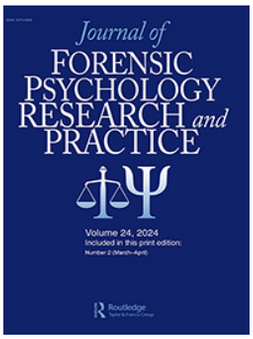

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Dynamic Relationship Between Protective Factors and Violent Outcomes Assessed Using the Structured Assessment of Protective Factors (SAPROF) in Secure Forensic Services

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ABSTRACT

This UK study is one of the first cohort studies exploring dynamic changes in risk and protective factors and the value of multiple risk assessments over time using the Structured Assessment of Protective Factors (SAPROF) tool. Multilevel linear regression was used to assess the stability of risk assessment ratings within patients and logistic regression to examine the likelihood of a violent incident following assessment. The analyses included 1560 observations for 65 adult forensic inpatients. This paper points to the need for services to model a more flexible review and application of the timescales in which the structured assessment/reassessment cycle operates.

KEYWORDS

Risk assessment; protective factors; SAPROF; violence in psychiatry

Introduction

Influenced by a growing demand for a more strength-based approach in clinical practice and the use of both risk and protective factors in violence risk assessment, the Structured Assessment of Protective Factors (SAPROF) instrument was developed in the Netherlands (de Vogel et al., 2009) to assess protective factors for violence risk in adults. The SAPROF is a risk-focused

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structured professional judgment (SPJ) assessment designed to supplement the Historical Clinical Risk management instrument (HCR-20 v3) (Douglas et al., 2014) for a more balanced and accurate assessment of violence risk in the context of complementary protective factors. Whilst the concept of protective factors in this context remain contested (Klepfisz et al., 2020; Polaschek, 2017), there is empirical evidence that such factors predict violence (or lack of) as accurately as risk factors (O'Shea & Dickens, 2016) and combining both elements is most accurate (de Vries Robbé et al., 2011). The SAPROF consists of mainly dynamic factors and aims to inform the treatment of adults with a history of violent or sexually violent offending by emphasizing positive factors which may inform decisions about clinical management. The predictive validity of the SAPROF alone and in conjunction with the HCR-20 has been established by a number of studies conducted with these populations in Europe (Abidin et al., 2013; Burghart et al., 2023; de Vries Robbé et al., 2015b; Neil et al., 2019; O'Shea & Dickens, 2016; Persson et al., 2017; Yoon et al., 2018), Canada (Coupland & Olver, 2020; Olver & Riemer, 2021) and Asia (Kashiwagi et al., 2018a; Zeng et al., 2015). However, most studies adopt an approach to testing predictive validity which can be seen as paradoxical given the nature of the SAPROF as an SPJ tool. Such tools are designed to underpin treatment planning based on an awareness of dynamic factors which are amenable to change. As forms of intervention, a high risk (or low protection) rating should trigger clinical efforts to reduce risk (or to improve protection). A strong relationship between high risk (or low protection) scores at assessment and subsequent violence suggests a lack of effective intervention and therefore actually a low association between assessment and outcome is desirable as it suggests effective prevention. This testing of SPJ instruments as part of an intervention rather than as a purely diagnostic tool has been achieved with other risk measures such as the Short-term Assessment of Risk and Treatability (START; Troquete et al., 2013) and the Brøset Violence Checklist (Abderhalden et al., 2008). The paradox was avoided in the study reported below as the ratings were made here by researchers unconnected to treatment decisions or patient contact, therefore less likely to influence prevention measures which could impact on violence outcomes.

At a more basic level, regardless of the intervention issue, most studies ignore the dynamic nature of risk and protection, which is equally central to the SPJ approach by adopting a standard-fixed approach, whereby risk factors are measured once and then used to statistically predict the occurrence of violence in a subsequent time window (Coid et al., 2015). Given the fluid nature of moods, thoughts, behavior, and interaction in mental health treatment settings, this "two timepoint" approach undoubtedly overlooks a huge degree of variability across shorter periods of time in the relationship between predictor and outcome. Douglas and Skeem (2005) emphasize the importance of repeatedly evaluating risk factors over time, rather than assuming that point

estimates will remain valid indefinitely, and the SAPROF authors have stated the need for repeated assessments over time to capture the dynamic nature of protection in this context (de Vries Robbé et al., 2013). But repeated clinical assessments are not commonly used in research where they have the potential to enrich understanding more widely (Hochstetler et al., 2016; Labrecque et al., 2014).

Previous studies have explored the potential benefits of repeat assessments and their relationship with violent outcomes, but not in relation to SAPROF. For example, Wilson et al. (2013) used a multiple-baseline design in which risk assessments (i.e., HCR-20, START) conducted every three months in a forensic service in Canada were examined in relation to violence in every subsequent three months over a total period of 15 months. They showed that fluctuations within HCR-20 and START sub-scales do not reflect a simple linear improvement process as a result of therapeutic interventions.

Some argue that repeated assessments can contribute to estimating the most accurate and precise duration between assessment and outcome (Dickens & O'Shea, 2015). Wilson et al. (2013) found that START scores were more predictive of violence in the shorter term (3–6 months) than the longer term (beyond 6 months) and that changes in risk factor levels between assessment points were predictive of institutional violence. While examining the association between risk/protection score and violence in the subsequent month, Whittington et al. (2014) found an increased within-person risk was associated with a substantial increase in the likelihood of violence, but also noted that the actual degree of change in risk was minimal. Thus the dynamic items on an SPJ instrument have the potential to change but may in practice remain fixed in a relatively stable population subjected to long-term incarceration and unresponsive to therapeutic initiatives. Whilst both the SAPROF and HCR-20 are designed as longer term predictive instruments than the START, they are both constricted entirely (or mainly) from dynamic factors. Such factors by definition have scope for change over unspecified time periods and such change has been observed (Wilson et al., 2013). This indicates the same analytical approach used with the START could be fruitful when applied to the SAPROF and HCR-20.

The evidence-base with regard to SAPROF's dynamic characteristics/potential is limited in terms of repeat assessments, with the tool having only been rated at one timepoint. More research using repeat measurements is needed to test out the "dynamicity" of protective factors and their link to reduced violence or increased positive outcomes (Coupland & Olver, 2020). This study sought therefore to explore this dynamic aspect of risk and protection by adopting analytical approaches to examine between and within-person fluctuations in both aspects and violent outcomes among forensic inpatients. These changes can be examined both descriptively and in terms of their relationship to predictive validity.

The main aim of this study was to examine changes in risk and protective factors among forensic inpatients across relatively short-time periods (1–3 months) within an overall 12-month timeframe and the relationship between such changes and violent outcomes. Specifically, the objectives of the study were:

(1) to track 3 monthly changes in SAPROF and HCR-20 scores over 12 months;
(2) to estimate the predictive validity of the SAPROF instrument over multiple 3-month periods and the overall 12-month periods;
(3) to estimate (a) the association between risk/protection scores and violence in the subsequent month and (b) the proportion of variability in SAPROF scores that can be attributed to either stable patient characteristics or dynamic changes within patients during follow-up.

The study also aimed to support the appreciation of and challenge to existing mind-sets and clinical models that focus predominately on risk reduction. The need to draw in the strengths and protective aspects of the individual and aspects of how they respond to their environment is still in its infancy in practice, and in some cases differing knowledge which is slowly being integrated into the planning and treatment process offered as standard. There is a need for more complex analyses and evidence to understand both individual- and group-level needs to inform the development and implementation of appropriate strength-based approaches.

Materials and methods

Design

In this cohort study, participant inpatients in forensic mental health settings in the UK were followed over a period of 12 months to measure outcomes in relation to violence over this timeframe. The STROBE Statement (https://www.strobe-statement.org/checklists/) of items that should be included in reports of cohort studies was used to guide the reporting of study results.

Settings and sample

The study was conducted in a forensic mental health inpatient service in the North-West of England, UK, with two levels of security as follows: (i) High Secure services, consisting of 210 beds across 13 wards, providing services for male patients who require treatment and care in conditions of high security; and (ii) Medium and Low Secure services,

consisting of 85 male and 11 female beds across 7 wards providing treatment and rehabilitation for men and women with severe and enduring mental health problems. Multidisciplinary team (MDT) working underpins the treatment model for these patients. The MDT will include appropriately trained and supervised staff including psychiatrists, clinical and/or forensic psychologists, mental health nursing staff, occupational therapists and social workers supported by other therapists including, for example, pharmacists, art therapists and speech and language therapists.

The focus and intensity of treatment varies across level of security, individual need and position on pathway through the respective service. Central to care delivery is the creation of a therapeutic milieu where the individual feels safe, supported, and engaged in goal-directed treatment. A work ethos is established to enable patients to develop occupational skills to assist in normalization, build self-esteem, reduce negative symptoms, and develop important life skills through positive reinforcement. Individual interventions often led by medication and supported by adjunctive occupational, psychosocial, and psychological intervention to address recognized problem areas are available across settings, as is offense-related psychological therapy when required. These sets of interventions support recovery and link to the pathway options for each person – whether this is a custodial, a further health placement, or community disposal post treatment.

Eligible participants were men or women aged 18 years or more who resided in one of these two settings at the study start point (1st February 2015) and met the criteria for a primary diagnosis of a serious mental health illness and/or personality disorder ($n = 272$). Those who lacked capacity to consent, were unable to participate due to health or security/confinement issues, or declined to participate were not included in the study ($n = 170$). Out of the 102 inpatients who gave consent to participate, 65 were included in the final data analyses, accounting for 1560 ratings/observations. Data collected for 27 participants were excluded from the analyses due to incomplete/unreliable assessments. This means that a sample of 65 patients were included in the study, as shown in Figure 1. Initial analyses indicated that the SAPROF AUCs were very different if the unreliable assessments were included, so a decision was made to exclude these. See Figure 1 for a flow diagram of participants.

Measures

The structured assessment of protective factors for violence risk: SAPROF (de Vogel et al., 2012)

The SAPROF is a 17-item violence risk assessment tool which contains 5 Internal, 7 Motivational and 5 External subscale items rated on a three-point scale (0 = the protective factor is clearly absent or there

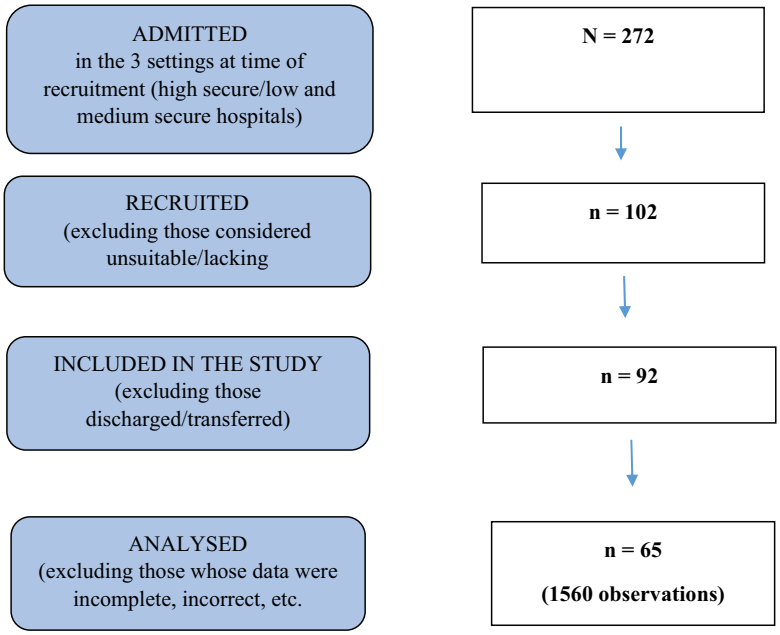

Figure 1. Study participants flow diagram.

is no evidence that the protective factor is present; 1 = the protective factor may be present or is present to some extent; and 2 = the protective factor is clearly present). Except for the first two internal items ("intelligence" and "secure attachment in childhood"), all other SAPROF items are dynamic and thus potentially changeable during treatment. While the scores for items 3–14 are expected to increase (due to improvement in balance in internal and social functioning, increased motivation) following treatment, items 15–17 are expected to decrease, as they relate to the protection offered by external professional care, which is expected to be reduced at discharge. The sum of all 17 items creates the total SAPROF protection score and this can range from 0 to 34. A five-point final protection judgment score (ranging from "low" to "high") can also be produced to make it more clinically useful (de Vogel et al., 2009).

For research purposes, as advised by the developers of the tool (de Vries Robbé et al., 2015a), the total score (ranging from 0 to 34) was used in this study, rather than a "final protective judgment", with higher scores reflecting a higher level of protective features. It should be noted that items 15–17 ("professional care", "living circumstances" and "external control") on the External subscale were scored 2 for all high secure patients as they are permanently supervised by mental health care professionals/under clinical control.

The historical, clinical, risk-20 (HCR-20 V3) (Douglas et al., 2014)

The HCR-20 is the most commonly used and validated tool to assess violence risk in the world (Douglas et al., 2013), used in correctional, forensic, general institutional and community settings. The tool contains 10 historical (static) variables ("H" scale), capturing previous problems with violent behaviors and attitudes, employment, relationships, mental and personality disorders and antisocial behaviors; 5 clinical (dynamic) variables ("C" Scale), capturing recent or current problems with psychosocial, mental health and behavioral functioning; and 5 (dynamic) risk management factors ("R" Scale), capturing relevant past, present, and future information with regards to living conditions, services, personal support and stress that are empirically associated with risk of future violence. The HCR-20 has satisfactory psychometric properties and has been shown to be a robust predictor of institutional and community violence (Douglas & Belfrage, 2014; Doyle et al., 2014). The HCR-20 prioritizes cases as low/routine, moderate/elevated or high/urgent – this trichotomous summary risk rating (SRR) is not a direct indication of future violence risk, rather a risk formulation based on clinical judgment which is used to inform the responsible clinician whether the person is not in need of any special interventions or monitoring (i.e., low/routine rating) or whether there is moderate/elevated risk, so immediate action or prioritization is needed (Douglas et al., 2014; Logan, 2014). Version 3 of the instrument was used.

The HCR-20-SAPROF combined index (de Vries Robbé, de Vogel, & Stam, 2012)

This newly developed measure aims to estimate the "overall total risk and protection score," where violence risk is counterbalanced by the available protection. This is calculated by subtracting the SAPROF total score from the HCR-20 total score and it can range from 34 to 38. The authors indicate that the predictive accuracy of this combined measure is higher than that of the HCR-20 alone. While values on the SAPROF (total score and subscale scores) do not reflect the risk of violent incidents but, rather, their absence, values on the HCR-20 and the HCR-20–SAPROF are considered to reflect risk of violent incidents.

Violence outcome measure

Incidents of institutional violence in the 12 months following the baseline assessment were accessed through the formal adverse incident reporting system used by the participating health care trust. The adverse incidents coded by staff as involving interpersonal aggression (i.e., verbal abuse, threats, and physical assaults targeting other patients or staff) or threats/actual intentional damage to property were included in this study. It can be assumed that the incident data obtained was reasonably

valid and reliable as national policy requires staff to formally record any incidents of aggression and/or violence on a daily basis, including details about date, time, incident type, people involved, location, outcome, etc.

Other data

Data relating to participants' socio demographic characteristics were also collected, including age, gender, ethnicity, marital status, primary and secondary diagnosis, mental health section, index offense, admission date, discharge date and discharge type if applicable.

Procedure

Potential participants who met the eligibility criteria and had capacity to consent were identified via the responsible clinicians at each site, then approached by a member of the research team who provided oral and written information about the study. For those who wished to participate after considering this information, written consent was obtained and initial socio-demographic characteristics were recorded. The assessments were then completed monthly using a pseudo-prospective design with risk and protection ratings coded on the basis of archival data that existed prior to the outcome (Douglas et al., 2013).

The assessments were scored each month over the study 12-month period (February 2015–January 2016) by in depth-examination of participants' clinical notes. For consistency, two researchers rated all assessments included in this study, each rating one assessment, without any knowledge of the other or of the incident outcome data, which was obtained after the assessment data had been collected. The raters received formal training by a certified trainer for each assessment, including lectures, discussions, case studies, scoring practices and formal inter-rater exercises. Regular consensus meetings were also held during the study to allow for reflection and feedback.

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human subjects/patients were approved by the North-West Liverpool East Research Ethics Committee (REC) (Ref # 14/NW/0300) in the UK. The study did not compromise any interventions/treatment as the ratings were not reported to care teams.

Data analysis

Missing data up to a maximum of three missing values out of 17 on the SAPROF (i.e., ≤18% missing) and out of 20 on the HCR-20 and START (i.e. ≤15% missing) were prorated by averaging available items (Neil et al., 2019). Assessments with more than 3 missing items were excluded as unreliable. Of the 1560 potential ratings (65 patients, with 12 monthly assessments on 2 instruments), 79 (5.1%) were excluded on this basis and 664 (42.6%) were prorated and included. Then, after calculating sample descriptives for each setting and overall, SAPROF and HCR-20 scores at five time points (i.e., Months 1, 4, 7, 10, and 12) were compared, and changes over time were computed using SPSS version 27. SAPROF change score was calculated based on the difference from Month 1 to Month 12. Receiver-operator characteristic (ROC) analysis for estimating predictive validity through Area Under the Curve (AUC) estimation (Mossman, 1994; Rice & Harris, 2005) was conducted for violence over the subsequent 12 months and also across four time periods at 3 months' intervals (i.e., Month 1 assessment and violence over the subsequent 3, 6, and 9 months; Month 4 assessment and violence over the subsequent 6 and 9 months, etc.)

We assessed the stability of risk assessment ratings within patients with Intra class coefficients (ICC). The ICC is a measure of how much of the variability that could be attributed to stability within patients and have a range from 0 (all variability between observations) and 1 (only variability between patients). The ICC was calculated using a multilevel linear regression model (xtreg in STATA) with adjustment for number of assessment episode, age as a continuous variable and sex.

We used logistic regression with repeated measures to examine the likelihood of a violent incident occurring within the 30 days following an assessment for all 12 of the monthly assessments. For analyses of the total patient population, a random-effects logistic regression (xtlogit command in STATA) was used considering repeated measures within patients, adjusted for the number of assessment episode, age, sex and length of stay/admission. In the within patient analysis, we used a within group estimator (xtlogit, fe in STATA) with the same adjustments. The within-individual logistic regression model used information from patients discordant on violent incidents during follow-up. This enabled analysis of changes in risk scores within the same patient, thereby controlling for potential confounding background characteristics (observed and unobserved). In such a self-controlled case series, the patients act as their own control (Petersen et al., 2016). Hence, we could investigate if the risk of a violent incident was more likely to occur in the periods

where an individual had an individual change in the rating of the risk assessment.

These analyses were performed in STATA 15.1 for Windows (Stata Corp., College Station, TX). Precision was evaluated with 95% confidence intervals (CI).

Results

Characteristics of the patient sample

Of the 65 participants, 40 (61.5%) were in High Secure services and 25 (38.5%) were in Medium/Low Secure services. The combined sample was almost exclusively male ($n = 61$, 93.8%) and primarily White British ($n = 50$, 76.9%). The majority ($n = 60$, 92.3%) were not in a relationship at the time of the assessments. The average age of patients was 36.6 years (standard deviation = 10.9 years, range = 21–55 years). Most had a primary diagnosis on the schizophrenia spectrum or another psychotic disorder ($n = 55$, 84.6%) and the remainder had either a personality disorder ($n = 8$, 12.31%) or affective disorder ($n = 2$, 3.0%). All participants were detained on Mental Health Act (MHA) sections of 6 months or more with over half ($n = 40$, 61.5%) detained for a violent offense. The remainder had either committed a nonviolent offense ($n = 21$, 32.3%) or no offense ($n = 4$, 6.2%). Nearly all participants (90.8%) had been admitted for 6 months or more prior to the first assessment of the study. The median number of months from admission to the first assessment was 25 but this varied markedly (IQR = 47) from 1 to 420 months. Twelve participants (18.4%) who entered the study were discharged prior to the end of the 12-month follow-up period.

Nearly two-thirds of the sample ($n = 41$, 63.1%) were involved in one or more violent incidents during the 12-month follow-up period. For those who were violent at least once, the median number of incidents was 2 (IQR = 5, range 1–53). In terms of base rates for each of the four study periods, the number and proportion of patients acting violently, and the number of incidents were as follows: March–May: 24 patients (36.9%); June–August: 22 patients (33.8%); September–November: 16 patients (24.6%); December–February: 17 patients (27.7%).

Changes in risk and protective factors over time

A key objective of the study was to track changes in the risk and protective factors identified over a one-year period of care and treatment for the study cohort. Table 1 reports and compares SAPROF and HCR-20 subscale and total

Table 1. SAPROF and HCR-20 subscale and total ratings at months 1, 4, 7, 10 and 12.

		Month 1	Month 4	Month 7	Month 10	Month 12	% change	Mean change Months 1–12	t	p
	N	62	62	57	55	52		51		
SAPROF Internal	Mean	**5.53**	**6.13**	**5.91**	**6.02**	**6.17**	**+11.57**	**+0.84**	**2.67**	.01
	SD	2.23	2.15	1.72	1.95	2.09		2.25		
	N	62	62	59	55	52		51		
SAPROF Motivational	Mean	**10.06**	**9.77**	**9.69**	**9.51**	**9.73**	**−3.28**	**−0.16**	**−.43**	.67
	SD	2.77	3.12	2.45	2.49	2.77		2.63		
	N	62	62	59	55	52		51		
SAPROF External	Mean	**7.19**	**7.21**	**7.29**	**7.45**	**7.27**	**+1.11**	**+0.10**	**0.93**	.36
	SD	0.74	0.79	0.79	0.81	0.79		0.76		
	N	62	62	57	55	52		51		
SAPROF Total	Mean	**22.79**	**23.11**	**22.98**	**22.98**	**23.17**	**+1.67**	**+0.78**	**1.18**	.25
	SD	4.38	4.85	3.42	3.94	4.55				
	N	65	65	64	60	55		55		
HCR-20 Historical	Mean	**17.77**	**17.75**	**17.73**	**17.62**	**17.67**	**−0.06**	**−0.02**	**−0.33**	.74
	SD	2.12	2.12	2.13	2.12	2.16		0.41		
	N	65	65	64	60	56		56		
HCR-20 Clinical	Mean	**4.86**	**4.08**	**3.72**	**3.40**	**3.63**	**−25.31**	**−1.50**	**−4.16**	<.0001
	SD	3.06	3.10	3.05	3.18	3.10		2.70		
	N	65	65	64	60	56		56		
HCR-20 Risk	Mean	**3.46**	**3.35**	**4.28**	**3.90**	**3.09**	**−10.69**	**−0.38**	**−1.63**	.11
	SD	2.20	1.86	2.20	2.27	1.72		1.72		
	N	65	65	64	60	55		55		
HCR-20 Total	Mean	**26.09**	**25.18**	**25.73**	**24.92**	**24.29**	**−6.90**	**−1.90**	**−3.41**	.001
	SD	5.06	4.86	4.86	4.86	4.67		4.11		
	N	62	62	57	55	51				
HCR-SAPROF Index Score	Mean	**3.18**	**2.06**	**2.93**	**2.05**	**1.31**	**−58.81**	**−2.16**	**−1.91**	.06
	SD	**8.54**	**9.18**	**7.11**	**8.25**	**8.61**		**−2.16**		

scores at baseline (Month 1), three intermediate time points (Months 4, 7 and 10) and at the study endpoint (Month 12).

It can be seen that there were significant improvements in the SAPROF Internal subscale, the dynamic subscales of the HCR-20 and the HCR-20 total score. Risk scores reduced, and clinical risk reduced substantially over the 12 months. Motivational and External protective factors remained unchanged during this period.

Changes in predictive validity over time

Another objective was to assess the predictive validity of the study instruments over multiple time points. Table 2 reports the AUC value (including 95% confidence interval and significance) for the SAPROF and HCR-20 instruments and the HCR-20-SAPROF index at baseline, the 3 intermediate time-points and at the end of the study/over the full 12-month period.

The overall predictive accuracy of the SAPROF, HCR-20 and the combined HCR-20-SAPROF Index over the standard 12-month follow-up period was acceptable with AUCs of 0.70 or above. The AUCs (and confidence intervals

Table 2. Predictive validity (AUC) for violence of SAPROF and HCR20 over the full 12 months and per 3-month sub-period.

		0–3 months after assessment				3–6 months after assessment				6–9 months after asessment				9–12 months after assessment				0–12 months after assessment			
Assessment month		AUC	95% CI		Sig	AUC	95% CI		Sig	AUC	95% CI		Sig	AUC	95% CI		Sig	AUC	95% CI		Sig
1	SAPROF Total	**.66**	.51	.81	.036	**.74**	.61	.87	.000	**.86**	.76	.97	.000	**.68**	.52	.84	.027	**.73**	.60	.85	.000
	HCR-20 Total	**.64**	.49	.78	.063	**.68**	.55	.81	.006	**.87**	.77	.97	.000	**.74**	.60	.88	.001	**.70**	.58	.83	.002
	HCR-20-SAPROF Index	**.68**	.53	.83	.018	**.74**	.62	.87	.000	**.91**	.83	.99	.000	**.74**	.58	.89	.002	**.74**	.61	.86	.000
4	SAPROF Total	**.74**	.60	.89	.001	**.79**	.67	.92	.000	**.63**	.45	.81	.159								
	HCR-20 Total	**.68**	.55	.81	.009	**.86**	.77	.95	.000	**.66**	.50	.82	.045								
	HCR-20-SAPROF Index	**.74**	.60	.87	.001	**.87**	.79	.96	.000	**.65**	.48	.83	.084								
7	SAPROF Total	**.70**	.53	.87	.018	**.68**	.52	.84	.024												
	HCR-20 Total	**.77**	.65	.89	.000	**.63**	.47	.79	.115												
	HCR-20-SAPROF Index	**.79**	.66	.92	.000	**.68**	.52	.85	.032												
10	SAPROF Total	**.64**	.48	.81	.087																
	HCR-20 Total	**.65**	.50	.80	.056																
	HCR-20-SAPROF Index	**.66**	.50	.83	.045																

for the subscales over this 12-month follow-up period were as follows: SAPROF Internal: .70 (.57–.84); SAPROF Motivation: .71(.58–.85); SAPROF External: .41 (.26–.55); HCR-20 Historical: .53 (.37–.68); HCR-20 Clinical: .71 (.58–.84); HCR-20 Risk: .60 (.46–.74).

When the follow-up period was split into 3-monthly sub-periods, it can be seen that there is no consistent pattern in the association of accuracy and duration of predictions. The February assessment for example was most accurate 9 months post-assessment, but the May assessment was most accurate 6 months post-assessment, while the August assessment at 3 months post-assessment. In other words, AUCs tended to be highest in the third study assessment period (September to November, study months 8–10), regardless of when the assessment had been made. As noted above, this period had the lowest number of violent patients ($n = 16$).

Variability of risk and protection within and between patients

There was a high stability in ratings within patients. The proportion of variability in SAPROF scores that could be attributed to stable patient characteristics ranged from 0.56 to 0.68. The ICC for the HCR-20 ratings were even higher,

Table 3. Odds ratios for violent episode the month after risk assessment according to type of risk assessment tool. Results from analyses in the total patient population (conventional analysis) and differentially exposed patients (within-patients analysis).

	95% CI				
Odds ratio	lower	upper	Observations	Patients	
Conventional analysis[7]					
SAPROF Internal[1]	0.81	0.69	.96	723	65
SAPROF Motivational[2]	0.79	0.71	.89	725	65
SAPROF External[1]	0.88	0.54	1.43	725	65
SAPROF Total[3]	0.86	0.80	.93	723	65
HCR-20 Clinical[4]	1.33	1.20	1.47	754	65
HCR-20 Risk[1]	1.10	0.95	1.29	754	65
HCR-20 Total[5]	1.14	1.06	1.22	753	65
HCR-20-SAPROF Index[6]	1.10	1.06	1.15	722	65
Within patient analysis[8]					
SAPROF Internal[1]	0.97	0.82	1.15	462	40
SAPROF Motivational[2]	0.91	0.79	1.04	463	40
SAPROF External[1]	0.97	0.50	1.85	463	40
SAPROF Total[3]	0.96	0.88	1.04	462	40
HCR-20 Clinical[4]	1.08	0.95	1.22	485	41
HCR-20 Risk[1]	0.92	0.78	1.08	485	41
HCR-20 Total[5]	1.01	0.93	1.10	484	41
HCR-20-SAPROF Index[6]	1.03	0.98	1.08	461	40

[1]Scale with a range from 0–10
[2]Scale with a range from 0–14
[3]Scale with a range from 0–34
[4]Scale with a range from 0–20
[5]Scale with a range from 0–40
[6]Scale with a range from −34 - +40
[7]Adjusted for number of risk assessment episode, sex, age and length of stay.
[8]Adjusted for number of risk assessment episode.

ranging from 0.60 to 0.76. Table 3 reports the results of the fixed-effects logistic regression analysis.

In the overall sample of violent and nonviolent patients ($n = 65$) (conventional analysis), the three SAPROF factors were all negatively associated with subsequent risk of a violent episode, as would be expected. A one-unit increase in the SAPROF Motivational Factors score was associated with a 23% reduction in the odds of a violent episode in the next 30 days. The analyses of within-patient variability for violent patients only ($n = 41$) showed, however, that these associations where substantially reduced and were close to no association for all of the SAPROF instruments.

The historical scale score of the HCR-20 was negatively associated with subsequent risk of a violent episode for the overall sample, but with wide confidence intervals, due to there being only one observation per patient for this factor. The dynamic HCR-20 factors (Clinical and Risk), the HCR-20 Total score, and the combined HCR-20-SAPROF index score in this group were all positively associated with an increased risk in the total patient population and this association was substantial for all measures apart from the Clinical factor. The analyses within violent patients only, however, showed only minimal associations with risk of violence.

Discussion

This study sought to explore dynamic changes in risk and protective factors with regard to inpatient violence in forensic settings in the United Kingdom (UK), as well as strengthen the evidence regarding the predictive validity of two well-established risk assessments tools, the HCR-20 and the SAPROF, and the value of multiple risk assessments over time. While the evidence is increasing regarding dynamic risk factors, research to date has tended to focus on risk status at a specific time point, revolving around static risk factors for violence. More studies conducting longitudinal research or multiple measurements over time and within patient/individual trajectories analyses are needed to better understand how changes or differences in dynamic factors can relate to the risk for violence over time (Douglas & Skeem, 2005). Exploring changes in both risk status/trait (inter-individual risk based on risk factors) and risk state (intra-individual risk based on largely dynamic risk factors) over time might provide clinicians the information needed to better judge when to intervene to reduce risk and which aspects of violence risk or protection to target.

Key results

Overall, this study adds to previous evidence with regard to risk and protective factors for forensic psychiatric patients, showing a significant decrease for dynamic risk factors (HCR-20 clinical and risk scores), as well as an improvement in the SAPROF Internal and Total scores. While it was expected for the External protective factors to stay the same during the study period, due to the mandatory nature of hospitalization (which means that these are always coded as present), a slight decrease in the SAPROF Motivational score was an unexpected finding, given that this is one of the key dynamic factors expected to increase, due to improvements in motivation, overall. It might have been something about the SAPROF individual motivational factors that were particularly challenging to improve/change in our cohort; patients who have experienced long-term hospitalization might show less evidence of improvement with regard to work, leisure activities, finance, even motivation for treatment.

Risk assessment scores were on average higher for SAPROF total score compared to those reported elsewhere (de Vries Robbé et al., 2015a, 2016; Kashiwagi et al., 2018b), but similar for HCR-20 total score. In terms of predictive validity, findings suggest that the SAPROF and HCR-20 are useful predictors of violence at 12-month follow-up, with AUCs of 0.70 and 0.73 respectively, while the combined HCR-20-SAPROF index outperform both, with an AUC of 0.74. These results are in line with those reported in previous research in this area, for example with' (de Vries Robbé et al., 2016)s AUCs of 0.75, 0.79, and 0.70 and those reported by (Kashiwagi et al., 2018b), i.e., 0.85, 0.67, and 0.78, for the predictive validity of the SAPROF, HCR-20 and the combined HCR-20-SAPROF at 12 month follow-up. However, the validity of AUCs based on a single risk assessment is questionable given the poor association within individuals demonstrated by the variability analysis.

When the follow-up period was broken down into smaller 3-monthly periods, no consistent pattern was found, although AUCs tended to gradually increase for 6–9 months following the first assessment, peaking at 9 months (with the highest AUC of 0.91 for the HACR-20-SAPROF index total score), but then leveling out or decreasing in the following months, especially the SAPROF total score. This could be down to certain contextual factors (e.g., length of stay/detention, treatment), socio-demographics (e.g., a decrease in this period in the number and proportion of patients acting violently, and the corresponding number of incidents, as indicated in our results) or an interesting seasonal pattern which needs to be further explored.

Some of these results are supported by previous research suggesting that scores are more positive and better predicting during later stages

following treatment (de Vries Robbé et al., 2016, p. 14), although in our study the HCR-20 and the SAPROF assessments were coded by researchers (and not part of routine clinical practice) and the extent or type of treatment in response to any assessments were unknown, so results are not directly comparable. Indeed, we consider determining the optimal interval of measurement for various risk factors to be one of the challenges that lays ahead for researchers (Douglas & Skeem, 2005).

Strengths and limitations

One potential limitation of this study is that, by using retrospective clinical notes, there is a possibility of missing information as the clinical notes are not initially recorded for research purposes; especially the internal SAPROF items, which have been shown to be more difficult to code from file then from daily interaction in clinical practice (de Vries Robbé et al., 2013) or one-to-one interviews with participants. Relying on clinical notes only raises issues of reliability and interpretation of the information provided. While this could be seen as a limitation, this method allows researchers to deal with attrition/non-engagement/unavailability for interview, hence allowing for more observations to be captured. It is also worth mentioning that NHS policy requires that patient behavior and incidents of aggression and/or violence is recorded daily. Risk assessments are also conducted as part of routine clinical practice therefore information relating to risk factors is usually documented. In an attempt to overcome this, all relevant reports in addition to the daily clinical notes were accessed in the scoring process to obtain as much information as possible. Because extensive file information was available including descriptions from clinical observations it was possible to code all dynamic items.

There's a potential for information bias due to misclassification of aggression and violence based on formal notes. Less severe events might be underreported using this method. Nonetheless, we anticipate a high positive prediction value, suggesting that instances labeled as aggression and violence are likely to be accurate.

An important strength of this study was the independence of the raters from the clinical decision making process. This detachment is important in a repeated measures design such as that used in this study to ensure evaluations do not influence treatment adjustments. If the assessments had been made by clinical staff as part of routine practice they would probably have led to changes in approach which then influenced subsequent violence risk.

Interpretation: implications for clinical practice and research

Using the appropriate risk assessment measures that are sensitive to important clinical changes is key to manage and ideally predict and prevent violence in clinical practice (Chu et al., 2011), but they are only a part of the puzzle. Interestingly, this study shows that changes in protective factors (within patients) showed weak or no association with subsequent risk of a violent episode, which could imply the dynamic aspect of SAPROF might not be well suited to predict the lack of violence. One could argue, therefore, if something changes within a patient and it does not tell us much about the risk for that patient, why look at this? The high stability in ratings between episodes and poor predictive ability within patients could be seen as an argument for reducing the number of assessments. However, these are not just risk tools. These are also guides for interventions and, if done with the person, they can be an intervention in their own right.

The SAPROF could be used as a tool to raise clinical awareness/curiosity regarding protective factors. It could offer the clinical team the opportunity to focus on setting positive treatment goals and nurturing protective factors, which in turn can have a positive therapeutic effect, offering hope and optimism among patients (de Vries Robbé et al., 2016, p. 19). Such a strength-based approach is key to achieve both a reduction of violence/reoffending risk, as well as recovery or improvement of patients' wellbeing. This should be integrated into a person-centered psychosocial approach that respects individuality, personal choice, and human rights, in line with the Good Lives Model, for example (Ward & Brown, 2004; Ward et al., 2007).

Given some of the mixed results in the current literature, especially with regard to prediction of future violence in the community/post discharge, less violent cohorts (Abbiati et al., 2016; Coid et al., 2015; Haines et al., 2018) and some of the findings reported here, it appears that more research is warranted to be able to generalize about the predictive accuracy of the SAPROF across different settings. However, its value in risk management and rehabilitation should definitely not be dismissed. The SAPROF is beneficial in providing more complete information within multidisciplinary team decision making, guiding current and future interventions to enable "a more complete and tailored needs-based treatment than if only dynamic risk factors were assessed" (Abbiati et al., 2016, p. 507).

The inclusion of protective factors in the broader appreciation of risk is now becoming a more common facet of the decision making within the clinical domain. This paper shows the potential for dynamic movement in individual risk status and therefore pointing to the need for services to model a more flexible review and application of the timescales in which the structured assessment/reassessment cycle operates. Clinical thinking readily

focusses and responds to recognized risk markers at an individual level. There is recognition that aspects within an individual's overall presentation which are now acknowledged as positive may need equal support and even targeted intervention to preserve and nurture is a broadening in clinical thinking and approach. The challenge now appears to be responding to the interactions of these risks with the protective features of the case with equal consideration. This need to expand interventions away from the sole focus on management of the factors labeled as risks is a shift and may not receive equal value within those delivering the care and support. The need to reconstruct the individual as more than a set of risks and strengths via formulation is key. This high-level practitioner skill, which allows a broader examination of the risk areas will contribute to the effective appreciation of each case, but requires more time to undertake and appreciate. Research incorporating the role of formulation and clinical skills, understanding, and assessing protecting factors and their relationship with violence is warranted. This person-centered, balanced, formulation-based approach is becoming more increasingly evident for researchers and will be a challenge not just for clinicians but also for those groups which oversee commissioning of services, whose role is to oversee appropriate care placement of individuals.

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