Assessing the Cognitive Contributors to Violence: A Pilot and Feasibility Study Protocol

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ABSTRACT

Background: In recent years there has been considerable progress in the development, validation and use of violence risk assessments (VRA). Their predictive ability however remains modest and, due to the repetitive use of certain risk factors, collectively, they appear to have hit an allegorical 'glass ceiling'. Further limiting VRA is the use of self-report, collateral information, and file reviews to assess risk-related factors, rather than validated performance measures. In parallel, findings from neuropsychology and neurobiology have highlighted brain regions associated with violent behaviour. Thus, it is hypothesised that VRA may benefit from the integration of behaviourally measured neuropsychological risk factors.

Methods/Design: The study follows a feasibility and pilot design with a prospective, observational approach. It aims to investigate the feasibility of using a neuropsychological battery to aid in the identification of violence risk in an inpatient and community setting, and to pilot a neuropsychological battery examining risk factors for violence. The primary outcomes of interest are violent incidents or offences recorded during the 6-month follow-up periods.

Discussion: It is our hope that the results of this study will contribute to the development of a structured tool to aid in the identification and assessment of cognitive impairments shown to be predictive of violence risk.

Keywords: Forensic, violence, violence risk assessment, neuropsychology, forensic neuropsychology, risk factors, mentally disordered offenders, violent offenders

1. Background

1.1 Introduction to the literature

The development and validation of violence risk assessments (VRA) have made considerable progress in recent years transforming from 'prediction' only, into 'prediction and management' tools, with more focus on the individual needs of offenders. Subsequently, converging findings from neuropsychological and neurobiological research have identified brain regions associated with violent behaviour and have highlighted a relationship between neurocognitive impairments and violence although findings have been inhibited by methodological limitations and poorly defined outcomes. Whilst there are VRA that encompass

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neuropsychologically informed risk factors, such as impulsivity and lack of insight, they are often assessed using collateral information and personal files, rather than validated performance measures. Moreover, meta-analytic findings have revealed that widely used VRA have low predictive validities, indicating that aside from the specific context in which the assessment will be used, there is no risk measure significantly *better* than another (Campbell et al., 2007; Desmarais et al., 2016; Yang et al., 2010). Further, Monahan and Skeem (2014) postulated that due to existing risk assessments using essentially the same factors and relying on self-report measures, only differing on how the factors are analysed, risk assessments have reached a natural limit, or a 'glass ceiling'. Thus, the addition of cognitive abilities to existing VRA, measured with validated neuropsychological tools, may have the ability to break the 'glass ceiling' and improve predictive accuracy, while subsequently identifying cognitive strengths and weaknesses of the individuals, and informing rehabilitation needs (Haarsma et al., 2020).

1.2 Violence risk assessments

Existing VRA range from unstructured to structured (Heilbrun, 2009; Skeem & Monahan, 2011), however, due to the inherent limitations of using unstructured clinical judgement alone (Skeem & Monahan, 2011), actuarial and structured professional judgement (SPJ) tools are recommended (Singh et al., 2014). There are several VRA with strong conceptual and empirical support for both violent and general offending in adults, youth, and psychiatric inpatients that fit within the actuarial and SPJ categories. For example, the Violence Risk Appraisal Guide (VRAG) (Harris et al., 1993), a well-validated actuarial measure, is designed to measure violent offending, the Historical, Clinical, Risk Scale (HCR-20) (Webster et al., 1997) is a risk-needs measure of violent offending, and is based on SPJ, and an actuarial risk-needs measure of general offending, as opposed to violent offending, is the Level of Service/Case Management Inventory (LS/CMI) (Andrews et al., 2006). Whilst these VRA are undoubtedly useful for the evaluation and prediction of risk, their predictive validity is rarely found to be more than 'modest' (Haque & Webster, 2013). A widely used method for investigating predictive validity is Area Under the Curve (AUC), which can span from 0 to 1, where .5 would be no better than chance that a violent offender would score high on a risk assessment over a non-violent offender, and 1 being near perfect accuracy (Singh, 2013). In 2011, Singh and colleagues investigated the predictive validity of nine risk assessments utilising AUC scores across 68 studies and found that the HCR-20, was only the fifth best predictor of violence with a pooled effect size of .70, with the highest measure being the Sexual Violence Risk Assessment-20 (Boer et al., 1997), revealing an AUC score of .78 (Haque & Webster, 2013; Singh et al., 2011). Within the same study, the VRAG resulted in AUC of .74, and the LSI-R was one of the lowest with an AUC of .67. Although an AUC score of .75 is interpreted as a large effect size, it appears that these assessments may benefit from more precise measures and specific domains.

1.3 Neuropsychology and violent behaviour

The cognitive abilities which have received the most attention in offending literature are executive functions (EFs), described as a constellation of higher level skills that aid in the control, regulation, and co-ordination of other cognitive abilities and behaviors, are controlled by the frontal lobes, and include working memory, poor inhibition, planning, response monitoring, and cognitive flexibility (Hoaken et al., 2007). Meta-analytic data has revealed a difference of 0.44 (Ogilvie et al., 2011) and 0.62 standard deviations (Morgan & Lilienfeld, 2000) between antisocial groups compared to non-antisocial controls on measures of EFs. While this group of cognitive abilities are highly interrelated, the failure to disaggregate them in research may inhibit the identification of specific neurocognitive mechanisms related to

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specific types of violence and offenders (Cruz et al., 2020). Thus, many have been investigated independently allowing for more specific examination of their relationship with violent behaviour. For instance, a 2017 study on inhibition, the ability to stop a mental process or action with or without trying to (MacLeod, 2007), found that violent prisoners performed significantly worse on the stop-signal task relative to non-violent prisoners with a partial correlation r = .20 (Meijers et al., 2017), and similarly, Kennedy and colleagues found that a measure of inhibition significantly differentiated violent and non-violent (d = 0.38) juvenile offenders referred for a court assessment (Kennedy et al., 2011). Likewise, Ross and Hoaken (2011) reported that inhibition in recidivist prisoners was more impaired relative to individuals who were in prison for the first time (partial η^2 = 0.07), and that response monitoring, defined as "evaluating the consequences of behaviour and making adjustments to optimise outcomes" (Thakkar et al., 2008, p. 2464), was also more impaired in recidivist prisoners (partial η^2= 0.05), though response monitoring has been less researched. However, both response monitoring and inhibition are core aspects of EFs, largely supported by the prefrontal cortex, which has been evidenced as one of the most significant brain structures to be compromised in violent and antisocial populations (Davidson et al., 2000; Raine & Yang, 2006), warranting a further investigation into the individual relationship between response monitoring and violence, especially prospectively. Attentional processes have also been implicated in violent behaviour, as they can affect learning, memory, and processing speed among many other cognitive abilities (Spreen & Strauss, 1998). Both correlational studies of forensic patients (Abidin et al., 2013) and between group studies of prisoners (Bryant et al., 1984) have found associations between attention deficits and violence, whereby violent offenders performed more poorly than non-violent offenders with an effects size of d= 0.83, and correlations with violent outcomes with a correlation of r= -.22. The relationship between attention and violence has largely been examined in inpatients, thus investigations of this construct in wider offending populations is warranted.

The diversity of EFs has been supported by Miyake and colleagues' EFs model (2000) which proposed that individuals can be impaired on a single executive domain and may not always have a general executive dysfunction. They supported this by demonstrating that three EFs (e.g., inhibition, shifting, and updating) individually relate to neuropsychological measures of frontal lobe functioning and IQ (Friedman et al., 2006). Given that individual EFs may be impaired while others are preserved, it is possible that the association between individual EFs and offending may differ between various subtypes of offenders and violence. Moreover, intelligence is correlated with EFs and neuroimaging studies have evidenced that intelligence and EFs depend on shared neural functioning (Barbey et al., 2012). Intelligence is a composite construct that in part comprises individual EFs (e.g. working memory) and the remainder is dependent on intact EFs for optimal performance (e.g. attention). Thus, intelligence may be a covariate in the relationship between EFs and violence, and given the significant overlap between intelligence in the form of full scale IQ and EFs, components of intelligence, namely, crystallized or fluid intelligence should be measured and controlled for in studies where it is appropriate.

Research has also highlighted impulsivity (Abidin et al., 2013; Coid et al., 2015; De Vogel & De Ruiter, 2006; Edwards et al., 2003; Howard et al., 2014; Zhou et al., 2014), risk taking (Lodewijks et al., 2008; Umbach et al., 2019), social cognition including affect recognition and empathy (Bock & Hosser, 2014; Brugman et al., 2016; Lodewijks et al., 2008; O'Reilly et al., 2015), and a lack of insight, specifically in mentally ill offenders (Alia-Klein et al., 2007; Bjørkly, 2006), as important neuropsychological abilities related to violent behaviour.

1.4 Neuropsychology and risk assessment

Based on the presented evidence, it can be hypothesized that validly measured neuropsychological domains have a place in VRA. Moreover, it is postulated that cognitive factors may add incremental validity. To our knowledge only one study, a doctoral thesis, specifically examined this. In 2015, LaDuke examined the potential for individual measures of EFs, such as attention, impulsivity, and verbal fluency, to add incremental validity to the LS/CMI (LaDuke, 2015). Findings revealed that, in a sample of prisoners (n= 95) recruited from a programme for treatment and re-entry services, only two of the measures (e.g., disinhibition and cognitive flexibility) predicted the outcome 'program failure', operationalized as returning to prison due to serious violations of programme rules. In addition, these measures not only significantly predicted program failure, but also demonstrated incremental validity over and above the LS/CMI independent of substance use. Moreover, trends toward significance were seen in another measure of disinhibition and measures of attention (LaDuke, 2015). Whilst this study implemented a rigorous prospective design, they were unable to measure violence as their outcome due to a low base rate of incidents.

Following the LaDuke (2015) study, to our knowledge, only one group of researchers have developed a risk assessment tool composed of cognitive factors. Haarsma and colleagues (2020) developed a mobile risk assessment to overcome the limitations of current VRA. They tested the tool on 730 probationers with an outcome of 'any new arrest', and findings revealed an AUC of .60 for cognitive performance alone, which is lower than existing risk assessments, however, when age, gender, and crime level were added to the model, the AUC score increased to .70, which is in line with existing assessments. While these findings are undoubtedly encouraging, limitations were detected. First, there is little explanation for how the tool domains were identified, aside from a literature review; second, the domains were seemingly not piloted before the development of the tool to ensure they individually and cumulatively predict re-offending; and third, with 400 instruments in use to assess, manage, and monitor violence risk (Singh et al., 2014), the development of new, stand-alone risk assessments is likely unnecessary, and a measure which complements an existing risk assessment may be more useful. Further, as evidenced in this study, the combination of cognitive risk factors and risk variables which are already comprised on risk measures, indicates the potential for additive value.

In sum, researchers have begun directly investigating the ways in which neurocognition can enhance the appraisal of risk, however, more research is necessary to overcome methodological limitations, and to evaluate the cumulative value of cognitive risk factors. Nonetheless, although the relationship between neurocognition and violence is largely characterized by small effect sizes, findings from Haarsma et al. (2020) are encouraging, though a gap remains for a tool which predicts violent outcomes. Moreover, VRA require the addition of new items to increase predictive accuracy and to break through the 'glass ceiling'. The current study aims to address some of these limitations by using rigorous methodology to identify neurocognitive domains and measures, administering validated cognitive measures, and by including inpatient and community offenders to increase generalizability.

1.5 Aims

The current study seeks to, (a) investigate the feasibility of using a neuropsychological battery to aid in the identification of violence risk in an inpatient and community setting, (b) pilot a neuropsychological battery of measures examining risk factors for violence identified through a meta-analysis and an international Delphi study (manuscripts in preparation), (c) identify neuropsychological measures that may improve the predictive accuracy of existing VRA, (d) identify cognitive impairments, measured using a valid neuropsychological tool, that explain the variance in violence risk in two groups of violent offenders, and (e) to identify cognitive abilities which predict inpatient vs community violence.

This study encompasses two distinct samples: forensic psychiatric inpatients (FPI) and community violent offenders (CVO). Currently, recruitment and baseline data collection are complete, with a total of n= 63 participants (e.g., FPI n= 32; CVO n= 31) and analyses have yet to commence.

1.6 Power calculation

A power calculation was conducted using G*Power 3.1 (Faul et al., 2007). To detect a medium effect size with 80% power and alpha set at 0.05 in a sample of n=32, a maximum of two predictors can be examined at one time, and a maximum of one predictor at time can be examined in the CVO group (n=31) to test primary and secondary hypotheses; consequently, the effects will not be cumulative. Covariates, including, crystallized intelligence, age, symptom severity (FPI only), lifetime history of TBI, and severity of TBI will be separately controlled for. Hypotheses will be examined in each group separately.

As the current study examined eight cognitive abilities, the following analysis plan has been developed a priori based on literature, meta-analyses, and a Delphi study to identify key cognitive domains which will be examined in our primary and secondary hypotheses. Where two predictors are allowed, attention and response inhibition will be examined, and attention only, where one predictor is allowed.

1.7 Primary hypotheses

Performance on measures of ***attention*** and ***response inhibition*** will:

1. Be significantly poorer in FPI relative to CVO.
2. Explain the variance in violent incidents/offences prospectively, over, and above traditional VRA.
3. Explain the variance in violent incidents (FPI) or violent offences (CVO) prospectively, where increased impairments will be associated with increased violence and violence severity.

1.8 Secondary hypotheses

Performance on measures of ***attention*** and ***response inhibition*** will explain the variance in perceived risk (FPI), antisocial behaviour (CVO), impulsivity, aggression, and violence severity, retrospectively and prospectively, where poorer performance will demonstrate an increase in these outcomes (Table 4), and will increase odds of perpetrating reactive violence relative to instrumental violence.

2. Methods/Design

2.1 Design

This is a feasibility study examining the viability of implementing a neuropsychological battery in forensic services to aid in the identification and assessment of violence risk, and a pilot study investigating the predictive and incremental ability of neuropsychological measures on risk-related outcomes. It follows a prospective, observational design with a retrospective component. All participants were tested at baseline, and outcomes were collected for 6-month prospective and retrospective follow-ups.

2.2 Participants

FPI were recruited from forensic mental health services, part of NHS Scotland, including high, medium, and low secure inpatient settings. CVO were recruited from Criminal Justice Social Work in Edinburgh, Scotland. Inclusion and exclusion criteria can be found in Table 1.

Table 1. Inclusion and exclusion criteria.

Group	Inclusion	Exclusion
FPI	• Male • 18-60 years old • Completed admission case review • Not being considered for transfer • Can give informed consent • English as their first language • Diagnosis of a psychotic illness	• Patients who have intellectual disabilities • Non-violent/non-contact sex offences or other offences without the presence of a violent offence • Disabilities which may impede their ability to engage in the assessment process (e.g., significant hearing, sight, and motor impairments)
CVO	• Male • 18-60 years old • Can give informed consent • English as their first language • Be under licence and therefore in the care of criminal justice social work for at least 6 months after testing • Has been convicted of a violent offence.	• Participants who have intellectual disabilities • No conviction of a violent offence • Disabilities which may impede their ability to engage in the assessment process

Note. CVO received £20.00 as reimbursement for their time spent participating in the study.

2.3 Data Collection and outcomes

A case-note review checklist was utilised to record data for the purpose of describing the sample. Historical and risk-related data, and a record of potential contributors to the aetiology of cognitive impairments were recorded from participant files where they were available (Table 2).

Table 2. Data collected from participant files.

Historical	Risk-Related	Potential Contributors [a]
• Age, ethnicity, education level/attainment • Date of current admission/ became service user • Source of current admission/services • Legislation for current detention (FPI only) • Current conviction status (if applicable) • Primary and secondary diagnosis (if applicable) • Year of first diagnosis with a psychotic illness (FPI only)	• Reason(s) for current admission/services • Offence(s) or alleged offence(s) leading to current admission/ services • Violent incidences during current admission/ services (if applicable) • Total number of previous convictions • Most serious previous offence • Previous types of offences	• Birth trauma • Abnormal infant development • Childhood history of physical or sexual abuse or neglect • Diagnosis/history of drug or alcohol dependence/misuse • Abnormal infant development • Neurological injuries or neurologically relevant diagnoses

Note. [a] This information was only available for a subset of CVO.

Additional data collected included:

Symptom Severity and Positive Symptoms (FPI Only*).* The Positive and Negative Syndrome Scale (PANSS) (Kay et al., 1987) will be used to measure symptom severity and positive symptoms. The PANSS is a routinely administered measure in some of the forensic psychiatry sites from which FPIs were recruited. When a PANSS was not available, the researcher completed the measure at the time of baseline testing. Symptom severity is operationalised as PANSS total score, and positive symptoms is operationalised as PANSS positive symptoms score.

Violence and Offending Proneness. The retrieval of routinely administered assessments (where available) included, the Historical, Clinical, Risk-20 Scale (HCR-20), Version 3 (Douglas et al., 2014) as a measure of violence proneness, and the Level of Service Inventory-Revised: Screening Version (LSI-R:SV) (Andrews & Bonta, 1995), and the Level of Service/Case Management Inventory (Andrews et al., 2006), as measures of offending proneness. Measure composite scores will be utilised for analyses.

Lifetime History and Severity of TBI. *The Ohio State University Traumatic Brain Injury Identification* (OSU-TBI) (Corrigan & Bogner, 2007) is a standardized procedure for learning about a person's lifetime history of traumatic brain injury. To measure lifetime history of head injury, number of TBIs with loss of consciousness was employed, and to measure TBI severity, the worst injury recorded was rated on a 5-point Likert scale ranging from, no history of TBI or very minor head injury to severe TBI.

Neuropsychological Battery. Development of the battery followed the National Institute of Mental Health's MATRICS initiative's development of the MATRICS Consensus Cognitive Battery (MCCB), which sought to identify not only domains identified by the research literature, but also those that have yet to be the subject of sufficient research, through expert consensus (Nuechterlein et al., 2006). The following measures were chosen based on a Delphi study and meta-analysis both examining cognitive predictors of violence. Operational definitions of independent variables (IV) are listed in Table 3.

Table 3. Operational definitions of independent variables.

IV	Measure	Operational Definition
Attention	Conners' Continuous Performance Test -Version 3 (Conners, 1995)	Number of omission errors
Response Inhibition	Stroop Colour and Word Test (Golden, 1978; Golden & Freshwater, 1978)	Interference score
Response Monitoring	Modified Wisconsin Card Sorting Test (Schretlen, 2010)	Number of perseverative errors
Risk Taking	Iowa Gambling Task-Version 2 (Bechara et al., 1994)	Proportion of cards chosen from disadvantageous card piles
Reasoning	Wechsler Abbreviated Scale of Intelligence, 2nd Edition (Wechsler, 2011)	Perceptual Reasoning Index (PRI)
Affect Recognition (negative and positive)	The Awareness of Social Inference Test (McDonald et al., 2003)	Number of correctly identified emotions
Cognitive Empathy	The Awareness of Social Inference Test (McDonald et al., 2003)	Number of correctly identified feelings
Lack of Insight	Positive and Negative Syndrome Scale (Kay et al., 1987)	Lack of Insight scale score
Crystallized Intelligence	Wechsler Abbreviated Scale of Intelligence, 2nd Edition (Wechsler, 2011)	Verbal Comprehension Index (VCI)

Note. Attention and response inhibition will be used to examine the primary and secondary hypotheses; the remaining variables will be subject to exploratory analyses. Variables are listed in the order in which they will be explored. Crystallized intelligence will serve as a covariate, and lack of insight will only be examined in the FPI group.

Primary and secondary outcomes and operational definitions can be found in Table 4.

Table 4. Primary outcomes and operational definitions.

	Outcome	Operationalisation
Primary Outcomes	Violent Incidents	Institution-recorded incidents of violence will be recorded and triangulated with patient notes to ensure consistency. *"An intentional act of physical aggression against another individual that is likely to cause physical injury"* (Meloy, 2006, p. 539)*, where the individual is the clear aggressor or instigator.* Mean number of incidents over 6 months.
	Violent Offences & Charges [a]	Violent offences/ charges operationalised by the same definition as above. Mean number of offences/charges over 6 months.
Secondary Outcomes	Level of Observation (perceived risk)	Daily mean level of observation over 6-months (183 days) prospectively and retrospectively (FPI only).
	Days on Enhanced Levels (perceived risk)	Mean number of days on enhanced levels prospectively and retrospectively over 6 months (FPI only).
	Length of Admission (perceived risk)	Time in months that a FPI has been in their secure environment.
	Breaches of License/Conditions	Mean number of breaches of license/conditions prospectively and retrospectively over 6 months. Breaches will not be limited to violence and aggression only (CVO only).
	Antisocial Behaviour	Mean number of charges or convictions of non-violent/non-aggressive offences which occurred during the follow-up period in the CVO sample, over 6 months.
	Aggression	Mean number of non-contact aggressive incidents/offences in both samples (e.g., verbal aggression, damage to property, threats, racial aggression, carrying a weapon, intimidating behaviours) over 6 months.
	Impulsivity [b]	Total score of BIS-11 (Patton et al., 1995)
	Severity of violence & Aggression	Mean severity of all violent and aggressive incidents and offences combined over 6 months. Codes range from 0 (completely non-violent) to 4 (severe violence) (Gunn & Robertson, 1976; Robertson et al., 1987).
	Reactive vs Instrumental Violence	Median score of all violent incidents and offences over 6 months. Codes range from 1= Purely reactive to 4= Purely Instrumental (Woodworth & Porter, 2002).

Note. BIS= Barratt Impulsivity Scale. [a] When reporting results, a clear distinction will be made between charges and convictions. [b] As impulsivity is already a well-established risk factor for violence, it will serve as a proxy outcome measure in the current study.

3. Statistical Methods

3.1 Unity of samples

The distinct difference between the FPI and the CVO sample is the presence of major mental illness in FPI and inpatient vs community violence. Thus, all FPI will be analysed together first, and then between group tests will look for any significant differences on measures and demographic information between the FPI and CVO sample. If there are no significant differences between groups, all participants will be analysed in one model, using a dummy variable to indicate the two groups, though, due to the differences between outcome measures (inpatient vs community), the sample will only be combined to examine self-reported impulsivity. To examine hypotheses on the entire sample (n=63), and to detect a medium effect with 80% power, six variables can be examined in one regression.

3.2 Data analysis

Statistical analyses will be conducted using R: A language and environment for statistical computing (R Core Team, 2013).

3.3 Feasibility outcomes

Descriptive statistics will be reported for feasibility outcomes. The predictive accuracy of cognitive measures will be assessed utilising Receiver Operating Characteristic (ROC) analysis, and area under the curve (AUC). For this analysis, any participant who is violent during the follow-up period will be coded as 1, with 0 indicating the absence of violence.

3.4 Feasibility criteria

A future, larger study will be considered if the current study meets the following criteria:

1. Mean tolerability for a single measure must not fall below 3.5. A score of 3 or below indicates that the battery is unpleasant for participants. Scores ranging from 7-4.0 indicate extremely pleasant to neutral. If the mean tolerability rating for a single measure falls below 3.5, the reasons for this will be examined, and its replacement with a new measure for the same construct will be considered.
2. The mean recruitment rate for all sites combined must not fall below 30%. In the case that less than 30% of participants are recruited from all those eligible, inclusion criteria and recruitment procedures will be investigated. To keep the sample that is already recruited, only changes to the inclusion criteria which do not threaten the validity of the study will be considered for review. If this is not seen as a possible solution, the study will be deemed infeasible.
3. If the completion rate for the core measures (WASI-II, CPT-3, Stroop, MWCST, IGT-2, TASIT) does not reach 70%, reasons for non-completion will be reviewed and changes will be made to ensure the battery is feasible for these populations to complete.
4. If variables specified in our hypotheses do not show sufficient sensitivity, specificity, predictive accuracy or add incremental validity to existing risk measures, the measures used for this study will be re-considered using literature and further meta-analyses.

3.5 Primary and secondary outcomes

Patient characteristics will be reported using descriptive statistics. Both offending groups will be compared on baseline performance and participants who were violent will be compared to those who were not during the follow-up period, using t-tests or the non-parametric equivalent.

Linear regressions will be utilized to examine primary and secondary outcomes, with the exception of reactive and instrumental violence, in which ordinal logistic regressions will be used. If there are a sufficient number of recorded incidents or offences, the mean number of violent incidents/offences per month of the follow-up period will be used as a continuous dependent variable. Should there be a low base rate of incidents, those who were violent during follow-up will be coded as one, and those who were not will be coded as zero, and logistic regressions will be used. If the majority of the primary outcomes are not naturally binary, a two-part model for semicontinuous data will be considered. Two separate linear regressions will be run to examine the variance in violent outcomes explained by risk assessments and individual predictors. The proportion of explained variance (R^2) from each model will be used to discuss and compare the models.

4. Discussion

Existing research presents convincing evidence that there is indeed a relationship between cognitive functioning and violent behaviour, however methodological inconsistencies remain. Moreover, the accuracy of existing risk assessments continues to remain at a moderate level. The current protocol aims to identify cognitive domains related to violent and risk-related outcomes, and to examine their utility against existing risk assessments in two forensic samples.

4.1 Strengths

There are several noteworthy strengths in the current study. First, the neuropsychological battery was developed based on rigorous meta-analytic reviews, and an international Delphi study, and care was taken to consider the abilities of the targeted populations; second, all neurocognitive measures are well-validated, clinical tools increasing the reliability and validity of results, and allowing for the calculation of the proportion of participants who have clinically significant neurocognitive impairments relative to norms, facilitating use in clinical practice; third, individuals were recruited from high, medium, and low secure inpatient settings, in addition to violent offenders living in the community, increasing the generalisability of results; fourth, a coding tool to examine instrumental and reactive violence has been included to investigate factors which may be specific to types of violence; fifth, validated measures were included to measure key co-variates including TBI and symptom severity; and sixth, all variables have been clearly operationalised.

4.2 Limitations

This study is not without its limitations. Like other observational studies in this field, there is a risk that the base rate of observational violence will be low, as a result of FPI being in intensive treatment and stable environments, and low level offences that may not be recorded as charges or convictions in CVO, are common within these populations, which may impede our ability to examine our primary hypotheses. To counter this, we have included secondary outcome measures, which are indicative of perceived violence risk, and it is hoped that these will serve as a suitable criterion variable in the case of low adverse incidences in both FPI and CVO samples. Also, this is a field which has struggled to obtain larger samples, given that antisocial personality disorder and other psychiatric illnesses are common among these populations, thus this has been designed as a feasibility and pilot study to inform a larger trial. Conducting pilot studies can answer questions about feasibility, recruitment potential, and patient acceptability, as well as, sourcing a justification for larger, future studies, and can provide best practice guidelines for logistical issues for a larger study. Moreover, conducting a pilot in advance of a primary study can increase the potential for a successful future study (Thabane et al., 2010). Accordingly, to remain transparent, we have pre-emptively chosen variables which were supported by the literature and expert opinion to test the primary and secondary hypotheses of the current study. Finally, the findings will not be generalizable to other sexes, as only men were recruited.

5. Conclusion

It is our hope that the results of this study and, if indicated, a larger future study, will contribute to the development of a structured professional tool to aid in the identification and assessment of cognitive impairments shown to be predictive of violence risk, our knowledge of the predictive utility of measures, and to determine whether the addition of the assessment battery increases the predictive accuracy of existing measures of risk and/or positively contributes to the formulation of offending risk.

Declarations

Conflict of interests: The authors declare that they have no conflict of interest.

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