Predictive validity of the HCR-20 for inpatient aggression: the effect of intellectual disability on accuracy

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Abstract

Background: People with intellectual disability (ID) account for a large proportion of aggressive incidents in secure and forensic psychiatric services. While the HCR-20 has good predictive validity in inpatient settings, it does not perform equally in all groups and there is little evidence for its efficacy in those with ID.

Method: A pseudo-prospective cohort study of the predictive efficacy of the HCR-20 for those with ID (*n*=109) was conducted in a UK secure mental health setting using routinely collected risk data. Performance of the HCR-20 in the ID group was compared to a comparison group of adult inpatients without an ID (*n*=504). Analysis controlled for potential covariates including security level, length of stay, gender and diagnosis.

Results: The HCR-20 total score was a significant predictor of any aggression and of physical aggression for both groups, although the AUC values did not reach the threshold for a large effect size. The clinical subscale performed significantly better in those without an ID compared to those with. The ID group had a greater number of relevant historical and risk-management items. The clinicians' summary judgment significantly predicted both types of aggressive outcomes in the ID group, but did not predict either in those without an ID.

Conclusions: This study demonstrates that, after controlling for a range of potential covariates, the HCR-20 is a significant predictor of inpatient aggression in people with an ID and performs as well as for a comparison group of mentally disordered individuals without ID. The potency of HCR-20 subscales and items varied between the ID and comparison groups suggesting important target areas for improved prediction and risk management interventions in those with ID.

Introduction

Aggression occurring within an inpatient setting can have a profound impact on the therapeutic environment. In forensic mental health settings, 48% of patients in studies had been violent (Bowers et al., 2011). Such incidents can have severe physical and psychological consequences; 2-13% of aggressive incidents in mental health settings result in severe injury (Bowers et al., 2011) and 4.4% of victims in more general health care settings received life-threatening injuries (Erkol et al., 2007). A recent review of workplace violence among healthcare workers found that 5-32% and 8-65% of victims of workplace violence met criteria for PTSD and anxiety, respectively. Experiencing such incidents can also lead to staff absence, restriction/change of staff duties, financial costs, and have detrimental effects on relationships with patients and colleagues (Lanctôt and Guay, 2014).

People with intellectual disability (ID) account for a disproportionate amount of aggressive incidents occurring within secure hospital settings. Dickens, Picchioni and Long (2013) found that just over half (51.8%) of all recorded incidents of aggression and self-harm occurred within the ID pathway of a secure psychiatric hospital, which accounted for just 27.9% of the sample. Fitzgerald et al. (2013) found that twice as many people with ID in medium-secure care engaged in violence over a six month period compared with a control group of patients without ID (80% vs. 40%); similar results were reported by Dickens et al. (2013) who found that 72.1% of the ID sample had engaged in aggression and/or self-harm compared with 47.2% of patients in the mental health pathway. Further, the mean number of incidents among those who did engage in aggression and/or self-harm was 24.3 for those in the ID pathway and 12.8 for the mental health pathway (Dickens et al. 2013). Accurate risk-assessment is a vital task

for mental health professionals in secure settings to ensure the safety and wellbeing of staff and patients. Given the heightened risk that individuals with an ID seem to pose, it is even more important to determine whether contemporary risk assessment guides accurately predict aggression within this diagnostic group.

The Historical, Clinical, Risk-Management 20 (HCR-20 (Version 2); Webster et al. 1997) is the most commonly used risk assessment within medium secure inpatient settings in the UK (Khiroya et al. 2009). It has good predictive validity and inter-rater reliability (Douglas et al. 2013), and has produced large effect sizes for inpatient violence compared to other guides (Campbell et al. 2009). However, it does not perform equally across all clinically and demographically defined groups (e.g., O'Shea et al. 2013). There is some evidence that the HCR-20 total and subscale scores can significantly predict inpatient aggression for patients with ID, including inappropriate sexual behaviour (Morrissey et al. 2007, Lindsay et al. 2008), and reconvictions following discharge from medium secure psychiatric facilities (Gray et al. 2007). Fitzgerald et al. (2013) found that the overall summary judgment was a significant predictor of inpatient physical aggression in an ID sample, producing very large effect sizes. However, none of the HCR-20 total or subscale scores were significantly predictive of physical aggression, and only the HCR-20 total and risk-management subscale were significant predictors of severe physical aggression. This finding may in part have been attributable to the study's small sample size (n=23), as the reported AUC values were in the moderate-large range despite being statistically non-significant.

When compared to other diagnostic groups, the HCR-20 has been found to perform more accurately in those with an ID for some types of aggression. Gray et al. (2007) found significantly larger AUC values for the prediction of post-discharge reconviction by the HCR-20

total score for those with an ID compared with those with a mood disorder, personality disorder or substance misuse. A similar pattern was observed for the prediction of violent reconvictions; however, the difference between the ID group and the mood disorder group was not significant. Fitzgerald et al. (2013) found that the summary judgment and historical scale score were significantly better predictors of inpatient physical aggression in people with an ID, compared with a control group of mentally disordered offenders without an ID. With the exception of the clinical scale, the remaining AUC values for the prediction of inpatient physical aggression and severe physical aggression were also larger in the ID group, although not significantly so. Although these results suggest that HCR-20 has superior efficacy in those with an ID, neither study addressed or controlled for demographic and clinical differences between the groups, such as age and gender. It has previously been shown that such factors affect the predictive efficacy of the HCR-20 (O'Shea et al. 2014, O'Shea et al. 2013) and therefore should be taken into account when comparing efficacy between groups.

The current study, therefore aims to compare for the first time the predictive efficacy of the HCR-20 for inpatient aggression in a group of secure psychiatric inpatients with an ID to a comparison group of secure psychiatric inpatients with a mental disorder but without a recorded ID diagnosis, whilst controlling for characteristics that differ between the two groups. We also aimed to examine the relative importance of the individual items for each of the groups.

Method

Setting and participants

St Andrew's provides specialist inpatient mental health care across four sites in England. Accommodation consists of gender specific medium secure, low secure, locked rehabilitation and open rehabilitation wards. Some wards provide specialist care based on age (e.g., older adults or adolescents), or diagnostic group (e.g., autistic spectrum disorder). Eligible participants were all inpatients aged over 18 years with an ID (according to an ICD-10 diagnosis of "mental retardation" [F70-79] made by the patients' responsible clinician and multidisciplinary team, i.e., with an IQ of less than 70, with or without impairment of behaviour) resident between September 2010 and March 2011 who had at least one HCR-20 risk assessment completed and who remained in St Andrew's for a minimum of three months following assessment. At St. Andrew's entry into specialist intellectual disability services would be based on deficits in intellectual and adaptive functioning confirmed by clinical assessment and/or standardised testing with evidence of onset during the developmental period (i.e., before the age of 18 years). Patients were excluded if they were missing data in excess of prorating guidelines in the HCR-20 manual (Webster et al. 1997). The comparison group comprised adult inpatients without an ID (*n*=504) resident during the same time period (previously reported on by O'Shea et al. 2014).

Procedure

The study was approved by the clinical audit and service evaluation committee at St Andrew's and employed a naturalistic pseudo-prospective design. Participants were routinely assessed for violence risk by their clinical team and incidents of aggression were extracted from entries in clinical notes. Data were collated from anonymised versions of patients' records and linked by a unique number.

Measures

Risk assessment

Risk assessment was conducted using the HCR-20 (Version 2; Webster et al. 1997) by registered psychologists and psychiatrists as part of routine clinical practice. Since the completion of this study, version 3 of the HCR-20 has been introduced (Douglas et al. 2013). The HCR-20 (version 2) comprises three scales; the historical scale (H10) contains ten relatively static items that reflect violence history and psychosocial adjustment, the clinical scale (C5) contains five dynamic items related to current level of symptomatology and functioning, and the risk-management scale (R5) includes five dynamic items capturing professional opinions regarding the individuals' ability to adjust to the institution or community. In practice, especially on low secure and locked wards that care for patients approaching discharge, R5 is rated twice, under the premises that the individual will remain institutionalised ('In') or be released to the community ('Out'). For the current study we only included the 'In' ratings since we were concerned with the prediction of inpatient aggression. Each item is rated as not present (No/0), possibly present (Possible/1), or definitely present (Yes/ 2) (Webster and Douglas 2001). Clinicians also form a summary judgment (SJ) regarding whether there is a low, moderate, or high risk of future aggression. The "Psychopathy" item (H7) was omitted as the vast majority of patients did not have a rating due to the additional time and training required to administer the Psychopathy Checklist – Revised (Hare 1991). It has previously been found that excluding this item has minimal effect on the predictive efficacy of the HCR-20 (Guy et al. 2010) and it has been removed from HCR-20 Version 3 (Douglas et al. 2013). HCR-20 total and subscale scores

were prorated for omitted items in accordance with instructions in the HCR-20 manual (Webster et al. 1997).

Demographic and clinical data

Patients' age, gender, admission date, legal status, self-reported ethnicity and ICD-10 psychiatric diagnoses as indicated by the patients' consultant psychiatrist were extracted from patient records.

Aggressive outcomes

Incidents of aggression and self-harm were extracted from progress notes for the three months following the HCR-20 assessment. Entries are made by a qualified member of the clinical team on each shift and are electronically flagged at the time of entry if any of a range of risk behaviours has occurred. We collated all entries that had been flagged as containing incidents of: "Aggression – Physical", "Aggression – Verbal", "Fire Setting", "Hostage Taking", "Intimidation/Bullying", "Self Harm/Suicide" and "Sexual Offending". Entries were coded using the Overt Aggression Scale (OAS; Yudofsky et al. 1986) by three trained researchers who were blind to the risk assessment. Incidents can be assigned to one of four categories: verbal aggression, physical aggression against objects, physical aggression against self, and physical aggression against people. These are then rated on a severity scale of 1 (least severe) to 4 (most severe). Inter-rater reliability was tested on a sample of n=260 incidents. For the purpose of the current paper we focused on physical aggression towards others and any aggression (excluding self-harm).

Data analysis

Independent sample *t*-tests and Pearson's Chi squared tests were conducted to examine whether sample characteristics, the prevalence of aggressive behaviour, mean HCR-20 scores and risk levels differed between the ID and comparison groups. One-way ANOVAs were conducted to examine if mean HCR-20 total and subscale scores significantly differed across assigned summary judgement risk levels. Differences in the predictive efficacy of the HCR-20 total, subscales and SJ between the ID group and comparison group were investigated using the rocreg function in Stata version 12 for Windows. This function performs a regression using Receiver Operating Characteristic (ROC) principles. ROC analysis calculates sensitivity and specificity and is the preferred method of investigated predictive accuracy as it is relatively unaffected by base rates (Mossman 1994). This allowed us to examine whether the area under the curve (AUC) values generated from ROC analyses differed as a function of ID whilst controlling for characteristics that differed significantly between the two groups. Significance was inferred from the absence of zero from the 95% confidence intervals for the rocreg coefficients, equivalent to $p<.05$. We also examined the predictive validity of the individual HCR-20 items for each group whilst controlling for covariates using rocreg analyses (item-outcome analysis). Significant AUC values were inferred from the absence of .5 from their 95% confidence intervals as the AUC parameter ranges from 0-1 with .5 reflecting chance performance; .75 is generally considered the threshold for a large effect size (Dolan and Doyle 2000). Except where stated, analyses were conducted using PASW Statistics version 18 for Windows.

Results

Participants

Of 120 eligible ID patients, 11 were excluded due to excessive missing data in their HCR-20 assessment. Sample characteristics are presented in Table 1. There were no significant differences between the gender and ethnic breakdown of the two groups; approximately two thirds of each group was male and just under half were Caucasian. The ID group was significantly younger than the comparison group (32.86 vs. 39.79 [$t(193)=-5.03$, $p<.001$]) and less likely to have an additional diagnosis of substance abuse (7.3% vs.14.7% [$\chi^{2}(1, n=613)=4.17$, $p=.041$]). Additional diagnoses were significantly different between the two groups [$\chi^{2}(5, n=613)=42.93$, $p<.001$]; examination of standardised residuals revealed that those in the ID group were significantly less likely to have a diagnosis of schizophrenia or an organic disorder and were significant more likely have a personality disorder, or hold other or multiple diagnoses compared to the comparison group. The ID group also had a significantly shorter time between admission and HCR-20 assessment (653.98 vs. 850.86 [$t(304)=2.20$, $p=.029$]). Legal status [$\chi^{2}(2, n=613)=8.91$, $p=.012$] and security level [$\chi^{2}(1, n=613)=16.37$, $p<.001$] also significantly different between groups with those in the ID group less likely to be detained informally and more likely to be held in medium security. Therefore, time between admission and assessment, age at assessment, substance abuse, co-morbid diagnoses, legal status, and security level were controlled for in the subsequent rocreg analyses.

[INSERT TABLE 1 ABOUT HERE]

Aggressive outcomes

There were a total of 3,205 incidents of any aggression and 1,113 incidents of physical aggression towards others during the follow-up period. Significantly higher proportions of those

in the ID group engaged in physical aggression towards others and any aggression compared to the comparison group (see Table 2). The mean number of incidents among those who engaged in physical aggression towards others was also significantly higher in the ID group compared to the comparison group.

[INSERT TABLE 2 ABOUT HERE]

HCR-20 scores and summary judgment

Mean HCR-20 total and subscale scores and distribution of risk estimates are presented in Table 3. The mean HCR-20 total score for the ID group was significantly higher than that for the comparison group; this appears to be driven principally by higher scores on the risk-management items. The level of risk assigned by the summary judgement also differed significantly between groups with those in the ID group being significantly less likely to be classified as low risk. Among the comparison group the HCR-20 total, C5, and R5 scores were significantly higher in those that had engaged in any aggression and physical aggression towards others compared to those who had not. For the ID group, R5 scores were significantly higher in those who had engaged in physical aggression towards others compared to those who had not; there were no other significant differences between subscale scores. Similarly, mean HCR-20 total scores differed significantly across the risk levels assigned by the summary judgment among the comparison group [$F(2,335)=23.34$, $p<.001$], but not among those with ID [$F(2,76)=2.17$, $p<.122$]. Post-hoc Tukey tests showed that mean HCR-20 scores were significantly higher in the moderate ($M=28.90$, $SD=4.78$, $p<.001$) and high risk groups ($M=29.52$, $SD=5.45$, $p<.001$)

compared to the low risk group (*M*=24.66, *SD*=6.30). Mean scores in the moderate and high risk groups were not significantly different (*p*=.669).

[INSERT TABLE 3 ABOUT HERE]

Predictive validity

Results of the rocreg analyses are presented in Table 4. AUC values ranged from .481 to .691 for the ID group and from .442 to .741 for the comparison group. HCR-20 total and R5 scores were significant predictors of any aggression and physical aggression towards others for both groups; H10 scores did not predict either outcome. C5 scores were a significant predictor of any aggression in both groups but only predicted physical aggression towards others in the comparison group; in both cases, C5 scores were significantly larger for the comparison group than the ID group. The SJ significantly predicted both outcomes for the ID group, but did not predict either for the comparison group. For the prediction of any aggression, the AUC value for the ID group was significantly larger than that for the comparison group. None of the AUC values reached the boundary of a large effect size; the largest value (.741) was obtained for the prediction of any aggression by C5 in the comparison group. Except for R5 and the SJ in the comparison group, AUC values were larger for the prediction of any aggression than physical aggression towards others.

[INSERT TABLE 4 ABOUT HERE]

Item-outcome analyses

Item-outcome analyses revealed that five of the H10 items, two C5 items, and two R5 items significantly predicted any aggression in the ID group, compared with one H10 item, all five C5 items, and three R5 items in the comparison group (see Table 5). The strongest predictors of any aggression in the ID group were H10.1 (previous violence), H10.4 (employment problems), H10.8 (early maladjustment), and R5.2 (exposure to destabilizers); for the comparison group they were C5.4 (impulsivity), C5.3 (active symptoms of mental illness), C5.2 (negative attitudes), and R5.4 (noncompliance with remediation attempts). H10.6 (major mental illness) and H10.10 (prior supervision failure) produced AUC values significantly smaller than .5 in the ID group. Fewer individual items were significantly predictive of physical aggression towards others; for the ID group three H10 items, one C5 item, and two R5 items were significant predictors compared with one H10 item, three C5 items, and one R5 item in the comparison group. The most important items for the prediction of physical aggression towards others remained the same as those for any aggression, with two exceptions; the AUC value for R5.5 (stress) exceeded that of H10.8 in the ID group and C5.1 (lack of insight) as a stronger predictor than C5.2 in the comparison group. H10.9 (personality disorder) produced an AUC value significantly smaller than .5 for the prediction of physical aggression towards others in the comparison group.

[INSERT TABLE 5 ABOUT HERE]

Discussion

This study provides further evidence that the HCR-20 total score is a statistically significant predictor of inpatient aggression for people with ID. We have demonstrated in the

largest inpatient sample to date that the predictive validity of the guide for patients with an ID is equivalent to that of other mental health patients in secure care. Unlike the sole previous study on this topic that used a control group of mentally disordered offenders without an ID (Fitzgerald et al. 2013), our analysis controlled for important potential confounding variables including gender, age, comorbid mental illness, security level and length of stay; as a result our findings are likely to be the most robust thus far. Like Fitzgerald et al (2013), the overall predictive validity of the HCR-20 total score did not significantly differ between the ID and comparison groups. However, there were significant differences in the performance of the C5 subscale and SJ. In accord with Fitzgerald et al (2013) the SJ produced a significantly higher AUC value for the prediction of physical aggression towards others in the ID group compared to the comparison group. In contrast with the same study, AUC values obtained for C5 were significantly higher in the comparison group than those with ID for both outcomes. The H10 scale failed to predict either aggressive outcome, and the R5 scale significantly predicted both outcomes for the two groups. The fact that the H10 scale did not predict outcome for either group is consistent with previous literature on the HCR-20 suggesting that the historical scale is not a significant predictor of inpatient aggression (e.g., O'Shea et al., 2013); however, it contrasts with recent research suggesting that static measures have dominance over dynamic measures in predicting violent outcomes among offenders with intellectual disability (Lofthouse et al., 2014).

In one sense, it is perhaps surprising that the predictive accuracy of HCR-20 is equivalent in ID and non-ID populations since the tool was mainly developed with and validated in samples more like the latter. However factors relevant to aggression and offending including antisocial attitudes, personality disorder, major mental illness, and prior violence (Keeling et al. 2007, Lindsay et al. 2006, Turner 2005) are found in all offender populations and may partly explain

why they are also predictive for exclusively ID samples (Camilleri and Quinsey 2011). The high base rates of aggression in the ID group in our study are to be expected since aggression is a strong predictor of use of the criminal justice pathway, secure mental health care, and out of area placement for individuals with ID (Lindsay et al. 2010, Chaplin et al. 2010).

While the AUC values were statistically significant they were substantially smaller than the large effect sizes (>.75) found by Fitzgerald et al (2013) for the prediction of inpatient aggression by the HCR-20 total score, H10 subscale and the SJ. AUC values in our study were broadly equivalent to those found by Morrissey et al (2007) whose study of a high secure sample found statistically significant predictive ability falling short of large effect sizes. This is an important finding since it offers less emphatic support for the HCR-20 in this population than does Fitzgerald et al (2013). There were a number of important differences in our study which might account for this apparent relative inferiority of prediction. First, our risk assessment ratings were undertaken in routine clinical practice, whereas Fitzgerald et al (2013) used a researcher to rate HCR-20 assessment and the aggression outcomes data. As a result, it is unclear whether this introduced bias through non-independence of ratings. This has, unfortunately, been a relatively common feature of predictive validity studies of the HCR-20 for inpatient aggression (O'Shea et al. 2013). In contrast, our aggressive outcomes data was recorded independently of risk assessment.

The large sample size facilitated a more fine-grained analysis of the predictive validity of the HCR-20 subscales and item scores than has previously been conducted. Our detection of a significant predictive effect for the C5 scale for both outcomes in the comparison group, but only for any aggression in the ID group, may reflect our relatively large sample; it is possible that the previous study was insufficiently powered to detect this. Self-evidently, and supported by our

data, it is likely in this type of setting that severe psychotic illness and personality disorder is less common in samples of ID patients than in other patients. It might therefore be expected that the resulting functional reduction of the total possible score on the C5 subscale among ID patients would reduce the potential for variability in sub-scale scores that would allow discrimination between, and hence successful prediction of, aggressive or non-aggressive status. However, C5 subscale scores were equivalent between groups. Nevertheless, this finding does suggest that improvements to the predictive accuracy of the HCR-20 for ID patients might be made by the consideration of ID-specific risk factors for aggression in addition to, or in place of, non-predictive C5 items. Note, however, that item-outcome analysis revealed that C5.4 (Impulsivity) and C5.2 (Negative Attitudes) had utility for ID patients in this study. Candidate dynamic ID-specific variables might include inter alia symptoms of frustration and mood swings (Tyrer et al. 2006), anger (Novaco and Taylor 2004), medical conditions (de Winter et al. 2011), and Attention Deficit Hyperactivity Disorder (ADHD; Rose et al. 2009). A recent study found that individuals with ID and co-morbid ADHD were approximately twice as likely as those without ADHD to have a history of offending behaviour for all categories, including aggression, sexual offences, theft, fraud, and fire setting. They were also more likely to have been referred to forensic intellectual disability services for an index offence involving physical aggression than the non-ADHD group (Lindsay et al., 2013). Similarly, individuals with ID and a higher number of co-morbid mental and physical health problems were at increased odds of displaying aggressive behaviour than those with fewer, less severe health problems (Crocker et al., 2013); chronic sleep problems, visual impairment and incontinence may be of particular relevance (de Winter et al., 2011). The role of anger in aggression for those with ID is less well supported; Nicoll and Beail (2013) found no difference in anger levels between offenders and non-offenders

with ID. Future research should examine whether the addition of these factors improves the ability of the HCR-20 to predict aggression among an ID population.

Our finding that the SJ predicted aggression in the ID group but not the comparison group replicates that of Fitzgerald et al (2013) but extends knowledge by controlling for potential confounding variables. Effect sizes for the SJ were also somewhat smaller in the current study and we repeat our caveats about important differences between the studies. The finding suggests that specialist ID clinicians are to an extent successfully considering a range of factors that are specific to aggression in patients with ID. For example, the relative potency of the frequency of interpersonal trauma events as a risk factor for in people with ID is well established (Hershkowitz *et al.* 2007, Martorell *et al.* 2009) and may be being considered by assessors. One possible explanation is that clinicians are factoring in current high levels of aggression to influence their SJ decision, or they may be considering protective factors such as level of functioning, communication and social skills to predict aggression. Future research could investigate ID-specialist clinicians' decision-making processes during risk assessment in order to clarify this.

Patients with ID in the current study had higher HCR-20 total scores compared with the comparison group; these were largely driven by higher ratings on R5 items which, in turn, were associated with aggression in the follow-up period. Item-outcome analysis revealed that two R5 items (R5.2 exposure to destabilisers and R5.5 stress) were the best predictors of aggression in the ID group on this subscale. The HCR-20 manual defines exposure to destabilizers in terms of both criminogenic (e.g., association with antisocial peers or exposure to circumstances similar to those involved in an index offence; (Gendreau 1994, June) and non-criminogenic (e.g., lack of basic living and social skills in areas such as housing, finance, food and leisure; (Bartels et al.

1991) needs. Since the extinction of inpatient aggression is unlikely without targeting the specific factors that predict it our finding underlines the importance of both offence-focused work and interventions aimed at raising the level of life skills in the ID inpatient population. Further, our finding that R5.5 was one of the strongest dynamic predictors for the ID group supports the imperative to provide successful stress inoculation treatments for this group (Meichenbaum 1985).

A number of H10 subscale items significantly predicted inpatient aggression in the ID group but not in the comparison group; further, these items had some of the larger effect sizes in our study. This finding suggests greater heterogeneity in the ID group for these items since they rarely are strong predictors of inpatient aggression in non-ID samples (O'Shea et al. 2013) and may provide some tentative support to the idea that static items exceed the predictive ability of dynamic items in this population (Lofthouse et al., 2014), depending on the items in question. Previous violence (H10.1) was an important predictor of inpatient aggression suggesting that there is a subgroup of ID-patients in secure care that are non-aggressive both prior to and during admission. This predictability may contribute to the relative success of ID clinicians SJ rating. H10.4 (Employment problems) was also a significant predictor; this may seem counterintuitive since few ID patients in secure services are likely to have a history of employment. However, the HCR-20 manual makes clear that the rating should be made largely on the basis of employment problems rather than employability. It is possible that this item is interpreted by raters in the context of patients' institutional work experience or programs in which case it might be expected that those who fail to engage are more likely to be aggressive. The presence of H10.8 (Early maladjustment) as an accurate predictor was not surprising given the extensive literature (Barron et al. 2004) around the role of adverse early life experiences in this group. Interestingly, two H10

items (Major Mental Illness and Prior Supervision Failure) predicted non-aggression in the follow-up period, and thus probably reduced the overall potency of the H10 subscale and HCR-20 total score as a multivariate risk factor for aggression. It is possible that patients with ID and major mental illness are attracting more effective risk management strategies.

Limitations

Our study examined a heterogeneous group of ID patients, and there was no categorisation by, for example, IQ. We were therefore unable to examine the differential predictive validity of the HCR-20 for groups within the overall ID category. Most ID patients in the current study setting had mild to moderate ID (i.e., those with an IQ ranging from 35-69) and care should be taken before generalising outside of this group. It is probable that, in our study, risk assessment by the clinical teams heightened their sense of the patient's risk and, as a result, they instituted appropriate risk management strategies that have deterred physical aggression. However, base rates of aggression were similar in both studies and may suggest that this is not the correct explanation. A further experimental limitation, yet a translational advantage of the current research, is its reliance on pre-existing, routinely collected information. Whilst this allowed data collection relating to a much larger sample of patients than has previously been used, we were unable to verify diagnoses through structured methods. However, diagnoses were made and verified by the consultant psychiatrist with their clinical team in accordance with ICD-10 guidelines and periodically reviewed. Also, we were missing around a third of data relating to ethnicity. This may be inevitable as ethnicity is a self-defined variable and patients may choose not to select a category. Finally, as our data related only to the prediction of inpatient aggression, caution should be executed in generalising findings to aggression occurring in community

settings, particularly given evidence that there may be different risk factors for inpatient and community aggression (Steinert, 2002).

Clinical implications and future research directions

Our overall findings are consistent with previous research. ID patients in secure settings frequently engage in a variety of aggressive behaviours. The HCR 20 is effective at predicting medium term risk of aggression for patients with an ID in a secure in-patient setting, but, given the lack of large effect sizes for the HCR-20 in this study, it will be necessary to review and improve its suitability for the prediction of inpatient aggression in this group. The predictive validity of HCR-20 for inpatient aggression in ID should be tested head-to-head with alternative short term assessments using robust methods. The potency of individual HCR-20 items varied between the ID and comparison groups. Focusing on those items identified as strong predictors of aggression in the ID group may improve risk management interventions and treatment for this group.

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Table 1: Sample characteristics

	ID (*n*=109)	**Comparison (*n*=504)**	**Test**
Mean age at assessment: years (*SD*)	32.86 (12.38)	39.79 (15.82)	$t(193)=-5.03$, $p<.001$
Mean time admission-assessment: days(*SD*)	653.98 (701.07)	850.86 (1334.45)	$t(304)=-2.20$, $p=.029$
Gender			$\chi^{2(}1, n=613)=0.96$, $p=.326$
Male	70 (64.2%)	348 (69%)	
Female	39 (35.8%)	156 (31%)	
Ethnicity			$\chi^{2(}2, n=613)=4.77$, $p=.092$
Caucasian	49 (45%)	235 (46.6%)	
Non-Caucasian	12 (11%)	92 (18.3%)	
Unknown	48 (44%)	177 (35.1%)	
Diagnosis			$\chi^{2(}5, n=613)=42.93$, $p<.001$
Schizophrenia	21 (19.3%)	220 (43.7%)	
Personality Disorder	31 (28.4%)	72 (14.3%)	
Schizophrenia & Personality Disorder	6 (5.5%)	42 (8.3%)	
Developmental	7 (6.4%)	33 (6.5%)	
Organic	1 (0.9%)	32 (6.3%)	
Other/Multiple	43 (39.4%)	105 (20.8%)	
Substance Use			$\chi^{2(}1, n=613)=4.17$, $p=.041$
Yes	8 (7.3%)	74 (14.7%)	
No	101 (92.7%)	430 (85.3%)	
Legal Status			$\chi^{2(}2, n=613)=8.91$, $p=.012$
Forensic	56 (51.4%)	273 (54.2%)	
Civil	52 (47.7%)	191 (37.9%)	
Informal	1 (0.9%)	40 (7.9%)	
Security Level			$\chi^{2(}1, n=613)=16.37$, $p<.001$
Low	61 (56%)	379 (75.2%)	
Medium	48 (44%)	125 (24.8%)	

Table 2: Base rates of aggression

	ID (*n*=109)	**Comparison (*n*=504)**	**Test**
Number of patients engaging in incidents			
Any aggression	91 (83.5%)	308 (61.1%)	$\chi^{2(}1, n=613)=19.75, p<.001$
Physical – Others	71 (65.1%)	181 (35.9%)	$\chi^{2(}1, n=613)=31.62, p<.001$
Mean frequency of incidents among those who did engage (*SD*)			
Any aggression	5.68 (10.78)	3.92 (4.38)	$t(79)=1.33, p=.188$
Physical – Others	11.02 (13.15)	7.15 (7.76)	$t(109)=2.68, p=.009$

Table 3: HCR-20 scores and risk estimate distribution

	ID (*n*=109)[a]	**Comparison (*n*=504)[b]**	**Test**
Mean HCR-20 scores (*SD*)			
Total	28.74 (5.13)	27.04 (5.61)	$t(611)=2.91$, $p=.004$
H10	14.25 (2.66)	13.69 (3.08)	$t(611)=1.77$, $p=.078$
C5	7.03 (2.18)	6.77 (2.36)	$t(611)=1.07$, $p=.287$
R5	7.49 (2.16)	6.59 (2.52)	$t(178)=3.80$, $p<.001$
SJ ratings			$\chi^2(2, n=417)=9.88$, $p=.007$
Low	9 (11.4%)	94 (27.8%)	
Medium	42 (53.2%)	158 (46.7%)	
High	28 (35.4%)	86 (25.4%)	

H10, Historical subscale of HCR-20; C5, Clinical subscale of HCR-20; R5, Risk-management subscale of HCR-20; SJ, summary judgment

a. SJ ratings available for *n*=79

b. SJ ratings available for n=338

Table 4: Differential predictive validity of the HCR-20 for i) any aggression and ii) physical aggression as a function of intellectual disability

Outcome	ID		Comparison		RocReg	
	AUC	**95%CI**	**AUC**	**95%CI**	**Coefficient**	**95%CI**
Any aggression						
HCR-20 Total	.669*	[.579, .753]	.674*	[.614, .723]	.021	[-.276, .308]
H10	.546	[.446, .636]	.521	[.458, .578]	-.092	[-.363, .178]
C5	.658*	[.572, .750]	.741 *	[.690, .794]	.327*	[.059, .640]
R5	.691*	[.606, .766]	.646*	[.586, .696]	-.178	[-.459, .077]
SJ	.640*	[.535, .722]	.546	[.477, .612]	-.373*	[-.738, -.094]
Physical - Others						
HCR-20 Total	.609*	[.522, .699]	.608*	[.552, .662]	-.003	[-.312, .305]
H10	.481	[.391, .562]	.442	[.389, .499]	-.138	[-.437, .172]
C5	.580	[.494, .654]	.663*	[.609, .712]	.345*	[.045, .641]
R5	.661*	[.576, .731]	.648*	[.604, .708]	-.052	[-.326, .297]
SJ	.621*	[.528, .701]	.557	[.489, .618]	-.243	[-.609, .100]

AUC, area under receiver operating characteristic curve; CI, confidence interval; H10, Historical subscale of HCR-20; C5, Clinical subscale of HCR-20; R5, Risk-management subscale of HCR-20; SJ, summary judgment

*Significant at .05 level based on inspection of confidence intervals

Table 5: Predictive validity of individual HCR-20 items as a function of intellectual disability

Item	Any Aggression				Physical - Others			
	ID		Comparison		ID		Comparison	
	AUC	95%CI	AUC	95%CI	AUC	95%CI	AUC	95%CI
H1	.804*	[.616, .955]	.571	[.406, .676]	.720*	[.585, .831]	.423	[.306, .539]
H2	.431	[.265, .561]	.511	[.430, .586]	.497	[.304, .662]	.499	[.436, .575]
H3	.623	[.474, .778]	.539	[.430, .654]	.608	[.401, .730]	.454	[.319, .548]
H4	.751*	[.609, .852]	.573	[.478, .650]	.704*	[.574, .812]	.494	[.409, .568]
H5	.561	[.399, .692]	.534	[.448, .609]	.387	[.226, .538]	.435	[.359, .505]
H6	.336*	[.209, .465]	.628*	[.559, .703]	.529	[.302, .687]	.581*	[.505, .658]
H8	.724*	[.573, .845]	.484	[.400, .570]	.674*	[.545, .799]	.440	[.368, .514]
H9	.541	[.354, .666]	.463	[.398, .528]	.624	[.428, .776]	.433*	[.369, .496]
H10	.252*	[.133, .333]	.512	[.430, .580]	.439	[.285, .599]	.465	[.379, .551]
C1	.630*	[.514, .756]	.616*	[.521, .694]	.567	[.339, .712]	.593*	[.507, .663]
C2	.683*	[.574, .845]	.653*	[.582, .715]	.565	[.347, .694]	.548	[.479, .601]
C3	.423	[.270, .581]	.692*	[.612, .756]	.497	[.369, .671]	.606*	[.527, .667]
C4	.419	[.274, .529]	.697*	[.625, .759]	.699*	[.512, .864]	.626*	[.552, .682]
C5	.543	[.410, .706]	.585*	[.506, .659]	.581	[.438, .755]	.532	[.458, .596]
R1	.516	[.301, .663]	.595*	[.515, .656]	.526	[.366, .677]	.585	[.487, .640]
R2	.708*	[.591, .851]	.603*	[.523, .682]	.716*	[.584, .858]	.580	[.489, .652]
R3	.641	[.477, .848]	.576	[.481, .658]	.632	[.469, .804]	.558	[.467, .622]
R4	.622	[.450, .773]	.632*	[.542, .697]	.559	[.384, .713]	.589*	[.511, .657]
R5	.701*	[.539, .820]	.580	[.480, .629]	.739*	[.591, .868]	.553	[.482, .607]

AUC, area under receiver operating characteristic curve; CI, confidence interval
*Significant at .05 level based on inspection of confidence intervals