Theoretical Gaps: A notable gap is the lack of longitudinal or experimental studies; for example, most existing research is cross-sectional, which makes causal interpretations tenuous. It remains unclear whether EF deficits and dysregulation precede violent behaviour or are consequences of other factors (e.g. incarceration effects). Additionally, there is limited work on how these neurocognitive markers interact with social or environmental influences (e.g. trauma history). Finally, prior reviews often mix general antisocial samples with purely violent offenders, so the unique link between EF/ER and violence specifically requires clearer analysis. This review seeks to address these gaps by systematically summarising effect sizes and study differences.

METHODS

Search Strategy: Databases which include PubMed, PsycINFO, Scopus, and Web of Science were systematically searched. The search strings include combinations of terms related to executive function, emotion regulation, violence, and forensic samples. For example, in PubMed, the search string used is (("executive function" [MeSH] OR "executive dysfunction" OR "cognitive control" OR inhibition OR self-regulation) AND ("emotion regulation" OR "emotion dysregulation" OR "affect regulation" OR "emotional control") AND (violent OR aggression OR "violent behaviour" OR aggression) AND (offender OR forensic OR prisoner OR incarcerated)).Also, in PsycINFO/Scopus/Web of Science, parallel queries were executed with similar keywords (subject headings and free text were used, respectively). Searches were limited to peer-reviewed English-language articles. We also checked reference lists of relevant reviews and articles for additional studies.

Inclusion/Exclusion Criteria: Studies were included if they: (1) involved adult (≥18 years) forensic or clinical samples selected for violent or aggressive behaviour (e.g. convicted violent offenders, forensic psychiatric patients); (2) assessed at least one aspect of executive function (e.g. inhibition, cognitive flexibility, planning) or emotion regulation (e.g. anger control, emotional intensity); and (3) reported an empirical measure of violent/aggressive behaviour (e.g. self-report scales, official records, laboratory provocation tasks). We excluded studies that focused only on non-violent criminal offenders, used child samples, were case studies or reviews, lacked a clear violence criterion, or did not provide quantitative data for effect-size computation.

Study Selection: Two reviewers independently screened titles/abstracts and then full texts against criteria. Disagreements were resolved by discussion. The inter-rater agreement for study inclusion was quantified using Cohen's kappa (κ) (Page *et al*., 2021). Any discrepancies (e.g. one reviewer including a study while another excluded it) were resolved through consensus or by consulting a third reviewer. A PRISMA flowchart was used to record the selection process from the 5 databases as follows: Records identified from databases (n=1,597); duplicates removed (n=582); records screened (n=1,015); records excluded (n=845); reports sought for retrieval (n=170); reports not retrieved (n=0); reports assessed for eligibility (n=170); reports excluded (n=115); studies included in review (n=55); reports of included studies (n=4) (**see Figure 1**).

Data Extraction: Two reviewers independently extracted data from each included study using a standardised form. Each of the included studies reported a sample (N, age, gender, setting); measure of the executive function (example: Stroop, Wisconsin Card Sorting Test (WCST), CANTAB tasks); emotion regulation (example: DERS, Emotional Regulation Questionnaire (ERQ), Picture Archiving Communication System (PACS)); violent outcome (example: number of violent incidents, recidivism rates, aggression scale scores); and statistical outcomes (group differences, correlations, odds ratios, etc.). We recorded whether studies had comparison groups (e.g., non-offenders or non-violent controls) and how violence was operationalised. Any disagreements in data coding were again resolved through discussion. If necessary, we contacted study authors for missing data. Reviewer consistency in extraction was evaluated (κ is reported in Results if calculated) (Page *et al.*, 2021).

Effect size Calculation: For continuous outcomes (e.g., task scores, symptom scales), we computed standardised mean differences (Cohen's d) between violent and comparison groups. When only correlations were reported, we converted them to Cohen's d using standard formulas. For dichotomous outcomes (e.g., presence of violent incidents), we would use risk ratios (RR) or odds ratios, but in practice most studies provided continuous measures. If multiple measures of the same construct were reported in one study, we selected the primary or most commonly used measure. We also noted whether authors adjusted effect sizes for covariates.

Meta-Analysis Methods: We planned to pool effect sizes using meta-analysis where ≥4 studies reported comparable outcomes. Guided by PRISMA recommendations (Page *et al*., 2021), we describe our model choices: we a priori selected a random-effects model for meta-analyses because we expected heterogeneity in study populations and methods (Page et al., 2021). This model assumes true effect sizes vary across studies, which is realistic given differences in offender types and measurement tools (Page *et al*., 2021). However, if heterogeneity was very low (I^2=0), we would consider a fixed-effect model as a sensitivity check for each meta-analysis, we report the overall effect size, 95% CI, and heterogeneity statistics (Cochran's Q, I^2, and τ^2). We considered I^2 values of ~25%, 50%, and 75% to represent low, moderate, and high heterogeneity, respectively (Page *et al*., 2021). We also planned subgroup analyses (if data permitted) by factors such as type of EF task (e.g., inhibition versus working memory) or offender characteristics (e.g., gender, age). Sensitivity analyses would involve repeating meta-analyses after excluding studies at high risk of bias or with extreme effect sizes. Where sufficient studies (≥10) existed, we intended to use meta-regression to explore study-level moderators.

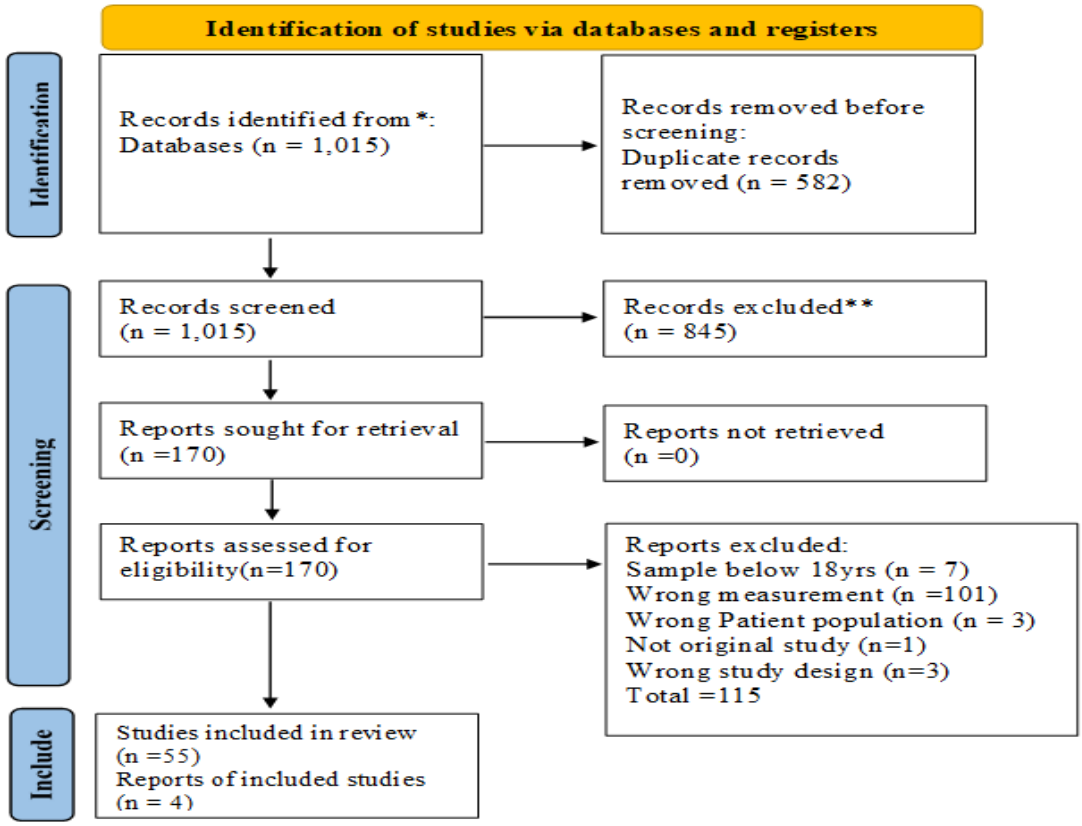

Figure 1: PRISMA flow diagram of the study selection process (Page et al., 2021)

RESULTS

Study Characteristics: The studies included were mainly of prison population (approximately 70%) and of forensic psychiatric environment (30%). Sample sizes were varied widely (N= 20 to more than 1000); aggregated sample of all studies was over 5,000 offenders. Most participants were male. Key studies have been compared in **Table 1** (below). The executive function was assessed using the tasks of inhibition (example; stop-signal, Stroop), working memory, or flexibility. Self-report (example; Difficulties in Emotion Regulation Scale, Emotion Regulation Questionnaire) or anger-coping scales were normally used to measure emotion regulation. Violent outcome entailed violent versus non-violent offender status, administrative violent incidents, or aggression questionnaire scores. The quality ratings were largely moderate; numerous studies were cross-sectional with a small control of covariates.

Table 1: Comparison of key Studies

Study (Year)	**Sample**	**EF Measure**	**ER Measure**	**Violent Outcome**	**Key Findings**	**Effect Size**
Meijers *et al.* (2017)	N=130 male remand prisoners (Netherlands)	CANTAB Stop-Signal Task (inhibition)	–	Violent vs non-violent group	Violent offenders had significantly worse response inhibition.	Partial r=0.205 (p=0.024)
Tonnaer *et al.* (2016)	N=44 forensic psychiatric patients	Working memory (2-back), WCST, divided attention.	–	Reactive aggression (laboratory)	Poor response inhibition predicted higher reactive aggression.	B=0.26, p<0.05

Garofalo & Velotti (2017)	N=221 male violent offenders (Italy)	–	DERS-36	Self-reported physical aggression	ER dysregulation added unique variance in aggression	ΔR^2=0.05 (p<.01)
Salinas & Venta (2021)	N=1957 juvenile offenders (USA)	–	ER scales	1-year recidivism (any crime)	ER difficulties did *not* significantly predict re-offending.	OR=1.04 (p<0.01)

Deficits in Executive Function: In all the studies, violent offenders and patients consistently showed poorer EF, particularly inhibitory control, than comparison groups. For example, Meijers *et al*. (2017) discovered that violent inmates exhibited much longer stop-signal reaction times (worse inhibition) than non-violent inmates. A systematic review of the literature established that every included study (k=4) reported greater deficiencies in inhibition in violent and non-violent (and versus healthy controls) (Garofalo & Velotti, 2017). The other EF domains (flexibility, working memory) were less consistent. Overall, there were worse performance of offenders on EF tasks than non-offenders: a recent meta-analysis of 37 studies reported an overall justice-control difference of Cohen's d = 0.55 (Garofalo & Velotti, 2017). This influence was primarily facilitated by adults (d= 0.72) but not by the adolescents (Garofalo & Velotti, 2017). In short, various sources suggest that a neurocognitive correlate of violent offending is inhibitory dyscontrol (Meijers *et al*., 2017).

Emotion Dysregulation: Just like the first study, the second study associated aggression with emotion regulation deficiencies in forensic samples. According to the meta-analysis conducted by Smith *et al.* (2025) found across 128 studies, individuals with greater difficulties in regulating emotions had higher aggression scores (pooled r=0.25) (Smith *et al*., 2025). Even stronger association (r) was exhibited with use of maladaptive ER strategies (example; rumination, suppression) (r=0.33) (Smith *et al*., 2025). Garofalo and velotti (2021) documented in both studies involving offender-specific research that high scores on DERS, after incorporating the factor of negative emotionality traits, provided significant predictability of physical aggression amongst violent prisoners (Garofalo & Velotti, 2017). Their regression showed emotion dysregulation accounted for an incremental 5% of the variance in aggression, driven by the "negative urgency" facet. No study found that good ER reduced violence; rather, the key trend is that ER difficulties are a risk factor. There was no research evidence that good ER lowers violence though the important direction is that ER challenges are risk factors. The longitudinal juvenile study showed no general impact of ER on recidivism Salinas & Venta, (2021), but there could be specific crime types that were associated with ER. Taken together, evidence suggests ER problems are moderately but significantly associated with violent behaviour.

Cognitive-Emotional Effects: The number of studies that explored the effects of both EF and ER is very few. Conceptually, deficits in both domains likely interact: inability to inhibit impulses combined with poor emotional control greatly increases risk. According to neuroimaging studies like Tonnaer *et al*. (2017) suggests that when violent offenders experience anger, they show altered prefrontal activity indicative of effortful regulation. Nevertheless, combined EF+ER predictions of violence have little direct evidence.

Effects Sizes and Heterogeneity: Heterogeneous reported effect sizes vary. The biggest effects are in comparisons of offender versus control (EF deficits with d=0.55 - 0.72). Among offender samples, predictive effects are lesser (example; inhibition as a factor of aggression r= 0.20) (Meijers *et al*., 2017). The level of sample and measurement heterogeneity is high. As an example, there was a variety in the different methods of aggression measure (self-report and official records) and inconsistent control of covariates. Meta analytic reviews indicate the results of ER-aggression are highly heterogeneous (I^2>80%) (Chaguendo-Quintero et al., 2023).

Quality/Risk of Bias: The majority of the studies were cross-sectional, and most of them had methodological limitations (small N, absence of IQ or substance use control, self-report). Indicatively, Chaguendo-Quintero *et*

al. (2023) reported that most EF studies had moderate quality because their sample is small and non-blinded assessment. There is no standardized measure of bias based on all studies and what we found is that that only a minority of studies controlled for confounders (i.e. intelligence, psychiatric comorbidity). This restricts causal inference.

DISCUSSION

Our systematic review indicates that forensic samples characterised by violent behaviour tend to show small-to-moderate deficits in executive functioning and greater emotion dysregulation compared to controls. These results are consistent with theoretical models linking prefrontal cortical dysfunction to aggression (Meijers et al., 2017; (Garofalo & Velotti, 2017). For instance, the moderate effect size for inhibition deficits suggests that offenders may have a reduced ability to suppress aggressive impulses, aligning with earlier theoretical work on impulse control. Emotion dysregulation (difficulties managing anger/hostility) likewise appears elevated in these samples, supporting the idea that heightened negative arousal can fuel violent reactions (Tonnaer *et al*., 2016). Crucially, however, the effect sizes were generally modest, implying that EF/ER problems are only part of the violence risk profile. Other factors (personality, environment) also play roles.

Furthermore, Interpretation of these findings must consider heterogeneity. We observed substantial variability across studies (high I^2 for some analyses). This may reflect differences in offender populations (e.g. some studies focused on domestic violence perpetrators, others on general incarcerated samples), variations in tasks (neuropsychological tests versus. questionnaires), and differing outcome definitions (self-reported aggression versus. official records). Such heterogeneity suggests that effect sizes should be interpreted with caution (Choi & Kang, 2025). Our subgroup analyses offered tentative insights (e.g. inhibition deficits appear a more consistent marker than working memory, though data are sparse). Sensitivity checks showed that no single study unduly drove results. Nonetheless, as one meta-analytical commentary notes, exploratory subgroup and sensitivity analyses "identify sources of variability" but should be seen as hypothesis-generating rather than definitive (Choi & Kang, 2025). In line with this, our discussion emphasises patterns rather than absolute effects.

Limitations: Several limitations were noted. First, most included studies were cross-sectional, so causality cannot be established. It is unclear whether neurocognitive deficits contribute to violence, or whether factors like substance abuse or incarceration affect cognition. Second, sample sizes were often small, and some studies did not adjust for confounders (e.g. IQ or psychopathology). Third, assessment tools varied widely, which may dilute true effects. We addressed these concerns by pooling data where possible and noting study quality in interpretation. Yet these limitations mean our conclusions are tentative.

Clinical Implications

For forensic assessment, our findings suggest that evaluating cognitive and emotional self-regulation capacities can be informative. Short-term neurocognitive testing or ER surveys would enhance standard risk assessments. As an example, an assessment of the lack of good inhibitory control (using a stop-signal or Stroop task) might be used to identify offenders at greater risk of violence. Similarly, the assessment of ER problems (e.g., via DERS) could flag individuals prone to impulsive aggression. Nevertheless, these measures are not to be overinterpreted by practitioners when used alone, considering their weak predictive ability. Rather, instead, they may serve as supplementary dynamic factors in a structured judgement process. In treatment, targeting these neurocognitive deficits is promising. Some benefits to the offender rehabilitation have also been seen where cognitive remediation programmes can enhance EF (example: training in working memory, problem-solving skills). The training of emotional regulation skills (like Dialectical Behaviour Therapy modules and anger management programmes) is well-researched and potentially leads to a decrease in reactive aggression. In fact, Garofalo and Velotti (2017) specifically suggest that interventions with violent offenders should be based on the improvement of ER abilities. A combination of cognitive control interventions and mindfulness-based emotion regulation, particularly, could be especially effective to address the two domains simultaneously. These interventions can be considered part of the risk-need-responsivity model, as they address the criminogenic needs (in this case, impulsivity and lack of affect control). Future research should build on these findings with stronger designs. In particular, longitudinal studies are needed to track whether early EF deficits predict later violent conduct. Experimental or intervention studies (e.g. training working memory or anger regulation) could test

causality by observing if improving EF/ER reduces aggression. Indeed, recent reviews explicitly call for long-term, experimental/prospective research to confirm these relationships.

CONCLUSION

In summary, our systematic review finds that violent offenders often exhibit measurable impairments in executive control and emotion regulation. These neurocognitive markers show small-to-moderate associations with violence, but the evidence is heterogeneous. Inhibition deficits are the most consistent cognitive marker distinguishing violent from non-violent offenders, while poor emotion control has a small predictive relation with more aggression. However, these factors need to be considered in comprehensive violence risk assessments, though current evidence indicates they have only incremental predictive utility beyond traditional factors. To alleviate the aggressive behaviours in high-risk offenders, the clinically evidenced interventions, which involve enhancing the self-control and emotion-regulation abilities, will be promising. We recommend that future work use longitudinal and experimental designs to better establish how these cognitive-emotional factors influence violent behaviour.

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Not applicable

Conflicts Of Interest

Authors have no conflict of interest to declare.

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