THE STRUCTURED ASSESSMENT OF VIOLENCE RISK IN ADULTS WITH INTELLECTUAL-DISABILITY: A SYSTEMATIC REVIEW

## Running title: Risk assessment in ID: a systematic review

## Keywords: Violence, risk assessment, intellectual disability, structured professional judgment, systematic review

## Abstract

Background: Whilst structured professional judgement approaches to assessing and managing the risk of violence have been extensively examined in mental health/forensic settings the application of the findings to people with an intellectual disability (ID) is less extensively researched and reviewed. This review aims to assess whether risk assessment tools have adequate predictive validity for violence in adults with an ID.

Methods: Standard systematic review (SR) methodology was used to identify and synthesise appropriate studies.

Results: A total of 14 studies were identified as meeting the inclusion criteria. These studies assessed the predictive validity of 18 different risk assessment tools, mainly in forensic settings. All studies concluded that the tools assessed were successful in predicting violence. Studies were generally of a high quality.

Conclusions: There is good quality evidence that risk assessment tools are valid in a forensic ID population but further research is required to validate tools in a non-forensic ID population.

## Introduction

Some people with an ID act aggressively to those around them and would benefit from improvements in how services prevent and manage such behaviour. Population surveys in the UK and elsewhere indicate that 7-10% of people with ID are estimated to act aggressively over a 6 month period ([Cooper et al., 2009](#_ENREF_8), [Emerson et al., 2001](#_ENREF_13), [Holden & Gitlesen, 2006](#_ENREF_20)) but rates are higher amongst subgroups with comorbidities and/or receiving specialist services ([Crocker et al., 2006](#_ENREF_9), [Cooper et al., 2009](#_ENREF_8)). This aggression can have a serious impact on carers and impair the staff-client relationship ([Hastings, 2002](#_ENREF_17), [Skirrow & Hatton, 2007](#_ENREF_43)) as well as restricting the person to institutional care.

There have been significant steps forward in the last twenty years in terms of developing structured approaches to risk assessment and risk management of violence, particularly in mental health (MH) populations. Whilst the research literature on risk assessment overall has been extensively examined and summarised ([Whittington et al., 2013](#_ENREF_47), [Singh et al., 2011](#_ENREF_42)) the specific application of the findings to people with ID is less extensively researched. Some, but not all, of the evidence-based approaches developed for MH services may be applicable directly to people with ID. Other approaches from MH services can be adapted for people with ID ([Verbrugge et al., 2011](#_ENREF_45)) and in addition some entirely distinct approaches tailored to ID needs have also been developed ([Lofthouse et al., 2013](#_ENREF_29)). This paper seeks to summarise the evidence base underpinning structured risk approaches when used in ID services specifically in order to guide future research and practice in this area.

### Risk and challenging behaviour

One fundamental limitation in directly applying the MH evidence base to people with ID is the distinctive way in which aggression is construed by practitioners and researchers in the two settings. In particular, most aggression by people with ID is viewed by professionals less as an issue of ‘risk’ and more as an issue of challenging behaviour. ([Blunden & Allen, 1987](#_ENREF_4)) ([Holland, 2004](#_ENREF_21), [Murphy & Clare, 2012](#_ENREF_36)). This has been defined as “culturally abnormal behaviour(s) of such an intensity, frequency or duration that the physical safety of the person or others is likely to be placed in serious jeopardy, or behaviour which is likely to seriously limit use of, or result in the person being denied access to, ordinary community facilities” ([Emerson & Bromley, 1995](#_ENREF_12)). It is a broad category encompassing antisocial acts such as spitting and smearing as well as self-harm and externalised aggression. Central to the concept is the idea that the behaviour may be the person’s means of communicating ([Emerson & Bromley, 1995](#_ENREF_12)) or their best attempt at problem solving ([Pityonak, 2001](#_ENREF_38)) and that responsibility for change therefore lies not with the individual but with their environment (physical, emotional, relational) which may be the focus of intervention ([Bush, 2012](#_ENREF_6)). Closely associated is the insight that if people with ID were living more fulfilling and less restrictive lives, much of their challenging behaviour, including that which carries a risk of harm to others, could be reduced ([La Vigna & Willis, 1995](#_ENREF_24)). Many of the seemingly aggressive acts carried out by people with ID within community settings are therefore likely to be viewed by practitioners as challenging behaviours requiring the use of both behavioural interventions alongside positive values-based attempts to improve the person’s quality of life ([Allen et al., 2005](#_ENREF_2)). This differs from the perspective adopted in forensic and/or MH settings where similar behaviours may be understood as offences involving *mens rea* and a greater degree of intentionality. Thus it is important to keep in mind a distinction between challenging behaviour, which is viewed as an expression or communication of need, and aggressive or violent behaviour for which the individual is considered culpable or which is thought to require management in restricted environments.

### Differing patterns of aggression in ID and MH services

Even when the concept of risk is employed, assessment and treatment of people with ID may present a number of specific difficulties ([Clare, 1993](#_ENREF_7)). In particular acquiescence and suggestibility, memory difficulties, difficulty understanding language and complex concepts, reading difficulties and responding inappropriately to questions due to poor understanding may be more prevalent in people with ID than in MH or offender groups generally ([Clare, 1993](#_ENREF_7)). Furthermore, in England and Wales the legislative context of risk assessment for people with ID is likely to be shaped to a greater degree by the Mental Capacity Act (2005) ([Mental Capacity Act, 2005](#_ENREF_34)) rather than the Mental Health Act (2007).

Applying research conducted with service users without ID raises theoretical issues as well. Explanatory models developed in non-learning disabled populations have been applied to people with ID without validation ([Johnston, 2002](#_ENREF_23)). The assumption that findings about offenders or alleged offenders without an ID can be applied to people with ID has been questioned ([McBrien & Murphy, 2006](#_ENREF_32)). For example, people with ID tend to experience relatively high levels of social exclusion, isolation and deprivation, which may make, for example, risk predictions using employment status as a key factor problematic.

Despite the differences, many of the developments in MH risk assessment are likely to be at least partly applicable to people with ID as there is significant overlap particularly in terms of general, historical and/or static risk factors. The divergence ([Allen, 2000](#_ENREF_1)) is likely to lie in those areas of dynamic risk which are considered most amenable to targeted interventions and thus are most relevant to improving outcomes (Douglas & Skeem, 2005).

### Implications for evidence-based risk assessment

A key criterion for evaluating the effectiveness of instruments in both populations is predictive validity ([Singh et al., 2013](#_ENREF_41)). Whilst structured professional judgement (SPJ) tools are designed primarily to underpin active decision making about treatment and management, the items providing the underlying structure must in some way be known to relate to violent behaviour. In the overall literature, the ability of instruments to guide predictions with levels of success that represent significant improvements over chance has been established for some time now which is welcome progress, but needs to be set against the related finding that even in the best-performing instruments, levels of predictive power still leave a sizeable margin of error and they have not been fully examined in people with ID ([Whittington et al., 2013](#_ENREF_47)). One implication of this is that risk assessment tools may be of greater practical value when applied for the purposes of risk management, for example when making decisions regarding levels of care and security monitored over time, than for the making of “all-or-none” decisions concerning, for example detention versus discharge ([Logan et al., 2011](#_ENREF_31)).

## Aim of the review:

With these issues in mind, a SR of primary research on risk assessment specifically in people with ID was planned. The overall aim was to identify which risk assessment tools have been found to have adequate predictive validity for a violent outcome in adults with an ID.

## Methods:

This review was conducted in parallel with a separate review of the risk *factors* associated with violence (as opposed to tools) in adults with ID and therefore the results of the search strategy, and the flow diagram of the results of study selection, incorporates the results of both of these reviews. The remainder of this paper refers only to those studies reporting on risk assessment tools. The results of the review of risk factors will be reported in a separate paper.

### Searching

A broad search strategy from a previous review, conducted across all at-risk populations (e.g. MH, ID and offenders), was adapted to reflect the specific population of individuals with an ID. Search terms included a combination of index terms and free text words. They did not include methodological filters to limit results to a specific study design nor date limits. The search strategies are available from the authors by request.

The searches were run across two electronic databases (Medline and PsycINFO) and citations were imported into Endnote XV® sequentially. Due to the limitations of Endnote XV®, duplicate references were deleted first electronically and then manually.

The search was initially run in April 2013 but was rerun in April 2014. Hand-searching of reference lists of included studies was also conducted.

### Inclusion criteria

Identified citations were assessed for inclusion at two stages. The criteria used are shown in Table 1. The review was not limited by design of study.

At stage one inclusion, all titles and abstracts of identified citations were scanned for inclusion by one reviewer (JH) and at this stage an inclusive approach was taken. The full papers of those citations meeting the inclusion criteria at stage one, were then obtained.

At stage two the inclusion/exclusion criteria were applied to the full papers identified at stage one by one reviewer (JH) and cross checked by a second reviewer (RM/JW). Any disagreements between reviewers were resolved by discussion at each stage and, where necessary, a third reviewer (RW/JM) was consulted.

### Data extraction

Predefined data on the population, study characteristics and outcomes assessed were extracted by one reviewer (JH) into a Microsoft Access® database developed for the purpose. Data from studies presented in multiple publications were extracted and reported as a single study with all relevant other publications listed. All data were checked for accuracy by a second reviewer (RM/JW).

### Quality assessment

The quality of studies was assessed using a modified version of the QUADAS 2 ([Whiting et al., 2011](#_ENREF_46)). The QUADAS 2 is designed to assess the risk of bias and applicability of primary studies included in SRs of diagnostic accuracy studies. It is comprised of four domains: patient selection, index test, reference standard (renamed ‘outcome measure’ here), and flow and timing. For each domain the risk of bias is summarised as Low/High/Unclear and for the first three domains only the applicability is summarised as Low/High/Unclear. One reviewer (JH) applied the quality assessment to each study and the evaluations were checked by a second reviewer (RM/JW).

### Synthesis

Characteristics of the studies and populations are synthesised in tables below and are discussed in a narrative review. Outcomes reported from the studies are also presented in tables and discussed.

Area under the Curve Analyses (AUC)

An AUC value is a measure of diagnostic accuracy calculated from a receiving operator curve that plots the true positive rate against the false positive rate at different thresholds. If a tool has perfect diagnostic accuracy then it will have an AUC of 1; whereas if it is no better than chance it will have a value of 0.5. In the subset of studies reporting AUC data, the mean values for the AUC and the 95% confidence interval boundaries were calculated for those tools tested in two or more studies. For tools tested in only one study, these values are simply listed for each tool.

## Results

The searches identified 4,303 citations for both reviews across the two databases with 724 citations being duplicated. After applying the inclusion criteria through the two stages 17 papers were identified as meeting the inclusion criteria and are included in this review.

Of the 17 included papers three papers ([Fitzgerald et al., 2011](#_ENREF_15), [Morrissey et al., 2007](#_ENREF_35), [Lofthouse et al., 2014](#_ENREF_30)) reported sub-group analyses of other papers. Therefore 14 studies ([Blacker et al., 2011](#_ENREF_3), [Dura, 1997](#_ENREF_11), [Gray et al., 2007](#_ENREF_16), [Lindsay et al., 2008](#_ENREF_27), [Lindsay et al., 2004](#_ENREF_28), [McMillan et al., 2004](#_ENREF_33), [Novaco & Taylor, 2004](#_ENREF_37), [Quinsey et al., 2004](#_ENREF_40), [Steptoe et al., 2008](#_ENREF_44), [Verbrugge et al., 2011](#_ENREF_45), [Drieschner et al., 2013](#_ENREF_10), [Fitzgerald et al., 2013](#_ENREF_14), [Lofthouse et al., 2013](#_ENREF_29), [Inett et al., 2014](#_ENREF_22)) are discussed below with the references for the three linked papers identified in the tables.

### Study characteristics

Details of the study characteristics of the 14 included studies are shown in Table 2. The earliest study was [Dura (1997)](#_ENREF_11) which was conducted in the US in 1997. The next published study was in the UK in 2004 ([Novaco & Taylor, 2004](#_ENREF_37)). Both of these initial studies were cross-sectional but the subsequent 12 studies were either prospective (n=9) or retrospective (n=3). Four of the studies were published within the last year of the search and were only identified in the updated search ([Drieschner et al., 2013](#_ENREF_10), [Fitzgerald et al., 2013](#_ENREF_14), [Lofthouse et al., 2013](#_ENREF_29), [Inett et al., 2014](#_ENREF_22)).

Ten studies were conducted in the UK and, of these, seven ([Lindsay et al., 2004](#_ENREF_28), [Novaco & Taylor, 2004](#_ENREF_37), [Gray et al., 2007](#_ENREF_16), [Lindsay et al., 2008](#_ENREF_27), [Steptoe et al., 2008](#_ENREF_44), [Fitzgerald et al., 2013](#_ENREF_14), [Lofthouse et al., 2013](#_ENREF_29)) had overlapping authors indicating the predominance of a small group of people researching in this area. The remaining four studies were conducted in the US ([Dura, 1997](#_ENREF_11)), Canada ([Quinsey et al., 2004](#_ENREF_40)), Australia ([Verbrugge et al., 2011](#_ENREF_45)) and the Netherlands ([Drieschner et al., 2013](#_ENREF_10)).

The majority of studies (n=11) were conducted in forensic mental health or probation settings with the remaining three being in residential/community settings. The number of participants in the studies ranged between five in a pilot study and 218 in a single cohort study. Follow-up time in prospective studies ranged from three months ([Lindsay et al., 2004](#_ENREF_28)) to an average of 6 years ([Lofthouse et al., 2013](#_ENREF_29)). The definitions of aggression used as outcomes in the 14 studies were generally similar though 11 studies used the rate of institutional incidents as an outcome measure and three used a criminal justice measure i.e. offences, reconviction or recidivism.

### Participant characteristics

Details of the participant characteristics are shown in Table 3. The studies predominantly included male participants with seven studies including only males and the other seven including between 64% and 93% males. The mean age ranged from 24.7 (±8.06) and 40.6 (±10.59) years though the age ranges within the individual studies were wide with the youngest participants being 17 years old and the oldest 82 years old.

Not all studies clearly reported their definition of ID but, where stated, the International Classification of Diseases version 10 (ICD 10) and Wechsler Adult Intelligence Scale (WAIS) IQ definitions were used. The level of ID of the included participants was predominantly mild i.e. IQ of 50-69.

Where participants were from a forensic or probation setting the offences included both violent and/or sexual offences.

Nine studies reported comorbidities for the participants though the level of detail varied and therefore comparisons across studies are limited.

### Study measures and conclusions

The 14 studies assessed the predictive validity of 18 different risk assessment tools. Seven studies also assessed other risk factors that are not included in this review (see ([Hockenhull et al., In prep-b](#_ENREF_19))). All studies concluded that the tools assessed were successful in predicting violence and that there was a role for such assessments in clinical practice (Table 4).

### Predictive validity

Six tools were assessed in more than one study. Six studies assessed the Violence Risk Appraisal Guide (VRAG), four the Historical Clinical Risk Management-20 (HCR-20), two the Risk Matrix 2000-V(RM 2000), two the Dynamic Risk Assessment and Management System (DRAMS), two the STATIC 1999 and two the Assessment of Risk Manageability for Intellectually Disabled Individuals who Offend (ARMIDILO). The remaining 12 tools were each assessed by one study. Three of the studies used an AUC analysis for their primary outcome, one an analysis of variance (ANOVA), one a Pearson’s Product-Moment correlation and two a Spearman’s correlation. Details of the outcomes are shown in Table 5 for tools assessed by more than one study and Table 6 for those assessed by only one study.

The VRAG was assessed by six studies and all six used an AUC analysis. The AUCs ranged from 0.56 to 0.87, with only one reported as statistically non-significant. The mean AUC was 0.73 showing a better than chance prediction (though CIs were not reported). The one study not reporting a statistically significant difference was using the VRAG to predict sexual incidents only whereas the others reported violence as the outcome.

The HCR-20 was assessed in four studies, all using an AUC analysis. The AUCs ranged between 0.72 and 0.80, all of which were reported as statistically significant. The mean AUC for the HCR-20 was 0.77 again showing a better than chance prediction of violence.

The RM 2000V was tested in two studies both of which used an AUC analysis. [Lindsay et al. (2008)](#_ENREF_27) assessed violent incidents and reported a p value of 0.07 indicating that the AUC estimate failed to reach statistical significance. [Blacker et al. (2011)](#_ENREF_3) assessed sexual reconviction and reported confidence intervals, the lower of which was below 0.5 suggesting the RM2000 V predicted at a level no better than chance in this study. ) The DRAMS was assessed by two studies; one using an ANOVA and one an AUC analysis. Both reported a statistically significant result.

The STATIC 99 was assessed by two studies both reporting statistically significant AUCs for sexual incidents with a mean AUC of 0.73.

The ARMIDILO-stable was assessed by two studies with the outcome measure in both being sexual recidivism. Both achieved high AUCs with a mean value of 0.88.

As shown in Table 6 the BPRS, WARS, a bespoke actuarial violence prediction tool ([McMillan et al., 2004](#_ENREF_33)), PCL-SV, and OGRS2, all reported statistically significant results. [Blacker et al. (2011)](#_ENREF_3) assessed the RRASOR, SVR20 and the acute subscale of the ARMIDILO using AUC analyses. Though the statistical significance was not reported for these analyses, examination of the AUC values and the reported 95% CIs show that none reported values above 0.50 for the lower CI.

[Verbrugge et al. (2011)](#_ENREF_45) assessed the HCR-20 ID supplement and reported an AUC of 0.80 with 95% CIs of 0.63 and 0.98. These values, all above 0.50, show an above chance level of prediction. This study had also assessed the HCR-20 without the ID supplement (Table 5) and reported very similar levels to that with the ID supplement (AUC = 0.80 [95% CI 0.63 and 0.96]).

[Drieschner et al. (2013)](#_ENREF_10) assessed two tools and reported the results for each subscale with three different outcomes, namely verbal aggression, aggression towards objects and physical aggression. The results varied with four Dynamic Risk outcome Scales (DROS) subscales (treatment engagement, coping skills and impulsivity) significantly correlated with all three outcomes and eight DROS subscales (problem recognition, attitude towards treatment, self-care, sexual deviancy, substance abuse, psychotic symptoms, vulnerability and social network) not significantly correlated with any of the outcomes. Three further scales (problem recognition, antisocial attitudes and realistic plans) were all correlated with verbal aggression but not with aggression towards objects or physical aggression. The Adult Behaviour Checklist (ABCL) externalising subscale was significantly correlated with all three outcomes whereas the internalising subscale was not significantly correlated with any of the three outcomes.

Finally, ([Inett et al., 2014](#_ENREF_22)) assessed the predictive validity of both the risk and strength scales of the Short Term Assessment of Risk and Treatability (START) at 30 and 90 days. The outcomes reported were verbal aggression, physical aggression and sexually inappropriate behaviour. At 30 days both the risk and strength scales had significant AUCs for both verbal and physical aggression but neither predicted sexually inappropriate behaviour above chance. At 90 days both scales continued to predict physical aggression better than chance but neither predicted verbal aggression or sexually inappropriate behaviour.

### Quality assessment

The results of the quality assessment showed that generally studies were of a high quality with low concern about the applicability of the results. However the level of risk of bias was unclear for six studies. There was unclear risk of bias in the two cross sectional studies ([Dura, 1997](#_ENREF_11), [Novaco & Taylor, 2004](#_ENREF_37)) due to a lack of information about whether the outcomes were measured without rater knowledge of the results of the risk assessment. One study ([Lindsay et al., 2004](#_ENREF_28)) was a pilot study and included only five patients. The participants were selected on the basis that they had all the necessary data and this therefore meant that there was a high risk of bias in patient selection and the effects on the applicability of the results is unclear. It was unclear from the [Fitzgerald et al. (2011)](#_ENREF_15) study how participants were selected therefore patient selection bias could not be assessed. [Drieschner et al. (2013)](#_ENREF_10) reported that the ABCL scale had been assessed by the same staff as those who recorded the MOAS outcome therefore there was a high level of bias for this scale. Finally, the applicability of patient selection in [Blacker et al. (2011)](#_ENREF_3) was of unclear concern as all participants had completed a sex offender treatment programme prior to being tested.

## Discussion

This SR identified 14 studies reporting the validity of 18 risk assessment tools in predicting violent behaviour in adults with ID. The earliest study was published in 1997, with 10 studies conducted in the UK. Generally studies used the risk assessment tools to predict violent behaviour by young males with a history of offending in forensic or probation settings. The studies were largely good quality and reported similar outcomes, with most studies reporting a better than chance level of success in predicting violence.

When the results of this SR are compared to the recently published SR of risk assessment in the general violence literature ([Whittington et al., 2013](#_ENREF_47)) some similarities are found: e.g. perpetrators tend to be young, male and convicted offenders. However there are some noticeable differences, not least in the relatively small number of studies identified here. Though [Whittington et al. (2013)](#_ENREF_47) used a broader definition of a risk assessment tool they identified 959 studies over a limited seven years publication period (2002-2008) . Therefore the area of risk assessment in adults with ID is a relatively under researched one although it would appear to be increasing in scope. The original search here in April 2013 identified 10 of the studies with the update in 2014 only one year later identifying an additional four studies. Furthermore whilst 10 of the 15 studies included in the SR were conducted in the UK the general violence risk literature is predominantly North American (52.2% US, 13.0% Canada) ([Whittington et al., 2013](#_ENREF_47)) with only 12.3% of studies conducted in the UK.

A further difference from the general literature is the quality of the studies, particularly in relation to the research design. In the general literature there was a preponderance of cross sectional design studies, high attrition in the longitudinal studies and only 6.8% of studies used an AUC analysis ([Whittington et al., 2013](#_ENREF_47)). In the review here only two studies used a cross sectional design, attrition was low in longitudinal studies and the majority used an AUC analysis.

The results of studies using an AUC analysis show similar levels of prediction as those found in the general literature ([Whittington et al., 2013](#_ENREF_47)) with mean AUC values for the VRAG at 0.73 (95% CI: 0.61, 0.93) compared to 0.72 (95% CI 0.65, 0.838), the HCR-20 at 0.77 (95% CI: 0.61-0.96) compared to 0.69 (95% CI: 0.582, 0.793) and the RM 2000 at 0.62 compared to a mean AUC of 0.77 in the two studies included in the general literature. It would therefore seem that risk assessments designed for general populations may be applicable to an adults with ID. However it should be borne in mind that whilst conclusions are broadly similar between the two reviews in this respect both report predominantly on a specific population in that they are young male offenders, with the present review only finding studies using risk assessments in people with mild or moderate ID. Therefore the applicability of the tools in a wider ID population cannot be evaluated.

To assess the applicability of risk assessment tools to adults with ID more studies are needed in wider groups e.g. non-forensic, female and severe/profound ID samples. There also needs to be more consideration of the issues involved in determining what is identified as violence/aggression in ID settings with the placing of challenging behaviour in that context.

Three of the tools assessed were designed specifically for use with adults with ID: DRAMS, ARMIDILO and the HCR -20 ID supplement. The DRAMS was assessed by two studies ([Lindsay et al., 2004](#_ENREF_28), [Steptoe et al., 2008](#_ENREF_44)) which both reported significant predictive validity. The ARMIDILO S was assessed in one small study ([Blacker et al., 2011](#_ENREF_3)) and one moderate sized study ([Lofthouse et al., 2013](#_ENREF_29)) and both reported high AUCs, Although the AUC value for the acute subscale in [Blacker et al. (2011)](#_ENREF_3) showed a better than chance prediction the CIs fell below 0.50 thereby failing to reach better than chance prediction.

One study ([Verbrugge et al., 2011](#_ENREF_45)) tested the predictive validity of both the HCR-20 and an HCR-20 ID supplement developed by [Boer et al. (2010)](#_ENREF_5) and found good prediction for both. However the results were almost identical with the non-adapted version reporting an AUC of 0.80 (95% CI: 0.63, 0.96) and with the ID supplement an AUC of 0.80 (95% CI: 0.63, 0.98). These results would suggest that an ID supplement to the HCR-20 does not increase the predictive validity of the HCR-20 raising the question about the utility in adapting tools for use in with adults with ID.

Through contact with local services the authors are aware that other tools have been developed specifically for this population. However, whilst these tools are being used in practice, their validity has yet to be formally assessed. It is likely that many other services have developed their own tools in this way which are used in clinical practice but are not validated. Tools developed by practitioners to address the local needs in clinical practice are potentially valuable in the development of appropriate and clinically useful risk assessment tools. However, they need to be formally assessed and results published so that the wider community have access to these resources. A further disadvantage of locally developed tools is the lack of comparability between tests and therefore the transferability of the results of any assessment. This is likely to have serious repercussions for regional and national service planning and collaborative research across areas ([Lindsay & Beail, 2004](#_ENREF_26)).It is recommended that if local services seek to develop their own in-house risk assessment, at the very least they should test it in parallel with an established risk assessment tool with a larger-scale database.

Furthermore no studies of tools that assess protective factors in predicting violence were identified. However this is still a very recent area of research in the general population and it is no surprise that these studies are yet to be done for adults with ID. It would be greatly beneficial to the research area if this was to occur. As a starting point, SRs of both risk factors and protective factors involved in predicting violence in adults with ID are currently underway to identify factors particular to this population. These reviews are intended to identify any factors not included as items in the currently available tools ([Hockenhull et al., In prep-b](#_ENREF_19), [Hockenhull et al., In prep-a](#_ENREF_18))

Since this review was conducted a SR of risk assessment and management in offenders with ID has been conducted ([Pouls & Jeandarme, 2015](#_ENREF_39)). However the Pouls and Jeandarme review differed from this review, in that it was restricted to adjudicated offenders and included people with borderline intellectual functioning, the authors reached similar conclusions i.e. that “mainstream” instruments seem to have equal validity for adults with ID but that the evidence is still preliminary.

The focus here has been particularly on the scientific robustness of the identified instruments in predicting risk but the more recent tools are designed to provide structure to professional judgements on individual clients and thus are a form of intervention rather than merely assessment. As such, action is needed to promote specific consideration of the features of risk for the individual patient that link to strategies for improved risk management ([Logan et al., 2011](#_ENREF_31)). Unfortunately, in this and the wider at-risk population, there is a potential that the judgement structuring process disaggregates the patient into a cluster of risk factors rather than seeing him or her holistically as an individual person. It might be preferable if the tools incorporated the risks into a narrative of the whole person which joins together the key issues i.e. case formulation. This represents a shift of focus away from simply identifying risk factors to thinking about how the key variables that are unique to the individual interact to cause them to act in a violent way ([Lewis & Doyle, 2009](#_ENREF_25)). Clinicians working with adults with ID have some advantage over those working in other areas by having developed an established routine for making connections between inherent personal and environmental factors laid out in the tools considered. Much of the understanding of clinical issues emanates from enhanced observations of the patient over time. It appears that for many it will be usual practice to consider the risk factors not as single items but as connected features of the whole person. If this is the case expanding this thinking to the outputs of SPJ tools will be more comprehensive and will benefit the patient group.

## Conclusions

Whilst there is good quality evidence that risk assessment tools are valid for adults with ID it is still an under researched area especially outside a forensic male population with mild to moderate ID. Further research is required to validate tools in a wider ID population particularly to identify protective factors.

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Table 1: Inclusion and exclusion criteria

|  |  |  |
| --- | --- | --- |
|  | Inclusion | Exclusion |
| Population | ID IQ<75Adults (18 years and over)  | IQ >75 |
| Assessment of risk | A structured risk assessment tool combining one or more factors considered to be predictive of violence | Individual factors whether assessed by a tool or not. |
| Outcome | A measure of violence either direct or proxy | Violence against selfMeasures of behaviour where aggression cannot be disaggregated |
| Other | English | Non-English papers/abstracts |

Table 2: Study characteristics

| **Study ID** | **Year** | **Country** | **Design** | **Setting** | **N** | **Follow-up (days)** | **Definition of aggression outcome** | **Measure of aggression outcome** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [Dura (1997)](#_ENREF_11) | 1997 | US | Cross-sectional design | Living assistance services | 67 | NA | Pinching, scratching, pushing, slapping, punching, kicking, grabbing, biting, or burning another person, spitting on another individual, pulling another’s hair. Actual physical contact between two people had to take place.  | Form recording frequency: never, monthly, weekly, daily, hourly, multiple times per hour. Risk of injury : low, medium, high |
| [Novaco and Taylor (2004)](#_ENREF_37) | 2004 | UK | Cross-sectional design | Inpatient forensic services, medium and low secure and rehabilitation | 129  | NA | Violent offence history and in-hospital assaults on staff or other patients | Hospital records |
| [McMillan et al. (2004)](#_ENREF_33) | 2004 | UK | Retrospective cohort study | Medium secure forensic service | 124 | 183 | Non-accidental behaviour that does or has the potential to do physical harm to another person. attempted physical violence; contact between the assailant and the victim; contact between an object and the victim; documented physical harm to the victim; or the victim was given medical attention  | Hospital database records |
| [Lindsay et al. (2004)](#_ENREF_28)a  | 2004 | UK | Prospective cohort study | High secure forensic service | 5 | 91.47 | Violent incidents | Major incident data analysis system  |
| [Quinsey et al. (2004)](#_ENREF_40) | 2004 | Canada | Prospective cohort study | Residential institutions | 58 | 474 SD=169.3 | Physical contact between the client and another person | Incident reporting form |
| [Gray et al. (2007)](#_ENREF_16)b | 2007 | UK | Pseudo-prospective case note analysis | Assessments taken at discharge from medium secure forensic service | 145 | Min 730 | Offenses classified as violence against the person by the Home Office, as well as kidnap, criminal damage, endangering life, robbery, rape, and indecent assault. | Home Office Offenders Index (2000) |
| [Steptoe et al. (2008)](#_ENREF_44) | 2008 | UK | Prospective cohort study | High secure forensic service | 23 | 182.5 | Violent incidents | Hospital database |
| [Lindsay et al. (2008)](#_ENREF_27)c | 2008 | UK | Prospective cohort study | Initial assessments conducted at 3 settings high security, medium & low, community.  | 212 | 365 | Recorded verbal aggression, physical aggression, destruction of property, and inappropriate sexual behaviour. | Recorded independent of the study through the nursing case notes |
| [Blacker et al. (2011)](#_ENREF_3)d | 2011 | UK | Retrospective cohort study | Assessments taken at the end of a probation treatment programme | 10 | 1825 | Sexual reconviction | Home Office Police National Computer  |
| [Verbrugge et al. (2011)](#_ENREF_45) | 2011 | Australia | Retrospective cohort study | Community justice programme (CJP)-post custodial release | 59 | Min 730, mean 1,331 | Violent recidivism | CJP client case files |
| [Drieschner et al. (2013)](#_ENREF_10) | 2013 | The Netherlands | Prospective cohort study |  Residential (forensic and non-forensic) | 218 | 6 months to 5 years | Aggressive incidents  | Extended Modified Overt Aggression Scale  |
| [Fitzgerald et al. (2013)](#_ENREF_14) e | 2013 | UK | Prospective cohort study | Medium secure units | 25  | Mean 172.60 days sd 36.10  | Institutional violence specifically physical aggression | Continuous care records using the Aggression vulnerability Scale |
| [Lofthouse et al. (2013)](#_ENREF_29)f | 2013 | UK  | Prospective cohort study | Community | 42 | 6 years | Any behaviour with a sexual motive including physical contact and non-physical contact offences. Such behaviours included indecent exposure, lewd and libidinous behaviour, exhibitionism and stalking to sexual assault and rape. | Case notes |
| [Inett et al. (2014)](#_ENREF_22) | 2014 | UK | Prospective cohort study | Forensic ID service low -secure | 27  | 30 days and 90 days | Verbal aggression, physical aggression to others, sexually inappropriate behaviour  | Incident severity scale based on the Overt Aggression Scale |
| [Lofthouse et al. (2014)](#_ENREF_30) |  |  |  |  |  |  |  |  |

a Pilot of [Steptoe et al. (2008)](#_ENREF_44), b[Fitzgerald et al. (2011)](#_ENREF_15), c [Morrissey et al. (2007)](#_ENREF_35), [Lofthouse et al. (2014)](#_ENREF_30), NA=not applicable, SD=standard deviation, e ID group only, f Subgroup of people with ID<70

Table 3: Participant characteristics

| **ID** | **% male** | **Mean age (SD)** | **Age range** | **Definition of ID**  | **Levels of ID** | **Offences** | **Comorbidities** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| [Dura (1997)](#_ENREF_11) | 64.2 | 38.1 | 22-64 | NR | Borderline = 0%, Mild = 41.8%, Moderate = 25.4%,Severe = 11.9%, Profound = 19.4%, Unclear = 1.5% | NA | NR |
| [Novaco and Taylor (2004)](#_ENREF_37) | 100 | 33.2 (11.6) | - | Developmental disabilities WAIS scores are reported | Mean 67.5, median 69.0, sd 8.0 | No details | Psychosis 10.9%, major defective disorder 15.5%, PD 18.6%, Chromosomal abnormality 3.9%, Asperger’s 1.6%, Tourette’s 1.6% |
| [McMillan et al. (2004)](#_ENREF_33) | 75.8 | 33.1 (10.2) | - | ICD 10  | Borderline = 0%, Mild = 80.6%, Moderate = 8.1%, Severe = 0%, Profound = 0%, Unclear/missing = 11.3% | No details | NR |
| [Lindsay et al. (2004)](#_ENREF_28)a  | NR | 39.4 (7.6) | 27-48 | WAIS IQ | All mild, ranging between 58 and 69 | Aggressive behaviour and child molestation n=1, fire-raising and assault n=1, assault and sexual assault n=3 | NR |
| [Quinsey et al. (2004)](#_ENREF_40) | 100 | 40.61 (10.59) | - | Diagnosis of mental retardation | No details | NA | Personality Disorder 59%, Paraphilia 36%, Psychosis 11%, Affective Disorder 9% Substance Abuse Disorder 2% |
| [Gray et al. (2007)](#_ENREF_16)b | 81.4 | 31.54 (8.94) | 18.8-65.8 | ICD 10 | Borderline = 0%, mild = 83.4%, moderate = 12.4%, severe =3.4%, profound = 0%, unclear = 0.7% | No details | Mental illness or personality disorder 66.2% |
| [Steptoe et al. (2008)](#_ENREF_44) | 100 | 38.4 (10.3) | - | NR | Mean IQ 64.6 sd 8.1 | Violent offences, 12 of which were combined with sexual offences, four with ﬁre raising and four capital offences. | Autistic spectrum disorder 34.8%, psychotic disorder 30.4% |
| [Lindsay et al. (2008)](#_ENREF_27)c | 100 | 38.7, 39.0, 34.3 | - | NR | Mean IQ = 66.6, 66.7, 64. | Violent offences 69.9, 35.7, 24.7, Sexual offences 56.2, 58.8, 55.2 | Mental illness 37.0%, 10.0%, 30.3% |
| [Blacker et al. (2011)](#_ENREF_3)d | 100 | 35 (14) | 19-82 | IQ <75 |  | Sex offences | NR |
| [Verbrugge et al. (2011)](#_ENREF_45) | 93 | 24.68 (8.06) | 16-44 |  | Unclear but 58 mild/moderate and one borderline  | Mixed group of offences | 22% had psychotic disorder |
| [Drieschner et al. (2013)](#_ENREF_10) | 86.4 | 33.8 (11.5) | - | WAIS III/ Groningen Intelligence Test 2 | Mean IQ 70.3 sd 9.7 | Ever convicted 77.6% | Psychotic disorder 27.9%, Mood or anxiety disorder 11.0%, Attention deficit or disruptive behaviour disorder 25.9%, Substance-related disorder 37.6%, Pervasive developmental disorder 20.3%, Paraphilia 6.6%, Borderline personality disorder 8.3%, Antisocial personality disorder 19.3%, Global Assessment of Functioning (GAF) (mean/sd) 41.6/10.9 |
| [Fitzgerald et al. (2013)](#_ENREF_14) e | 92.0 | 29.77 (10.29) | - | ICD-10 | Mild = 84.0%, moderate = 12.0%, unspecified = 4.0% | NR | None 20.0%, Mental illness 4.0%, PD 28.0%, other 16.0%, Mental illness and personality disorder 12.0%, Mental illness and other diagnosis 8.0%, Personality disorder and other diagnosis 12.0% |
| [Lofthouse et al. (2013)](#_ENREF_29) | 100 | 32 (11.9) | 17-63 | WAIS | All below IQ of 70, Mean IQ=67 (SD=5.5, range 54-75) | Sexual offences | NR |
| [Inett et al. (2014)](#_ENREF_22) | 100 | 39 | - | ICD-10 or DSM IV-TR | Borderline = 14.29%, Mild = 42.86%, Moderate = 3.57%, Unspecified = 17.86%, Borderline intellectual functioning = 21.43% | Mixed group of offences | Affective disorders 3.57%, Autistic spectrum disorders 17.86, Organic and genetic disorders 7.14%, Personality disorders 10.71 |

a Pilot of [Steptoe et al. (2008)](#_ENREF_44), b[Fitzgerald et al. (2011)](#_ENREF_15), c [Morrissey et al. (2007)](#_ENREF_35), [Lofthouse et al. (2014)](#_ENREF_30), d Based on 44 special needs group of which 10 were ID, NR = not reported, NA not applicable, e ID group only, f Subgroup of people with ID<70

Table 4: Study measures and conclusions.

| **Study ID** | **Tools used** | **Other factors assessed**  | **Conclusions** |
| --- | --- | --- | --- |
| [Dura (1997)](#_ENREF_11) | BPRS | Vineland adaptive behaviours scales (expressive communication) | Both expressive communicative ability and level of mental illness symptoms were strong predictors of aggressive behaviour. |
| [Novaco and Taylor (2004)](#_ENREF_37) | WARS | Tools: STAXI, NAS, PI , WAIS Factors: Parents had alcohol or drug problems: police involvement in parents behaviour, Age Length of stay Physically abused Parental anger/aggression | High internal and intermeasure consistency, and some concurrent validity with staff ratings, was found. Retrospective validity regarding physically assaultive behaviour in the hospital was obtained. Hierarchical regressions revealed that patient-reported anger was a significant predictor of assaults post admission, controlling for age, length of stay, IQ, violence offense history, and personality variables |
| [McMillan et al. (2004)](#_ENREF_33) | Actuarial measure i.e. frequency of physical violence in the six months prior to assessment. | Clinical prediction by an assessment team | Findings suggest that it is possible to predict who is at risk of violence in forensic populations with intellectual disabilities. |
| [Lindsay et al. (2004)](#_ENREF_28)a  | DRAMS |  | Initial results would suggest that the DRAMS is a reliable instrument apart from the therapeutic alliance category. Initial signs suggest that it may be predictive of aggressive incidents in residential settings. |
| [Quinsey et al. (2004)](#_ENREF_40) | VRAG | Tools: Problem identification checklist, dynamic anti-sociability subscales of the proximal risk factor scale, Client denies all problems | The Violent Risk Appraisal Guide was the best predictor of new violent or sexual incidents and a variety of other pre-release predictors were related to the likelihood of antisocial incidents of any kind. Overall predictive accuracy was moderate. |
| [Gray et al. (2007)](#_ENREF_16)b | VRAG, PCL-SV, HCR-20, OGRS |  | In this study, the authors have shown that the Violence Risk Appraisal the Psychopathy Checklist—Screening Version and the History, Clinical, Risk Management—20 were all significant predictors of violent and general reconviction in this sample |
| [Steptoe et al. (2008)](#_ENREF_44) | DRAMS | WARS concurrent validity | The reformulated DRAMS has good construct and concurrent validity. It appears to be a reliable assessment tool and informs on risk levels relating to stable and acute proximal factors.  |
| [Lindsay et al. (2008)](#_ENREF_27)c | VRAG, HCR-20, PCL-R, RM 2000-C, STATIC 99, SDRS | EPS | The Violence Risk Appraisal Guide, all HCR-20 scales, the Short Dynamic Risk Scale, and the Emotional Problems Scales (Internalising and Externalising) showed significant areas under the curve for the prediction of violence. The Static-99 showed a significant area under the curve for the prediction of sexual incidents. |
| [Blacker et al. (2011)](#_ENREF_3)d | SVR-20, RM2000, RRASOR, ARMIDILO |  | The ARMIDILO-Acute, SVR-20 Psychosocial Affect, and overall scales were better predictors of sexual recidivism for the intellectually disabled subgroup (AUCs ranging from 0.75 to 0.88). |
| [Verbrugge et al. (2011)](#_ENREF_45) | HCR-20, HCR-20 with ID supplement, VRAG |  | Predictive validity was generally good. Although statistical signiﬁcance could not be determined, use of the ID Supplement resulted in a small improvement in predictive validity relative to the HCR-20 and VRAG. |
| [Drieschner et al. (2013)](#_ENREF_10) | Dynamic Risk outcome Scales (DROS), Adult Behaviour Checklist (ABCL) | Sex, Court mandated treatment, DSM IV psychopathology, Reason for admission, GAF | The best predictor of aggressive behaviour was aggression early in treatment, followed by coping skills deficits and impulsiveness. The relevance of the results for the treatment of aggressive behaviour and methodological issues in the recording of inpatient aggression are discussed. |
| [Fitzgerald et al. (2013)](#_ENREF_14) e | HCR-20, VRAG |  | The HCR-20 and the VRAG have excellent predictive efficacy in offenders with an ID. A structured clinical judgement based on the HCR-20 was especially predictive. |
| [Lofthouse et al. (2013)](#_ENREF_29)f | ARMIDILO-S, STATIC-99 VRAG |  | Results suggest that dynamic variables are useful in predicting sexual reoffending with individuals with an intellectual disability, confirming previous findings. The ARMIDILO-S is a promising dynamic risk assessment for individuals with an intellectual disability. |
| [Inett et al. (2014)](#_ENREF_22) | START |  | This study represents the first attempt to examine the predictive validity of the START with ID offenders, and a step forward in the understanding of dynamic risk factors for violence in this population. The significant predictive relationship with incidents of physical aggression and property damage offers clinicians a preliminary evidence base supporting its use in low-secure settings. |

a Pilot of [Steptoe et al. (2008)](#_ENREF_44), b[Fitzgerald et al. (2011)](#_ENREF_15), c [Lofthouse et al. (2014)](#_ENREF_30), [Morrissey et al. (2007)](#_ENREF_35) dBased on 44 special needs group of which 10 were ID e ID group only, f Subgroup of people with ID<70

Table 5: Outcomes for tools assessed by more than one study

| **Study ID** | **Outcome** | **Results** | **P** |
| --- | --- | --- | --- |
| ***Violence Risk Appraisal Guide*** |
| ([Quinsey et al., 2004](#_ENREF_40)) | Violent/sexual incident | AUC = 0.69, CI 0.55-0.83g (SE 0.07) | 0.02 |
| [Gray et al. (2007)](#_ENREF_16)b | Violent reconviction | AUC =0.73, CI 0.55-0.91g (SE 0.09) | <0.05 |
| [Lindsay et al. (2008)](#_ENREF_27)c | Violent incident | AUC =0.71 | <0.0001 |
| ([Verbrugge et al., 2011](#_ENREF_45)) | Violent reoffending | AUC =0.79, CI=0.66-0.93 (SE 0.07) | <0.001 |
| [Fitzgerald et al. (2013)](#_ENREF_14) e | Institutional violence | AUC =0.87, CI=0.71-1.03 (SE 0.08) | NR p<0.05 |
| [Lofthouse et al. (2013)](#_ENREF_29)f | Sexual incidents | AUC = 0.56  | 0.555 |
| ***Historical Clinical Risk Management-20 (version 2)*** |
| [Gray et al. (2007)](#_ENREF_16)b | Violent reconviction | AUC = 0.79, CI 63-95g (SE 0.08) | <0.05 |
| [Lindsay et al. (2008)](#_ENREF_27)c | Violent incident | AUC = 0.72 | <0.001 |
| [Verbrugge et al. (2011](#_ENREF_12)) | Violent reoffending | AUC = 0.80, CI 0.63-0.96 (SE 0.09) | <0.001 |
| [Fitzgerald et al. (2013)](#_ENREF_14)e | Institutional violence | AUC = 0.77, CI 0.57- 0.97 (SE 0.10) | NR |
| ***Risk Matrix 2000 V*** |
|  [Lindsay et al. (2008)](#_ENREF_27)c | Violent incident | AUC = 0.62 | 0.07 |
| [Blacker et al. (2011)](#_ENREF_3)d | Sexual reconviction | AUC = 0.63, CI 0.21-1.04, (SE 0.21) | NS |
| ***Dynamic Risk Assessment and Management System*** |
| [Lindsay et al. (2004)](#_ENREF_28)a | Major incidents Control day vs day prior vs day of | F(df=1,4)=64.22 | <0.01 |
| [Steptoe et al. (2008](#_ENREF_11)) | Violent incident | AUC = 0.73 | <0.001 |
| ***STATIC 99*** |
| [Lindsay et al. (2008)](#_ENREF_27)c | Sexual incidents | AUC = 0.71 | 0.0001 |
| [Lofthouse et al. (2013)](#_ENREF_29)f | Sexual incidents  | AUC = 0.74  | 0.010 |
| ***Assessment of Risk Manageability for Intellectually Disabled Individuals who Offend S*** |
| [Blacker et al. (2011)](#_ENREF_3)d | Sexual recidivism | AUC = 0.86, CI 0.62-1.13 (SE 0.13) | NR |
| [Lofthouse et al. (2013)](#_ENREF_29)f | Sexual incidents | AUC = 0.90 | <0.001 |

CI= 95% confidence intervals, SE =standard error, g calculated from SEs a Pilot of [Steptoe et al. (2008)](#_ENREF_44), b[Fitzgerald et al. (2011)](#_ENREF_15), c Lofthouse et al. (2014), Morrissey et al. (2007) dBased on 44 special needs group of which 10 were ID, e ID group only, NR =not reported, NS= non-significant

Table 6: Outcomes for tools assessed by one study

| **Study ID** | **Tool** | **Outcome** | **Results** | **P** |
| --- | --- | --- | --- | --- |
| [Dura (1997](#_ENREF_2)) | BPRS | Agg behaviour | Pearson’s r= 0.39 | <0.01 |
| ([Novaco & Taylor, 2004](#_ENREF_37)) | WARS | Hospital assaults | Spearman’s = 0.28 | <0.05 |
| [McMillan et al. (2004](#_ENREF_7)) | Actuarial prediction of violence | Physical violence | AUC = 0.77, CI 0.69-0.86 |  |
| [Gray et al. (2007)](#_ENREF_16)b | PCL-SV | Violent reconviction | AUC = 0.73, CI 0.53-0.93g (SE 0.10) | <0.05 |
| OGRS2 (subsample n=85) | Violent recidivism | AUC = 0.853, CI 0.76-0.94g (SE 0.045) | <0.01 |
| [Lindsay et al. (2008)](#_ENREF_27)c | RM 2000-S | Sexual incidents | AUC = 0.61 | 0.08 |
| RM 2000-C | Sexual or violent incidents | NR | >0.05 |
| PCL-R(sub sample n= 53-60) | Aggressive incident | Spearman’s rho=0.11 | >0.05 |
| SDRS | Violent incident | AUC = 0.72 | <0.001 |
| [Blacker et al. (2011)](#_ENREF_3)d | RRSAOR | Recidivism | AUC = 0.47, CI 0.00-0.94 (SE 0.24) |  |
| SVR20 overall | Recidivism | AUC = 0.75, CI 0.45-1.05 (SE 0.15) |  |
| ARMIDILO acute | Recidivism | AUC = 0.75, CI 0.45-1.05 (SE 0.15) |  |
| [Verbrugge et al. (2011](#_ENREF_12)) | HCR-20 ID | Violent reoffending | AUC = 0.80, CI 0.63-0.98 (SE 0.09) | <0.001 |
| [Drieschner et al. (2013)](#_ENREF_10) | DROS - Problem recognition | Verbal agg | NR | >0.05 |
| Agg towards objects | NR | >0.05 |
|  Physical agg | NR | >0.05 |
| DROS - Antisocial attitudes | Verbal agg | Spearman’s = 0.334 | <0.001 |
| Agg towards objects | NR | >0.05 |
| Physical agg | NR | >0.05 |
| DROS - Attitude towards the treatment | Verbal agg | NR | >0.05 |
| Agg towards objects | NR | >0.05 |
| Physical agg | NR | >0.05 |
| DROS - Treatment engagement | Verbal agg | Spearman’s = 0.359 | <0.001 |
| Agg towards objects | Spearman’s = 0.320 | <0.001 |
| Physical agg | Spearman’s = 0.309 | <0.001 |
| DROS - Realistic plans | Verbal agg | Spearman’s =0.266 | <0.001 |
| Agg towards objects | NR | >0.05 |
| Physical agg | 0.296 | <0.001 |
| DROS - Coping skills | Verbal agg | Spearman’s = 0.443 | <0.001 |
| Agg towards objects | Spearman’s = 0.386 | <0.001 |
| Physical agg | Spearman’s = 0.443 | <0.001 |
| DROS - Social skills | Verbal agg | Spearman’s = 0.403 | <0.001 |
| Agg towards objects | Spearman’s = 0.322 | <0.001 |
| Physical agg | Spearman’s = 0.291 | <0.001 |
| DROS - Self-care | Verbal agg | NR | >0.05 |
| Agg towards objects | NR | >0.05 |
| Physical agg | NR | >0.05 |
| DROS - Impulsivity | Verbal agg | Spearman’s = 0.461 | <0.001 |
| Agg towards objects | Spearman’s = 0.383 | <0.001 |
| Physical agg | Spearman’s = 0.295 | <0.001 |
| DROS - Hostility | Verbal agg | Spearman’s = 0.391 | <0.001 |
| Agg towards objects | NR | >0.05 |
| Physical agg | NR | >0.05 |
| DROS - Sexual deviancy | Verbal agg | NR | >0.05 |
| Agg towards objects | NR | >0.05 |
| Physical agg | NR | >0.05 |
| DROS - Proclivity for substance abuse | Verbal agg | NR | >0.05 |
| Agg towards objects | NR | >0.05 |
| Physical agg | NR | >0.05 |
| DROS - Psychotic symptoms | Verbal agg | NR | >0.05 |
| Agg towards objects | NR | >0.05 |
| Physical agg | NR | >0.05 |
| DROS - Vulnerability | Verbal agg | NR | >0.05 |
| Agg towards objects | NR | >0.05 |
| Physical agg | NR | >0.05 |
| DROS - Social network | Verbal agg | NR | >0.05 |
| Agg towards objects | NR | >0.05 |
| Physical agg | NR | >0.05 |
| ABCL Externalising  | Verbal agg | Spearman’s = 0.628 | <0.001 |
| Agg towards objects | Spearman’s = 0.561 | <0.001 |
| Physical agg | Spearman’s = 0.587 | <0.001 |
| ABCL Internalising | Verbal agg | NR | >0.05 |
| Agg towards objects | NR | >0.05 |
| Physical agg | NR | >0.05 |
| [Inett et al. (2014)](#_ENREF_22) | Total START risk Scores 30 days | Verbal agg | AUC = 0.664, CI 0.569-0.760 (SE 0.049) | <0.001 |
| Physical agg | AUC = 0.710, CI 0.606-0.815 (SE 0.053) | <0.001 |
| Sexually inappropriate  | AUC = 0.492, CI 0.400-0.584 (SE 0.047) | >0.05 |
| Total START risk Scores 90 days | Verbal agg | AUC = 0.573, CI 0.406-0.740 (SE 0.085) | >0.05 |
| Physical agg | AUC = 0.693, CI 0.606-0.780 (SE 0.045) | <0.001 |
| Sexually inappropriate  | AUC = 0.545, CI 0.447-0.643 (SE 0.05) | >0.05 |
| Total START strengths Scores 30 days | Verbal agg | AUC = 0.336, CI 0.242-0.431 (SE 0.048) | <0.001 |
| Physical agg | AUC = 0.251, CI 0.160-0.342 (SE 0.047) | <0.001 |
| Sexually inappropriate  | AUC = 0.491, CI 0.400-0.583 (SE 0.047) | >0.05 |
| Total START strengths Scores 90 days | Verbal agg | AUC = 0.430, CI 0.265-0.595 (SE 0.084) | >0.05 |
| Physical agg | AUC = 0.287, CI 0.207-0.367 (SE 0.041) | <0.001 |
| Sexually inappropriate  | AUC = 0.431, CI 0.333-0.529 (SE 0.05) | >0.05 |

CI= 95% confidence intervals, SE =standard error, g calculated from SEs b[Fitzgerald et al. (2011)](#_ENREF_15), c [Lofthouse et al. (2014)](#_ENREF_30), [Morrissey et al. (2007)](#_ENREF_35) dBased on 44 special needs group of which 10 were ID, agg = aggression