



Contents lists available at ScienceDirect

Psychiatry Research

journal homepage: www.elsevier.com/locate/psychres

Predicting violence using structured professional judgment in patients with different mental and behavioral disorders

Nicola S. Gray^{1,2}, John Taylor³, Robert J. Snowden^{*}

School of Psychology, Cardiff University, Cardiff, United Kingdom
Partnerships in Care PLC, Borehamwood, United Kingdom

ARTICLE INFO

Article history:

Received 9 June 2010
Received in revised form 13 October 2010
Accepted 15 October 2010
Available online xxx

Keywords:

Violence risk assessment
HCR-20
Schizophrenia
Personality disorder
Mood disorder
Intellectual disability

ABSTRACT

We examined whether a leading instrument for the prediction of future violence in those with a mental disorder. The Historical, Clinical, Risk Management-20 (HCR-20) was equally effective across a wide range of mental health diagnoses. Records at the time of discharge from secure psychiatric services were used to score the HCR-20 risk assessment scheme. Patients were stratified according to whether they had received a particular mental health diagnosis. Reconvictions within 2 years of discharge were obtained from official sources and classified as to whether the offence was violent or not. Those with a diagnosis of either personality disorder or substance abuse were most likely to be reconvicted, whilst those with either a diagnosis of schizophrenia or mental retardation were the least likely. The HCR-20 was a statistically significant predictor of future violence in all groups; however, it returned only weak effects for the personality disordered group, but strong effects for those in the schizophrenia or mental retardation group. The HCR-20 risk assessment scheme is effective across a wide range of diagnoses. Nevertheless, the prediction of future events appears more difficult in those disorders characterized by impulsive behaviors and further research efforts are needed to understand how such prediction can be improved.

© 2010 Published by Elsevier Ireland Ltd.

1. Introduction

The prediction and management of future violent behavior is now a fundamental clinical skill for those involved in providing clinical services for both forensic and civil psychiatric patients (Louw et al., 2005). Unstructured clinical prediction appears poor (Monahan, 1981) and hence instruments have been developed that aid the clinician in making these judgments. The Historical, Clinical, Risk Management-20 (HCR-20) (Webster et al., 1997) is an example of a structured professional judgment scheme whereby the clinician is systemically guided through a series of risk factors that they must decide which are present or absent for any patient being assessed. The HCR-20 has been shown in studies across the world to be a good predictor of future violent behavior in many settings (Douglas and Webster, 1999; McNeil et al., 2003; Gray et al., 2003, 2008) – for a meta-analysis see (Campbell et al., 2010), and is now widely accepted by many clinicians as the instrument of choice for predicting future violence.

The role of a particular diagnosis in the aetiology of violence remains a controversial and emotive topic (Fazel et al., 2009). For example, a diagnosis of schizophrenia has been recently shown to increase the chances of an individual committing homicide by a factor of 20 (Fazel et al., 2009) – though much of this is down to associated risks due to substance abuse.

For other clinical conditions the picture seems a little clearer. Many studies have attested to an association between violence and psychopathic traits (Serin, 1991), between violence and personality disorders (Johnson et al., 2000), and between violence and substance abuse (Steadman et al., 1998). Thus, mental health diagnosis would appear to be an important consideration in any violence risk assessment of an individual. However, other studies have suggested that clinical factors may not be a major concern even in those with a mental disorder, and that instead criminogenic risk factors are of paramount importance (Bonta et al., 1998; Phillips et al., 2005).

The HCR-20 risk management scheme was developed for use with mentally disordered offenders. Given the heterogeneity of this group, and the possibility that violence may be driven by quite different factors in these different diagnostic groups, it is surprising that there have been no studies that have compared the performance of this instrument across a range of psychiatric diagnoses to test its efficacy in different groups. We therefore attempted to examine the role of diagnosis as a moderator of the predictive efficacy of the HCR-20 in a large sample of mentally disordered offenders being discharged from secure psychiatric services.

* Corresponding author. School of Psychology, Cardiff University, United Kingdom. Tel.: +44 29 208493; fax: +44 29 20874858.

E-mail address: snowden@cardiff.ac.uk (R.J. Snowden).

¹ Present address: Ty Catrin Personality Disorder Service, Pastoral Cymru, Dyfrig Road, Cardiff CF5 5AD, United Kingdom.

² Present address: School of Medicine, Swansea University, Swansea SA2 8PP, United Kingdom.

³ Present address: Partnerships in Care PLC, Imperial Place, Maxwell Road, Borehamwood, Hertfordshire, WD6 1JN, United Kingdom.

2. Method

2.1. Design

The study was a pseudoprospective case-note analysis of patients discharged from independent sector, medium secure facilities in the UK.

2.2. Participants

Patients were discharged from 4 independent sector medium secure psychiatric units (Llanarth Court Hospital (LCH); Kneesworth House Hospital (KHH), Hertfordshire; Stockton Hall Hospital (SHH), and Redford Lodge (RL), between December 1992 and before December 31st 1999 (LCH and SHH), 31st December 2000 (KHH) or 30th September 2001 (RL).

The total sample consisted of 996 male patients with a mean age at discharge of 37.7 years (S.D. = 9.2, range = 16.9–71.2 years). Most patients (69.2%) were of Caucasian ethnic origin, 21.6% were of black Caribbean or black African origin, 2.4% were of Asian origin, 1.5% were of other of mixed ethnicity and 5.2% were of unknown ethnicity. The mean length of stay within the medium secure service was 436 days (S.D. = 510, range = 7 to 3785 days).

Psychiatric diagnoses were made by a consultant psychiatrist upon admission using International Classification of Diseases (ICD-10) criteria (World Health Organization, 1992). For the purposes of analyses we then grouped these diagnoses into the 11 subcategories relating to mental and behavioral disorders (F00–F99) of the ICD-10, namely:

- (F00–F09) organic, including symptomatic, mental disorders ('organic'),
- (F10–F19) mental and behavioral disorders due to psychoactive substance use ('substance use'),
- (F20–F29) schizophrenia, schizotypal and delusional disorders ('schizophrenia'),
- (F30–F39) mood [affective] disorders ('mood disorders'),
- (F40–F48) neurotic, stress-related and somatoform disorders ('neurotic'),
- (F50–F59) behavioral syndromes associated with physiological disturbances and physical factors ('physiological'),
- (F60–F69) disorders of adult personality and behavior ('personality disorder'),
- (F70–F79) mental retardation,
- (F80–F89) disorders of psychological development ('development'),
- (F90–F98) behavioral and emotional disorders with onset usually occurring in childhood and adolescence ('childhood'), and
- (F99) unspecified mental disorder.

Many patients had comorbid diagnoses and hence these patients appear in more than one category.

2.3. Measures

The HCR-20 (Webster et al., 1997) is divided into 10 items related to historical factors (e.g., history of mental illness), 5 items related to current clinical presentation (e.g., current symptoms of major mental illness) and 5 items related to future risk factors (e.g., non-compliance with remediation attempts). Each item was scored as 0 (not present), 1 (partially or possibly present) or 2 (present), leading to a maximum total score of 40.

2.4. Procedure

Ethical committee approval was obtained from the Ethical Committee of the School of Psychology, Cardiff University. Participants were not asked to give informed consent for the study as the design was based solely on case-note review following discharge and with data being anonymised after collection.

Two psychologists completed all assessments by access to file-based information. All background psychiatric and mental health reports on the patients were obtained as were their full criminal record history, admission and discharge reports, social work

and probation information, and nursing records. All risk assessments were completed blind to outcome following discharge. The current study's inter-rater reliability was uniformly high and consistent with previous research (HCR-20 total: $r = 0.80$; history subscale: $r = 0.92$; clinical subscale: $r = 0.90$; risk management subscale: $r = 0.85$). All lifetime convictions were obtained from the Home Office Offenders' Index (a UK Government data-base of all convictions), both prior to admission to hospital and following discharge. Only convictions following date of discharge were classified as "outcome" data in terms of offending following release from hospital.

2.5. Statistical analysis

Our major tool for statistical analysis was that of signal detection theory (MacMillan and Creelman, 1991). This technique examines the trade-off between the correct prediction of reconviction (hits) and the false prediction of reconviction (false positives) for all levels of the risk instrument. The resulting curve is known as the receiver operating characteristic (ROC) and the efficacy of the instrument can be ascertained by the area under the curve (AUC) of the ROC. We classified our effect sizes according to the figures provided by Rice and Harris (2005). Whilst our major focus is on the prediction of future violent offending we also present data for the prediction of any offence (which includes violent offences). This is done because there is evidence that the two are strongly linked (Snowden et al., 2007) and, because more of the sample are convicted for any offence than for a violent offence, it offers a statistically more sensitive test of performance.

3. Results

3.1. Sample sizes and offending rates

In all we were able to score the HCR-20 and obtain follow-up information on 890 of the patients. Table 1 gives information on diagnoses and offending rates after discharge. As many patients have comorbid diagnoses the totals within the groups are greater than the total sample size. Overall 173 (19.4%) of this sample were convicted for an offence within 2 years of discharge from the unit, and 101 individuals (11.3%) were convicted of a violence offence.

3.2. Diagnosis and reconvictions

We first wished to see if a particular diagnosis was associated with better or poorer outcome as expressed through the reconviction data. However, it is clear that we did not have sufficient data for some subgroups to perform any meaningful analysis. Somewhat arbitrarily, we chose to only examine groups in which the sample size was over 100 individuals. Data from the other groups are presented in Table 1 in italics for information but were not further analysed.

For the remaining 5 groups comparisons of offence rates were made via a series of Chi-square tests (Fisher's exact test, see Agresti, 1992) and their significance is reported in Table 2 (upper right part of matrix is for violent conviction and lower left part is for any conviction). For any reconviction those with substance misuse disorders were reconvicted at the highest rate, those with a personality disorder also had elevated rates, whilst those with schizophrenia-like disorders or mental retardation had the lowest rates. The pattern for violent reconvictions

Table 1
Information relating to sample sizes and conviction data stratified by diagnosis.

	Number	Percentage	Nos. reconvicted	Percent reconvicted	Nos. violent	Percent violent	Further analysis
Total	890	100	173	19.4	101	11.3	
Organic	21	2.4	3	14.2	3	14.2	x
Substance misuse	116	13.0	44	37.9	21	18.1	✓
Schizophrenia	568	63.8	89	10.0	49	8.6	✓
Mood disorder	100	11.2	19	19.0	11	11.0	✓
Neurotic	18	2.0	5	27.8	1	5.5	x
Physiological	0	0	–	–	–	–	x
Personality disorder	160	18.0	46	28.8	33	20.6	✓
Mental retardation	115	12.9	14	12.1	8	7.0	✓
Development	15	1.7	2	13.3	1	6.7	x
Childhood	6	0.7	3	50.0	3	50.0	x
Unspecified	24	2.7	10	41.7	6	25.0	x

Table 2

Results of statistical comparison of offending rates 2-years post-discharge (Chi-square comparisons). The upper right triangle represents comparisons for violent recidivism whilst the lower left triangle is for any recidivism.

Group	Substance misuse	Schizophrenia	Mood disorder	Personality disorder	Mental retardation
Substance misuse	–	*	ns	ns	*
Schizophrenia	***	–	ns	**	ns
Mood disorder	**	ns	–	ns	ns
Personality disorder	ns	***	ns	–	**
Mental retardation	***	ns	ns	***	–

Not significant $p > 0.05$.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

was similar, save that the group with substance use disorders no longer had the highest rates.

3.3. Prediction of violent offending at 2 years

The major aim of this paper was to examine if the HCR-20 violence risk prediction scheme was accurate across a range of mental health diagnoses. First, looking at the sample as a whole (top of Table 3), we found that the HCR-20 was a very good predictor of future violent reconvictions producing an AUC=0.73. We also find that both the history scale and risk scale produced significant predictions, but that the clinical scale did not (see Gray et al., 2008 for a discussion of these effects).

3.3.1. F20–29: schizophrenia, schizotypal and delusional disorders

Table 3 illustrates the performance of the HCR-20 in predicting violent offending and any offending in this diagnostic sample. The HCR-20 was a significant predictor of both violent offending and any reoffending, producing large effect sizes (Rice and Harris, 2005).

3.3.2. F60–69: disorders of adult personality and behavior

Whilst the HCR-20 was statistically significant in predicting both violent and any reoffending, we were surprised to see that the AUCs were somewhat lower than the group average given that offending and violent offending are both raised in this population. Indeed the AUCs for the HCR-20 can only be described as a 'weak effect size' (Rice and Harris, 2005). The loss of predictiveness appears to be consistent across both the history and risk scales (the clinical scale was not predictive in the overall sample).

One possible reason for this low AUC is that this population contains a rather heterogeneous group of diagnoses, including, for example impulse disorders (such as kleptomania), gender identity disorders (such as transsexualism), disorders of sexual preference (such as pedophilia), etc. However, the term 'personality disorder' more normally refers to the disorders listed under F60–60.9 such as paranoid personality disorder, dissocial personality disorder, and emotionally unstable personality disorder. We therefore repeated this analysis isolating those with a diagnosis related to section F60–60.9 (specific personality disorders). However, this did not improve the predictive power of the HCR-20 (violence offence AUC=0.59 (± 0.06) and any offence AUC=0.59 (± 0.05)).⁴

3.3.3. F10–19: mental and behavioral disorders due to psychoactive substance abuse

Whilst the HCR-20 was statistically significant in predicting both violent and any reoffending, again the levels of prediction were either weak or moderate (Rice and Harris, 2005). This appears most

noticeable in the history scale which was no longer a significant predictor of future violent offences.

3.3.4. F70–79: mental retardation

The HCR-20 was a good predictor in this group, producing very large effect sizes. It is noticeable that all 3 subscales were significantly predictive in this sample, including the clinical scale which was not predictive in the other samples.

3.3.5. F30–39: mood disorders

The HCR-20 was significantly predictive in this sample producing a moderate effect size for violent offences (though it was only a weak predictor of any offence).

3.4. Comparisons of AUCs across diagnoses

Table 4 compares the AUCs (see Hanley and McNeil, 1982) produced by the total HCR-20 score for prediction of a violent conviction (upper right part of table) and for any reconvictions (lower left part of table) at 2 years for the different psychiatric diagnoses. The pattern of results was similar for both types of convictions. Notably, the AUCs for the prediction of reconvictions were smaller for the personality disorder group than for either the schizophrenia group or the mental retardation group. The only other significant findings were that the mental retardation group had larger AUCs than the substance misuse group, and the mood disorder group (any convictions only).

4. Discussion

In line with previous studies we have found that diagnosis by itself is a significant predictor of future violent reconvictions (and any convictions). Our analysis has also shown that whilst the HCR-20 score is a significant predictor of future violent re-offences (and of

Table 3

Area under the curves (AUC) of the receiver operating characteristic of the HCR-20 and its history, clinical and risk subscales. The standard error of measurement (SEM) is given in brackets next to each AUC. Those in bold are significant at $p < 0.05$ from chance (0.50) levels. Data are stratified by mental health diagnosis.

Diagnosis		Total	History	Clinical	Risk
All mental disorders	Violent	0.73 (0.03)	0.72 (0.03)	0.55 (0.03)	0.70 (0.03)
	Any	0.69 (0.02)	0.69 (0.02)	0.51 (0.02)	0.68 (0.02)
Schizophrenia	Violent	0.74 (0.04)	0.75 (0.04)	0.54 (0.04)	0.68 (0.04)
	Any	0.72 (0.03)	0.74 (0.03)	0.50 (0.03)	0.68 (0.03)
Personality disorder	Violent	0.62 (0.05)	0.63 (0.05)	0.51 (0.06)	0.62 (0.06)
	Any	0.62 (0.05)	0.63 (0.05)	0.50 (0.05)	0.62 (0.05)
Substance use	Violent	0.65 (0.07)	0.60 (0.07)	0.48 (0.08)	0.69 (0.07)
	Any	0.63 (0.05)	0.62 (0.05)	0.45 (0.06)	0.65 (0.06)
Mental retardation	Violent	0.80 (0.07)	0.84 (0.06)	0.68 (0.10)	0.70 (0.09)
	Any	0.80 (0.06)	0.79 (0.07)	0.64 (0.09)	0.76 (0.07)
Mood disorder	Violent	0.67 (0.07)	0.69 (0.09)	0.57 (0.07)	0.69 (0.08)
	Any	0.63 (0.06)	0.67 (0.07)	0.55 (0.06)	0.61 (0.07)

⁴ For the other personality disorders not included in this analysis (e.g. ICD codes F61–F69) the AUC for violent offences was 0.96 (SE=0.05) $p < 0.05$, and for any offences AUC=0.79 (SE=0.15) $p = 0.08$.

Table 4
Results of statistical comparison of AUCs for the HCR-20 to predict reconvictions. The upper right triangle represents comparisons for violent recidivism whilst the lower left triangle is for any recidivism.

Group	Substance misuse	Schizophrenia	Mood disorder	Personality disorder	Mental retardation
Substance misuse	–	ns	ns	ns	*
Schizophrenia	ns	–	ns	*	ns
Mood disorder	ns	ns	–	ns	ns
Personality disorder	ns	*	ns	–	*
Mental retardation	*	ns	*	*	–

Not significant $p > 0.05$.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

any offences) its accuracy is not equal across the different diagnostic categories.

4.1. Rate of reconviction

Our finding of the differential rates of conviction amongst those with different diagnoses is consistent with a large literature on this topic (e.g., Monahan, 1992; Scott and Resnick, 2006; Grann et al., 2008; Elbogen and Johnson, 2009). We found that the presence of a personality disorder or a substance use disorder was associated with elevated rates of reconvictions (compared to the mean of our sample), whereas a diagnoses of schizophrenia or of mental retardation was related to a much lower rate of reconviction.

Elevated rates of reconviction amongst those with substance use disorders is a common finding (e.g., Elbogen and Johnson, 2009) and it is not surprising that most risk assessment instruments (including HCR-20) have some measure of substance abuse as a risk factor for future violence. Likewise, elevated rates of crime are a common finding in those with a personality disorder (Widiger and Costa, 1994) and again many risk assessment instruments (including HCR-20) regard the presence of such a diagnosis as a risk factor. It should, however, be noted that there are many personality disorders. Diagnostic and Statistical Manual (DSM-IV) (American Psychiatric Association, 1994) lists 10 specific types and one *not other specified* and it is not clear that all these subtypes will have an elevated reconviction rate. As with other forensic settings, those with dissocial personality disorder (equivalent to antisocial personality disorder in DSM-IV) were by far the most prevalent (53% of the personality disorder diagnoses) in our sample with only the group diagnosed with emotionally unstable personality disorder (equivalent to borderline personality disorder in DSM-IV) making any other sizable contribution (19%). Hence, our results are likely to be representative of those with dissocial personality disorder and probably emotionally unstable personality disorder but great caution must be exercised in extrapolating to other forms of personality disorder.

The finding of reduced rates of violent reconviction in those with a diagnosis of schizophrenia is consistent with similar studies (Quinsey et al., 2006) but may seem at odds with the many studies that show schizophrenia as a risk factor for violent behavior (Fazel et al., 2009). The discrepancy lies in whether such patients are compared to other low-risk individuals (in community settings) or other high-risk individuals (in secure settings) as in the present study. Hence its use as a 'risk factor' may depend upon the clinician's judgment of the context in which they are applying the prediction.

The diagnosis of mental retardation was also associated with a low rate of future convictions. Gray et al. (2007) have argued that this is because many events that would normally be dealt with by the police or courts are often not pursued in this population (see also Turner, 2000; Green et al., 2002). Hence, the findings of lower conviction rates in this population may not reflect any actual differences in the rate of violent behaviors.

Finally, the rate of reconviction for those with a mood disorder was close to the sample mean. Whilst we note that this group is quite heterogeneous (as it includes major depression, bi-polar disorder and mania) the finding that these disorders are neither a risk factor nor a protective factor for future violence or crime is in line with recent findings on this matter (e.g., Elbogen and Johnson, 2009; Grann et al., 2008; though see also Arseneault et al., 2000).

4.2. Prediction of reconvictions

4.2.1. Schizophrenia

The HCR-20 was shown to be a good predictor of future reconvictions in the group with schizophrenia. Surprisingly there have been few attempts to examine the efficacy or risk assessment instruments in this population despite the large percentage of patients in forensic psychiatric settings that suffer from this disorder (Tengstrom, 2001). Our data show that the historical (and often non-clinical) factors are of importance in this population and hence any risk assessment of these patients must pay attention to these variables as well as to the clinical presentation of the individual.

4.2.2. Mental retardation

The diagnosis of mental retardation is one of the few psychiatric diagnoses that have received specific attention with respect to whether risk assessment instruments are effective in this population (Quinsey et al., 2004; Gray et al., 2007; Lindsay et al., 2008). All studies show that the HCR-20 is effective in this population, and there is some evidence that it is more effective in this group than in other diagnostic groups. The reasons for this appear to be that the clinical scale of the HCR-20 is an effective predictor of future violence in this group, whereas in most other psychiatric diagnostic groups this scale is not effective for long-term predictions (see Gray et al., 2004). The clinical scale contains items that are dynamic (e.g., insight into problems, current mental illness symptoms, and response to treatment) in that they are expected to change over time and circumstances (e.g., effective treatment). Hence, such items are good at the short-term prediction of violence but less effective in long-term prediction (Gray et al., 2003, 2004). However, for patients diagnosed with mental retardation it seems likely that same items will actually be fairly stable over time and circumstances and hence they are also effective predictors of longer-term violence as we demonstrate here. Whatever the reason for this greater prediction, it seems clear that the HCR-20 is an effective instrument for this psychiatric diagnostic group.

4.2.3. Mood disorders

Remarkably there does not seem to be any previous study of the effectiveness of risk assessment instruments for people with mood disorders. Given the very large presence of these disorders in the general population (e.g., Elbogen and Johnson, 2009) the present data provides an important evidence-base to support the use of HCR-20 for such patients. However, our diagnostic group contained those with

major depression, bi-polar disorder and mania, and therefore further and larger scale studies are needed in order to investigate the efficacy of the HCR-20 in these different clinical conditions.

4.2.4. Substance abuse

Given that substance abuse problems are over-represented in forensic populations (Hodgins, 1992), and that it appears to exacerbate any risk that is conferred by mental illness (e.g., Swartz et al., 1998; Hodgins et al., 2003; Fazel et al., 2009), the rather moderate effect sizes of the HCR-20 are of some concern.

4.2.5. Personality disorder

The rather weak performance of the HCR-20 (though statistically significant) is of concern as this group had the highest rate of violent reconvictions in this study (and in many other studies, e.g., Johnson et al., 2000) and hence trying to predict violence within this high-risk group is of paramount importance. Belfrage et al. (2000) studied a population of personality disorder offenders in a maximum security institution and used the HCR-20 and the PCL-SV to predict future instances of institutional violence. In line with the present results they found that the history scale of the HCR-20 was not predictive of future violence. Belfrage et al. (2000) postulated that this lack of efficacy might have arisen due a restricted range due to very high scores in this group. A supplementary analysis (available through the authors) of our data found no such problems. Other studies have examined prisoner cohorts that are likely to contain many people with a personality disorder (in particular antisocial personality disorder). Coid et al. (2007) obtained an AUC of 0.64 and Dahle (2006) AUC equivalents of 0.61–0.67 for violent reconvictions. Hence, these studies are also in broad agreement with the AUC obtained here (0.62).⁵

The personality disorders are normally grouped into three clusters: cluster A (odd), cluster B (dramatic) and cluster C (anxious). In our study we have not distinguished between these clusters. This was due to the unequal, and in some cases very low, numbers in these groups. A consideration of only those patients with a primary diagnosis in the F60–60.9 range showed that the majority were cluster B (77.0%), with 9.5% diagnosed with cluster A, and only 1.4% with cluster C. A further 12.2% has a personality disorder that was not otherwise specified. It is well established that clusters A and B appear to be associated with violent behavior, whilst cluster C may be a protective factor (e.g., Coccaro et al., 1997; Johnson et al., 2000). Clearly, further studies are needed to examine the effectiveness of the HCR-20 with respect to these specific clusters.

4.3. Speculation

One possible reason for the relatively poor prediction of the HCR-20 for those with personality disorders or substance abuse disorders is that both of these conditions are associated with impulsive behavior and a chaotic lifestyle. Thus, their behavior may be simply less predictable and more prone to outside influences that we cannot know about at the time of the evaluation of future risk. Second, it is noticeable in some studies (e.g., Dahle, 2006) that many people died during the course of the study. It may well be that the risk factors for violence to others have some overlap to those that predict harm happening to the self (through either deliberate self-injury, poor care (e.g., drug-taking) or accidents). Hence, we may have preferentially lost to the study those with high HCR-20 scores and thus lost predictive power due to this. We are currently exploring possible methods for obtaining such data on this cohort.

It is imperative that further studies follow-up on these current findings to see if it can be replicated (and under what conditions) and to explore what factors may explain this lowered predictive validity.

⁵ There is also a specific study of women with a diagnosis of personality disorder (Warren et al., 2005). They show that the HCR-20 is inversely related to very violent crime (AUC < 0.50).

4.4. Limitations

Our study suffered from a number of limitations, and so we address the implications of these in this section.

First, we examined reconvictions recorded in official sources. Clearly, reconvictions are only the 'tip of the iceberg' of all violent behavior. Of particular worry here is that different diagnoses may influence the manner in which actual offences are translated into reconvictions. We have already mentioned that those with a diagnosis of mental retardation may often be treated differently by the criminal justice system, and this could also occur for other diagnoses (e.g., those with psychotic symptoms being found not guilty by reason of insanity). Whilst these factors will influence the base-rate of reconviction, it is not clear that they would influence the accuracy of the HCR-20. One might argue that they should produce more 'noise' in the reconviction data, and hence this should serve to decrease the accuracy of the HCR-20. However, the accuracy of the HCR-20 was at its highest for those with a diagnosis of mental retardation or schizophrenia. Hence, this does not appear to be a problem in terms of the accuracy of the instrument. It would clearly be advantageous to obtain data utilising both self-report and informant information to get a better picture of the patient's true behavior (Monahan et al., 2001).

Second, the HCR-20 aims to produce a structured clinical judgment (SPJ) about future risk. However, the present study used the actuarial scores arising from the approach – a common strategy in research. However, it has been shown that the SPJ can be predictive even when the actuarial score is not predictive (de Vogel and de Ruiter, 2005). It is possible that a similar situation may be occurring for our personality disorder/substance abuse sample and we are currently investigating this possibility. Third, we used diagnoses as given in the psychiatric records as given by the responsible clinician (as the nature of our design does not permit us to interview the patients). We believe that this mimics how the HCR-20 is often used within a clinical setting. However, future studies may also be needed that produce a more consistent classification system.

Our categorisation of patients into different diagnostic criteria was based on whether the patient had received such a diagnosis irrespective of whether this diagnosis was considered primary, secondary, etc. Whether the diagnosis was considered primary or otherwise was based upon the importance of this diagnosis with respect to any other diagnosis by the responsible clinician. However, further analyses using just the primary diagnosis revealed the same pattern of results. Further, we used diagnosis at the time of admission. It can be argued that diagnosis at the time of discharge would have been more appropriate as the clinician would have more information related to the patient by this time. However, this information was often missing from the files, and hence for consistency we used the diagnosis at the time of admission.

4.5. Conclusions

The HCR-20 was a significant predictor of future violence in all the psychiatric diagnostic groups that we were able to test. However, there were also some variations in the efficacy of the instrument between these groups. Most notably the HCR-20 was most efficacious in those with a diagnosis of mental retardation and least in those with a personality disorder. We interpret this to reflect the consistency of the patients' behaviors (particularly violent and antisocial behaviors) across different contexts with those with a diagnosis of personality disorder or substance abuse being particularly impulsive and inconsistent.

Conflict of interest

The authors have no conflicts of interest.

Acknowledgements

We thank the UK Home Office for providing us with information concerning criminal convictions in our cohort of mentally disordered offenders. We are grateful to Partnerships in Care PLC for financial support (Grant RCPS336).

References

- Agresti, A., 1992. A survey of exact inference for contingency tables. *Statistical Science* 7, 131–153.
- American Psychiatric Association, 1994. *Diagnostic and Statistical Manual of Mental Disorders (4th Edn DSM IV)*. American Psychiatric Association, Washington D. C.
- Arseneault, L., Moffitt, T.E., Caspi, A., Taylor, P.J., Silva, P.A., 2000. Mental disorders and violence in a total birth cohort. *Archives of General Psychiatry* 57, 979–986.
- Belfrage, H., Fransson, G., Strand, S., 2000. Prediction of violence using the HCR-20: a prospective study in two maximum security correctional institutions. *The Journal of Forensic Psychiatry* 11, 167–175.
- Bonta, J., Law, M., Hanson, K., 1998. The prediction of criminal and violent recidivism among mentally disordered offenders: a meta-analysis. *Psychological Bulletin* 123, 123–142.
- Campbell, M.A., French, S., Gendreau, P., 2010. The prediction of violence in adult offenders. A meta-analytic comparison of instruments and methods of assessment. *Criminal Justice and Behavior* 36, 567–590.
- Coccaro, E.F., Berman, M.E., Kavoussi, R.J., 1997. Assessment of life history of aggression: development and psychometric characteristics. *Psychiatric Research* 73, 147–157.
- Coid, J., Yang, M., Ullrich, S., Zhang, T., Roberts, A., Roberts, C., Rogers, R., Farrington, D., 2007. *Predicting and Understanding Risk of Re-offending: The Prisoner Cohort Study*. Ministry of Justice, London, UK.
- Dahle, K.P., 2006. Strengths and limitations of actuarial prediction of criminal reoffence in a German prison sample: a comparative study of LSI-R, HCR-20 and PCL-R. *International Journal of Law and Psychiatry* 29, 431–442.
- de Vogel, V., de Ruiter, C., 2005. The HCR-20 in personality disordered female offenders: a comparison with a matched sample of males. *Clinical Psychology & Psychotherapy* 12, 226–240.
- Douglas, K.S., Webster, C.D., 1999. The HCR-20 violence risk assessment scheme – concurrent validity in a sample of incarcerated offenders. *Criminal Justice and Behavior* 26 (1), 3–19.
- Elbogen, E.B., Johnson, S.C., 2009. The intricate link between violence and mental disorder. *Archives of General Psychiatry* 66, 152–161.
- Fazel, S., Gulati, G., Linsell, L., Geddes, J.R., Grann, M., 2009. Schizophrenia and violence: systematic review and meta-analysis. *PLoS Medicine* 6, e1000120.
- Grann, M., Danesh, J., Fazel, S., 2008. The association between psychiatric diagnosis and violent re-offending in adult offenders in the community. *BMC Psychiatry* 8, 92.
- Gray, N.S., Hill, C., McGleish, A., Timmons, D., MacCulloch, M.J., Snowden, R.J., 2003. Prediction of violence and self-harm in mentally disordered offenders: a prospective study of the efficacy of HCR-20, PCL-R and psychiatric symptomology. *Journal of Consulting and Clinical Psychology* 71, 443–451.
- Gray, N.S., Snowden, R.J., MacCulloch, S., Phillips, H., Taylor, J., MacCulloch, M.J., 2004. Relative efficacy of criminological, clinical and personality measures of future risk of offending in mentally disordered offenders: a comparative study of HCR-20, PCL: SV and OGRS. *Journal of Consulting and Clinical Psychology* 72, 523–530.
- Gray, N.S., Fitzgerald, S., Taylor, J., MacCulloch, M.J., Snowden, R.J., 2007. Predicting future reconviction in offenders with intellectual disabilities: the predictive efficacy of VRAG, PCL-SV, and the HCR-20. *Psychological Assessment* 19, 474–479.
- Gray, N.S., Taylor, J., Snowden, R.J., 2008. Predicting violent reconvictions using the HCR-20. *The British Journal of Psychiatry* 192, 384–387.
- Green, G., Gray, N.S., Willner, P., 2002. Factors associated with criminal convictions for sexually inappropriate behaviour in men with learning disabilities. *Journal of Forensic Psychiatry* 13, 578–607.
- Hanley, J.A., McNeil, B.J., 1982. The meaning and use of the area under a receiver operating characteristic (ROC) curve. *Radiology* 143, 29–36.
- Hodgins, S., 1992. Mental disorder, intellectual deficiency, and crime – evidence from a birth cohort. *Archives of General Psychiatry* 49, 476–483.
- Hodgins, S., Hiscoke, U.L., Freese, R., 2003. The antecedents of aggressive behavior among men with schizophrenia: a prospective investigation of patients in community treatment. *Behavioral Sciences & The Law* 523–546.
- Johnson, J.G., Cohen, P., Smailes, E., Kasen, S., Oldham, J.M., Skodol, A.E., Brook, J.S., 2000. Adolescent personality disorders associated with violence and criminal behavior during adolescence and early adulthood. *The American Journal of Psychiatry* 157, 1406–1412.
- Lindsay, W.R., Hogue, T.E., Taylor, J.L., Septoe, L., Mooney, P., O'Brien, J., Johnston, S., Smith, A.H.W., 2008. Risk assessment in offenders with intellectual disability. A comparison across three levels of security. *International Journal of Offender Therapy and Comparative Criminology* 52, 90–111.
- Louw, D.A., Strydom, C.C., Esterhuysen, K.G.F., 2005. Prediction of violent behaviour: professionals' appraisal. *Criminal Justice* 5, 379–406.
- MacMillan, N.A., Creelman, C.D., 1991. *Detection Theory: A User's Guide*. Cambridge University Press.
- McNiel, D.E., Gregory, A.L., Lam, J.N., Binder, R.L., Sullivan, G.R., 2003. Utility of decision support tools for assessing acute risk of violence. *Journal of Consulting and Clinical Psychology* 71, 945–953.
- Monahan, J., 1981. *Predicting Violent Behavior: An Assessment of Clinical Techniques*. Sage, Beverly Hills, CA.
- Monahan, J., 1992. Mental disorder and violent behavior. *The American Psychologist* 47, 511–521.
- Monahan, J., Steadman, H.J., Silver, E., Appelbaum, P.S., Robbins, P.C., Mulvey, E.P., Roth, L.R., Grisso, T., Banks, S., 2001. *Rethinking Risk Assessment: The MacArthur Study of Mental Disorder and Violence*. Oxford University Press, USA.
- Phillips, H., Gray, N.S., MacCulloch, S., Taylor, J., Moore, S.C., Huckle, P., MacCulloch, M.J., 2005. Risk assessment in offenders with mental disorders. Relative efficacy of personal demographics, criminal history, and clinical variables. *Journal of Interpersonal Violence* 20, 833–847.
- Quinsey, V.L., Book, A., Skilling, T.A., 2004. A follow-up study of deinstitutionalized men with intellectual disabilities and histories of antisocial behaviour. *Journal of Applied Research in Intellectual Disabilities* 17, 243–253.
- Quinsey, V.L., Harris, G.T., Rice, M.E., Cormier, C.A., 2006. *Violent Offenders: Appraising and Managing Risk*, 2nd Edition. American Psychological Association, Washington D. C.
- Rice, M.E., Harris, G.T., 2005. Comparing effect sizes in follow-up studies: ROC area, Cohen's d, and r. *Law and Human Behavior* 29, 615–620.
- Scott, C.L., Resnick, P.J., 2006. Violence risk assessment in persons with mental illness. *Aggression and Violent Behavior* 11, 598–611.
- Serin, R.C., 1991. Psychopathy and violence in criminals. *Journal of Interpersonal Violence* 6, 423–431.
- Snowden, R.J., Gray, N.S., Taylor, J., MacCulloch, M.J., 2007. Actuarial prediction of violent recidivism in mentally disordered offenders. *Psychological Medicine* 37, 1539–1549.
- Steadman, H.J., Mulvey, E.P., Monahan, J., Robbins, P.C., Appelbaum, P.S., Grisso, T., Roth, L.H., Silver, E., 1998. Violence by people discharged from acute psychiatric inpatient facilities and by others in the same neighborhoods. *Archives of General Psychiatry* 55, 393–401.
- Swartz, M.S., Swanson, J.W., Hiday, V.A., Borum, R., Wagner, R., Burns, B.J., 1998. Taking the wrong drugs: the role of substance abuse and medication noncompliance in violence among severely mentally ill individuals. *Social Psychiatry and Psychiatric Epidemiology* 33, S75–S80.
- Tengstrom, A., 2001. Long-term predictive validity of historical factors in two risk assessment instruments in a group of violent offenders with schizophrenia. *Nordic Journal of Psychiatry* 55, 243–249.
- Turner, S., 2000. Forensic risk assessment in intellectual disabilities: the evidence base and current practice in one English region. *Journal of Applied Research in Intellectual Disabilities* 13, 239–255.
- Warren, J.I., South, S.C., Burnette, M.L., Rogers, A., Friend, R., Bale, R., van Pattern, I., 2005. Understanding the risk factors for violence and criminality in women: the concurrent validity of the PCL-R and HCR-20. *International Journal of Law and Psychiatry* 28, 269–289.
- Webster, C.D., Douglas, K.S., Eaves, D., Hart, S.D., 1997. *HCR-20: Assessing Risk for Violence (Version 2)*. Simon Fraser University, Vancouver, Canada.
- Widiger, T.A., Costa, P.T., 1994. Personality and personality disorders. *Journal of Abnormal Psychology* 103, 78–91.
- World Health Organization, 1992. *The ICD-10 Classification of Mental and Behavioural Disorders*. WHO, Geneva.